STUDIES OF COMPUTER MEDIATED COMMUNICATIONS SYSTEMS: A SYNTHESIS OF THE FINDINGS

FINAL REPORT ON A WORKSHOP SPONSORED BY THE
DIVISION OF INFORMATION SCIENCE AND TECHNOLOGY
NATIONAL SCIENCE FOUNDATION

STARR ROXANNE HILTZ AND ELAINE B. KERR

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PREFACE

This report is an attempt to collect and synthesize current knowledge about computer-mediated communication systems. It focuses on computerized conferencing systems, for which most evaluational studies have been conducted, and also includes those electronic mail and office support systems for which evaluative information is available. It was made possible only through the participation of the many systems designers and evaluators listed below, who took the time to help to build a common conceptual framework and report their findings in terms of that common framework.

The following people attended the face-to-face workshop where the initial plans for pooling our knowledge were developed:

James Bair
John Bregenzer
James Danowski*
Starr Roxanne Hiltz*
Kenneth Johnson
Peter Johnson-Lenz*
Trudy Johnson-Lenz*
Elaine Kerr*
Valarie Lamont*
Jane McCarroll*
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Ronald Rice*
John Senders*
Elliot Siegel*
Richard Stern*
Murray Turoff*
Stuart Umpleby*

Those with asterisks following their names also participated in the subsequent discussions and drafting efforts on EIES, which completed the development of the conceptual framework and the outlines of the chapters in this report.

Data reports were contributed by:

James Bair
John Bregenzer
David Brown
James Danowski
Morley Greenberg
Edward Housman
Elaine Kerr
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Peter Johnson-Lenz
Trudy Johnson-Lenz
Hubert Lipinski
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Jane McCarroll
Richard Miller
Jacob Palme
John Senders
Elliot Siegel
Sarah Spang
Murray Turoff
Stuart Umpleby

Those who wrote or drafted parts of the actual manuscript are credited on the title page. Authorship is noted in the body of the report under the title of a section, where a contributor provided the final draft. In addition, three persons provided the first draft of the literature review for a portion of a chapter: Murray Turoff for systems software, Valarie Lamont for group determinants of acceptance, and Jane McCarroll for group impacts.

We also wish to express our appreciation to the following people who provided critical readings of portions of earlier drafts of this manuscript: Richard Dalton, Valarie Lamont, Clifford Lynch, Jane McCarroll, Jacob Palme, Elliot Siegel, and Stuart Umpleby.

This rather mammoth project was not without its problems, some of which are described in the concluding chapter. From the authors' point of view, one of the most severe was that it required more than five times the twenty days each of effort for which National Science Foundation support was provided. We would like to thank Upsala College, particularly President Rodney Felder and George Fenwick, for their assistance in assuring the completion of the project.

The manuscript can be considered a first draft, since the authors are in the process of rewriting and adding to many of the sections in order to create a more integrated and complete synthesis. This will be published by Academic Press in 1982 as Elaine B. Kerr and Starr Roxanne Hiltz, Computer-Mediated Communication Systems: Status and Evaluation.

This final report to the National Science Foundation, and the revised book version, should be of use both to researchers studying this new form of electronic communications and to those organizations planning the installation of electronic mail or other computer-mediated communication systems who will need to be aware of the lessons gleaned from the studies presented here.

Order of Authorship

The two authors contributed equally to this effort. However, since "first authorship," even if alphabetical, may be interpreted to mean that one is more the author than the other, it was decided to share first authorship. On the final report for the National Science Foundation project of which Hiltz was Principal Investigator, Hiltz is listed first. On the rewriting and condensation for the book version, Kerr is listed first.

CHAPTER I

INTRODUCTION

This report grew out of a grant from the National Science Foundation to synthesize what is known about computer-mediated communication systems from the results of their associated evaluations. It was stimulated by the desire to capture and document what was learned from the completion of the EIES operational trials, and to compare these findings with those of other computer-mediated communication systems: conferencing systems, electronic message systems, and general information-communication systems designed to support "knowledge workers," or those managers, administrators, and professionals who retrieve, process, and communicate information.

The EIES field trials are one of the most intensely evaluated of recent information science endeavors. A formal evaluational effort was built into each of the seven official operational trial groups. In addition, the Hepatitis Data Base and White House Conference on Library and Information Services user groups contained formal evaluation components.

One product of these group experiences and accompanying evaluations was a final report for each of the nine groups, plus the overall cross-group evaluation. These separate reports contain major differences in what was measured and reported, and they do not facilitate the comparative overview of different approaches to evaluate this information exchange medium or the different experiences of each of these groups.

Other computer-based communication systems have been evaluated in the past. The most extensive studies in addition to the EIES trials were by Johansen, Vallee and their colleagues for the PLANET system. In addition, Bair and Edwards conducted extensive research on NLS, and some evaluative data have been published for a number of other systems. Reading the various individual reports, however, it is not possible to reach any conclusions about the relative influence on the findings of the group and application, the features of the specific systems used, or the evaluation methods employed.

All scholars who had published evaluative studies of these systems were invited to compare their experiences, and to systematically attempt to examine and report their research within a common framework that they would develop.

This report presents the comparative findings and methods, including their implications for needed future research, as well as short case studies and an appendix with the comparative data specifically collected from a panel of experts for this study.

We hope that the results of our efforts will be useful to students of computerized communications and those interested in the impacts of this emerging technology.

Overview of the Medium

Computer-based communication systems use a computer to structure, store, and process communications. Users compose text items by typing on terminals linked to a central computer either directly or by telephone lines and a packet-switched network such as Telenet or Tymnet.

Geographically-dispersed groups are able to communicate at a speed and cost superior to telephone, mail, and face-to-face meetings. A permanent written transcript is maintained of the proceedings. The medium is asynchronous, meaning that time and space are minimized as barriers to interaction and that people can participate at the time and pace most convenient to them.

This is a new form of enhanced human communication, made possible by the proliferation of terminals, development of time-sharing digital systems, and the reduced costs of computer time. Based on a hybrid of computer science, communication theory, and information science, its potentials are now beginning to emerge with a core of user experience and related evaluational studies. We present here the current state of the art.

Although the basic configuration resembles a written version of the telephone conference call, there are important differences in addition to the self-determined participation rate. Because text items are retained in the computer until deliberately deleted, they may be copied to others or merged into larger documents, as well as allowing latecomers to catch up with the proceedings.

These systems typically include some or all of the following components:

o MESSAGES: may be sent to an individual, a number of individuals, or a group, and may be open or blind copied. In some systems there is the option of using a regular signature, a pen name, or anonymity. Those to whom messages can be sent may or may not be restricted. Messages are retained in the computer and delivered when the recipient signs on line. Confirmation of the time and date of delivery is usually provided to the sender.

o CONFERENCES: are a common writing space for group deliberations. Upon accessing a conference, users are brought up to date in the proceedings. Membership is controlled by a moderator. Participation is usually asynchronous but may at times be conducted in 'real time.' Conferences may be a few weeks to several years in duration, and the size may range from two to more than fifty members. Some conferences may be 'public,' or open to all members of a given system.

o NOTEBOOKS OR FILES: are personal spaces useful for drafting or coauthoring material which later will be submitted to other parts of the system, and for storage of items such as customized programs and documents.

o BULLETINS or JOURNALS: are spaces for the generation and submission of reports, newsletter items, and formal papers. Special software may allow refereeing by anonymous reviewers, and abstracts can permit recipients to access the full text only if it is of interest.

o TEXT EDITOR: allows users to revise or modify material while preparing it or afterwards.

Advanced systems may also include mechanisms for such tasks as searching and retrieving, indexing, voting, merging text, delayed entries, alarms, reminder files, and calendars. They may also be integrated with data bases and decision support or other analytical tools.

Procedure

A two-day face-to-face workshop was held in New Jersey in July 1980 and attended by eighteen researchers working in this field and representing twelve separate research projects related to the operational trials of EIES and a number of other systems. Invited to attend were all known scholars who had published evaluational findings. Because of expense or time conflicts, some could not attend the face-to-face workshop; however, their participation was solicited in the group's post-meeting activities through EIES, mail, or telephone.

At the workshop, the major findings for each of the operational trials and other evaluational projects were summarized, with the focus on the similarities and differences discovered among them. The participants were then divided into subgroups to generate the lists of factors about which data would be systematically collected. Following the workshop, the EIES system was used to continue this work and to organize and write the report. The lists were reviewed and refined by on-line working groups and transformed into "data report forms." These forms and working papers were distributed via EIES and the mail to gather additional input from others working in the area, so as to collect comparable data for as many projects as possible.

Synthesizing Expert Opinions: A Modified Delphi Approach

While some of the operational trials or case studies of computer-mediated communication have been extensively documented in the literature, there are many about which only sparse accounts are publicly available. This is particularly true of the acquired wisdom of designers, who tend to prefer to work on new enhancements of their systems rather than document and critique the successes and failures of software that has already been implemented. Another problem is that even the published studies do not use a common framework, so that it is difficult to compare the results of various studies or to construct a basis for the generation of cumulative results for future research.

Conversations within the "invisible college" of scholars working in this area indicated that many of them had observations that had not been documented in the open literature. The opinions formed on the basis of their studies were a form of expertise available to be tapped. A modified Delphi approach was chosen to gather and synthesize this acquired knowledge.

Delphi is a method for collecting and utilizing the opinions of experts. It may be characterized as:

> ... a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem. To accomplish this 'structured communication' there is provided: some feedback of individual contributions of information and knowledge; some assessment of the group judgment or view; some opportunity for individuals to revise views; and some degree of anonymity for the individual responses (Linstone and Turoff, 1975:3).

This project can be considered a "modified Delphi" because the last condition was absent. This was considered necessary for the group to understand the context of the differing opinions or observations. In all other respects, it was a Delphi. Common data report instruments were designed and mailed to systems designers (for the systems module), group leaders or managers (for the task module), and evaluators (for the acceptance and impacts modules). The results were tabulated, summarized, and returned to the respondents, who were invited to comment on observed differences or to change their ratings if the comparative data and discussion altered their opinions.

Factors in Computer-Mediated Communication Systems

The conceptual framework used to integrate this report is a closed system with multiple feedback loops. Expanding and building on the list of factors generated by Vallee et al. (1974:22), the determinants of acceptance and usage of computer-mediated communication systems can be categorized as characteristics of the SYSTEM itself, including terminals and other equipment available to users, the TASK or activity being performed on line, attributes of the INDIVIDUAL user, and attributes of the GROUP or organizational context. The interaction of these factors determines the level of system ACCEPTANCE, which includes both the amount of use and the users' subjective attitudes of satisfaction or dissatisfaction. EVALUATION of these systems may produce feedback to the designers which can change the nature of the system itself and the tasks or applications for which it is subsequently employed. The evauation methods used will to some extent filter the IMPACTS upon attitudes and behaviors of the individuals or groups.

There are of course societal inputs which may intrude upon this system of variables, such as government regulations and changes in the economy. Such influences external to the system and its user community are defined as outside the limits of this study.

Comparability of the Data

We are confronted with the classic problem of comparing apples and oranges. Both independent and dependent variables tend to be conceptualized and measured differently in most of the studies. We have tried to equate them by pulling out a common set of variables and asking the researchers to report their results regardless of the specific indicators used. An empirical fruit salad is served as a result. Data are plucked from their initial context and set down next to one another under a conceptual salad dressing. Whether this serves to make the data digestible and palatable, or merely creates a false uniformity that glosses over the initial differences among the studies and destroys their integrity, will have to be judged by the reader.

DESCRIPTIONS OF THE SYSTEMS AND GROUPS STUDIED

Below is a brief overview of the nature of each of the groups represented in this report. The shortened name refers to it throughout the body of the report and in the Appendix. Listed first are EIES operational trials, followed by other systems.

EIES OPERATIONAL TRIALS

EIES (Electronic Information Exchange System) was designed by Murray Turoff. It includes messages, conferences, notebooks, and a large number of special structures and advanced features. Its development and initial years of operation were financed by the National Science Foundation's Division of Information Science and Technology. Grant applications were solicited and competitively awarded to scientific groups wishing to use the system (NSF 76-45). Each group was required to produce an evaluation of its experiences. The four groups listed first were small scientific research communities with no specific goals other than improving their informal communications. Subsequent operational trial groups tended to have specific goals or tasks that they wished to accomplish in addition to improving their communications.

FUTURES: The Futures Research Group was coordinated by Joseph P. Martino and evaluated by John Bregenzer. It was composed of researchers from the multidisciplinary futures community who were concerned with planning, forecasting, and anticipating the future. Examples of such research include the development of structural and cross impact models, the generation of scenarios, and the conduct of Delphi sequences (See Martino and Bregenzer, 1980; Bregenzer and Martino, 1980).

SOCIAL NETS: The Social Networks group, led by Linton C. Freeman, included scholars from a variety of academic disciplines concerned with studying the nature of social networks (See Freeman and Freeman, 1980). Although two members took part in the face-to-face workshop meeting and contributed to the project, data reports were not completed for this group.

GST: The General Systems Theory group, coordinated by Stuart A. Umpleby, consisted of a small research community attempting to integrate a number of scientific disciplines under the rubric of a systems approach to theory (See Umpleby, 1980).

DEVICES: Jane H. McCarroll headed this multidisciplinary group which consisted of those concerned with the research and development of devices for the disabled (See McCarroll, 1980).

OTHER EIES GROUPS:

HEPATITIS: Elliot Siegel coordinated a group of experts in the field of viral hepatitis collaborating with the National Library of Medicine to validate and update a hepatitis data base intended to facilitate information transfer to health practitioners (See Siegel, 1980).

JEDEC: This group, facilitated and evaluated by Peter and Trudy Johnson-Lenz, utilized EIES to develop standards for the Joint Electron Devices Council (See Johnson-Lenz and Johnson-Lenz, 1980b).

LEGITECH: Coordinated by Chandler Harrison Stevens and evaluated by Valarie C. Lamont, LEGITECH connected a large number of researchers concerned with scientific and technology issues of their various state legislatures. A special self-filtering communication structure, called "Topics," was designed for their use (See Lamont, 1980; Stevens, 1980; Johnson-Lenz and Johnson-Lenz, 1988d, 1981).

WHCLIS: The White House Conference on Library and Information Services, coordinated and evaluated by Elaine B. Kerr, utilized EIES for the planning of that national conference (See Kerr, 1980).

WORKLOAD

"Mental Workload" can be described as the study of human factors in complex man-machine systems, such as the cockpit of a jet plane or the control panel of a nuclear power plant. Most of the members of this multidisciplinary group were engineers or psychologists. A group conference was concerned with the definition and discussion of the effects of physical, emotional, and mental stress on the decision-making behavior of people working with high technology equipment. In addition, it had the goal of producing an on-line "electronic journal." The group was the least satisfied of all of the small research communities studied by Hiltz (1980). Although the software for the journal was completed, only one article was ever "published." There was a lively discussion at the time of the Three Mile Island incident, but the group conference never seemed to achieve closure on topics. Hiltz observed that facilitative leadership seemed to be missing: the group's nominal leader spent comparatively little time on line, and no one else assumed a leadership role. One of the evaluation reports completed for the effort (Guillaume, 1980:27) reports a similar conclusion:

> The types of activity and interactions observed and the continuing lack of social and procedural interactions suggest that the failure to produce a journal was not a result of the hardware and software aspects of the system, but rather a result of the failure of the group to recognize and apply appropriate maintenance and task functions which would have facilitated the work of the group. These functions were particularly necessary because of the initial ambiguous attitudes regarding the usefulness of the system... The failure, then, was a result of a breakdown in group processes.

Other Systems

PLANET

PLANET is a very simple conferencing system. The user need not learn many commands, wait for line prompts, or use carriage returns. It is the easiest of these systems to learn to use. The other side of this coin is that there are few features. Lines or items, once entered, cannot be edited, and users can communicate only with those in the same conference or discussion group. PLANET has been studied with a wide variety of user groups, particularly geologists and other scientific or research groups (See Johansen, DeGrasse, and Wilson, 1978; Johansen, Vallee, and Spangler, 1979; Vallee et al., 1975, 1978). It is now licensed for commercial use to Infomedia Corporation, headed by Jacques Vallee. At the Institute for the Future, current research and development are focused on HUB.

HUB

The HUB system adds three other forms of computer-mediated communications to an unstructured conferencing capability similar to PLANET: graphical communication through a shared visual space, communication focused on the operating of computer programs through its program workspace, and communication focused on the creation and editing of a document in its document workspace (Lipinski, Spang, and Tydeman, 1980:159). User groups have included corporate planners and computer scientists in academic and military settings.

COM

This is a conferencing system designed by Jacob Palme and developed at the Swedish National Defense Research Institute (See Palme, 1979 and Palme et al., 1980). It currently has about 375 active users; most are researchers at various technical institutes. Evaluations have been conducted by an anthropologist and so far are available only in Swedish (see Adriansson, 1980).

CONFER

CONFER is a conferencing system designed by Robert Parnes which currently operates on Amdahl computers at the University of Michigan and Wayne State University. More than 1500 users have been informally observed during a period of five years, including a wide variety of students, staff, and faculty at the two universities and outside user groups of both a not-for-profit and commercial nature. Since CONFER is a special applications program running under the Michigan Terminal System, users may also access a large number of other computing facilities under MTS, including text processors, data bases, statistical packages, and programming languages (See Parnes, Hench, and Zinn, 1977; Zinn, 1979).

PANALOG

Edward M. Housman of GTE Labs is the designer of this conferencing system. A research effort, it has more than one hundred users from all walks of life: teenagers, scientists, deaf people, artists, technicians, executives, etc. Only one user at a time can be on line (See Housman, 1980; Seabrook, 1978).

NLS

The On Line System, designed by Douglas Englebart to augment knowledge work, is now called AUGMENT and marketed by TYMNET. NLS is a general office support system. It is well suited to document production, particularly when used with with an intelligent terminal and a special "mouse" device for editing. It includes three communications capabilities: the exchange of messages asynchronously or in real time and the exchange of files. It does not include a conferencing component or other structures to maximize group communication.

An early evalution of NLS was conducted by Bair (1974) and serves as the main basis for his input to this study. Another evaluation of NLS in non-military business settings was conducted by Edwards (1977).

OICS

OICS is an acronym for the Office Information Communication System. This extensive project, conducted by Bell Northern's Software Research group, headed by Don Tapscott, employed a pilot system built especially for the study. It is a fully integrated office system, which has as one of its components the COCOS electronic mail system, developed by BNR, allowing users to compose, send, forward, reply to and file electronic messages. For paper correspondence, there is a program which automatically generates formatted letters and memos. There is also the capability for short synchronous messages.

Several text editors are available for text processing, and a line-oriented editor with a terse user interface was chosen most often (Tapscott, 1980:7). There is also a text formatting program for document production, including pagination, tables of contents, and an automatic spelling check using three dictionaries as data bases.

An information retrieval subsystem provides data bases for any type of information; a project bibliography and conference and seminar schedule were among those used during the pilot study. There is also an administrative function subset, with features such as phone lists, cost tracking schedules, and personal logs.

Finally, analytical tools include both simple calculations such as those which could be done with a desk calculator, a variety of statistical applications including graphical output, and data processing facilities.

The study is a "quasi-experimental" field study. Nineteen "knowledge workers," consisting of seven managers, eight professionals, and four administrators, were given electronic work stations and the use of the system, and were compared with a control group. Data collection included a pretest questionnaire, monitor statistics on use (which averaged more than three hours per day), and post-test interviews and questionnaires (Ibid).

MACC @MAIL

This system originated in 1976, when the fledgling EDUNET organization financed the University of Wisconsin to develop an electronic mail system for communication among its network members. It was then called Telemail. Later users included members of "Theory Net," an "invisible college" in the area of theoretical computer science sponsored by the National Science Foundation (Landweber, 1979). The system has been used fairly steadily. For instance, during a two-week monitoring period in early 1980, there were 387 registered users, of whom 202 were active, and about 150 sessions per day. An on-line EXPLAIN command can be used to obtain explanations of the available commands as well as a tutorial. Based on experiences, there are plans to enhance the system, including the addition of a conferencing-like capability (Roberts, 1980).

USC-MSG

This system was included as another example of a fairly simple message system. Its full name is MSG and LINK on TENEX at USC-ECL. The study included here involved thirty-eight residents of a retirement community (See Danowski and Sacks, 1980). USC-ECL stands for the Educational Computing Laboratoris at the University of California.

WYLBUR

The electronic mail system at the University of California's Divsion of Library Automation is implemented through a series of extensions to the widely used WYLBUR text-editing system (See Lynch, 1980). It is included as a third example of an electronic mail system.

This implementation of MAIL with WYLBUR was developed by the Division of Library Automation of the University of California. There are at least two other implementations of a MAIL system using WYLBUR-- at Stanford and at New York University.

CONCLUSIONS

This study does not begin to include all the existing computer-based communication systems. There are many commercial electronic messaging systems without published evaluations, and many proprietary systems used within single organizations. More than a thousand employees are linked by electronic mail at Continental Bank; more than five thousand use electronic messages on the ARPANET; Texas Instruments has a worldwide network of eight thousand terminals that handles more than four million messages annually; and more than twenty-five million messages a year flow through Hewlett-Packard's internal system. In addition, just about every major office products company has developed or announced plans for electronic mail services, including Tymnet's OnTyme, Telenet's Telemail, and Datapac's Envoy 100. Satellite Business Systems, Xerox ("XTEN") and AT&T ("Advanced Communication Systems") have announced the forthcoming availability of these systems. Datapoint, Wang, DEC, Prime, and IBM, among others, include this capability in their new "integrated" office systems being designed and introduced (Panko, 1980b:1-2).

The largest publicly available multi-function system is The Source, recently purchased by The Reader's Digest. Conferencing systems include a private network within Proctor and Gamble; a conference system operating at the University of Wisconsin originally developed at the federal Office of Emergency Preparedness by Murray Turoff and others; the Florida Education Computing Network Conference System (Mailman, Hubbard, and Canache, 1981); and the KOMEX system in Germany (GMD, 1979).

Our criterion for inclusion in this study was those systems which had produced a published evaluation; however, because of limitations in travel funds for workshop participants and in available time of some of the invited participants, not all systems that have been evaluated were actively involved in the exercise of pooling their findings.

As was indicated above, the most extensive of previous evaluations was for the PLANET system. Its designers completed only the systems design instrument for this study. Robert Johansen suggests that the extensive studies made at the Institute for the Future be referred to directly (see the Reference listings for Johansen and Vallee).

Other invitees who were unable to attend the face-to-face workshop and actively participate in the synthesis effort were Edwards of NLS

(Edwards 1977), and Panko and Uhlig have studied the use of HERMES and MSG on the ARPANET (Panko and Panko,1981; Uhlig, 1977). Their work, like that of Johansen and his colleagues, has been incorporated into this synthesis effort as much as possible through a review of their published findings.

It should be clear at this point that the studies and systems covered in this report by no means constitute a representative sample of computer-mediated communication systems. Given our criterion of a published evaluation and the rapidly changing nature of the emerging technology, the sample is unavoidably small. The results, however, should be more than merely suggestive of the directions that the medium will take in the future. As the prototypes in terms of both development and assessment, these systems will likely continue to serve for some time as the models for future elaboration.

CHAPTER TWO

SYSTEM AND TASK CHARACTERISTICS

The "system" includes a number of separable clusters of characteristics. Its core is the set of software capabilities and qualities defining what it can do and how it interacts with users. These software characteristics can in turn be divided into those dimensions common to all interactive computer systems and those peculiar to computer-based communication systems. A short hierarchical list of system characteristics, showing the interrrelations of software characteristics, appears as Table 2-1.

We used an expert panel of computer scientists involved in the design of the systems included in this study to rank and discuss the relative importance of various software features and to report the extent to which they are currently included in their systems. The full set of responses is included in Appendix II. Presenting the results of this survey constitutes the bulk of this chapter. Table 2-2 lists the short definitions of software characteristics presented to the panel.

A second set of characteristics can be thought of as "Implementation." On what type of computer is the sofware implemented? How many ports are there? Is it linked to a digital packet switching network? How is the system priced and paid for? What form does the documentation take? What kind of training and user support are provided? Implementation characteristics can change; for example, more ports can be added. We asked the designers to describe these characteristics of their systems, and their responses appear in the Appendix.

Finally, there is the equipment for the individual user. The desirable characteristics of terminals are treated in terms of reviewing the human factors literature relevant to this area.

"Task" is treated briefly at the end of the chapter, in terms of a morphology which we developed and used for descriptions of the tasks performed by members of the various user groups included in this study.

In covering the software characteristics, our approach is to use two dimensions simultaneously to order the discussion. First is the division between the general characteristics of interactive systems and those peculiar to computer-based communication systems. The second is to categorize the characteristics in terms of the relative importance accorded them by the designers and the extent to which there is agreement or disagreement about their relative importance. Table 2-3 presents an overview or summary in terms of the mean importance ratings and the amount of agreement or dispersion in these ratings. There is considerable overlap between the two dimensions: general characteristics of interactive systems tend to fall disproportionately into the high importance and high agreement cells of the table, while ratings of system characteristics dealing with the capabilities of computer-based communication systems in particular tend to fall into the moderate to low importance cells, as the result of exhibiting more disagreement among the designers.

Table 2-1
SYSTEM FACTORS

A. INTERACTIVE SYSTEMS- GENERAL INTERFACE FACTORS

LEARNING
- ACCESSIBILITY
- COMPREHENSION
- GUIDANCE & SELF-DOCUMENTATION
- INFORMATIVE
- SEGMENTATION

ADAPTABILITY
- CONTROL
- FLEXIBILITY & VARIETY
- LEVERAGE & SIMPLICITY
- MODIFIABILITY

BEHAVIOR
- HUMANIZATION
- REGULARITY & PREDICTABILITY
- RESPONSIVENESS

ERROR CONTROL
- FORGIVENESS & RECOVEREY
- PROTECTION
- SECURITY
- RELIABILITY
- CLOSURE

COMPUTERIZED CONFERENCING SYSTEM FACTORS

ATMOSPHERE
- SENSE OF COMMUNITY
- EVOLUTION
- HUMAN HELP

COMMUNICATIONS
- COMMUNICATION RICHNESS
- SPECIAL PURPOSE COMMUNICATION STRUCTURES
- INDIRECT COMMUNICATION CHANNELS
- DOCUMENT DISTRIBUTION
- VOTING

TEXT PROCESSING
- TEXT EDITING
- TEXT FORMATING
- DOCUMENT FORMATING
- TEXT MOBILITY
- TEXT RETRIEVAL & LINKAGES
- VIRTUAL TEXT REFERENCING
- ACTIVE & ADAPTIVE TEXT

SPECIALIZED SUPPORT SOFTWARE
- INTEGRATED DATA STRUCTURES
- USER SIMULATIONS
- MARKETPLACE STRUCTURE
- PRIVILEGES & PROTECTION

GENERAL SYSTEM FACTORS

OPERATIONAL PRACTICES
- EVALUATION & FEEDBACK
- PRICING
- PRIVACY
- OWNERSHIP
- ACCESS POLICIES
- TRAINING AND DOCUMENTATION

HARDWARE
- CAPACITY OF CENTRAL UNIT
- STORAGE
- COMMUNICATION BANDWIDTH
- RELIABILITY
- AVAILABILITY
- NETWORK INTELLIGENCE
- DISTRIBUTED PROCESSING

EQUIPMENT CHARACTERISTICS
- ACCESSABILITY
- HUMAN FACTORS ENGINEERING (SEE LIST BELOW)
- TERMINAL INTELLIGENCE
- APPEARANCE OF PRINTED MATERIAL FROM TERMINAL
- TERMINAL INTERFACE CHARACTERISTICS

SYSTEM SOFTWARE FACTORS

A computerized conferencing or message system is an interactive computer system. There is a considerable literature on system factors and their relationship to system acceptance. A number of major reviews exist already: Martin, 1973; Walker, 1971; Bennett, 1972 and Shneiderman, 1980. More specific reviews relating to message and conferencing systems are found in: Uhlig, 1977, Vallee, 1976, and Hiltz and Turoff, 1978b. The knowledge in this literature consists of two almost distinct categories. In the human factors literature results have been obtained by examining and experimenting with human physiology; they deal with such questions as print size, brightness of screens, and layout of keyboards. Most of these considerations apply to both computerized conferencing systems and interactive systems in general. A few specifics in this category will be dealt with in more detail at the level of terminals and output rates. However, it is clear that if users suffer from problems such as eye strain, backache and other physical discomforts, they will have a low tolerance for terminal-oriented systems. Our major concern here are the factors at the systems level which are more variable since they are dependent upon software implementation.

Unfortunately, what is known about considerations at this level does not rest on the same foundation as fundamental human factors. Much of the "wisdom" rests on either "introspection" or field trials, rather than controlled experimentation and basic psychological processes. We are dealing with cognitive processes and there have been few controls on user population characteristics. Much material is based upon the reflections or introspection of designers and implementers of "successful" systems. Field studies usually involve user polls about their reactions. However, users seldom have the opportunity of comparing alternative designs for achieving the same objective. Rarely are field trials matched in any way other than having users of different systems sometimes respond to the same questions. Introspective studies are often suspect because "success" is usually implicitly taken to be usage when the users have no choice or basis of comparison. And system designers have an understandable bias. Over the years, however, very few social scientists have investigated this area, and it is only recently that more attention has been paid to comparative studies (Shneiderman, 1980).

As a result, the factors that have been chosen are the ones that repeatedly occur in the literature. This gives them some foundation and recognizes that they can be very important if not minimally satisfied. The difficulty comes in assessing factors in combination and determining which factors may be more fundamental or may be independent measures of an interface. In fact, we are unable to find any studies that attempt to quantifiably assess the interactions among the factors. Given this situation, our discussion of factors cannot escape from a degree of subjective evaluation. Our survey is based upon the responses of designers and their degree of consensus.

The system factors defined in Table 2-2 are divided into those which apply to interactive systems in general and those which seem to have unique relationships to computerized conferencing or message systems.

Most specific interactive systems oriented to a particular application produce a subset of factors that appear to be crucial to the nature of that application. The procedure followed was to administer the list of factors with the short definitions included to the system designers who were to rate the factors on two dimensions: the extent to which they are important for systems of this type if the "ideal" system were to be constructed, and the extent to which they were incorporated into the design of that system. The instructions were to try to rate no more than about 25% of the factors as "very important" on a one-to-five scale, since it would not have helped us to learn that everything was "very important." What we wished to uncover were differences in points of view about the relative importance of factors. It should be noted that several of the designers objected to the list provided on the grounds that it seemed to reflect the biases of the EIES designer, Murray Turoff, who compiled it. An opportunity was provided on the last page to list and describe other, omitted, system factors which they felt were equally or more important than those listed.

It is important to remember that the various computer-mediated communication systems were designed to meet very different needs in very different environments. A major distinction is between INTERNAL systems for intra-organizational communication (usually dealing with office support in a homogeneous environment where the users are co-located and the systems stress "mail" and word processing rather than teleconferencing), and EXTERNAL or INTER-ORGANIZATIONAL communication systems (usually involving remote access through networks, heterogeneous user populations, and teleconferencing as well as mail).

TABLE 2-2

DEFINITIONS OF SYSTEM FACTORS

INTERACTIVE SYSTEMS - GENERAL INTERFACE FACTORS

ACCESSIBILITY: The knowledge and effort needed by users to gain access to a system.

CLOSURE: Informing users when an operation has been successfully or unsuccessfully completed.

COMPREHENSION: The ability of users to understand as a whole what the system is capable of accomplishing, before having to learn how to do it.

CONTROL: The ability of users to feel in control of the computer, while making sure they understand what they are doing and where they are in the interaction.

FLEXIBILITY & VARIETY: The ability of users to tailor the system to their own style of interaction in carrying out tasks.

FORGIVENESS & RECOVERY: The ability of the system not to penalize users unnecessarily for mistakes and to provide mechanisms to easily recover from errors.

GUIDANCE & SELF-DOCUMENTATION: The ability of the system to provide guidance or training to the user as and when required.

HUMANIZATION: Treating the user as an intelligent human being rather than as a slave of the computer.

INFORMATIVE: Proving clear information for users on what they are being asked to do in terms of operations or errors.

LEVERAGE & SIMPLICITY: The ability of users to execute significant computer operations with a minimum of interface effort (minimization of the number and length of user-supplied entries).

MODIFIABILITY: The ability of users to adapt the system to serve their needs.

PROTECTION: Protection of the system from damage by a user interaction.

SECURITY: Ability to protect the users' data from errors unintentionally or intentionally generated by the system or other humans.

SEGMENTATION: The ability of the user to learn only the minimum in order to carry out a specific task.

REGULARITY AND PREDICTABILITY: The ability of a user to anticipate the actions of the computer and to expect consistent responses to operations and functions.

RELIABILITY: The ability of the system to function without error or loss of data. Also, the frequency and length of of instances of the system being unavailable during scheduled operation.

RESPONSIVNESS: The ability of the system to respond quickly and meaningfully to user requests to carry out various operations and functions.

COMPUTER MEDIATED COMMUNICATION SYSTEMS - SYSTEM FACTORS

COMMUNICATION RICHNESS: The richness of the communication options offered, such as conferences, messages and document access, and the variety of communication features associated with the options, such as confirmations of deliveries, notifications of access, use of pen names, status reports of readership, footnote and commenting or voting features. This factor is concerned with what might be considered general-purpose communication structures.

SPECIAL PURPOSE COMMUNICATION STRUCTURES: The ability of the system to supply or be adapted to supply special-purpose communication structures for activities such as facilitating, providing protection from information overload by filtering, allowing participation by very large groups through rules of order, incorporating systems such as personalized calendars which allow direct or indirect communications among the users.

INTEGRATED DATA STRUCTURES: The ability of the users to communicate data in other than free text and the ability of the computer to recognize data items and who has authored them. It is usually assumed that such structures maintain the identity of the creators or suppliers of the data and allow authorship control over the segments of the data structures the user is responsible for. An example of this might be a budget planning system.

INDIRECT COMMUNICATION CHANNELS: The ability to set up indirect communication linkages among individuals and groups, such as informing a group of authors what the readers are looking for and not finding in key word searches.

VOTING: Provision of voting scales which may be associated with items for responses by others, with feedback to participants.

PRIVILEGES & PROTECTION: The ability of the system to preserve the access privilege structure provided by the author of material and to deal with read, write, edit and utilize access both on the part of the sender and receiver. In some instances it is necessary to allow a function triggered by a user to access material for utilization that was supplied by another user. However, the user making use of this material would not necessarily have reading privileges for that material. An example is being able to ask of someone else's calendar if they can meet on a certain date and time. This is "utilize" access and is different from the more standard forms of access usually provided on interactive systems. The ability of the user to understand the forms of access and to make use of them as well as to be able to track their use by others on his or her material is a further aspect of this factor.

SENSE OF COMMUNITY: The ability of the system to provide features, such as membership and interest directories, which allow users to form communities of interests as needed.

EVOLUTION: The ability of the system to change through feedback from its user community.

HUMAN HELP: The ablity of the system to supply human help directly to users.

TEXT EDITING: The direct modification of text during the composition process.

TEXT FORMATING: The ability to have the computer set up the formats for text such as paragraphing, tables, spacing, margins, etc.

DOCUMENT FORMATING: The ability to format a document by paging and incorporating such things as headings.

DOCUMENT DISTRIBUTION: The features which allow the distribution of documents to interested parties.

TEXT MOBILITY: The ablity to move text around the system, such as from a message into a personal notebook.

TEXT RETRIEVAL & LINKAGES: The relationships, indexes and linkages set up to relate items of text to one another, and the possibilities of dealing with non-linear type documents such as in "hypertext."

VIRTUAL TEXT REFERENCING: The ability to reference and incorporate existing text items in new text items in a virtual manner.

ACTIVE & ADAPTIVE TEXT: The ability of text to incorporate programs or functions that are executed as part of the delivery mechanism to readers. This includes the ability of text to contain forms or surveys for the reader to respond to and to make conditional on various factors or specific responses what the reader actually sees.

USER SIMULATIONS: The ability of a system to develop tailored programs to simulate aspects of users' communication behavior, and thereby augment their communication capabilities by acting as an intermediary. A simple example would be a background task to carry out a search while the user is off line.

MARKETPLACE STRUCTURES: Software designed to facilitate payments based on the provision and use of information. For example, the ability of a user to advertise and price information and to collect revenues for its use.

Table 2-3
Summary of Ratings of System Features
Relative Importance (Means- Shown in Parentheses)
and Amount of Agreement (Standard Deviations)

IMPORTANCE	AGREEMENT (SD 1.0 or less)	DISAGREEMENT (SD 1.1 or more)
HIGH IMPORTANCE (X < 1.5)	Accessability (1.2) Text editing (1.2) Humanization (1.3) Guidance and self documentation (1.3) Control (1.3) Forgiveness & recovery (1.3) Responsiveness (1.4)	
MODERATE IMPORTANCE (X = 1.5-2.0)	Reliability (1.6) Text mobility (1.6) Segmentation (1.7) Text retrieval & linkages (2.0) Closure (2.0)	Protection (1.6) Evolution (1.6) Informative (1.9) Communication Richness (2.0) Sense of community (2.0)
LESS IMPORTANCE (X = 2.1 or more)	Human help (2.1) Text formatting (2.3) Document distribution (2.6) Integrated data structures (2.8) Virtual text referencing (3.1)	Regularity and predictability (2.2) Leverage and simplicity (2.3) Privileges & protection (2.3) Flexibility (2.6) Active and adaptive text (2.6) Modifiability (2.7) Special purpose structures (2.8) Indirect communication channels (2.8) Voting (2.8) Marketplace structures (2.8) Comprehension (3.0) User simulations (3.0)

GENERAL INTERFACE CHARACTERISTICS

With the exception of text editing, all of the system characteristics for which there is near unanimity on high importance consist of factors applicable to any interactive computer system. We will deal first with the characteristics in the top left cell of Table 2-2, which can be considered the systems design equivalents of "motherhhood and applie pie," according to the ratings of our panel. We will then turn to the factors given moderately high ratings, and finally to those which are considered less crucial.

Accessibility

Accessibility is generally recognized to be important by almost all designers working with populations of non-computer oriented users. It is also one of the issues most ignored by designers of systems software. Complaints about standard sign-on protocols through industry-provided executive software or various communication nets are rather commonplace. In itself it rarely seems to be a determining factor in acceptance except in extreme cases of individuals who are already highly negative and looking for further excuses not to use the system. While it is a factor often expressed historically, it might better be considered a component of the more general area of "humanization" discussed below. The less a user has to do to access the specific task or system, the better. With the proliferation of more intelligent terminals and microcomputers, this problem is being solved by sign-on procedures stored in the terminal's software which automatically execute the steps needed to access a task. While most computer manufacturers have discovered this as an issue to address, some of the interconnection schemes from one nation's digital network to another require users to supply addresses of more than 16 characters.

Accessibility in practice is of course also a function of the availability of terminals. Ideally, terminals would be ubiquitous--on everyone's desk at home as well as at work.

The designers are fairly unanimous that accessibility is very important. Seven rate it as "1", "very important," and two rate it as "2", "important." Judgments about what is easy and what is difficult are illuminated by the comments. For instance, the COM designer rates his system as only a "3" because remote users must use a phone and modem rather than simply turning on a switch, and CONFER's Parnes likewise gives the system a "3" because of the difficulty of the TELENET interface. Yet the @MAIL designer, Dave Brown, gives his system a "1" when it requires a telephone, modem, and the unfriendly TELENET interface for remote users to access. There is evidently some disagreement about precisely what constitutes easy accessibility. From the comments of most of the designers, it would seem that an ideally accessible system would require merely setting one switch on a terminal and entering an identifying name and password.

Control and Forgiveness

Control is the user's sense of being in control of the system rather than the system dictating the interaction. One aspect of this is providing mechanisms with which users can easily escape or change their minds about procedures in which they find themselves. It also means they should be allowed to delete items such as messages or conference comments if they change their minds. Some message systems are set up like the post office so that writers lose control of their material once it is sent. In most systems, control problems usually result from not providing users with an understanding of how to master the machine and the poor working of interactive questions which give the impression of "bullying" the user (Bennett, 1972). Control as a subjective reaction is probably also associated with "forgiveness and recovery." This is the extent to which the system forgives the user for making an error. The usual objective is that the user should not have to exert more effort to correct an error than it took to make it in the first place. Most current systems do not provide complete audit trails, so that the deletion of a text item usually means that it must be retyped. However, most attempt to provide a secondary confirmation question before completing a requested deletion. Individuals who integrate a system into their daily tasks, spending long hours with an interactive system, find forgiveness a crucial factor, since when working under pressure they tend to have a higher than normal error rate. In constrast, new users are likely be slower and and more careful. It is therefore possible that forgiveness is a crucial factor for the experienced users, and in this sense is tied to the concept of leverage and simplicity which makes forgiveness a more challenging design problem.

The panel of designers is fairly unanimous that control is a crucial characteristic for computer-based conferencing systems. All rate it as "1" or "2" in importance. The comments indicate that it is particularly important for inexperienced users. The close tie to the concept of forgiveness and recovery is indicated by the fact the the mean rating and standard deviation is exactly the same for the two system characteristics.

Guidance and Self Documentation

Guidance is the degree to which a system allows users to learn as they use it. Many writers have observed that users prefer "trial and error" learning (Bennett, 1972) so that the most effective form of guidance is selective help messages which can be triggered for printout at any point in the interaction. It is also possible to have the system demonstrate to the user how to interact with it by mimicking an interaction supplied from a stored file. The dynamic aspects of an interactive system are much easier to show by illustration than by descriptive writings. Comprehensive write-ups are usually too wordy for most users to tolerate and are more often used as references to answer specific questions from experienced users.

The designers are fairly unanimous on the crucial importance of this characteristic. The only exception is the WYLBUR mail system, whose designer feels that such on-line guidance to enable users to learn without studying print is useful mainly for casual users, and that it is better to rely on print. More specifically, Lynch feels that at least for a mail system, one should be able to read just a few pages of documentation, and then USE it-- one should not need online help. Most of the other systems report the successful use of "help," "explain," or "?" commands to allow users to get documentation or tutorials on line.

Responsiveness

"Responsiveness" is the ability of the system to react quickly to user actions. It may be better to have slightly slower and regular response rates than highly irregular ones for a given operation (Martin, 1973). Users are willing to wait longer when they believe their requested operations take more effort, although their beliefs may be different from the reality of what is time consuming for the computer.

All the designers have made efforts to keep response time low. During busy periods, however, it may decline or become erratic on most systems. CONFER, for instance, reports that response is virtually instantaneous if system activity as a whole is low; however, during busy periods, it may take as long as five seconds for the system to respond with a prompt. EIES tries to deal with the problem by assigning priorites according to the nature of the operation being carried out, with composition receiving the highest priority and therefore the lowest response time, and searches receiving the fastest of four priority levels.

Humanization

The term that has recently emerged to encompass a number of these factors, with the additions that the system should be polite and respectful to users and that transactions should be courteous, is "humanization" (Sterling, 1975, 1974). This includes a number of values about the protection of private information. In terms of computerized conferencing systems it is associated with protecting pen names and anonymity in those systems which provide them. It suggests that the system should relieve the user of unnecessary chores and should address ethical issues such as the ownership of information.

Six of the nine designers rate "humanization" as being of the highest importance; the other three give it a "2". However, what is "human" seems to be interpreted differently. CONFER, HUB and PLANET emphasize the use of simple English words for commands and prompts, while WYLBUR implicitly disagrees that the use of full English is the "natural" human tendency by emphasizing the availability of multiple command abbreviations rather than full English language words. The designer notes that full words are available, but users stop using them fairly quickly. MACC mentions its "friendly" documentation and EIES its human user consultants available for help. As the PANALOG designer states, "All feel the user should be treated as a human being...", but the problem is that what seems friendly and natural to the novice may begin to seem verbose and burdensome to an experienced user.

Leverage and Simplicity/Modifiability

Leverage and simplicity suggest that more experienced users wish to perform more powerful operations with less need to directly interact with the system and need a longer lever with which to execute tasks. One way to provide this is to allow them to define their own commands. Another approach is to provide more general high-level commands for all users. As a system becomes more complex in terms of the options offered, this measure becomes associated with how modifiable the system is. This is the extent to which it can be tailored to reflect the user tasks as opposed to the basic system design. Highly tailored message systems which reflect the corporate memo form have been modified to reflect user tasks. More general systems attempt to provide this degree of modifiability within a more general framework. It is easier for users to accept a system which appears on the surface to fit into their task environment. A general system that can be tailored to a host of different user environments is not an easy system level task, and most of the initial message and conferencing systems do not have this degree of modifiablity.

Both these characteristics elicited much disagreement about their relative importance and yielded relatively low mean ratings. The highest ratings for the importance of "leverage" came from the most complex systems (EIES, HUB, and OICS) where they are perhaps most necessary. There is fairly close agreement in this case between the extent to which a system is reported as having the characteristic and the relative importance assigned to it. This is also true of modifiability: the designers of modifiable systems feel that it is important. For instance, HUB, which responds a "4" on importance and a "5" on the inclusion of modifibility, comments that its "basic structure cannot be changed. Assembly language complex to modify." However, there seems to be some difference of interpretation in what "modifiability" means. It was defined as "the ability of users to adapt the system to serve their needs." The WYLBUR representative reports that "if the system meets needs, there is little need to modify it (an implementor operation, as opposed to tailoring, which the user does.") However, the possibility of "tailoring" is included in the concept which we labelled "modifibility."

Flexibility and Variety

Flexibility and variety give users the ability to adapt their own personal style of interaction to the system. One way of accomplishing this is to provide different interfaces such as both commands and menus. Even when given a fairly homogeneous population of users in which the optimum interface can be predicted, there will still be a minority who prefer a different mode of interaction. Another aspect of flexibility is the users' ability to be at one level in the system regardless of the task being performed. In other words, any command may be executed at any time in any system state. This gives users the greatest ability to control their sequence of actions. Certainly the design choices here influence the sense of control that users feel.

Flexibility is closely related to the concept of modifiability and the ratings are similar: relatively low, but with considerable disagreement, as some designers assign it a high degree of importance. The COM designer, Palme, feels that there is a risk that too much flexibility will give too much complexity for novices. The MACC @MAIL designer feels that such features are expensive and little used.

Informativeness

An "informative" system is one in which error messages or other information delivered to users pinpoints the state of the system. For example, an error message informs users of what kind of error has been made, rather than simply that an error has occurred. Because this can mean a 30% or more added programming effort for a reasonably complex system, it is sometimes neglected in the press to get a system operational.

The importance of a system being informative is given a moderate rating overall, and with considerable disagreement. This is because one system, PANALOG, gives the characteristic a "5" rating. If this response were excluded, all the other ratings are "1" or "2"; in other words, it would rate quite high. There is the problem, however, of a fine line between being "informative" and being bothersome or "verbose" and annoying users with too much information about what a program is doing or can do.

OTHER FACTORS- INTERACTIVE SYSTEMS DESIGN

Having dispensed with motherhood (accessibility), apple pie (humanization), and other agreed-upon ideals for interactive systems, we will now turn to other interactive system characteristics that are rated as somewhat less important or have less consensus as principles.

Reliability

"Reliability" is the ability of the system to maintain data, in this case communications, without loss. For fostering human communication this is a crucial item in that no system will be used that loses communications. Most designers are well aware of this point and it does not seem to have been a problem in any of the systems to date.

All of the designers except Housman of PANALOG rate reliability as a "1" or "2" and use measures such as back-up files to ensure minimal data loss in the event of a system crash. Housman maintains that the PANALOG users accept occasional message losses, especially with apologies.

Protection and Security

Protection, sometimes referred to as "bullet proofing," is the objective of protecting the system from possible damage by users. This can be somewhat difficult in a time-sharing environment. The impact is that damage to the system by one user may hurt others.

Some SOURCE users, for example, threatened to destroy system directories unless price increases were rescinded.

The complement of protection of the system from the user is the security of the user's data from damage or mistakes made by the system. For instance, can whole files be wiped out by a bug or crash? Can errors occur whereby unauthorized persons obtain access to materials which were not directed to them?

The importance of protection is rated moderately high overall, but there is disagreement. As in several other instances, it is caused by the response of the PANALOG designer, who gives this characteristic a "5"; all others rate it at the top or next to top level of importance.

The same rating pattern occurs for the closely related concept of security: seven of the nine designers give it a "1" and one rates it a "2". The PANALOG designer gives it a "5", thereby reducing its average importance. The HUB system automatically encrypts files to increase security. However, in the case of power or hardware failures, system errors may damage or delete files.

As the COM designer notes, privileges which may be useful in some instances also provide a possible loss of protection from a mistake made by the privileged user: for instance, giving a conference organizer or moderator deletion privileges means that she or he might mistakenly delete items or whole transcripts.

Closure

Closure is the notification to a user that an initiated operation has been completed. It should come often enough to free short-term memory before proceeding to the next task. The nature of computerized conferencing and message systems usually leads to rapid closure by successive prompts and confirmations that messages have been sent. As a system becomes more complex the nature of closure becomes more sensitive. In a very sophisticated system a user can trigger tasks to be accomplished while doing something else or even while off line. The issue then arises as to when to notify a user of closure or non-closure, if for example, a message has not been delivered. Beginning users seem to want more closure than do more experienced users (Shneiderman, 1980). Closure is probably not independent from the measure of "control" discussed below.

Te desirability of closure is a very controversial issue among the designers. The HUB designer, who rates it a "4" on the 1-5 scale, states that it becomes very tiresome and is needed only if you have a "flaky" system that might not always carry out the expected procedure because of a crash or software bug. Therefore, messages are not acknowledged as sent on HUB, and complex tasks are acknowledged by the receipt of the next prompt in the sequence rather than by any confirmation that the preceding step has been accomplished. It should be remembered that HUB includes a modelling system; certainly it would be tiresome to have every step of a set of computations confirmed. The next lowest rating, a "3", is given by OICS, which is also not a conferencing system, but a general management and office support system. On the other hand the designers of the three large American conferencing systems, CONFER, EIES and PLANET, all give closure a "1" in importance. And the designers for the message systems give it a "2". In other words, the perceived importance of closure seems to be related to the main function of a system, whether it is group conferences, messages, or other professional or office support functions.

Segmentation and Comprehension

In discussing the concept and problems of segmentation in Electronic Message Systems (EMS), Panko (1981:10-15) has presented an argument that may be generalized to other types of computer-mediated communication systems and other classes of users:

> Looking at managers, the largest segment consists of people who want to delegate all terminal work. The next segment works at the terminal but only in a limited way, being content to learn only a few features. The next segment consists of people who use the system aggressively....EMS should provide good support for all levels of users. In the simplest segment, for instance, a secretarial support system is needed, or perhaps a message system very much simpler and more automatic than any of today's systems. For the complex users, extensive power could be supplied.
>
> It may...be possible to define a simple core set of commands that users could lean quickly. Later, other commands or clusters of commands could be added as desired. While many people have conceived this notion, implementation has proven surprisingly difficult, because one never knows what a given user will wish for next...
>
> Unfortunately, many programmers have adopted a philosophy that works against market segmentation. At the heart of this strategy is a belief that indirect users and simple users are in some sense bad people who must be educated to see the light and use the system (to its) full complexity...

> Since programmers often control development, it is usually difficult to do anything but expand the system to meet the needs of (the) most complex users. Medium users are left to reel through an open-ended set of commands with many error states and subtle assumptions. Light users, the most numerous in managerial circles, are pretty much left to fend for themselves.

In other words, Panko is arguing for segmentation of the system into different levels of complexity for different "market segments" of users.

Comprehension and its tradeoff with segmentation is one of the more controversial design issues leading to major differences among systems. To a large extent it is not a major factor for elementary message systems with about five to nine alternative commands. For instance, the WYLBUR-MAIL designer commennts that "Our experience is that once a user masters a small subset of commands (which is very quick), he picks up commands as he needs them with very little trouble. One key to this is to have a consistent syntax". Comprehension means that users fully understand all the functions a system could perform even though they may not necessarily know how to perform all those functions. The level of effort to completely understand a rich system might be far more than beginning users are willing to expend before doing useful work. One can overcome this problem by segmenting the system into small functional pieces that users only learn as needed to accomplish specific tasks. The danger of complete segmentation is that users may never realize that the system is capable of doing more than what was initially learned. JOSS (developed by Shaw and Baker at the RAND Corporation in the early 1960s) was so well segmented that even some experienced computer people viewed it as a calculator-type system after only half an hour's exposure and never realized it had fundamentally the power of FORTRAN. In other words, after a brief exposure it was written off as a very simple and not too powerful system. Many of the tradeoffs between these two objectives are made in the initial material and training provided new users and the mechanisms provided for later learning. However, for complex systems, exposing users to a menu rather than to a limited set of commands does make them more aware of options that they may not yet comprehend but might at some point find useful. In most conferencing systems, simple messaging is usually taught first, since this allows people to quickly begin to communicate with others and gives them an initial sense of accomplishment and comprehension.

In rating the importance of comprehension, none of the designers feel that it is very important, and some of the comments indicate that some feel that, as defined, it is a liability rather than an asset. For instance, Palme, who gives comprehension a "4" for importance and a "3" for inclusion in COM, seems to feel that it is a good thing that his "system appears limited to novices who need not see advanced features." On the other hand, the companion concept, segmentaton, is generally rated as "1" or "2" in importance, with the exception of OICS, which rates it a "3". The key part of the system, presented to all users even when the system's more complex capabilities are hidden, seems to vary quite a bit. For instance, for HUB the "conferencing module is the core; other services are learned as needed." By contrast, in MACC's @MAIL system, the core commands have to do, of course, with the basics of sending and receiving messages.

Brown notes that the user can get along with only two commands, "TO" to send a message, and "PRINT" to print an incoming message.

Regularity and Predictability

Regularity and predictability mean that the system does not behave in unexpected ways. In terms of the current generation of systems, most of the irregularity is generated by the digital packaging systems being used which tend to throw users off systems or occasionally misdirect communications. As a general rule, most irregularity occurs at the interface between systems. Sometimes this can occur in te same computer when the conferencing package is composed of a host of separate systems such as a text editor.

The reason for the lack of consensus on the importance of this characteristic is again attributable to a deviant response from the PANALOG designer, who gives it a "5". Seven of the nine rate this characteristic as a "2" in importance and most rate their systems as "2" on the one-to-five scale for incusion. However, there is a difference in interpretation underlying the apparent agreement on importance. About half the designers responded in terms of predictability or regularity for response time, rather than in terms of the predictability of what the system will do, which is the way in which the characteristic was defined.

In summary, the above factors are applicable to all interactive systems as well as to computerized conferencing systems. It is impossible to satisfy all of them in terms of any sort of global design optimization. Instead, the designer is faced with formulating some sort of workable compromise reflecting the nature of the system's use and the user population. Many of these items have inherent conflicts or represent some sensitive balance between two conflicting objectives.

Too much guidance can give users the feeling they are not in control. Frequent closure can reduce their ability for a high level of leverage. Full comprehension can significantly reduce the opportunity for segmentation. With a very modifiable system it is difficult to have generalized routines to make the system informative. Making the system totally forgiving can reduce the flexibility and variety of the interface. Finally, there are numerous internal design tradeoffs, such as between responsiveness, regularity, and accessibility versus reliability, protection, and security. In general these factors can be divided into three groups: those concerned with learning or extending one's knowledge of the system: guidance, forgiveness, segmentation, informative, and closure; those concerned with use of the system: control, comprehension, leverage, modifiability, and flexibility; and those concerned with the environment in which the internals of the system operate: accessibility, regularity, reliablity, responsiveness, security, and protection. Humanization largely represents some attempt to incorporate many of these into one grouping with the addition of the ethical component. For computerized conferencing these ethical issues are associated with ownership and privacy of the material and the identities of users.

The following factors have unique relationships to computerized conferencing and in some cases message systems. Some of these factors are more characteristic of some systems than others. And, as can be seen, there is variability in their importance ratings by the designers. This is to be expected since these systems are less than ten years old, while interactive systems have been in existence for about twenty years. In terms of user populations, the users of message systems may have exceeded 100,000 by now. Conference systems are still in the tens of thousands, and interactive systems have probably exceeded one million users if specialized business information systems are included.

One cannot expect to have general agreement at this stage of development as to the proper mix of factors or their significance for various applications and circumstances.

Text Handling

Since users are composing text, most systems have at least a crude text editing capability. In some cases a time-sharing system will utilize an existing text editing package, and in others a powerful text handling system is integrated into the system itself. There are also some aspects of text handling that seem unique to situations in which one is communicating text items among different individuals. The following classification of text handling features tends to reflect the levels of capability one can consider incorporating into a communication environment.

Text editing in this context is the simple literal or explicit correction of text during composition or afterwards to edit it. The design of text editors can be optimized based upon bandwidth and terminal type; the best editor for a slow-speed hard copy terminal may be very different from that for a high-speed CRT. Ultimately much basic text editing will be performed off line at the terminal since the cost of logic to accomplish this is becoming cheaper than the communication cost between the terminal and computer. There are many alternative editor designs and more are being developed with the growth of the microcomputer market. Concerning the relative acceptability of different editors, people seem to prefer the one they learned first and are quite reluctant to exert the effort to master a new one. It is analogous to the use of typewriter keyboards and behind the observation that the more optimum keyboard layouts available have not been able to penetrate the mass market.

The importance of a good text editor (although the definition of what is "good" lacks consensus) is the only feature of computer-mediated communication systems about which the designers are unanimous: it is rated at the top of the list, along with accessibility. However, the nature and capabilities of what is available vary tremendously, from full text editing capabilities on systems like OICS (which includes the UNIX editor) and WYLBUR 9 which is basically a text editing system to begin with, with the message capability as an add-on); to HUB, which allows text editing only on the line currently being written; and PANALOG, which offers mainly the backspace and rubout. COM is taking the approach that will probably become more prevalent in the future: the introduction of a choice of editors, so that users may choose the one best suited to their terminal (hard copy or CRT) and level of experience.

The more sophisticated forms of handling text do not seem to be crucial for the initial acceptance of these systems. On EIES it takes about 100 hours of experience before there is a shift to writing documents larger than one-page conference comments or messages. However, there is good reason to believe the sophisticated text handling features are important for long-term acceptance within an organzatonal context. The early EMISARI system allowed its users by the virtual referencing capability to compile weekly status reports incorporating earlier communications, and this was felt to be necessary to the day-to-day operation of the system.

No text handling features, other than basic text editing, are given consistently high ratings for importance. But text mobility and the related concept of text retrieval and linkages do receive consistently moderately high ratings.

Text mobility is the ability to transfer or copy pieces of text, such as incorporating part of a message into a report, for use for other than its original purpose. Associated with this is virtual text referencing which allows the user to reference an existing piece of text inside another without copying the original. In other words, a single item can be used in many different locations merely by referencing it. This facilitates the ability of groups to coauthor drafts and controls the responsibility for text items. It can be crucial to supporting accountability in formal organizations.

Most systems facilitate text mobility with copy commands or saved files which can be moved to other locations and reentered. All except the PANALOG designer rate the capability as "1" or "2".

Text retrieval and linkages are necessary to facilitate the easy compilation and reading of large documents. The definition referred to "the possibilities of referring to non-linear type documents." Readers of books are not limited to reading them completely, front to back, in sequence. In "hypertext," readers can choose which parts to read in what order, flip back and forth, and specify if they wish to see more on a particular topic or proceed to something else.

The PLANET system gives this the lowest rating; as a "simple" system to use, it retains simple linear transcripts. The PANALOG designer, who rates this capability as top importance, describes an interesting variation: the system traces the linkages among conversational messages and can trace all the "ripples" of any message.

Text formatting is the ability to vary the format of text without disturbing the literal copy. This is performed by specifying margins, page sizes, and options such as right justification and columns. Both authors and receivers of the material may need separate text formatting capabilities operating on the same text item. Text formatting becomes important when formal material, reports, and larger documents are being communicated. One difficulty is that such formatting is done for a hard copy and may actually be annoying for a reader on a CRT, for whom "page numbers" and "new pages" may be annoying.

Document formatting is the ability to control the format of a set of pages and treat that set as one complete document, providing automatic headings and pagination. Most of these features are common to any system that handles some kind of text inputting and they are not particularly different for computerized conferencing systems.

Document distribution is a form of communication. How to distribute larger documents and their abstracts so that they reach those interested and do not foster information overload is a fundamental design issue. Usually this is accomplished by communicating abstracts and providing a way for readers to access the complete document. The system often notifies the author when the larger document has been read.

Active and adaptive text means that one can allow programming capabilities as part of the text itself. For example, a text item could query its readers and use their responses to determine the flow of more text. This ability to mix programming and text can in the long run impact upon writing styles and the nature of documents. However, few systems yet provide this in terms of being an easily learned and controlled feature.

Evolution

Evolution is the idea that an interactive system grows by initially establishing a simple system and providing mechanisms for user involvement and feedback from which to advance the system design. This approach is more common with interactive systems which provide cognitive support rather than merely routine data retrieval (Walker, 1971). The technology is so new, and the possibilities for alternative functions and capabilities so numerous, that an approach of feedback, evaluation, and incremental implementation of new features is desirable. The problem is that users are then faced with a system that changes as they use it. The success of this approach is tied to the ways in which changes are presented to users and whether they feel they had adequate input to the process. It is also based on the view that users cannot adequately understand what they might do with a new technology like computerized conferencing until they have an opportunity to experience it.

The PLANET system does not have evolutionary mechanisms built in, and its designers and implementors have frequently stressed the need for a stable system rather than a constantly changing one that confuses the user. They give evolution a "4". The other designers give it a "1" or "2" rating. COM's Palme does warn, in a similar vein, that "too much change can discourage users," especially if the system evolution is guided by the expressed needs of the most advanced users, who may request changes that are detrimental to the acclimation of new users. By contrast, PANALOG's designer says that system evolution is simply "fundamental;" HUB's designer reports that the system has been evolved largely thorugh user feedback, with the third "evolution" currently being installed; the WYLBUR MAIL system's designer comments that "some of our best ideas have come from users," and CONFER's Parnes reports that his system is "constantly maturing because of user-input actively solicited" by him. In sum, the desirability of system evolution based on user feedback is rather controversial.

Communication Richness

Communication richness refers to the ability of the computer to offer a variety of ways of delivering material that are not conceivable with the mail and telephone. Even an elementary message system can incorporate features such as tailored approval by reviewers before a message is forwarded to its final destination. The original EMISARI system allowed messages to be sent to data which meant they would be delivered to those retrieving the specific data items. In terms of current systems, CONFER has a unique footnoting capability for its conference comments, and some message systems regulate message sending by job position. EIES has the ability to send messages to key words that individuals have tagged as "interests," with the resulting communication being delivered to those selecting that interest. As yet there is no clearcut pattern to these options except that they provide mechanisms by which the content can be the address and the delivery therefore can be highly conditional on the state of the system and its user population. This a high-level merging of the conditional capabilities of a computer system with those of a communications system.

The desirability of communication richness in computer-mediated communication systems is far from agreed upon, with the ratings ranging from "1" to "4". The mail systems, which offer only one or two structures for communication, are firmly opposed to offering a variety of structures. Interestingly, no one claims that their system now completely embodies the concept of communication richness. The conferencing and general purpose office support systems tend to rate it most highly and to embody the concept most fully in their designs, but COM's designer, who reports that his system includes most of the "rich" features mentioned in the definition, indicates they are not actually used with any great frequency; the simpler structures instead carry the bulk of the communications. He feels, furthermore, that if the features which provide "richness" and variety of options increase the system's complexity, they may do more harm than good.

Sense of Community

The sense of community was first noted by Ulric Neisner (1964) in his early study of programmers associated with the MAC system. He observed that in the relatively fast development atmosphere of one of the first interactive systems, the only way users (who in this case were programmers) were able to keep up was with informal communications within the close community that developed. The idea of formal user groups for major pieces of software has been accepted by industry, and others have observed that the relative success of user communities seems to be correlated with how much they exchange information on the use of the system and their willingness to help each other. In fact, a conferencing system is used at the University of Wisconsin to support user communities of different major software systems; each system is the topic of a different conference. In a number of other systems conferences or message files are devoted to discussions of system problems or used as sounding boards for new features.

The conferencing systems tend to rate the sense of community highly, and to provide mechanisms such as open on-line directories with biographical entries so that users may more easily locate others with similar interests and get to know each other. In some systems (CONFER and PLANET) the attempt to build a sense of community is limited to specific conference activities, and users cannot easily browse through a list of all system members.

A compromise is reached in COM and EIES. For COM, all users must enter a short personal description, but this public description may include no more than their address. To provide for privacy, there is a facility for protected conferences, meaning that all information about the conference (description of the conference, list of members in it, etc.) are invisible to outsiders. Palme notes, however, that "this facility is used VERY LITTLE by our users, so it does not seem to be very important." On EIES, some groups have simply chosen not to have their members fill in their directory descriptions and conference moderators choose whether or not to list conference descriptions in the public space which contains conference abstracts. On the specifically office-oriented systems, HUB and OICS, a sense of community is not considered important. Although their designers do not comment, one can speculate that it is felt that "chit-chat" resulting from socializing on line is to be discouraged. Another explanation is that mail and office support systems for intra-organizational communication do not need facilities such as directories, because most of the people know each other.

The atmosphere of a "community" can be further engineered by providing direct notification to participants of when a person "enters" or "leaves" a conference, as in PLANET, or by letting users find out "where" in the system a person is at a particular time. For instance, COM informs all users when a person connects or disconnects his or her terminal from the system and gives a list when you enter COM of who is currently connected. Palme notes that "you are also told in which conference a person is at the moment, which I also feel adds to the togetherness feeling you create. Some few of our users however feel that this facility is an infringement of their privacy rights."

Such specific mechanisms are highly dependent on the scale and mode of use of the conferencing system. For instance, unless users frequently participate in a conference "synchoronously" (at the same time), it makes no sense to make such a notification and it actually may be misleading. An example of the extent to which it may be misleading is that most EIES users participate in many conferences and have an automatic routine to scan them all and print new entries; they are not actually at their terminals when the conferences are scanned, and a notification to others that they were "entering" and "leaving" would be misleading. Problems of scale also emerge in a large system. At any one time on EIES, there are likely to be twenty to twenty-five users on line, and during a typical twenty-minute session, about half of them will sign off line and be replaced by others. That would yield an annoying once-per-minute notification of the comings and goings of system users. When one thinks of a system with thousands of users, which is now possible, such notifications would totally clog up the communication channels.

Human Help

Human help is the idea that users can get aid from persons dedicated to helping them by communicating their questions and requests for help on line. In those systems which provide this and other mechanisms for learning, it seems to be the most popular approach and ranks highest when evaluated by users. While it may be more costly than the alternatives, it apparently provides greater satisfaction. On EIES, feedback from users indicates that this is among the most popular aspects of the system, for both experienced and inexperienced users. On some systems special software is provided to facilitate this function. User consultants, as they are called, mutually review their responses to user queries to establish consistency.

User consultants may be a vital element in system acceptance. As Bair (1979:257, in Uhlig, Farber, and Bair) puts it:

> Although the best documentation and assistance may be available and frequent courses given, a continually available channel of communication with the (service providers) is necessary . . . The feedback mechanism should enable users to ask questions at any time, receive a response as fast as possible from an expert, and submit design suggestions which may eventually be implemented.

Reporting the results of another case history of office automation, Open Systems (1981:7) concludes that to obtain high acceptance and participation rates, "you have to do a lot of 'hand holding' initially-- like 24 hours of training (and encouragement) per person-- from an outside group specializing in social psychology."

Though evaluations indicate that human help is very important, especially if provided by non-programmers, as on EIES, the systems designers rate it relatively low. The modal rating for the availability of human help s a "2". Although WYLBUR reports that human help is easily and directly accessible, it is rated only a "4" in importance. Explaining this rating, Lynch notes that that the bulk of questions are usually handled by users helping one another. This may be another difference attributable to the distinction between intra-organizational systems, for which many users are co-located, and network systems linking people who are geographically dispersed.

The other below average rating is for HUB, which reports that each group on its system does have a contact person to help. Thus, the value of human help available both on and off line is somewhat controversial and is an issue that could merit a cost-benefit study. It could be, as Open Systems suggests, that it is the nature of the human help that is important: that users need to be trained in facilitating social system change, rather than in the mechanics of a specific system, speaking the users' language rather than the designers' language.

Privileges and Protection

Privileges and protection are very sensitive issues in communication systems. They are complicated by the use of indirect communication channels and the possibility of using information without being able to directly read it, as in group calendars. Also, editing privileges must be under the control of whoever is responsible for the original text, which may be either the author or the person who requested the text to be drafted.

Ratings of the importance of these capabilities range from "1" to "4". EIES, OICS, and PLANET rate it very highly, but CONFER gives it only a "4" and does not see it as a major part of these systems, although it is conceded that it may be valuable for particular applications.

Special Purpose Communication Structures

Special purpose communication structures tailor a specific set of communication protocols to a given situation. Simple examples are "electronic mail" which mimics the current internal memo system even to the replication of memo formats. Both HUB and EIES are evolving specialized structures to facilitate group problem solving. This is a reflection of the fact that even face-to-face meetings evolve structures for special purposes, from simple brainstorming protocols to legislative rules of order. However, a number of the structures that have evolved are not simple extrapolations of current face-to-face structures, but rather reflect the opportunities offered by the computer. The large group networking of Inquiries and Responses on the EIES system is a case in point.

Although two of the designers rate the availability of special purpose structures such as filtering very high, WYLBUR states that it is simply "not important." Miller, reporting for PLANET, is of the opinion that "many 'software' implementations of 'filtering' and special structures are better performed by human beings." However, if "many" are, which are better done by software, at least in terms of cost? The circumstances in which special structures are necessary or useful is certainly a controverisal issue, according to the responses of our panel of designers, and a prime area for research.

Integrated Data Structures

Integrated data structures are just beginning to emerge in the more sophisticated systems such as HUB and EIES. This is the merger of classical data base systems with a computerized conferencing system. However, most of the applications currently under way are cases in which the contents of the data base have a degree of qualitative input to be maintained. Status reports by components of ongoing projects is a typical example. As yet there is no system in which a generalized data base system is merged completely with a computerized conferencing system. RESOURCES on EIES is an attempt in that direction for formatted textual data bases.

Five of the eight designers responding rate integrated data structures as only a "3" in importance; thus there is fairly high agreement that they are "not seen as a major part of a general conferencing system," as the CONFER designer puts it. However, OICS, which comes close to this capability and will soon have an on-line data base for a budgeting system, rates it as a "1". This may be a case where the value of a feature cannot be determined until it is implemented and its perceived benefits measured for a variety of applications.

Indirect Communication Channels

Indirect communication channels refer to the the ability to alert users to the information and communication needs of others without direct communication. An example is collecting the unmatched keys used in searches of conference files and supplying the list to those writing into the file. In the EMISARI system this was used on the Policy file by those scheduling the policy committee rulings. In these systems patterns of communication and informal behavior can be processed by the computer to aid users. This area has only been explored in very primitive ways in the current generation of systems. An analogy is the use of library sign-up cards in the back of books. Before these were replaced by computer systems, people in organizational libraries could discover who else had read the same books, and this could result in the establishment of new communication paths, especially in R&D organizations. Because this implies certain dangers of invading privacy, it is a factor that can greatly impede the acceptance of such systems. It is probably best to make the use of indirect communications a very explicit process of which users are completely aware, and to reach agreement with them for incorporating new features of this type.

Several of the designers did not understand the explanation of indirect communication structures which was given. With the exception of EIES, the other designers all gave such a capability only a "3" or a "4", if they responded at all.

Voting

Voting provides a mechanism for formal feedback and promoting consensus within conferences. It can take the form of using scales already provided, such as one-to-five or one-to-ten ratings on desirability or feasibility, a rank ordering of items (see for instance, Hiltz, Turoff, and Johnson, 1981), or user-defined scales. EIES, HUB, and PLANET, designed as conferencing systems, provide a wide variety of scales, as does CONFER, which has created a technique called "Dynamic Value Voting" specifically for the computerized conferencing context. PANALOG provides simply as "YES, NO, or ABSTAIN" voting scale for issues, and COM allows voting but without any pre-constructed scales, since they are felt to constrict answers too much. Systems designed mainly to support mail or offices without a group conferencing capability do not include voting, as might be expected.

There is a great deal of disagreement about the relative importance of voting, with the ratings of importance closely paralleling the extent to which voting is incorporated into a system.

User Simulation and Marketplace Structures

These are two special structures that could be incorporated into computer-mediated communication systems. Neither of these examples gained much enthusiastic support, or even a great deal of understanding, at this point in the development of these systems.

User simulation is the idea that the system can allow its users to set up models to work for them to obtain information and carry out communications. This has only been accomplished in a very primitive way to date in terms of users establishing profiles of keys with which the system monitors communication traffic to highlight items of potential interest. Other techniques of an artificial intelligence nature could be applied to facilitate this function.

Ratings of the importance of this feature spread all the way from "1" to "5", and there is no relationship between current degree of implementation and the importance rating accorded. This is another example of a special structure for which there is too little development and experience with a variety of applications for any consensus to emerge among designers.

Marketplace structures make it possible to pay people for information or services provided on line. For instance, those who reviewed a draft paper could be credited for their effort. Or a charge could be made for the privilege of reading a report; this type of royalty would be paid by a reader to an author without the intermediary of a publisher.

Once again, ratings range all the way from "1" to "5". It is possible that those who rate it as completely unimportant do not understand the concept. The @MAIL system on MACC has implemented a system so that a reader can be charged for accessing a file, with the author receiving the credits. Certainly, if "electronic publishing" is to develop in the future, some such structure must be implemented to motivate authors to use this method to distribute their work in lieu of the royalties that would be received if it were published in more traditional ways.

OTHER CAPABILITIES

In addition to the rather extensive list of possible software features offered our panel of designers, we asked "What important characteristics of computer systems for human communication have we omitted? Please give a name and brief description for any important omitted system qualities or characteristics."

One characteristic was mentioned by two different designers and therefore should be added to a list of desirable software features. This is a "SCANNING" capability which would enable users to easily skim a condensed text version, index, or abstract of available items to to locate and select those of interest without reading the full text of all items of possible interest.

Several other characteristics are suggested by one designer:

INTERFACE COUPLING: if several interfaces are provided, such as menus and commands, they should be coupled in a cognitively "natural" manner so that the transition among them is simple for the user.

CHAIRMAN or MODERATOR: if there are conferences, they should have a leader who has the power to keep the entries on the topic. This can be provided by software giving the leader the ability to edit or delete items considered irrelevant, or to add keys or other devices to help order and integrate the discussion.

COM's designer, Palme, who realized that this item had been omitted, notes that their conference "organizers" are allowed to delete items or to move items to a conference more suitable to the subject of the item. "Deletion is very seldom used, moving items is seldom used but still valuable."

WYLBUR suggests "SCRATCHPAD FILES," which are defined as "the ability to create text and send it without naming the file." Such a problem would probably not occur to a designer who started with a communication system rather than a word processing system, since communication systems are not built around "files," at least at the level of user awareness. However, inconvenient though it may seem, many mail systems are tacked onto word processors, and require you to save and name a file before sending it to someone-- "a major nuisance", in Lynch's words.

PANALOG suggests "PERSONAL CORRESPONDENCE FILES; TICKLER FILES." Such a capability means that users have their own set of message files, one of which is time-fused to return a a designated message on an indicated date.

THE ROLE OF TERMINAL FEATURES IN DETERMINING THE ACCEPTABILITY OF COMPUTER-MEDIATED COMMUNICATION SYSTEMS

by

JOHN SENDERS

The acceptability of anything is a derived measure which reflects the degree to which a user of the thing will prefer its use to some alternative course of action. In many cases the alternatives are not available for examination or test. Then the acceptability must be inferred from some index of behaviour which meets certain criteria of face validity and common sense. Thus mere frequency of use is not enough: the user may have no alternative and the activity may be necessary. It is also the case that opinion will not suffice since with enough practice virtually anything can become natural and easy to do. For the user of anything who has acquired all the skill to be unaware of the shortcomings, the thing is acceptable and the judgment not useful. In essence the skilled user has been put into a procrustean bed and altered to fit the tool which he must use. It is for these reasons that we must examine the whole question of acceptability from the point of view of the complete novice or at least the infrequent and unskilled user (who can still recall the difficulties of use of the tool).

The present task is to analyze terminals and associated equipment and specify those characteristics which lead to acceptability. In the absence of experimental determination we must depend on experience with terminals in other uses, or even with other equipment in other uses. The exactness of our results is of necessity somewhat vitiated by the remoteness of the data from the use of terminals in an electronic conferencing system. We are, in fact, compelled to consider the characteristics of devices in general and to extract from the lists of 'good' characteristics those which are relevant to terminals, and then further to extract the characteristics which are specific to computer-mediated communication systems.

General Considerations

The acceptability of any large system is to a greater or lesser extent determined by the characteristics of the interface between the user and the system. A system may have outstanding functional characteristics and yet find poor acceptance because of the difficulties encountered by the infrequent user who finds stumbling blocks where the expert designer saw none. Similarly, the acceptability of the larger system can be strongly influenced by trivial problems of hardware design which have almost no effect on the utility of the system for the dedicated user. Such trivia will, again despite the quality of the larger system, 'turn off' the occasional user and induce outright rejection and unwillingness to explore further.

Although the essence of computer-mediated communication systems is the procedural characteristics of the system-- the way in which the system works, the way in which the user signs on, the way in which the user composes and transmits a message and so on--the casual user sees the terminal equipment first of all. The broadest of generalizations must be made: the interaction of the user should be with the contents of the system and neither with the terminal nor with the program. In particular the terminal should disappear. That quality of a tool which allows the user to feel the 'tool-work' interface rather than the 'hand-tool' interface is called projicience. A terminal should be projicient; it should allow the user truly to feel as if he/she is dealing directly with the content of the system. Similarly the program should disappear and become "transparent."

Conceptually it is easier to imagine the latter being the case. The program can be made in such a way that the user manipulates content rather than context: the user uses the system much as he uses his own memory, without conscious thought and with complete automaticity. Naturally for the highly experienced user this happens. The problem arises for the infrequent user. Here the skills of the programmer and the system designer play a most important role.

For the terminal it is more difficult. Is it possible for the terminal to have projicience? There are no absolute criteria which can be supplied the designer of terminals which will allow the goal to be achieved. Much depends on his intuitive skill. Too much experience is not a good preparation for either terminal or system design. The designer needs both experience and the ability to become again naive. Despite the fact that there are no absolute criteria, there are nonetheless a number of characteristics of terminals which will influence the acceptability of the equipment for all users.

Physical Characteristics

The list of characteristics of terminals which will affect user acceptance is very long. Almost any imaginable change, either physical or temporal, will have an influence. For many of these, and a list which is by no means complete can be found in Table 2-4, it is possible only to say that there will be limits below which a terminal becomes unsatisfactory. For instance, we can say that the contrast should be as high as possible but we cannot with confidence give a lower level below which acceptance will be less than, say, 50%. The list is really a tabulation of aspects of terminals which must be considered if one is engaged in terminal design.

The Display System

One of the most critical of the physical characteristics of terminals is the display system. The size of the display is not very critical given only that the characters printed on the screen (or paper) are sufficiently large to be read with ease by the majority of users under typical working conditions. There is, of course, a strong interaction between type size and the brightness, distance, glare, contrast, and color characteristics. If one assumes that the display is oriented properly with respect to the user, then in general, the higher the contrast, the brighter the display elements, the finer the resolution (matrix size), the less the glare, the less the flicker, the better. Ideally, the picture would have the quality of a well-printed book. Since this cannot be achieved with present commonly available technology, the system designer should strive toward that goal confident that the closer he approaches it the more acceptable will be the display. If it were possible to get the contrast attainable with print on paper, then it would be worthwhile to have a white screen with black type. Given available techniques, it is today acceptable to have bright type on a "black" screen.

Type fonts should be similar to those presented in books or by the standard IBM typewriter. They are easily read at a distance of 16 inches by a reader with even not fully corrected vision. The type should be larger than the usual typewriter (although of the same form) in order to overcome the lower contrasts achievable with either thermal printers or VDU's.

TABLE 2-4
CHARACTERISTICS TO BE CONSIDERED FOR TERMINAL DESIGN

PHYSICAL TERMINAL CHARACTERISTICS

- The Display System
  - Spatial Characteristics
    - Size
    - Orientation to User
    - Shape
  - Visual Characteristics-CRT'S
    - Brightness
    - Contrast
    - Colour
    - Glare
    - Flicker
  - Visual Characteristics-Hard Copy
    - Paper size and type
    - Print size and appearance (i.e., dot matrix)
  - Content Characteristics
    - Type Fonts
    - Character Rate
    - Scroll Method
    - Line Method
    - Page Method
    - Line Width

The Control System

Spatial Characteristics
- Size of Control Panel
- Layout of Panel
- Size of Keys
- Separation of Keys
- Shape of Panel
- Orientation of Panel
- Standardization

Functional Characteristics
- Input Rates
- Multiple Keying Response

Force and Other Characteristics
- Keystroke Forces, Maximum
- Keystroke Forces, Minimum
- Blower Noises
- Blower Wind Effects
- Keystroke Noises
- Printhead Noises
- Sound Signal Types and Availability

General Physical Characteristics

Machine Size
- Weight
- Height
- Display and Control Orientation

Portability

Shock Resistance

Reliability

Maintainability

Machine Flexibility
- Desired Mobility
- Undesired Mobility
- Flexibility of Control-Display Arrangement

Power Cord Length

GENERAL SYSTEMS CHARACTERISTICS AND WORKING ENVIRONMENT

Working Environment Characteristics

Thermal Characteristics
- Display Heat Output
- Control Panel Heat Output
- Room Temperatures

Auditory Characteristics
   Blower Noises
   Keystroke Noises
   Printhead Noises
   Signal Tones

Connection Characteristics
   Telephone Availability
   Handset Type
   Reliability of Local System

Seating Flexibility
   Height Changes
   Back Angle Changes
   Seat Angle Changes
   Back Force Changes
   Swivelling Capability
   Comfort

General System Characteristics

Access of Equipment
   Location
   Number of Users/Sharers
   Night and Weekend Access
   Freedom to Take to Own Office
   Freedom to Take Home
   Freedom to Take on Travel

Financial Matters
   Telephone Costs
   Long Distance Costs
   Paper Costs
   Maintenance Costs
   Rental Costs
   Purchase Costs

General Terminal Characteristics

Local Memory
Local Processor Capability
Programmability

The User Population

The particular effect which any of the listed characteristics will have depends to a significant degree on who is the user of the equipment. The skill, experience and expectations of the user will contract or expand the range of each of the variables tabulated which will be within the bounds of acceptability. A nervous uncertain user will be more intimidated by terminal and hardware difficulties than someone who is familiar with all the vagaries of terminals and who has learned to ignore them while using the system. Further, the experienced user will have a higher degree of efficiency in reaching his or her goal and will therefore have a higher degree of tolerance of terminal deficiencies.

Particularly as users gain experience, they will wish changes in terminal behaviour and responsiveness. More functions will be brought into play. The novice is commonly aware of only a small fraction of the system's potentialities and of the capability of a terminal to satisfy his needs. Many users remain novices forever since their use of the system may be infrequent although extend over a long time. Their use of the more elaborate system functions and terminal features will remain simplified and limited. Further, there will be interactions between terminal characteristics and the environment in which it is to be used.

The Computer-Mediated Communications Environment

Since it is not our goal to define all good terminals but only those which are good for computer-mediated communication systems, we have to inquire whether there are any characteristics which are uniquely required for the activities performed in such a system. The principal difference between CMCS usage and all other use of terminal equipment is that in the CMCS environment vastly larger quantities of textual material will be presented to and entered by the user than in other uses. Thus each aspect of a terminal which will determine acceptability in general will be more critical in the CMCS environment since there will be much more reading on-line than in other usage. Screen brightness, flicker contrast, jumpiness and so on will all be more important. Again, however, there are no hard and fast rules about how much of each of these will be tolerable or, as appropriate, required. The best advice to the system designer is to use the terminal which has maximum flexibility and responsiveness to the demands of the user. Ideally a terminal will be adjustable to whatever the user may want at any time and under any conditions of use. As users' needs change so should terminal configurations change to accommodate them.

Conclusions

Each of the listed characteristics is important and each unquestionably interacts with some of the others. The performance effects are generally flat in nature: as one changes the characteristic one gets little if any change in performance, and, frequently little if any change in opinion. The former is due largely to the fact that even if there are important and consistent differences in the efficiency of the man-machine relationship for the differences in the physical nature of the terminal, these are almost completely obscured by the adaptive nature of the human user of the equipment. Even the hypothetical change in effort required to maintain the performance at a constant level may be imperceivable to the human user since his experience in detecting minor changes in effort in a 'mental' task is limited.

The data in the handbooks and literature sources of journals and technical reports are the major basis of selection. The other is the opinion of experienced human factors engineers who may have special skills in perceiving equipment from the point of view of the naive user. Because of the interactions mentioned above, the specification task is not simple and, in fact, probably does not have unique solutions. The more appropriate method would be to optimize each aspect of terminal equipment and trust that the whole is not too much less than the sum of the parts.

TASK TYPE

Unable to find any suitable typology of tasks but aware that the type of work or task which an individual or group tries to accomplish on line affects both the perceived utility of the system and the impacts which the system will have, we decided to develop our own set of task characteristics. These are defined in Table 2-5.

The group manager, leader, or other persons likely to be familiar with the task being attempted on line was asked to report the extent to which each of these characteristics described the task for that user group. A one-to-five scale, where "1" equals "low" and "5" equals "high" was used. The responses are included as an Appendix.

Unfortunately, we do not have the ability to correlate this information with any other data, so that it remains purely descriptive. For example, because we do not have any overall user acceptance ratings, we cannot test the extent to which acceptance varied according to task type. We suspect that it does, since computer-mediated communication systems are probably more suitable for some types of tasks than for others.

We can determine that some characteristics elicited almost uniform answers, and can speculate that this represents a kind of "self selection," with these task characteristics being highly favorable for applications of computer-mediated communication systems. Most are reported to be fairly complex, high on documentation requirements, in need of high levels of coordination and exchange among participants, and aided by computer augmentation for shared analysis or data bases.

Table 2-5

DEFINITIONS OF TASK FACTORS

I. TASK ATTRIBUTES

URGENCY: The degree of pressure to meet a deadline

INTENSITY: The relative amount of an individual's available effort that must be committed to accomplishing the task

SATISFACTION: The individual and group desirability of being involved in accomplishing the task

UNIQUENESS: Extent of known previous experience by members with the task

NOVELTY: Previous experience of participants with the task

IMPORTANCE: The priority or commitment to accomplishment set for the task

UNPREDICTABILITY: The degree to which certain sub-tasks occur without warning

DURATION: The length of time over which a task is accomplished

REGULARITY or REPEATABILITY: The frequency with which the task occurs

ACCOUNTABILITY: The extent to which responsibility for actions must be accounted for by an individual

VISIBILITY: Degree to which the work or task is made known to others

EXPOSURE TO HAZARDS: Mental and physical dangers present in the task

COMPLEXITY: The level of knowledge and skill needed

GROUP ORIENTATION: The dependence of the individual upon others for accomplishing the task

PHYSICAL DEMANDS: The physical exertion or strength required

II. TASK MANAGEMENT FACTORS

DOCUMENTATION REQUIREMENTS: The extent to which a written record or written presentation is required for information pertinent to the task

COORDINATION NEEDS: The need to coordinate the work on the task with tasks being accomplished by others

EXCHANGE NEEDS: The need to exchange information with other individuals

MANAGEMENT NEEDS: The necessity to regulate the activities of a group

EFFICIENCY: The degree of benefit derived from the accomplishment of the task relative to the amount of time expended

POLICIES: The regulations governing the process whereby the task must be accomplished

COMMUNICATION OPTIONS & ALTERNATIVES: The degree to which the task may be accomplished using communication options other than the system under consideration

STRUCTURING, FACILITATION & LEADERSHIP (ie. GROUPWARE): The degree to which the communication process must be structured and facilitated

COMPUTER AUGMENTATION: The degree to which the communication aspects of the tasks involves shared analysis and data bases that can be aided by a computer environment

SUMMARY

1. In terms of system software, such characteristics of all interactive systems as accessibility, "humanization" and responsiveness are most highly rated. Text editing capabilities are also rated by system designers as extremely important, because users without microcomputers spend most of their time on line entering text. There is quite a bit of disagreement about the relative importance or even desirability of many of the software features unique to computer-mediated communication systems, such as system evolution and "communication richness. (See summary chart in Table 2-3).

2. Those terminal characteristics related to visibility are most crucial in this environment, since one must be able to see what is being typed and comfortably read the output.

3. Most of the groups whose use of computer-mediated communication systems has been evaluated were performing tasks which were complex, high in documentation requirements, in need of high levels of coordination and exchange among participants, and amenable to augmentation by the computer for shared analysis of data bases. One can surmise that such task characteristics are particularly suited to the use of computer-mediated communication systems as a primary means of communication for a group.

CHAPTER THREE

ACCEPTANCE AND USAGE OF COMPUTER-MEDIATED COMMUNICATION SYSTEMS

Initial exposure to this communications medium often occurs at small group demonstrations of a particular system or presentations at formal meetings. Afterwards, some onlookers feel excited and eager to try it themselves. Others frown, voice skepticism, or leave early. They want to have nothing to do with it. How can the same presentation of the same system produce such a range of initial reactions?

Among the people invited to make free use of EIES during the initial operational trials, about 40% never signed on at all or used the system so little (less than five hours) that they never really mastered it. Others became addicted almost from the beginning, signing on several times a day and claiming that it was one of the most productive, stimulating things they had ever encountered. Some users were not subsidized at all and made real economic sacrifices to pay the $100 or more a month they spent on EIES out of their own pockets. A few reported going into debt and leaving other bills unpaid to maintain access to a communications system that they found essential and irreplaceable. Why is it that the same system is rejected as not worth the trouble to learn by some, and considered so valuable by others that they endure economic hardships to use it?

In this chapter, we will first present the conceptual framework developed to synthesize the findings of research projects that included any observations of the determinants of acceptance of computer-based communication systems. Seven researchers, chaired by

James Bair, developed the initial list of factors during the face-to-face meeting of the group. (The others were Hiltz, Lamont, Senders, Siegel, Stern, and Turoff). This initial list was expanded and definitions added in subsequent work on EIES. The lists of factors were then revised into a data-reporting instrument, distributed to all project participants and others known to have evaluation data on these systems. Data reports were returned for six EIES studies and four other systems-- NLS, HUB, OICS, and COM. After summarizing the results of previously published research, we will examine each of the potentially important factors and present the results of our synthesis questionnaire.

THE CONCEPTUALIZATION AND MEASUREMENT OF ACCEPTANCE

Acceptance is the degree of willingness of an individual or group to utilize computer-mediated communication systems. It is a subjective factor and not easily measured. Although it is often mistakenly equated with usage, usage can be considered a measure of acceptance only if:

1) Individuals are motivated to use the system. They have a task they consider important which can be performed on line;

2) They have convenient access to terminals; and

3) They are completely free to use alternative systems for their communication activities.

As a result, the degree of compliance pressure exercised must be considered when attempting to relate usage to acceptance. If a person is directed to use a system or otherwise lose their job, they will use it but at a cost to their morale and productivity if their dissatisfaction continues. One consultant associated with a commercial electronic mail system strongly recommends that use by the "boss" will produce acceptance by others:

> We have used electronic mail when our bosses have...It becomes necessary or even critical to use electronic mail when your boss does so. Once the manager of a group begins to pass around information, meeting announcements or even work assignments by means of electronic mail, the people in that group become frequent users of the mail system (McQuillan, 1980).

In view of this, many of the research-oriented field trials of this technology may be more enlightening for understanding acceptance than the commercial applications where users frequently have no real alternatives or face high compliance pressure to carry out their tasks using the system provided.

The relationship between usage and compliance at the extremes can be represented in this manner:

DEGREE OF ACCEPTANCE

BY

COMPLIANCE PRESSURE AND USAGE

	LOW COMPLIANCE	HIGH COMPLIANCE
LOW USAGE	LOW ACCEPTANCE	ACTIVE REJECTION
HIGH USAGE	HIGH ACCEPTANCE	UNDETERMINED

Hours of use as a measure of acceptance can only be considered a valid and complete indicator if users are motivated, have access, and are not subject to compliance pressure from superiors or peers. None of the field trials met all these conditions. Ideally, one would supplement the amount of use as an indicator with subjective ratings of a system's acceptability and potential benefits.

In practice, the amount of system usage is usually collected by an automatic monitor in terms of hours of use per person, and is the only indicator which is both easily collected and used in most of the research studies.

One useful distinction is between the operator of a system and the user, who may not be identical. The operator may be a secretary who is given instructions to input or retrieve materials. As Reichwald (1980:5) puts it:

> The circle of users, on the other hand, extends to all those who make a contribution to the discharge of their duties by having direct or indirect recourse to the technical facilities.... in the situation of the operator, the technical features of the system are the primary factor that determines acceptance or non-acceptance, while in the situation of the user the contribution of the system to the performance of the tasks at hand... is the question that matters. Over and above this, however, it must be recognized that both the operator's and the user's willingness to work with the new system long-term is strongly influenced by the organizational consequences which the adoption of the system entails.

Acceptance is a composite of many factors. Our approach is to delineate these factors in a morphology that is largely situationally independent. The factors will be discussed in the context of what is known about them and their influence upon acceptance of the technology. To "know" in this context includes confirmed hypotheses as well as the acquired wisdom of those who have sought to design and evaluate the use of these systems.

We have categorized the determinants of acceptance and usage of computer-mediated communications systems into the characteristics of: 1) the individual user, 2) the social group or organizational context, 3) the task, and 4) the system itself, including the equipment with which the system is used. Aspects of the system and task which may be important have been covered in the preceeding chapter. Since any one field trial tends to cover only one system and one main type of task our evaluators could not report on correlations for these factors with degree of acceptance.

The list of potentially important factors developed for the individual and group categories is shown in Tables 3-1 and 3-2. This brief overview serves as both a warning of the complexity of the problems involved in pinpointing the determinants of acceptance and as an outline of the factors which will be examined in detail in this chapter.

The factors expressed under these categories are formed to be largely context independent in that they can apply across a variety of systems and situations. Our approach is to discuss each factor in turn, since there is little data on the influence of the factors in combination. Even where there is hard evidence, we know only the limits of extreme values of factors leading to very high or very low acceptance. The difficulty in dealing with the intermediate range and the relationships among factors in this range is that the relative degree of importance of any factor can be highly situationally dependent. This has been demonstrated by observing that the same system can be accepted by one group and completely rejected by another.

The interplay between objective "reality" and subjective expectations and impressions further complicates the process of conceptualization. The reality of the system-- what it can do and how one goes about using it-- may not be known. In particular, mistaken expectations may characterize those users who are not knowledgeable about computers. User expectations about the system or the situation may differ considerably from reality. For example, the user may know that one types into such systems, but may not know that one has to wait for prompts before typing; or that one must prefix commands with a special symbol (such as a + in EIES or a ! in COM) in order for the computer to know that it is a command to be executed. The computer system may thus appear to be totally capricious and unresponsive. Secondly, the actual experiences that a user may encounter may or may not be statistically typical of the experiences of average users. For instance, a user who habitually tries to sign on only at the busiest midday time may encounter a much higher than average number of busy signals and much slower response time than is typical.

TABLE 3-1

CHARACTERISTICS OF INDIVIDUALS WHICH MAY AFFECT SYSTEM ACCEPTANCE

A. Attitudinal Variables:

1. Attitudes toward task
   a) Relative importance or priority
   b) Degree of liking or disliking of the task (pleasant/unpleasant, challenging/boring, etc.)

2. Attitudes toward media
   a) Attitudes towards computers in general
   b) Expectations about the specific system
      1) Anticipated usefulness
      2) Anticipated impacts on productivity
      3) Anticipated difficulty of use
   c) Attitudes towards alternative media (telephones, letters, travel, etc.)

3. Attitudes toward the group (liking, respect, whether they an important reference group)

4. Expectations about how system use will affect relationships with the group

B. Skills and Characteristics:

1. Personal communication skills
   a) Reading speed
   b) Typing speed
   c) Preference for speaking or writing
   d) General literacy (writing ability)

2. Previous related experience
   a) Use of computers
   b) Use of computer terminals
   c) Use of other computer-based communication systems

3. Physical or intellectual disabilities

C. Demographic Characteristics:
1. Age
2. Sex
3. Educational level
4. Race, nationality or subculture

D. Environmental Variables:
1. Available resources, including secretarial support
2. Position in the organization (or status in the informal group)
3. Amount of pressure to use the system (from superiors and peers)

E. Psychological Variables:

1. Personality characteristics (Myers-Briggs Types of indicators)
2. Basic values (Parsonian pattern variables)

TABLE 3-2

GROUP AND ACCESS FACTORS WHICH MAY AFFECT SYSTEM USE

I. GROUP FACTORS

A. STRUCTURE
   1. Size
   2. Degree of geographic dispersion
   3. Centralized vs. decentralized control
   4. Pre-existing communication ties or network

B. LEADERSHIP
   1. Style
   2. Level of effort of activity by the leader

C. COHESIVENESS
   1. Socio-metric ties
      a) Have they met face to face?
      b) How many group members are known to each other before they begin communicating on the system?
      c) Have they worked together previously?
      d) Do they form cliques, have many "individualists," or are they an integrated group?
   2. Competitiveness
   3. Trust or openness among members

II. SELECTED ACCESS FACTORS

A. Terminal Access
   1. Own vs. shared vs. no regular access in office
   2. Availability of terminal to take home
   3. Type of terminal (CRT vs. hard copy; speed)

B. Direct (hands on) vs. indirect use

FINDINGS OF PREVIOUS STUDIES

Bair (in Uhlig, Farber and Bair, 1979:243) notes that:

> ... the single most common cause of system failure is user rejection... This does not imply that the system design and performance are not also major factors in rejection. However, the way the system was implemented has caused most failures by not overcoming the threatening nature of the complex and intrusive technology. In some cases, rejection by potential users occurred before the technology ever entered the organization.

The most extensive description of active rejection behavior occurs in Bair's report on the Augmented Knowledge Workshop (NLS). A group of approximately twenty "knowledge workers" in an organizational unit were first invited to use the system on a voluntary basis. Acceptance was so poor that management ordered use of the system. This requirement was enforced by instructing secretaries not to type handwritten drafts without authorized exceptions, and by supervisors insisting that only work submitted on line would be reviewed. The circumstances surrounding this rather draconian measure are described as follows:

> The resistance to learning a new System as a way of doing one's daily knowledge work was higher than expected. Traditional work patterns were adhered to with a great deal of persistence by the population, a manifestation of the "rejection phenomenon." This occurs frequently upon introduction of new technology; however, it was surprising in this context. It demonstrates that education and an understanding of the technology in general are not [sufficient] prerequisites for immediate acceptance...
>
> Excuses for not using the System were exemplified by comments such as, 'there isn't a terminal around,' 'I can't remember how to do it,' 'there isn't a good manual that I can understand,' 'I have too much work to do,' etc. ...
>
> Individuals manifested a range of behaviors, from trying to ignore the whole thing to actively campaigning against it...Ego threat was identified on the basis of verbal and non-verbal behaviors over a period of several months. When questioned about their work, subject's defensiveness was noted by facial flushing, elusive or aggressive statements, or reverse attack where the subject would say, 'if I had nothing else to do like you, I'd learn it....' Complaining within earshot of the observer usually centered around how busy [he or she was] and how important it was that he not be imposed upon (Bair, 1974:28-31).

As Bair so insightfully observed, system acceptance involves changes in the most basic habits embedded in one's daily activities: how one thinks, composes materials, and communicates. Acceptance of a system involves not only the learning of new skills and habits, but the extinction of old habits.

Findings for Scientific Groups Using EIES

Hiltz's (1980) study of five scientific communities that used the EIES system for 18 to 24 months included a chapter on the determinants of amount of use. The findings are summarized:

> Motivational variables, rather than characteristics of the medium, were most strongly associated with level of usage. The most important reason given for limited use was that other off-line professional activities took higher priority. The relative priority of EIES-related and other professional work was by far the most important reason given both on the follow-up questionnaire checklist and the open-ended post-use questionnaire.
>
> The strongest correlate of the amount of use was the anticipated level of use before encountering the system at all. This variable is a conglomerate of individual attitudes and expectations, probably including the relative importance of communicating with others in the group and the amount of time available for such activities after the more mandatory job-related tasks were completed.
>
> Access barriers as a class (including access to a terminal, trouble with Telenet and system unavailability) were the second-ranking factor accounting for amount of use. Among the variables hypothesized to be positively related to level of use, but which were not significantly related, were receipt of personal training, reading and typing speed, attitudes toward computers, previous experience with computer terminals or message systems, and how well known the person was in their specialty. On the other hand, groups that were composed of a high proportion of high-status members were, on the average, more active than groups which had a smaller proportion of well-known members.

Results of a Study of NLS

Gwen Edwards (1977) reports extensive data on the correlates of the amount of use of NLS, a computer-based text-processing and communications system. These results are examined in detail because it is the only system other than EIES for which there is a publicly available study exploring a wide range of variables on the acceptance of a computer-based communication system.

Edwards' study was based on a questionnaire distributed to 250 NLS users in thirteen organizations. Ninety four, or 38%, responded. Of these, 30% were managers, 42% researchers, and 28% support staff. Some of the researchers also had a supervisory role, as a total of 40% reported some supervisory responsibility. In looking at the correlates of usage, the dependent variable "general usage" was divided into three ordinal classes: "low" usage of less than an hour a day (28%), "medium" usage of one to three hours a day (31%), and "high" usage of more than three hours a day (41%).

In summarizing the differences in findings between the NLS study and the study of five EIES groups, Hiltz (1980: chapter two) observes:

> The NLS setting was quite different from the function for which EIES was used during the operational trials. It was used as a tool to directly support the regular, paid job. It is therefore most important in increasing the generalizability of the EIES findings that many of Edwards' findings about the importance of attitudinal variables are similar. Though results for attitudinal variables measured with the same question are similar, there are some contradictory findings for other variables. The explanation may be that the specific questions used were quite different; or, the differences may be attributable to use by an office staff to support their work on the job vs. use by academics to support their informal, out of organizational communication.

Edwards reports that general attitudinal and access variables are most highly related to the amount of use of NLS. The strongest correlation was with having a terminal at home. Typing skill was found to be related only for those who had a negative perception of the system; there was no relationship between typing skills and amount of use for those with medium to highly positive perceptions. Edwards states that "Once the perceptual barrier is crossed, typing skill is irrelevant to usage." She suggests that "we can recommend that when implementing an Office of the Future system, it will be beneficial to convince potential users that they need not know how to type to make effective use of the system."

The other variables most strongly related to total use involve perceptions of the utility of the system:

1. The perception that use of NLS would improve one's professional image was positively related to the amount of use. This variable was not found to be a predictor for the scientists on EIES. A possible explanation is that the opinions of organizational peers are more important to one's future career than are the opinions of peers located elsewhere, who do not influence tenure or promotion.

2. The perceived impact on productivity was measured with an identical question in the EIES study. The correlations were similar in direction but stronger for NLS.

3. Usage was related to the perception that NLS would increase the accessiblility and visibility of one's work to others.

4. There was a moderate relationship with the user's initial perception of the system and subsequent general use. There was also a moderate relationship with training and the sophistication of the terminal.

Generally, correlations with communications use were similar to but weaker than those with general or total use. One exception is sharing a terminal, possibly because the concern with privacy influences communication use more than it does general usage.

The differences in correlations for training and terminal sophistication for NLS and EIES may be explained by the greater complexity of the NLS system for beginners. At the time of the study, it was command-driven and designed to be used on a sophisticated terminal. It is unlikely that a beginner could learn NLS in the absence of training or personal contact with an experienced user. On the other hand, EIES was designed for use on a simple terminal, and to be usable by beginners in a menu-driven mode without the necessity of formal training or personal instruction.

The differences for these variables, then, are probably attributable to design differences between the two systems. On the other hand, one could speculate that the difference on the training variable may be explained by the development of better formal training materials and procedures for NLS.

Table 3-3

VARIABLES USED IN EDWARDS' NLS STUDY

ACCESS: User indicates that there was or was not difficulty accessing the system

ACCESSIBILITY OF WORK: The degree to which the accessibility of the user's work to others is perceived to have increased or decreased

COMMUNICATIONS USAGE: Frequency of using the system for communications purposes (exchange of messages, documents, linking in real time)

DIRECT/INDIRECT USAGE: Direct interaction on the terminal vs. using the system by support staff

GENERAL USAGE: Total hours per week

GROUP INCENTIVE: Use is required or requested, or the user feels free to use the system as he or she chooses

HOME USAGE: Individual does or does not occasionally use a terminal at home

IMAGE: The degree to which the user believes his or her professional image has increased or decreased

INITIAL PERCEPTION: The user's retrospective reaction to the system when it was first introduced (thought it would be useless, thought it would revolutionize work/communication processes)

INVOLVEMENT: The user was or was not involved in the decision to use NLS

PERCEPTION: An index constructed from questions on current perception of the usefulness of NLS and attitude scales on compatibility-incompatibility of the system to normal working/writing/thinking/organizing style; flexibility-inflexibility of the system; reliability-unreliability of the system

POSITION: Support staff, research, management

PRIVACY: Avoidance of the system for work of a confidential nature; taking precautions to ensure the confidentiality of work, such as changing password; or not letting the privacy factor affect use

PRODUCTIVITY: The degree to which a user believes that work efficiency/productivity decreased or increased as a result of using the system

PROFESSIONAL IMAGE: Belief that the system increased or decreased professional image

PROXIMITY: The distance between the closest available terminal and the user's office

QUALITY: The degree to which a user believes the quality of work increased or decreased as a result of using the system

SHARING: The individual has sole or shared use of the terminal

SUPERVISION: The user does or does not supervise other employees

TELECONFERENCE: The user has or has not ever participated in a teleconference

TERMINAL TYPE: Teletype only, CRT with teletype version, display-based version of NLS with spcial terminal and electronic cursor

TRAINING: Formal program, trained by other employee in charge of training, by other users of NLS, or no training

TYPING SKILL: The user does or does not know how to type

Table 3-4

Correlations (Gamma) with General Use and Communications Use of NLS

Source: Edwards, An Analysis of Usage and Related Perceptions of NLS

Variable	General Usage	Communications Usage
POSITION	-.10	.08
SUPERVISION	-.21	-.30
INVOLVEMENT	-.37	-.22
GROUP INCENTIVE	-.05	.09
TRAINING	.31	.23
TYPING	-.38	.22
TELECONFERENCES	-.22	-.50
TERMINAL PROXIMITY	.05	-.23
TERMINAL TYPE	.41	.48
SHARING	-.14	-.40
DIRECT-INDIRECT USAGE	.18	-.01
ACCESS PROBLEMS	-.18	-.01
PRIVACY	-.23	-.43
INITIAL PERCEPTION	.35	.27
PERCEPTION INDEX	.38	.24
PROGESSIONAL IMAGE	.50	.49
ACCESSIBILITY	.44	.35
PRODUCTIVITY	.49	.38
QUALITY	.38	.12
HOME USAGE	-.69	-.52

THE PREDICTIVE POWER OF INDIVIDUAL CHARACTERISTICS

At this point, we will begin to systematically examine the variables included in this synthesis. The reasoning behind their inclusion will be explained, any relevant work on the factors reviewed, and the data for the studies presented.

The panel of evaluators was asked to report their findings according to the following scale:

++: Strong quantitative evidence of a positive relationship

+: Quantitative evidence of a moderate relationship or qualitative evidence of a positive relationship

0: Evidence of no significant relationship

-: Moderate to weak negative relationship shown by quantitative evidence, or qualitative evidence of a negative relationship.

--: Quantitative evidence of a strong negative relationship

For predicting acceptance, then, the "0" is not at all a neutral response. The key distinction is between the zeroes, meaning the factor is not a predictor, and the other responses.

Attitudinal Variables

Given the findings of both Edwards and Hiltz, it was expected that the relative priority of the on-line vs. off-line tasks would be a very important variable. Of course, when and if all members of a professional network and all tasks can be accessed and performed on line, the distinction would no longer exist. At the present time, however, most users of these systems can access only a limited number of colleagues who are on a system for a specific task which forms only a subset of the total work that must be performed.

Assessment of the relative priority or importance of a task is only one dimension of attitudes that will affect how much time one is likely to spend on line performing the task. The other is its intrinsic attractiveness or interest. It could be that an on-line group activity is admittedly not very high on the list of the employing organization's priorities, but that the individual finds the activity enjoyable or rewarding for other reasons and therefore "makes time" for it.

Relative importance of the task was measured by some of the EIES evaluators. The Devices for the Disabled group reports a strong quantitative relationship with amount of use. Two other groups checked "+", meaning qualitative evidence or a moderate positive relationship. These were Mental Workload and Hepatitis. In addition, we have a report from HUB of a "+". The relationship with subjective satisfaction is generally reported to be at the same level, except for General Systems Theory, which reports no relationship for subjective satisfaction.

Combined with previous reports from Edwards and Hiltz, then, we can say that whenever the relative importance of task has been studied, it has been found to be an important determinant of amount of use of CMCS.

"Liking" for the task has results reported for five studies. The Hepatitis Knowledge Base evaluator reports quantitative evidence for a strong positive relationship for both amount of use and subjective satisfaction; for this group it is found to be even more important than the perceived relative importance of the task. On the other hand, for HUB there was no relationship found for amount of use and a weak positive relationship for subjective satisfaction. Devices for the Disabled reports a weak positive relationship for both aspects of acceptance, compared to the strong positive relationship for task importance. General Systems Theory reports the same level of predictive power as for task importance, and for WHCLIS there is some evidence of a positive relationship with subjective satisfaction. In sum, liking for task seems to be generally important, but probably in most cases it is not as powerful a predictor as is the importance of the task. But in special circumstances where a user has many tasks that cry out for attention because of their importance (such as the Hepatitis researchers), the liking for the task may be a deciding factor.

Attitudes toward Computers

There are very mixed results for this variable. A strong positive relationship is reported for the Hepatitis group on EIES with subjective satisfaction, and a moderately positive one for amount of use. The OICS study reports a strong positive relationship with subjective attitudes toward the system. A moderate positive relationship is reported for amount of use and/or subjective satisfaction for the Devices for the Disabled on EIES, HUB users, and NLS users studied by Bair. On the other hand, no relationship is reported for WHCLIS on EIES, and Hiltz found no overall relationship for the five EIES groups she studied. Whether the conflicting findings can be attributed to different indicators of attitudes toward computers, or to conditions or group characteristics which make this variable relevant, cannot now be determined.

Pre-Use Expectations about the System

This includes both general expectations about the system, such as the ease or difficulty of use, and specific expectations about its usefulness or impact on productivity. We are not sure how and when such expectations are formed, or how they may be influenced by training or publicity before users first sit down at the terminal and sign in. But users do report such expectations, and they sometimes have a powerful effect, influencing perceptions of the system and the amount of time and frustration which they are willing to invest in learning to use it.

For the EIES groups, the WHCLIS evaluation reports a strong positive relationship with the amount of use for both of these pre-use types of expectations, and a moderate relationship with subsequent levels of subjective satisfaction. The LEGITECH evaluator found some evidence of a relationship with amount of use. The JEDEC evaluation reports a moderate relationship for both with amount of use. On the other hand, results for Devices for the Disabled show no relationship; and General Systems reports a weak negative relationship between anticipated usefulness and subjective satisfaction. Umpleby explains that those who expected little were pleasantly surprised, while those with great expectations felt some disappointment.

Turning to other systems, there are moderately positive relationships reported for HUB. The NLS study found a strong positive relationship between general pre-use expectations and subsequent amount of use, and a moderate relationship between anticipated usefulness and subsequent use. The OICS study had only subjective satisfaction measures for correlation; there, both types of expectations were found to be moderately strongly related.

Both Bair and the Johnson-Lenzes report one specific aspect of expectations that are significant. The latter, in reporting the results of their study of JEDEC on EIES, found that belief in and/or interest in EIES itself as a communication medium was a very strong predictor. As part of their baseline questionnaire, JEDEC participants were asked an open-ended question about their reasons for participating in the project. Those who listed as their first reason a belief in the potential of the communications medium itself used the system much more than did others (Johnson-Lenz and Johnson-Lenz, 1980a:46). What Bair calls a "projected attitude" of not only liking the system at the beginning, but expecting that attitudes and liking will improve over time, was very highly correlated with the amount of use of NLS.

Attitudes toward the Group

Attitudes toward the group include such factors as whether one likes them as persons, respects them as capable colleagues or coworkers, and perhaps most importantly, trusts them and feels cooperative rather than competitive. For instance, the study of five scientific research communities on EIES (Hiltz, 1980) found that those scientists who felt that others in the group acted unethically and might "steal" one's contributions or ideas did not become heavy users of the system.

Perception of Self with Respect to Group

This variable has to do with the relative social status of the individual vs. the group. Does the user perceive the group as composed mostly of peers, of those with higher professional status, or lower professional status? It could be measured subjectively, as Hiltz (1980) did on a seven-point scale, asking for pre-use perceptions of whether individuals felt they were ranked near the top of their field, about average, or were in a relatively unknown or newcomer status. It could also be gathered in terms of objective measures such as organizational rank of the members of a single bureaucracy, or citations to a scientist's work in a citation index.

It could be speculated that relatively lower-ranking members of a group would be motivated to use the system most, in order to make themselves more visible to the higher-ranking members and increase their status. However, Hiltz (1980) found no relationship between self-reported relative rank at pre-use and subsequent amount of use of EIES for the five scientific communities she studied.

Unfortunately, none of the studies included in our survey covered measures of this variable.

Degree of Pressure to Use the System

One form of compliance pressure is to be ordered to use a system to enter or retrieve materials for others. The secretary usually fits into the high compliance pressure category, whereas managers and professionals usually choose whether or not to use a computer-mediated communications system for their work. Although there are of course many other differences between managers or professionals and secretaries, the amount of free choice vs. compliance pressure may be one of the reasons why Panko and Panko (1981:18) found that whereas 71% of the managers and professionals using the system themselves had highly positive attitudes towards it, only 46% of the secretaries had highly positive attitudes.

For EIES, there were two groups for which measures of this variable were included in the studies. Hepatitis reported a strong positive relationship with both amount of use and satisfaction-- that is, the evaluator found that the more pressure placed on the physicians to use the system, the more they used it and the more they liked it. On the other hand, no relationship was found for Devices for the Disabled. Bair included a measure of this variable in his NLS study, and reports a moderate relationship with amount of use. For HUB, a moderately strong positive relationship is reported for both amount of use and subjective satisfaction.

Once again, we conclude that the variable needs further study. Measures of different aspects or types of compliance pressure should be separated, and the conditions under which they are effective for increasing use and satisfaction determined.

Biographical Characteristics

Since many user groups do not include a wide variety of ages among their memberships, few studies have included age as a variable. When a relationship has been found, older users (above 50) generally tend to use the system least and have the lowest levels of subjective satisfaction. For instance, Open Systems (1981:7) reports that in an office automation pilot project at Hanscomb Air Force Base, "Workers over the age of 50 don't like the new approach and are worried about career aspirations because of it." There are, however, exceptions.

For instance, among EIES general users, one woman in her nineties became an addict.

General Systems reports a moderately strong negative relationship between age and both amount of use of EIES and subjective satisfaction. Among other EIES user groups, no relationship is reported for Hepatitis and JEDEC, both of which were composed mostly of mid-career participants. A strong negative relationship is reported for the Swedish COM system between age and amount of use, and a moderate negative relationship between age and both use and subjective satisfaction for OICS. HUB trials found no relationship.

One possibility is that older users need lengthier or different kinds of training than younger users who are more likely to have previous experience with computer systems. On the other hand, it may be that older users are less likely to accept changes in such basic communication patterns, despite any special training efforts. But the fact that Danowski and Sacks (1980) report beneficial effects for aged users of a message system suggests that it may be worthwhile to invest in specially designed training sessions for older users to overcome any initial attitudinal or learning barriers.

Because most of these systems are used primarily at this time by male professionals and managers, there are generally not enough female subjects matched on other biographical characteristics for sex differences in acceptance to be statistically discernable. We generally have reports that either sex was not studied or that there is no relationship between the sex of user and acceptance. But there may be a difference in style of use. Palme reports that women write more "letters," or private messages, and make fewer conference entries on COM.

With regard to level of education, we again have a limited range for most groups. Most users have had at least some college education. It may be that the minimum skill level of a high school graduate is required for these systems, but if a user group does not include lower educational levels, no relationship will appear between educational level and acceptance. No relationship is reported for JEDEC on EIES. For HUB, a moderately strong positive relationship is reported, but this is qualified by the comment that it refers to degree of education about computers, rather than general educational level. For COM, a moderately positive relationship is reported for level of use, and for OICS, a moderately positive relationship for both amount of use and subjective satisfaction. We conclude that educational level, at least for a certain minimal level such as college education, may be a fairly important predictor of acceptance. However, see the section below on "general literacy" for evidence that children and others without a college education can use and like these systems.

Only one study included race or ethnicity as a variable. This may be because, since most managers and professionals in Western nations are white males, there is not a large enough number of other ethnic groups to use the variable. HUB is the system giving a data report, and it reports no relationship.

Personality Factors

There has been little research on the relationship between personality factors and acceptance (amount of use or subjective satisfaction) of computer-based communication systems. There is reason to believe, however, on the basis of qualitative observations and impressions, that basic personality characteristics and values have predictive power.

Shneiderman (1980:55-57) reviews some personality traits and their conjectured relationship to programmer work styles:

> Assertive/passive. The assertive individual who is not afraid to ask pointed questions, is not intimidated easily... is often seen as the superior programmer type.
>
> Internal/external locus of control. Individuals with strong internal locus of control feel able to and seek to dominate situations. They feel they have the capacity to influence their world and control events. Individuals with external locus of control feel that they are victims of events beyond their control and are perfectly content to allow others to dominate them.
>
> High/low tolerance for ambiguity. The early stages of program design and composition may require a higher tolerance for ambiguity... Decisions must be made on limited data and there must be a willingness to take risks while proceeding on to the next decision.

Individuals who are assertive, have high internal control, and high tolerance for ambiguity probably will accept and use computerized communication systems more than those with the opposite traits.

Shneiderman reviews the Myers-Briggs Type Indicator, which he says "gives insight into programmers and their interaction" (Myers, 1962).

Based on the theories of Carl Jung, it measures four personality dimensions, some components of which are listed in Table 3-5 for illustration.

Table 3-5
PERSONALITY TYPES

INTUITIVES	SENSING TYPES
Like solving new problems	Dislike new problems unless there are standard ways to solve them
Work in bursts of energy... with slack periods in between	Work more steadily, with realistic idea of how long it will take
PERCEPTIVES	JUDGING TYPES
Tend to be good at adapting to changing situations	Best when they can plan their work and follow the plan
Don't mind leaving things open for alterations	Like to get things settled and wrapped up
INTROVERTS	EXTROVERTS
Like quiet for concentration	Like variety and action
Dislike telephone intrusions and interruptions	Often don't mind the interruption of answering the telephone
Work contentedly alone	Like to have people around
FEELING TYPES	THINKING TYPES
Tend to be very aware of other people and their feelings	Are relatively unemotional and uninterested in people's feelings
Enjoy pleasing people, even in unimportant things	May hurt people's feelings without knowing it

Source: Shneiderman, 1980

A current research project on EIES aims to administer a computerized personality profile using items from the Myers-Briggs Type indicators, and then correlate the responses with subsequent amount of use of the system. The hypotheses are that intuitives, perceptives, introverts, and thinking types will be most comfortable with extensive use of this form of communication.

In our synthesis questionnaire, introversion/extroversion and innovativeness/risk taking were listed as variables under personality characteristics. WHCLIS reports a "+" for both personality dimensions. For the Hepatitis group, there was qualitative evidence of a positive relationship between innovativeness or risk taking personality dimensions and acceptance of the system. HUB reports no relationship for introversion/extroversion but a "+" for innovativeness/risk taking. Bair's NLS study is apparently the only one which included scales that generated quantitative evidence about the influence of personality characteristics. An "Organizational Climate Index" was used as a measure of personality and value characteristics. He reports finding strong positive relationships between introversion and both use and subjective satisfaction, as well as between innovativness and both dependent variables.

Bair's earlier study reported that:

> ... reactions seemed to correlate with the observer's assessment of personality type. Those who seemed to be closed minded were the most threatened by required use ... Also, those manifesting a high ego involvement with their work reacted more negatively than did others... [another] variable was one that is most obvious and generally true of any new tool--aggressiveness (generic use). The least aggressive subjects initially ignored the System. As the more inhibited persons saw their colleagues becoming involved... they responded to the pressure to become real AKWs ("augmented knowledge workers") (Bair, 1974:30).

In sum, we do not yet have enough evidence to know the full range of personality characteristics that may predict acceptance of these systems, or the most valid way to measure them in the context of user acceptance studies. However, evidence to date indicates that personality characteristics may be important predictors and should be included in future studies.

Basic Values and User Acceptance

The EIES evaluation of five user groups by Hiltz (1980) found weak support for a relationship between basic values and subsequent use. The pre-use questionnaire contained sets of questions on two of the "pattern variables" used by Talcott Parsons and subsequent sociologists to characterize value patterns. These are "universalism-particularism" (whether scientists are judged solely by their work, or instead on the basis of who they are and personal relationships), and "affectivity-affective neutrality" (whether they are emotionally committed to their theories, or totally objective and emotionally uninvolved.)

There are weak relationships which indicate a tendency for those responding at the "emotional commitment" end of the scales to use EIES more, and for those in the "balanced" area between the relevancy and irrelevancy of personal attributes for judging scientific work to use it more than those at either extreme. These results suggest possible relationships, but are not sufficiently strong or consistent to be conclusive.

Bair reports that for his NLS study, in which part of the Organizational Climate Index measured basic values, they correlated at .62 with amount of use and .54 with subjective satisfaction, a strong positive relationship. McCarroll reports some relationship for the Devices for the Disabled group. She notes that if a user believes that information should be shared, then more of an obligation is felt to try a computer conferencing system as a way of implementing this value with actions.

We did not specify what we meant by "basic values" in our synthesis questionnaire, but simply asked for reports of any values that seemed to be correlated. None of the other studies included any value measures. Among those which might conceivably be related, in addition to the Parsonian "pattern variables," are democracy and decentralization as opposed to authoritarianism or centralized control and decision making in organizations. Judging from the types of users who self-select to use EIES, the technology seems to have a strong appeal to those who value decentralization and participatory democratic decision making.

Communication Skills and Preferences

On the face of it, it would seem that since these systems are used by typing and reading that these skills should be related to system acceptance. However, this is not necessarily the case; as reviewed above, Hiltz found no relationship, and Edwards found that only for those managers with an initially negative attitude and set of expectations toward the system in general was typing speed correlated with subsequent amount of use.

The findings are mixed. For Devices for the Disabled on EIES, there was no relationship between typing speed and amount of use or subjective satisfaction. The JEDEC study found no relationship between reading or typing speed and amount of use. However, the General Systems group and the Hepatitis group found some evidence of a positive relationship between typing speed and acceptance measures, and the WHCLIS group data shows a strong positive relationship between typing speed and amount of use (Kerr, 1980, table 14). For NLS users, Bair reports no relationship between typing speed and system acceptance measures; but for HUB, a moderately positive relationship is reported for reading speed as well as typing speed.

It would appear that within the context of certain types of tasks or a negative attitude toward a system initially, poor typing skills will be a barrier to acceptance. The fact that many studies show no relationship indicates that good typing skills are certainly not a prerequisite to acceptance of these systems. We need further specification of the conditions under which typing skills are related to acceptance, and of steps which can be taken to decrease the likelihood that initially poor typists will be reluctant to use a system.

Another aspect of communication skills is "general literacy," by which was meant facility with the written word. A person may not feel as skillful or persuasive writing as speaking, or may not have a broad enough background to be able to assimilate the references and materials that can be found though an on-line information exchange system. Unfortunately, paractically no one included measures of this variable in their study. For the Hepatitis group on EIES, Siegel notes that since there was no variance, with all of the participants highly literate physicians, no observed relationship was possible. This is probably true of most of the user groups studied thus far. There is a report of a relationship for Devices for the Disabled on EIES. There, rather than interpreting general literacy in terms of facility with written English, the evaluator picked up another dimension, the nature of research habits. She reports that for her group, if a person generally makes a practice of searching all available information sources when working on a problem, they are more likely to give the medium a serious try.

On the other hand, there are studies which indicate that high levels of literacy are not necessary in order to use and benefit from these systems. For instance, Danowski and Sacks (1980) were studying a group of elderly, most of whom probably had not attended college. And Kerr and Hiltz have current projects involving cerebral palsy and other young children. (See Kerr et al, 1979 for early results; a more comprehensive evaluation is in process.)

Previous Experience with Computers or Terminals

It might be hypothesized that a person familiar with computers and computer terminals would accept computer-mediated communication systems more readily. For instance, it might seem logical that their initial learning time would be less. However, Hiltz (1980) found that there was no relationship between previous experience with computers or terminals and the time to learn the basics of EIES or to feel comfortable with the system. Only in the time reported to learn the more advanced features did previous computer experience make a difference. And Spang notes in her data report for HUB that previous use of a similar system may actually decrease the likelihood of accepting a different system with a similar function but new interface. Specifically, she notes that: "If people are in the habit of using communication systems such as electronic mail, they find teleconferencing harder to accept." There is no standardization among systems, so that the commands or responses needed to perform a similar operation are different and one becomes frustrated by error messages given when a response from the familiar system is given to a new system. For example, in order to terminate a session, one might have to enter "logoff" for one system, "good bye" for another, and "--" on a third. Thus, it could be argued that "too much" previous experience could be negatively related to system acceptance.

Among the EIES groups, Devices for the Disabled reports no relationship. General Systems reports some evidence of a relationship, while Hepatitis and WHCLIS report a strong positive relationship. For JEDEC, the finding was that only one type of previous experience-- using a computer terminal to play games-- was positively related to the amount of subsequent use.

For the HUB system, there is both quantitative and qualitative evidence of a positive relationship between previous computer experience and both amount of use of HUB and subjective satisfaction with it. Since HUB includes a sophisticated package for modelling, previous experience might be particularly relevant. OICS, another fairly complex or sophisticated set of capabilities, also reports a strong positive relationship. Bair's study of NLS found a moderately strong relationship for amount of use, but what he termed a "surprising finding," a moderately negative relationship, for subjective satisfaction.

This leaves us with a thoroughly conflicting set of findings. For some groups and some systems, but not others, previous computer and terminal experience may contribute to acceptance, while for others, it is not related or may even have a detrimental effect. What can be done to aid acclimation to a new system for those who have no previous experience at all and for those to whom the language and interface of another system is already second nature are important questions.

Some standardization of user interfaces would alleviate the problem of familiarity with one system hindering the learning of another. However, as we have seen in the Systems chapter, there is a great deal of disagreement among designers about optimal specifications for computer-mediated communication systems, so it is likely to be some time before standardization among systems takes the burden off the user of remembering N different "languages" for talking to N different systems.

Access to Alternative Media

This variable covers alternative means of communication with the on-line group, and their availability, cost, and feasibility. For example, is it possible to meet face to face without an unreasonable expenditure of travel time and money? How difficult is it for the members to communicate by phone? Are they generally "always there" at their desk when called, or is telephone ping pong the rule?

General Systems reports findings in the expected direction, that if there is "no access to alternative media, satisfaction increases." Hepatitis reports a similarly negative relationship with amount of use. OICS shows a "+" for subjective satisfaction and access to alternative media, but since this response form does not have any negative relationships indicated, we suspect that the "+" was used for a weak to moderate relationship of any kind. HUB reports a ++" for both amount of use and acceptance.

Productivity and Work Patterns

It was hypothesized by the researchers working on the acceptance section that high producers might be workaholics who would be more likely to enthusiastically embrace these systems as productivity-enhancing tools. However, the "productivity" entry on the acceptance module of our questionnaire seems to have been interpreted by some respondents as referring to a dependent variable rather than an independent one--that is, use of the system is reported as having increased productivity, whereas what had been intended by the item was the question of whether already highly productive people are more likely to accept such a system.

On a single cross-section, it is of course impossible to untangle cause and effect. Did highly productive workers use the system more, or did using the system make them more productive, or-- probably-- both? Whatever the direction of causation, those who do report a relationship generally find it to be either a strong positive one supported by quantitative data (NLS), or a moderately strong or qualitatively supported finding (JEDEC, OICS). The Hepatitis evaluator notes that for what it's worth, a relationship was observed in the other direction-- the group as a whole did see use of EIES as boosting productivity on assigned tasks. The only exception is Devices, which reports no relationship.

Related to productivity are work patterns and duration. Is the person strictly a "nine to five" worker, or does he or she put in very long hours, including some night and weekend work? Those who work very long hours would be assumed to have higher levels of acceptance of or need for a computer-based communication system to support their work. In particular, it was assumed that those who do quite a bit of night and weekend work would especially appreciate the extension of support services to the 24-hour availability provided by such systems.

Length of the work day or work week as a correlate of acceptance was not included in most studies. Bair does report a strong positive relationship for NLS. Hepatitis reports a "+". On the other hand, no relationship is reported for the Devices group.

The data are similar for night and weekend work as a correlate of acceptance, except that we have two additional studies supporting a relationship. The Devices group reports a positive relationship between night and weekend work and satisfaction with use of the system (though not with amount of use). And for JEDEC, if use of a terminal at home is taken as a proxy measure of use of the system nights and weekends, then there is a relationship with total amount of use that is significant at the .05 level.

In sum, the only way to untangle causality between work patterns and system use would be with a three or more wave panel study that collected detailed data on productivity and work patterns before system use, after some system use, and after a great deal of system use. The available data do support the conclusion that high producers who work long hours and do some of their work nights or weekends are likely to use these systems more than their counterparts, and to be more satisfied with them as a means of communication.

GROUP FACTORS IN DETERMINING ACCEPTANCE

Structure

a. Size

Size can be defined very simply as the number of members in a group. In general, for other media, people in large groups seem to be more dissatisfied with the group process than those in small groups. As membership increases, resources are increased, enabling more efficient problem-solving. However, there is a point of diminishing returns where time for task completion decreases at the expense of lowered efficiency, and the range of ideas increases at the expense of greater difficulty in reaching consensus.

Also, as size increases, the number of communications channels increases to a number greater than the individual members in a group.

Larger groups tend to break down into smaller ones which impedes the management of the entire group. Finally, as size increases, the more aggressive members of the group tend to dominate, leading to increased feelings of limited participation by members and thus to decreasing levels of satisfaction. (Kowitz and Knutson, 1980; Shaw, 1976).

These findings for face-to-face groups may not hold for computer-mediated group communications, where different group dynamics occur. If a group is too small, then there is not enough on-line activity so that there is generally something new waiting whenever a person signs on line. This can be a negative reinforcement, and discourage use. On the other hand, a "too large" group would be one that generates so many daily communications that the members of the group feel overloaded and unable to respond or cope adequately. Avoidance of the system may result in such a case.

Optimum size is a function of both activity levels and the amount of structuring and filtering of communication. For example, in the "Topics" structure on EIES, members are organized into "exchanges" and each exchange may have up to hundreds of "topics" generating daily entries. However, each member selects only those topics in which she or he is interested; thus most of the information is filtered out and does not overload the participants (See Chapter V, Johnson-Lenz and Johnson-Lenz, 1981; Stevens, 1980).

Since most of the evaluations synthesized here involved only one group, it would not be possible for the evaluator to quantitatively test the effects of variations in group size on system acceptance. However, the observer/evaluator might gather qualitative impressions of whether a group was too large or too small to function effectively.

Two of the largest EIES groups report a negative relationship between group size and amount of use of the system. General Systems Theory had over forty members at some points. It did not include any special structures to filter communications, and there was some complaint, especially among infrequent users, of receiving unwanted "junk mail" in the form of large numbers of waiting group messages whenever they signed on. LEGITECH reports a strong negative association. It grew to over 70 members. There was a special software structure, but the evaluator reports that a small number of the researcher-members contributed almost all of the inquiries and responses in their topic exchange and group conference. The more passive users may have been discouraged by the small number of active users. Or they simply were content to let those active users generate the information while they acted as observers to the information flow. Why this happened cannot be documented for LEGITECH. Perhaps the passive users felt that they could not make as valuable a contribution as the more active users. Perhaps their research offices were not organized in such a way as to facilitate inquiry response exchange.

The evaluator for Hepatitis on EIES, which was sized at about ten, reports a positive relationship between group size and both use and satisfaction. Apparently this group was near the lower limits of effective group size for this medium. The HUB evaluator observed a strong positive relationship between group size and both amount of use and subjective satisfaction. No details are provided on the ranges of group size within which the relationship holds for HUB.

b. Degree of Geographic Dispersion

The dispersion variable refers to the specific geographic location of each member and the distance separating each location. It would seem that the greater the geographic separation of members, the more acceptable computer-based communications systems would be to users. The medium would allow more interaction with more individuals than would be feasible with face-to-face meetings or telephone conferencing. It also encourages an expanded resource network which can be established regardless of geographic limitations. On the other hand, distance is not the only criterion. Individuals residing in the same geographic location may have communication needs similar to those who are more separated. Particularly in large urban areas, users may not be able to meet regularly or reach each other on the telephone.

We asked the evaluators if they had any evidence to support the assumption that computer-mediated communciation is best suited to geographically dispersed groups. HUB reports a strong positive relationship between geographic dispersion of the group and acceptance of the system, and the Hepatitis group on EIES reports a strong positive association for amount of use and a moderate relationship for subjective satisfaction. Both the General Systems and the Devices groups on EIES report some evidence of a positive relationship for acceptance. Though not systematically queried on this topic, LEGITECH users did indicate that the presence of researchers from other states was an incentive to pose questions. And Bair notes that for NLS, "Although not addressed in the questionnaire, geographic dispersion was reported to increase (strongly) usage and satisfaction during extensive interviews and observations." Thus, the evidence is totally in support of the assumption that has been made, that the more geographically dispersed a group, the more likely they are to use a computer-mediated communication system and the more satisfied they are likely to be with it as a medium of communication.

c. Centralized vs. Decentralized Control

This refers to the type of network which is established for information exchange, decision-making and administrative fuctions. The most effective structure depends on the needs of the group. At one end of the continuum, there is one control locus which regulates all information sent to and received from members. The information flow is two-way between the control locus and members but there is little or no information exchange among the members themselves. At the other end of the continuum, all members interact equally with each other.

The research in this area points to several factors to be considered. Where speed and efficiency are important, centralized networks such as the wheel and chain seem to be better than decentralized networks. Where simple problems must be solved, centralized networks are more accurate, but complex problems are solved more accurately with decentralized networks.

Another factor pointed to by the research is morale, which apparently is better in a decentralized network than in a centralized one. This, of course, has implications for cohesiveness.

The research also suggests that:

> Distinguishing between networks typically involves using concepts of centrality and distance. The communicative distance from one member's position in the network to another is the sum of the communicative links required for a message to be sent and received along the shortest possible route....the relative centrality of any member's position is the sum of distances between that position and all other positions in the network. The most central position in any network is the position with the lowest number representing relative centrality (Fisher, 1974:159).

Finally, Shaw has looked at the communication network as an independent variable using 3, 4, and 5-person networks. His analysis closely examines who-to-whom and direct/indirect communication patterns. The conclusion is that the structure seems to affect the emergence of leaders, organizational development and problem-solving efficiency (Shaw, 1976).

Controlled experiments have indicated that computerized communications as a medium seem to naturally support decentralized, egalitarian decision-making processes (Hiltz et al., 1980). Thus, it might be supposed that user groups which are decentralized or egalitarian in structure to begin with would adapt most readily to the medium.

d. Pre-Existing Communications Network

Pre-existing ties refer to any organized interactions, generally formal, among members. This may take the form of membership in a society or professional organization, a newsletter or regular face-to-face meetings. These prior ties imply a minimum level of familiarity among members.

If members have interacted in a prior context, there should be fewer problems in initiating and maintaining interaction on a new communications medium. The knowledge that one's peer group is participating in this process tends to make individuals more accepting of the medium. In addition, the familiarity or comaraderie reduces the initial problems in introducing people to each other in order to initiate the interaction process.

Bair operationalizes this variable as a "need to communicate" (more)... It may act in a curvilinear fashion. Below certain levels -- that is, no previous communication whatsoever-- there are no ties to start building on, and probably no felt need to improve communications. Above a certain level, existing communication channels may be so good that there is no need to improve them. For instance, suppose you have a group of eight managers who all have offices within fifty feet of one another on the same floor. They are not likely to feel that their communications channels need the kinds of improvement that can be achieved with a computer-based communication system.

Bair's finding for NLS is that when the adequacy of the pre-existing communications network is measured as a "need to communicate," there is a strong positive relationship with amount of use and a moderately positive relationship with subjective satisfaction. However, as noted above, the "need to communicate" is a composite variable rather than a pure measure of the nature and strength of pre-existing communication channels. For OICS, there is a positive relationship with subjective satisfaction. HUB reports a positive relationship with both amount of use and subjective satisfaction. Among the EIES groups for which the variable was included-- General Systems, Devices, Hepatitis, LEGITECH, and JEDEC-- a positive relationship is reported for amount of use. For most of these studies, we do not know exactly how the nature and strength of the pre-existing communications were measured. It is reported for JEDEC (Johnson-Lenz and Johnson-Lenz, 1980a:62). JEDEC had quarterly face-to-face meetings. The strength of pre-existing communications before system use was measured by how much the person reported communication about JEDEC matters in between these face-to-face meetings-- not at all, a little, some, or a lot. What they found is that those who had communicated only a little in between meetings also used EIES significantly less.

An explanation of the observed relationship is also reported for LEGITECH on EIES. Lamont notes that an initial core group of users from the Minnesota, Massachusetts and Pennsylvania legislative research groups knew each other and had interacted before their use of EIES. They wrote the most comments in the group's policy conference, and seemed to be more satisfied with the system than those who had not communicated at all before their use of EIES.

Finally, Umpleby comments that the same pattern was true for GST members- - those who knew each other before system use communicated more on line.

Leadership

a. Leadership Style

Research indicates that leadership style depends in part on the personality of the leader. In the simplest dichotomy, an individual's style may be self-oriented (authoritarian) or group-oriented (egalitarian), with any number of degrees between this range. Looking at the task-related literature, the most productive style depends on the group's needs. An authoritarian figure would have a tendency to dominate the communication process to the extreme that individual members would not participate or would participate in a limited way. While the literature does not address computer-based communications, it would seem reasonable to suggest that such domination in the extreme would decrease the acceptance of this medium because individual members could not participate in a constructive and meaningful way. On the other hand, some groups need an authority figure to organize the group, and to assume at least some administrative and decision-making responsibility in order to complete a task.

The group-oriented leader would seem to be effective in this medium. Generally, this type of leader fosters and encourages participation from all members, moves them to consensus and includes all those interested in policy formation. Each individual's skills are brought to bear on the task at hand. This style, however, also presents problems. The egalitarian concept can be used to the extreme whereby all members are so equal that nothing gets accomplished. The sense of leadership and direction is lacking, which tends to confuse and frustrate members. (Hare, 1976).

The behavior of the leader depends not only on personal attitudes but also on the characteristics of the situation. For example, the task-oriented leader seems to be more effective in situations which are either highly favorable or unfavorable for the leader. On the other hand, the relationship-oriented leader is more effective in situations which are moderately favorable or moderately unfavorable to the leader. (Kowitz and Knutson, 1980).

For the EIES groups, Hepatitis reports a strong positive relationship between leadership style and amount of use, and a moderate relationship to subjective satisfaction. All other studies which observed leadership style report a moderate relationship with amount of use-- General Systems and the Devices group on EIES, and the NLS and HUB as amount of use of the system by the members of the group. Besides the Hepatitis report meantioned, General System reports no relationship for subjective satisfaction, but a moderate one for amount of use.

None of the studies report details on just what it is that constitutes an effective leadership style in this medium. A fruitful reasearch project might be a content analysis of the "style" of communications entered by successful and unsuccesful leaders of on-line groups.

b. Leadership Effort

Leadership effort can be easily measured in terms of amount of time spent reading and writing on line each seek. Ideally, a measure would also include time spent off-line thinking and planning and communicating with group members, but this is not as easily collected since there is no computer to automatically log off-line time.

Some leaders are simply more active than others in terms of time spent communicating with other group members. The level of effort depends on the leadership style and situation. Some leaders may perceive a need for considerable interaction and communication on their part while others may feel that their participation could lead to a decreased participation on the part of other members. Clearly, a balance is called for. With computerized conferencing activities, this balance can be attained using a number of channels: messaging, anonymous messages, a conference agenda item, etc. This can be particularly effective if the leader is dominating the activities. If the leader is not spending sufficient time providing direction, the situation may be harder to balance. While the previously mentioned channels can be used to inform the leader that more direction is needed, the members must be familiar enough with the system and with each other to articulate their needs.

The most active of the EIES leaders was in LEGITECH. By the beginning of June 1980, he had spent 1650 hours on line, about twice that spent by the next most hard-working or active leaders, who were in the Futures and General Systems groups. The evaluator reports qualitative evidence of a negative relationship between this very high participation rate by the leader and the amount of use and subjective satisfaction of the other group members. She notes that, in an attempt to bring a large number of researchers up to speed quickly and to keep them informed on the status of all aspects of the project, the project leader contributed the majority of all conference items. Private message exchanges indicated that this decreased the enthusiasm of some of the other members to check in and contribute to the conference. What was perceived as "too much" leadership effort and activity "led first to information overload and then to a feeling of dissatisfaction." However, one unique aspect of computerized conferences, compared to face to face meetings, lies in mechanisms to remedy such a situation. Private messages served to define the problem to allow the emergence of other leaders.

Other groups for which observations are available on leadership activity tend to report a moderately positive relationship between amount of leadership effort and the acceptance of the system by the group members-- General Systems, Devices, and Hepatitis groups on EIES, and the HUB study. The only exception is Bair's study.

Based on the data, then, we can conclude that a kind of reverse J curve would characterize the relationship betteen leadership effort and acceptance of a system by the other group members. Up to a certain point, the more the leader communicates on the system, the more the group members are likely to use it; but if the leader becomes extremely active, the other group members may feel deluged with information overload, or resentful of what appears to be domination of the proceedings.

Cohesiveness

Cohesiveness is "...the ability of group members to get along, the feeling of loyalty, pride and commitment of members to group...the degree of liking that members have for each other...cohesiveness is not a process so much as a state of being. As groupness emerges from group interaction, the group may be characterized at some level of cohesiveness." The literature also points to a relationship between cohesiveness and productivity. Specifically, there seems to be a direct relationship between cohesiveness and productivity but only up to a point. At the upper end of the continuum a curvilinear relationship becomes apparent. For example, there may be extremely high cohesiveness but low productivity. Many factors are cited as contributing to this phenomenon. One is that extreme familiarity lends itself to more social interactions vs. task oriented activities. Another is that the group has a reserve productive capacity which it simply does not utilize (Fisher, 1974).

While the literature does not specifically refer to motivation with respect to cohesion, it should at least be mentioned. Vallee et al. (1975) make reference to the relation between motivation and participation in computer conferencing. Those users with high motivation and high personal stake seem to interact more often (and using more lines) than others less motivated. It would seem that motivation would also have an impact on cohesiveness, but again, the literature does not specify the relationship.

Kowitz and Knutson (1980) point up the relationship between cohesiveness and satisfaction when they say that "...members enjoy their group experiences and feel that certain needs have been met." The concepts are very closely related, with members of cohesive groups are more satisfied and vice versa.

Cartwright and Zander (1968) measure group cohesiveness by looking at several items: interpersonal attraction among members, evaluation of the group as a whole, closeness or relation to the group and expressed desire to remain in the group.

We have broken cohesiveness down into two main components-- the types and density of social ties, and the affective or emotional components of these relationships among the members. Two aspects of the affective component have been singled out: the amount of competitiveness vs. cooperation among the members, and the amount of trust, a related phenomenon.

Sociometric Ties: Type and Density

Social ties vary in their strength and intimacy, ranging from minimal familiarity with someone-- having read their work or otherwise "heard of" them-- through working relationships such as coauthor or student-teacher or manager-staff member, to personal ties including close personal friendships. The "density" of social ties is a group aggregate measure which refers to the proportion of all pairs in a group which are connected by the tie. For example, if you have a group of five persons, there are (N * N-1) or 20 possible friendship pairs. If in fact ten friendships are reported, this is half of those theoretically possible. The density would be observed/maximum, or 10/20, .50.

The ties among a group may be diagrammed in a kind of "sociogram" where each person is a node and a line indicates a tie. With this system of representation, one can see if the ties divide the group into two or more distinct "cliques," or whether there seems to be a single integrated group. One can also observe the proportion of isolates-- those with no ties whatsoever.

It was hypothesized that groups with a greater density of ties before conferencing would use a computer conferencing system more. The most important kind of pre-existing ties are probably miminal familiarity-- having met or heard of someone-- and existing working relationships. The former can be manipulated somewhat by having a face-to-face meeting prior to use of the system, for groups in which the density of acquaintance is very low.

a. Face-to-Face Meetings Prior to Conferencing

Within the computerized conferencing context, this refers to the bringing together of a group prior to their first experience on the system. For some groups, this is a structured part of the experiment where members can meet socially to discuss how they are going to use the system and to meet each other. This provides people with an opportunity to match faces with names and numbers and to know something of the personality of the members.

b. Working Relationships Prior to Conferencing

In many instances, people who are members of an electronic group have already established some relationship prior to the conferencing. In fact, the existence of these ties was probably the basis for forming the group in the first place. It has been felt by some people that the existence of such a base greatly facilitates the acceptance of a new communications medium. If nothing else, less time is spent introducing people to each other and waiting for the ties to develop. More important, however, prior ties do indicate that a communications need has already been established for the group and computerized conferencing is a means of further facilitating that communication. For example, in LEGITECH, individual researchers had already developed a telephone/ mail networking system. While this factor was not formally analyzed, individuals did indicate interest in participating because "X" from state "Y" was also on line.

c. Existence of Cliques, Isolates or Integration into a Single Group

One of the EIES groups (Social Networks, not by chance) included in its evaluation a complete three-wave study of changing social ties, including one at pre-use. Types of ties measured were "minimal": having heard of someone or read something by them, through having met them, previously communicated by telephone or mail, worked with the person, friendship, and close personal friendship. When diagrammed, there were two distinct cliques apparent in the friendship ties, and many isolates who had no friends.

It was found that after use of EIES, the density of all types of ties increased, there were fewer isolates, and the two distinct cliques became integrated into a more or less single friendship and collegial network. However, the study looks at density, cliques and isolates as dependent variables, as effects, rather than as predictors of acceptance. If comparable pre-use measures were collected for all groups in the future, we might assess the effect of various levels of pre-existing social ties on subsequent acceptance of the system.

Those studies which did include some observation of the density of sociometric ties at pre-use report that there is a positive relationship with acceptance. The studies reporting such data include Hepatitis, Devices, General Systems, and NLS.

Competition

Competitiveness is often discussed in terms of a contrast with its antonym, the concept of cooperativeness. "In groups which are motivated to cooperate, the members all work toward a group goal which depends on interdependent activity on the part of the members, while in competition an individual's reward depends on his own achievements which can usually be maximized only at the expense of other group members." (Hare, 1976, summarizing May and Doob, 1937; Vogler, 1968, 1969).

Hare cites a considerable number of sources to demonstrate that cooperative members have more positive responses to each other, have more favorable perceptions, are more involved in and have greater satisfaction in the task, work less at cross purposes and are more efficient and productive.

Other studies look at the effect of individual characteristics on group activitiy, the most recent being Mettee and Riskind, 1974, and Silverthorne, Chelune and Imada, 1974.

Hare reports on a study done by Deutch which looked at the effects of cooperation and competition on group process. The cooperative groups had the following characteristics:

1. Stronger individual motivation to complete group task...
2. Greater division of labor...
3. More effective intermember communication...
4. More friendliness...
5. More group productivity... (Hare, 1976).

The participants in computer-based communications systems are generally members of a group with an identified goal, i.e. developing a more effective communications system, extending a resource network, etc. In order to develop a cooperative situation, the group goals must be viewed as more important than individual goals or the rewards for cooperation must be greater than being competitive. Acceptance of this type of system would probably be higher in the cooperative situation if members viewed the technology as facilitating the group process, goals and cooperative efforts.

There are many different kinds of competition-- over money or other scarce resources, prestige, or power, for instance. Perhaps some kinds of competition are not incompatible with cooperation. In addition, one can have high competion within the larger social environment-- such as an industry or a scientific community-- and have cooperation within a small piece of that community which works on line together.

Hiltz (1980) included several questions on the overall amount of competition and the specific kinds of competition which characterized the various scientific specialty areas represented on EIES. Generally, there was no relationship between perceived degree of overall competition in a field and amount of use made of the system. However, "unfair" forms of competition are negatively related to system acceptance.

Only two groups report studying degree of competition-- HUB and the Hepatitis group on EIES. Both report a weak to moderate or qualitatively supported relationship. Thus, while competitiveness may pose some barrier to a group's acceptance and use of a system, it does not seem to be an important variable.

Trust or Openness among Members

This is the degree to which members feel that they can communicate with each other in an "open" atmosphere. It would seem that the more trust felt among members, the greater the degree of acceptance of this medium. If members feel that there are hidden agendas being carried out, this can lead to a decrease in participation. This medium carries a great potential for that activity in the ability to send private messages and to control membership in groups and conferences. Most importantly, there is nothing but peer pressure to enforce the norm that ideas and information contributed by group members belong to the author and are not to be quoted or used without permission.

One specific dimension of cooperation vs. competition is the amount of trust group members feel for one another. Hiltz (1980) found that distrust of the motivations of others, as measured by the perception that some of the group members act unethically, almost invariably resulted in low use of the EIES system. The HUB and Hepatitis groups were also the only ones reporting observations on trust, and both report a moderately positive or qualitatively supported relationship with acceptance measures.

OTHER DETERMINANTS

The last page of the initial data collection instrument for determinants of acceptance asked the researchers to list any other factors which were omitted from the list submitted to them. Two potentially important determinants were reported-- access to terminals and direct vs. indirect use. These factors were added to a second round of data reporting for all studies.

Access to Terminals

How this factor was omitted from the initial list generated by the working group now seems mysterious-- perhaps it is just "too obvious"; or more likely it was because of the division of labor within the working group, which assigned "equipment" to one person and individual and group determinants of acceptance to others.

The JEDEC study included several questions which measured access to terminals among participants-- at their place of work and at home. It was found that:

> ... those with their own terminals used the system far more. The observed difference between those who have their own terminal and those who must share one is significant at the .01 level. Sharing a terminal does not seem much better than having no access at all.
>
> The (data) showing average use level for those with and without home terminals further confirms this by showing that those with home terminals used the system much more...(In addition) participants were asked in the telephone follow-up interview to list obstacles to the effective use of EIES for JEDEC work. Seven people reported lack of a terminal as their first mention of an obstacle... all of these varied results seem to point quite clearly to the conclusion that convenient access to a terminal is essential for EIES use. Furthermore, anything that detracts from maximal access, such as not being able to take the terminal home or having to share it with another seems to result in a significant and substantial reduction in activity (Johnson-Lenz and Johnson-Lenz, 1980a:32-34).

Bair reports similar findings for the NLS study-- a strong positive association between having a personal terminal and amount of use, and a moderate positive relationship with subjective satisfaction. Furthermore, he notes that type of terminal is important. "The availability of high speed displays strongly predicted use and satisfaction."

The final report on the study of NLS use at the Rome Air Development Center gives more detail on the importance of terminal access:

> Terminal availability is a crucial variable affecting the learning process. There is strong resistance to leaving one's work space to work in another or to physically carry a terminal to that area from some other work space. Ideally, every user would have his own terminal. This is not warranted by current usage levels here, nor is it feasible financially. However, it has become a problem to the point where it caused some people not to use the System (Bair, 1974:28).

For those who responded to the second round of data requests on this item, terminal access was unanimously reported to be positively related to amount of use. Having one's own terminal at one's place of work, as opposed to shared access with others, is particularly important; having a terminal to take home (or on trips) somewhat less strongly related.

On type of terminal, contrary to Bair's findings for NLS users, the Hepatitis evaluator reports that print capability was preferred to high speed CRT's, and that both were generally available to the participants.

Direct vs. Indirect Use

Direct use refers to "hands on" use of the system, typing in and printing out all interactions. Completely indirect use would mean that usage was delegated to an intermediary such as a secretary who operated the system, typing in materials from hand written notes or dictated drafts, retrieving and printing out waiting items, and delivering them to members of the on-line group. Generally, it would be expected that interaction with a system primarily thorugh an intermediary will be associated with lower levels of use and satisfaction. However, the availability of a secretary or other intermediary to enter long drafts of documents or otherwise take over some of the mechanics of operation of the system when there is a heavy workload or other problems might increase total use and satisfaction.

Kerr's study of WHCLIS reports a strong correlation between direct use of EIES (typing in material themselves vs. delegating) and total amount of use of the system. On the other hand, Siegel found no relationship.

SUMMARY

There is sparse of evidence about many of the determinants of acceptance of computer-mediated communication systems. The Futures study included none of the variables which we have reviewed; Mental Workload included only one; COM; only two, and several others, only a handful of the variables.

The evidence which we have collected and reviewed is summarized in Table 3-6. The two best predictors, based on existing evidence, seem to be a pre-existing communications networks which can create the demand for enhanced communication among the group members, and the nature of the leadership provided to the on-line group. Attitudes (expectations about the system and its potential usefulness), some previous experience with computer terminals, having one's own terminal, and the degree of geographic dispersion of the group are also predictors that have held across many studies.

TABLE 3-6
SUMMARY TABLE OF ACCEPTANCE FACTORS

	MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
AREE	Pre-existing communications network (2++;6+) Leadership style (1++;4+) Previous experience (4++; 3+;1=0) Own vs. Shared Terminal (3++;2+) Expectations about system (3++;2+;1=0) Geographic Dispersion (2++;3+) Anticipated usefulness (3++;3+;2=0) Terminal to take home (2++;2+;1=0) Night or weekend hours (2++;3+;1=0) Attitudes toward computers (4+;1=0)	Task importance (1++;3+) Education (3+;1=0) Liking for task (1++;2+;1=0) Degree of pressure (1++;2+;1=0) Innovativeness (1++;3+) Introversion vs. extroversion (1++;1+) Basic values (1++;1+) Perceptions of professional role (3+;1=0)
DISAGREE	Typing speed (1++;3+;3=0) Attitudes toward group (3+;2=0) Age (1--;2-;2=0) Leadership effort (4+; 1-;1=0)	Type of terminal (2+;1=0) Reading speed (1+;2=0) Previous productivity (1++;1+;2=0) Work hrs/day or week (1++;1+; 1=0) Access to alternative media (1++;1-) Centralized vs. decentralized (2+;1-;1=0) Size of group (1++;1+;1-;1--) Direct vs. indirect use (1++;1=0)

KEY

"Agree" means that 75% or more of the studies reporting results reported that the variable did predict acceptance (in terms of amount of use); and that there is agreement in the way in which the variables are related, positively or negatively.

The numbers in parentheses summarize the observations. For example, "2++; 6+" means that two studies reported a strong quantitative, positive relationship; six reported a qualitatative or weak quantitative positive relationship. A notation that "3=0" means that three studies found that the factor did not predict acceptance.

CHAPTER IV

IMPACTS OF COMPUTER-MEDIATED COMMUNICATIONS UPON INDIVIDUALS AND GROUPS

A conceptual framework was constructed for studying the impacts of computer-mediated communications, recognizing that the development of a rigorous model was not a reasonable goal, given the current state of the art. We were willing to tolerate a certain amount of ambiguity or lack of conceptual rigor, aware that this is but a beginning. We began by identifying large areas of impacts and the systematic characteristics of usage under which they occur, after which specific impacts could then be determined. As a consequence, we worked with a holistic methodology in which the emerging list of impacts generated the conceptual structure, which in turn created the awareness and consideration of additional impacts.

Literature reviews, use of findings from earlier studies, and the administration of data report instruments to evaluators provided the data with which we attempted to verify whether the hypothesized relationships did in fact exist. Verification sources thus included qualitative data (subjective impressions from observations, anecdotal data, and speculations) as well as quantitative data. Using experts within the field as the source from which to pool the results of myriad evaluations, we were one step removed from the actual subjects or users of these systems.

It was within these guidelines that we attempted to identify both past and future impacts of computerized communication systems, while both nestling our conclusions in grounded data and speculatively peeking into the future. This was clearly an ex-post-facto, emergent and exploratory kind of methodology from which we believe testable hypotheses and controlled experiments will be derivable.

Below is the taxonomy of impacts within which the data were organized and examined:

TABLE 4-1
IMPACT CATEGORIZATIONAL SCHEMA

TYPE OF IMPACT	COGNITIVE	AFFECTIVE	BEHAVIORAL
INDIVIDUAL	1	2	3
GROUPS, ORGANIZATIONS, COMMUNITIES	4	5	6
INSTITUTIONS AND SOCIETY	7	8	9

Although the original plan was to divide each of these cells into immediate, short-term, and long-term impacts, superimposing the time dimension was not feasible for most of the impacts discerned. Similarly, it was decided at this point not to consider impacts according to specitied systemic features or functions, but rather to explore computer-mediated communication systems as a whole. The refinement of this schema is one of the major needs of future research.

The impacts were divided into six categories- by level (individual, group, and societal) and by type (cognitive, affective, and behavioral). Types of impacts were defined as follows:

INDIVIDUAL: COGNITIVE Thinking and knowing (ideas, concepts, or information thought to be true or factual; values, opinions, or attitudes about things and ideas rather than about people)

INDIVIDAL: AFFECTIVE Feelings (emotions such as sense of well being vs. isolation, feelings of liking or disliking others); opinions, values, and attitudes about people

INDIVIDUAL: BEHAVIORAL Doing: individual communication styles and patterns; effectiveness of such communication or work patterns for individuals

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GROUP: COGNITIVE Ideas, purposes, goals; group and intellectual resources; group norms and values; social definitions of truth

GROUP: AFFECTIVE Informal structure (affective feelings of liking or disliking others); group cohesion; attitudes towards purposes and goals

GROUP: BEHAVIORAL How the organization relates to other groups and to the community; nature of communications; organizational features, formal structure, lines of communication; communication processes and effectiveness; informal structure (how the group members relate to each other)

SOCIETY: COGNITIVE Political; goals, purposes, values, and thoughts; basic ideas of society; knowledge, values to specify changes in societal and political ideas; skills, science and technology

SOCIETY: AFFECTIVE Attitudes toward culture and goals; nature of life and society; feelings such as alienation; changes in intergroup relationships of liking and disliking; values and meanings about people (rather than about things or ideas)

SOCIETY: BEHAVIORAL Political behavior such as lobbying or otherwise acting to influence the polity; economic; societal level of communication processes and outcomes; changes in social patterns and institutions

In discussing observations and findings with evaluators, we realized that very few have any data on the societal level. Existing field trials and experiments have involved only relatively small numbers of users in a few organizations. Trying to project the findings of these small-scale studies to a situation in which most of a society is connected by computer-mediated communication systems is at this point a very speculative enterprise. Therefore, while recognizing that societal-level impacts will ultimately be the most important, we limited our survey to those levels for which there are existing data: the individual and group levels (cells one through six in Table 4-1).

TOWARD A DEFINITION OF IMPACTS

Impacts are outcomes, effects, or consequences. They consist of significant social changes resulting from or spinning off from other changes. We are concerned here only with those technologically-induced impacts that are directly linked to computer-mediated communication systems. Although impacts are frequently unanticipated consequences of other changes, we are attempting to predict them from present knowledge so as to be able to minimize or avert negative outcomes and maximize positive ones.

Impacts may be functional, dysfunctional, or neutral. The same change may have very different impacts on various subgroups, which need to be identified, and at different points in time.

Impacts are potential rather than predetermined, emergent rather than static, and conditional upon their context. They are dependent on the underlying social structure of the user groups and the design of the communication systems. "Groupware" is the configuration of group process and software. It refers to system design, or the presence or absence of specific system features, although some impacts are more design-sensitive than others. It also refers to the task or purpose of participation by different user groups, as well as the dynamics of the group context. The groupware variable raises such questions as: What are the effects on the user groups of different designs? Of different structures for organizing the flow of communications? Of different types of group process? This chapter presents generalizations about the impacts of computer-mediated communication systems. The section to follow focuses on the ways in which such impacts are conditional upon the groupware.

Impacts are also a function of factors both inherent in and extraneous to the electronic medium. They are dependent upon the cultural and social milieu, as well as the group and organizational context in which users are operating. Although it is not yet possible to anticipate all the antecedent and intervening variables which interrelate to determine or constrain impacts in specific situations, some of these are:

- Access to the technology
- Attitudes toward the technology
- Characteristics of the medium
- Cost, equipment, and other peripheral aspects
- Personality and other individual characteristics
- Ability or expertise
- Communication needs
- Power
- Leadershsip styles
- Nature of the task
- Types of constituencies or subgroups
- Reference groups
- Socio-economic status
- Rewards or sanctions
- Type of group membership:
    - Ascribed or achieved
    - Formal or informal
    - Compulsory or voluntary
    - Duration
    - Source
    - Status (position) and role:
        - Norms
        - Salience
        - Consistency or integration
        - Conflict
        - Clarity or ambiguity of expectations
        - Observability and visibility of performance
        - Commitment, ambivalence, or disinterest

We operated also within an awareness of this larger constraining framework offered by Hiltz and Turoff (1978b:261-262):

> The particular impacts to be found also depend on a complex interaction among at least four sets of factors:
>
> 1. What is being looked for, and how, and for how long. That is, choosing a level of impact and factors within it to focus on probably precludes finding other types of impacts. What is found in a study depends partly on how long it goes on; certainly, the behavior of users and the impacts of such use will be much different after five years than after a two-hour experiment... Finally (and most important for this set of factors), findings are going to be partially an artifact of the evaluation methodology chosen (the controlled experiment; the field experiment; the field trial; questionnaires and interviews with users; participant observation in and/or content analysis of the proceedings of conferences; or simulations).
>
> 2. Features and characteristics of the system itself, and its implementation. This includes the complexity, flexibility, and style of user interface of the system, as well as the print speed of the terminal used.
>
> 3. Application areas, that is, the kinds of groups that are using the system; for what purposes or services; and in what type of environment (e.g., work at home, remote meetings, scientific communication, social or educational services).
>
> 4. Characteristics of the user and the immediate environment. Included here are user attitudes and motivation...; user skills -- reading and typing speeds, relative skill and preference for spoken rather than written communication; type of role played by conference moderators or other human facilitators on the system; and the total communication and work load of the user.

PROCEDURE

A list of possible impacts, derived from the research literature and our collective experiences, was developed at an initial face-to-face meeting of the group, which was composed of the Johnson-Lenzes, Kerr, McCarroll, Parnes, and Umpleby. All except the latter participated in a collaborative discussion and voting procedure on EIES, joined by

Roxanne Hiltz, in which the typology was refined and the questionnaire developed. The list was subsequently elaborated, refined, and categorized by "voting" on the cell in the taxonomy into which each impact best fit. Definitions of the cells were formed and modified in the process. And it was then distributed as a data-gathering instrument to a group of expert respondents for their validation, data, and comments.

One of several difficulties with the review of the existing literature is that it frequently does not distinguish between the type of methodology, the design of the system being used, the application areas, or the characteristics of the users and their immediate environment. Although the literature is fairly extensive, it is scattered, some is out of print, and much has not been formally published. Existing studies tend to be either application-oriented or conjectural discussions of potential impacts upon subgroups. This review, then, is extensive but not exhaustive.

The voting task was arduous, since many of the listed impacts did not clearly fit into the one of the nine categories. We recognized that the taxonomy selected might not be ideal, but could not construct one that was clearly superior. An alternative methodology of clustering the impacts into natural groupings and assigning descriptions to the resulting clusters of meaningful configurations was abandoned because of its relative complexity.

Items based on research not specifically related to computer-mediated communication systems were removed, as were redundancies and those which referred to types of applications rather than to impacts or effects. The final list was reduced to those items for which we suspected there might be empirical evidence, and those which might be significant despite our ignorance of evidence or the unlikelihood of concrete supporting data. The final list, however, still exceeded the shorter length we had hoped to achieve.

The list is by no means considered exhaustive. A good many impacts had implications for several cells, and in these cases assignment was made according to the judgment of the cell in which the primary impact occurred. We were still unable to state many of the possible impacts with a comfortable degree of precision, while others implied specific impacts beyond what could be specified in simple questionnaire statements. Precise definitional and conceptual boundaries do not yet seem possible.

Data reports were returned for seven EIES groups and five other systems: CONFER, COM, NLS, OICS, and USG-MSG.

We hope that one of the outcomes of this research will be further structuring and categorization within each cell, beyond ordering the lists in terms of magnitude as has been done here. For example, within the group level, it should be possible to arrange the impacts by effects on problem-solving activities, effects on group structures, and effects on group relationships, by time, and by the interrelationships among the impacts themselves.

COGNITIVE IMPACTS ON INDIVIDUALS

Impacts of computer-mediated communication systems upon individuals are categorized into cognitive, affective, and behavioral levels.

Cognitive impacts are those involving thinking and knowing. They consist of ideas, concepts, or information thought to be true or factual, as well as values, opinions, and attitudes about things and ideas rather than about people.

Below is the list of hypothesized cognitive impacts at the individual level which was submitted to our group of experts:

Computer-based communication systems create new perceived needs for information.

Continuing education and Computer Assisted Instruction (CAI) expand learning over a lifetime for many.

Learning occurs by the written word rather than through audio and visual media.

It requires new skills.

It discriminates in favor of the literate (writers, typists, etc.)

It increases the variety of ideas.

It may improve spelling and typing.

Literacy and information processing abilities improve.

Personal goals change with greater awareness of the global situation.

It expands "effective scope": the number of alternatives, pertinent stimuli, awareness, social and cultural horizons.

Users are able to deal with larger amounts of information more efficiently.

Because the volume of information can become overwhelming, it increases the possibility of information overload.

Because information overload requires periodic reassessment of goals and priorities, there is a reduced tendency to follow traditional patterns.

These items suggest that mental constructs undergo change as users become familiar with the medium. Communicating via computer impacts upon the ways in which people think. The greater the duration of exposure, the greater are the likelihood, frequency, and intensity of such impacts.

Discriminates in Favor of the Literate

It discriminates in favor of the literate and educated, since it is grounded in writing and reading skills. Those already accustomed to dealing with words, ideas, and conceptual models will have a major initial advantage. Over time, as new generations begin to take it for granted, it will continue to act as an impetus into the world of ideas and away from the world of things. As an integral part of the communication-information age, computerized communications expand cognitive worlds.

The expert panelists who examined this impact found supporting evidence, with the exception of two studies which found no evidence one way or the other. COM reports strong quantitative evidence ("++"), whereas the others had weak quantitative evidence or qualitative evidence ("+") that this occurred in the predicted direction. The COM evaluator, Adriansson, found that more than 80% of both new and experienced COM users agreed with the statement that "Those who are good at written communication are favored." The

CONFER evaluator comments that this is a tautology, and NLS has strong anecdotal data to support it. The JEDEC evaluators examined several components of literacy, however, and found no empirical support (Johnson-Lenz and Johnson-Lenz, 1980b:36-38).

Typing skills, as a component of literacy, produced comments. OICS reports that regression equations showed knowledge of typing to be an asset. The Devices for the Disabled group examined the impact but found no relationship ("0"), noting that although typing skill sometimes makes a difference, the data are not consistent. JEDEC also reports "0", with the finding that typing speed was not supported by the data.

Handling Larger Amounts of Information

Users are able to deal with larger amounts of information more efficiently. They can exchange far more information in a given time span than would be possible with conventional media (Vallee and Askevold, 1975:59; Turoff, 1972: 163), and can sift through masses of information on complex issues. The individual's capacity to absorb and process information is greatly expanded (Bezilla, 1980a:1).

This hypothesized impact produced a mixed response from the panelists. OICS reports a "++"; four others report "+" (General Systems, Hepatitis, CONFER, and NLS); two report a "-", meaning that they studied the impact and found a moderate to weak negative relationship opposite to that described; and the Mental Workload group reports a stronger "--", meaning that there was strong quantitative evidence refuting the impact. The negative finding for the Devices for the Disabled group is attributed to information overload. The evaluator notes that it "seems to take a long time to learn how to deal with the amount of communications active users generally receive." The Legitech comment is similar: "Users were not used to the great amounts of information coming to them. Only a few seemed able to organize their offices in such a way as to develop a more efficient communication system to deal with the overload." This would suggest then, that for some users, efficiently dealing with larger amounts of information is a longer-ranged impact possibly learned by extended experience with the medium. Attributes of the medium itself are suggested by the NLS evaluator, whose "+" response is said to be "due to the unique capabilities of NLS to structure stored text (including messages) - 'hypertext,' and the use of high-speed displays."

Although not responding to this item on the data report, the COM evaluation did include questions on two components of the ability to handle larger amounts of information. Over 80% of COM users agreed with the statements that "Information is easier to disseminate" and "Information reaches more people."

Learning via the Written Word

Learning occurs by the written word rather than through audio and visual media. This may be because written material can be more effective for communicating factual information, as a result of its precision and greater comprehension (Rice, 1980a:24). Only two respondents reported studying this impact. General Systems Theory reports a 'confirming "+" with no comment. OICS has strong quantitative evidence of this impact, but appears to focus the response on learning the system itself rather than more general long-term learning. ("Training was leader-led instruction with hands-on administration. Physical and on-line user materials provided.") The respondents may have perceived more than one dimension in the question as stated.

New Information Needs

With easy access to remote resources, these systems may create new perceived needs for information. As geographic distance is removed as a major barrier to dialogue, access to both consultant and data base resources could become limitless (Johansen, Vallee, and Spangler, 1979:20-21).

The findings of the OICS evaluation are especially illuminating since they contradicted the initial hypothesis that the disparity between perceived "information needed" and "information received" would decrease:

> There were a number of improvements between the pretest and the posttest in the perceived 'information received.' But the perceived 'information needed' increased correspondingly. These findings suggest as access to information improved for the pilot group, expectations increased, as did perceptions of what was required (Tapscott, 1980:13).

Seven respondents to this item were in agreement, checking "+" or "++". McCarroll, commenting on the Devices for the Disabled group, says there is "qualitative evidence from discussions and comments -

perceived need for information increases, upon realizing more is being done in the field than some individuals are aware of - primarily therapists and consumer groups affected this way." The only deviant data was from the Mental Workoad group which reports a "--" to indicate strong quantitative evidence of a negative impact.

Information Overload

New information sources are not without cognitive cost. The volume and pace of information can become overwhelming, especially since messages are not necessarily sequential and multiple topic threads are common, resulting in information overload (Vallee et al., 1978:123-124; Johansen, Vallee, and Spangler, 1979:137-138). Information overload presents itself first as a problem, then as a constant challenge to be overcome. Intensive interaction with a large number of communication partners results in the mushrooming of the absolute amount of information and the number of simultaneous discussions, conferences, and other activities well beyond normal coping abilities. System features to enable users to effectively deal with this form of mental distress include filters, associations, keys, alarms, reminder files, word and text processing, user-defined functions, automatic collections, and search and retrieval capabilities. These are supplemented by learned habits and skills of individual users, who must periodically reassess goals and priorities, such as selectivity, organization, filtering, and time management. There is a drain on mental energy for those who do not succumb to overload. And a mental expansion for those who meet the challenge.

Most of the panelists supported this impact with moderate to weak quantitative evidence or qualitative evidence ("+"). The Devices for the Disabled group notes that "Many users (were) not able to keep up with messages or conferences." Legitech points to user comments that this was a problem in messages and conferences; however, a filtering mechanism was established with Inquiry/Response software to ease information overload. The two respondents reporting conflicting negative findings ("-") suggest the group-dependence of this impact. One was the Hepatitis group on EIES, which had relatively strong leadership and a specific task to accomplish, which in combination may have mitigated the problem of overload. The negative finding from NLS is attributed to factors specific to that system: hypertext, high-speed displays, and unique text structuring and storage capabilities.

Reduced Tendency to Follow Traditional Patterns

Because information overload requires periodic reassessment of goals and priorities, there is a reduced tendency to follow traditional patterns. The literature review did not include this issue, and of the five experts responding to this item, two (NLS and OICS) found no impact ("0"). Mental Workload reports a "++" and both the General Systems Theory and Hepatitis groups report "+", but with no comments. Although this coping mechanism may be a possible longer-range solution to the problem of information overload, the relatively short-term studies conducted thus far do not fully confirm it.

Literacy Improves

Literacy and information processing abilities improve. People can think more clearly without the pressure to respond immediately. With more control over the use of one's time and more information easily available, cognitive energies can be invested more efficiently. Housman (1980:5) observes the "very powerful 'intellectual enhancement' effect made possible by such close linkage of minds ... Ideas get bounced around, criticized, and enhanced very rapidly and there is generally no hesitance to throw out a 'wild' idea or a severe criticism." Each of the four respondents to this item indicated agreement. Greenberg of OICS, however, qualifies this to refer to information processing abilities only and not literacy. And Bair of NLS attributes this impact to the unique features of that system.

Requires New Skills

Because it requires new skills, learning can become an unending process and new communication skills are acquired (Vallee et al., 1978:157-159). Skills such as typing, spelling, and facility with the written language improve, as do conceptual abilities and intellectual work habits. Data indicate that skills increase directly with use of the system (Hiltz and Turoff, 1978a). Reporting the results of a set of laboratory experiments comparing face-to-face decision-making groups with computerized conferencing groups, Hiltz observes:

> In regard to gaining skill, users soon learn to take advantage of the unique possibilities for presenting complex arguments or sets of information by using outlining and indentations and by constructing directional diagrams with boxes and arrows....they learn to very skillfully use the retrieval and editing capabilities of the computer to re-use and rearrange stored materials for new purposes (Hiltz, 1978b:13).

The respondents generally agreed, with the Devices for the Disabled group providing firm quantitative support. Other needed skills mentioned are understanding the logic of the system (Legitech) and learning to be comfortable while interacting on a computer terminal (CONFER). Only the Mental Workload group indicated a "0" for the absence of either supporting or refuting evidence.

Improves Spelling and Typing

And it may improve spelling and typing skills. However, we found no mention in the literature of this projected impact, and very mixed results in our panel: two groups report "+", two "-", and two "0". Bair notes for NLS that it increases carelessness, which has also been observed on EIES. But the potential exists when perfect formal copy is needed, aided by built-in word processors and spelling correction programs.

Increases Variety of Ideas

It increases the variety of ideas. Organizations and people learn more and more quickly of events of interest to them:

> Computer conferencing provides a continuous, content-rich stream of useful information. Traditionally, people who receive a lot of information receive it in chunks: conferences, seminars, journals, papers, magazines, books, correspondence and occasional conversations. Users of

> computer networks, on the other hand, receive a steady stream of information, directed specifically at their interest, and often referred their way by peers or colleagues (Bezilla and Kleiner, 1980).

The panel of experts generally agreed. Each rated it with a "+" except for the Hepatitis group which accorded it a "++". The only exception again was the Mental Workload group which reports a "--" for a finding in the opposite direction. Lamont explained Legitech's position: "By its inquiry/response structure, it increased the variety of responses to questions by calling on state/federal agencies not usually approached for answers."

Lifetime Learning

Continuing education (through computer-mediated communication systems) and computer-assisted instruction (CAI) could expand learning over a lifetime for many. Ideally, this involves embedding CAI systems within communication structures for interactive lessons, with built-in reinforcements and self-paced learning, connecting the student with both the teacher and peer group, and would most benefit the handicapped, incarcerated, and rural dwellers (Turoff and Hiltz, 1977:7; Hiltz and Turoff, 1978b). Although CAI and video education frequently have fallen short of expectations, combining the programmed individualization of the computer with the dynamics of video could produce exciting and innovative teaching methods (Bezilla, 1980b). Potentials include tailored learning experiences and individualized learning networks (Johansen, Vallee, and Spangler, 1979:126-127). Demographic projections of shifting age, household, geographic, and economic characteristics also point to a possibly increased use of teleconferencing for CAI, given its advantages of cost, flexibility, and accessibility (Johansen, McNulty, and McNeal, 1978:43-65). Institutions of higher education will be better able to meet the continuing challenges of falling enrollments and older students returning to school, particularly if their flextime jobs require course offerings at a distance from the traditional centrally-located campus. Individualized educational packages tailored to personal lifestyles and career aspirations will be possible (Scher, 1980b). Only three evaluators responded to this item, possibly because it implies a future projection rather than a current reality. But two gave it a "+" and one a "++".

Expands Effective Scope

It expands "effective scope," or the number of alternatives, pertinent stimuli, and awareness of social and cultural horizons. Cognitive transmission and human memory are enhanced by the power of the computer to aid in organizing, synthesizing, analyzing, and presenting ideas. Improved cognitive retention and the ability to structure and precisely present complex ideas are made posible with the availability of a written modifiable transcript of the proceedings, the ability to search and retrieve past items, graphic capabilities, and asynchronous participation. The accuracy, efficiency, and timeliness of ideas and information are greatly improved (Turoff et al., 1978:46-47). There is not only more time for reflecting on ideas, but also the ability to revise, review, and edit previous entries, as users may be able to deal with larger amounts of information more efficiently. Positive support was obtained from the panel, with all rating it a "+".

Personal Goals Change

Personal goals can change with growing awareness of the global situation. A more enhanced world view can alter individual aspirations and expectations. The literature review gave no clue to this, but all the experts except one support it with a "+"; the exception was OICS which reports no relationship.

SUMMARY

Advanced users of computer-mediated communication systems can take advantage of the processing power of the computer as an integral part of the communication process, by developing customized command interfaces, designing forms to collect and disseminate formulated information, writing adaptive text that permits the reader to indicate whether other material is desired, as by well as performing various processing computations on the information produced in these ways (Hiltz, 1978c:7). Such enhancements of the ability to seek, process, store, manipulate, and disseminate information increase the efficiency of intellectual work. For instance, about 80% of experienced COM users agreed that the "efficiency of work routines" increases. It also makes possible new forms of large-scale collaboration and cooperation in "knowledge work."

The development of new cueing mechanisms to replace the absence of non-verbal cues in the electronic medium has cognitive implications. Although the absence of non-verbal cues is frequently perceived by new users as a troublesome barrier and they complain of the lack of accuracy of their cueing perceptions and the seeming thinness of computerized communications compared with face-to-face communications, there are offsetting advantages. Communication may be asynchronous. And computer-mediated communications fully utilize the computational, memory, and processing functions of the computer such that users have full control over both the spaces and times that are occupied at any given point or according to any self- or group-defined sequence. In an important sense, it is possible to be in more than one place at a time and to be in several times at one place (Kerr and Bezilla, 1979).

> The net effect may be described as a heightened sense of personal interaction. Not with a machine, but with a more rational, structured world where users possess greater control over multidimensional interactions that seem more efficient, more information-laden, more promising, less confining than those enjoyed through conventional media (Bezilla, 1980c:30).

As cognitive abilities expand, this may be a new threshold toward rationality. Certainly, more rational means for evaluating information are available (Bezilla, 1980a:1). Scenarios drawn by futurists conflict in their visions of just how these possibilities will be used.

The summary table below considers the amount of agreement or disagreement among the panel of experts, as well as the size of the sample from which the conclusion was drawn. Within cells, the impacts are ordered by the amount of consensus. For example, the expansion of effective scope produced unanimous agreement, whereas three of the panelists offered contradictory evidence to the hypothesized impact that users are able to more efficiently handle larger amounts of information. "Agreement" here signifies the absence of any dissenting votes. Those items appearing within the "disagree" category have at least one "-" from the panelists, but those at the top of this list tend most toward agreement. The raw data are presented in Appendix II.

The overall pattern suggests that the more socially significant cognitive impacts, such as those including conceptual skills and learning, generated support, whereas those which may be more trivial, such as spelling and typing skills, and those which are clearly negative in impact, such as information overload, are much lower on the list.

In terms of fruitful areas for further research, the top right and bottom left cells are most promising. Impacts in the top left cell of the summary table are so solidly supported by a large number of studies that further work is not likely to add much to our knowledge. Those at the bottom left, where existing studies have yielded contradictory findings, might best be further explored with quasi-experimental or experimental designs that probe the conditions under which the sometimes observed impacts do or do not occur.

The numbers in parentheses summarize the observations. For example, "1++;5+;1--" means that one study reported a strong quantitative positive relationship; five reported a qualitative or weak positive relationship; and one had strong negative quantitative evidence. A notation of 2=0 means that two studies found no relationship.

TABLE 4-2
INDIVIDUAL COGNITIVE IMPACTS

	MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
AGREE	Expands ettective scope (8+) Requires new skills (1++;8+; 1=0) Discriminates in favor of the literate (1++;7+;2=0) Personal goals change (5+; 1=0) Reduced tendency to follow traditional patterns (1++; 2+;2=0)	Literacy improves (1++;3+) Lifetime learning (1++;2+) Learning via the written word (1++;1+)
DISAGREE	New information needs (2++; 5+;1--) Increases variety of ideas (1++;6+;1-) Information overload (2++;6+;1=0;2-) Improves spelling and typing (2+;2=0;2-) Handling larger amounts of information (1++;4+;2-; 1--)	

AFFECTIVE IMPACTS ON INDIVIDUALS

Affective impacts upon individuals involve feelings and emotions, such as senses of well-being or isolation and liking or disliking others. Also included are opinions, values, and attitudes toward people.

Computer-mediated communications can have significant consequences at the level of individual affect.

This is the list of hypothesized affective impacts administered to the panel of experts:

> Computer-based communication systems have the potential for addiction.
>
> As addiction and heavy usage increase, it creates distance or isolation from close relationships outside the electronic medium.
>
> Friendships can endure longer.
>
> Terminated friendships will be more a function of changed interests than distance.
>
> Friendship ties resolidify to counter residential mobility.
>
> It can increase affective ties and sense of personal interaction.
>
> But participants sometimes feel a lack of group interaction and interpersonal feedback: those who need or want immediate feedback might be frustrated, at least in the short run.
>
> It increases the number and strength of support systems: kin, friends, the availability of professional help.
>
> It supports self-presentation and emotional subtleties.
>
> It introduces new sources of stress; e.g. with more potential time together, family life might be strengthened or there might be more divorce and domestic violence; new sources of stress for individuals as workday can expand, priorities change, and new social networks connect people in new ways.
>
> It can enhance the candor of opinions.
>
> It increases status compared to peers without access to computer-based communications.

If the challenge of information overload is not dealt with, discomfort with the electronic medium and inability to cope with its output may produce avoidance of the system, manifested in infrequent, reluctant, or ineffective usage, or dropping out. Data accounting for this low level of participation are not yet available.

Because communication channels are restricted to the transmission of typed words and nonverbal cues are absent, the technology is often perceived initially as impersonal and cold. The possibilities for perceiving an absence of personal contact and group interaction (Ferguson and Johansen, 1975:39-40,56) and consequent felt remoteness from the group reduce the likelihood that the social and emotional needs of new or inexperienced users will be met and could permit reduced interaction, social isolation, or anomie. Two examples are quoted in a review of electronic mail systems:

> There can be a sense of remoteness ... People will sometimes feel a little lonesome and miss phone conversations (Lasden,1979:56).
>
> Every once in a while we have to tell our home workers to come in and rejoin society because their messages start becoming paranoid...they'll show increased levels of anxiety and misunderstanding (Ibid:58).

Offsetting evidence is offered by a full-time consultant on the EIES system:

> Sometimes I do miss the 'coffee breaks' that would be a part of a normal office working environment. Because, yes, sometimes working this way is lonely. The tradeoff, however, is well worth it. My work literally spills over into the rest of my life ... Most people, including some of my friends, don't understand. To me, this is a far saner way of living than I've ever had before (quoted in Kleiner, 1980:535).

Potential for Addiction

These systems have the potential for addiction. Because they can provide a steady source of needed information, links with those sharing common interests, rapid feedback, and an efficient use of time and energy, some users find themselves spending ever-increasing amounts of time on line, and this time is given increasing salience and priority over other activities.

Observations and interviews with members of a number of computerized conferencing and electronic messaging systems yielded descriptions of the compelling quality of the medium and the gradual non-debilitating addiction of some users. Addiction is defined as "returning to the terminal, more than...work or information needs alone would at first seem to justify," and may be "one of the first harbingers of change in attitudes and habits in the Information Age." Only qualitative evidence now exists:

> This list of addiction symptoms...(was) 'seconded' by a chorus of other users:
>
> 1. Signing on at least several times a day ("Maybe something is waiting").
> 2. Physical irritation when system is inaccessible.
> 3. Preference shown toward composing thoughts and writings on line.
> 4. Preference towards developing concepts on line.
> 5. Preference towards conducting collegial relationships on line.
> 6. Signing on 'just one more time' before going to sleep.
>
> Many users first notice they are addicted when they have to pay or account for their own network connect time. Others notice when they find themselves staying late at the office to catch up on the work they missed because they were using the terminal. Others do not have to notice; they have co-workers, friends, spouses or children who notice for them, jealous of the time the user spends on the system ... But some users...only notice that they are addicted when the system goes down. 'You know you've had it when your fingers start drumming on the tabletop,' one user said (quoted in Bezilla and Kleiner, 1980).

The respondents generally supported this impact, with the exception of General Systems which finds unspecified conflciting evidence and OICS which found no relationship in either direction. Comments from the nine reporting a positive relationship include observing heavy usage, people missing the system when they could not access it, burnout, and other anecdotal data.

Creates Isolation

Heavy usage and possible addiction can create distance from primary relationships external to the electronic medium:

> While computer network addiction is not dangerous, it can create problems for the user. Spending so much of one's time with any medium...will certainly displace time from other activities. The two areas that are most likely to lose an addict's attention are working situations that are off the terminal, and friendships and personal relationships with those who are not on-line (Ibid).

They predict that "this problem may resolve itself when most of an addict's work and personal life is accessible via terminals, and computer networks become just another communications tool, as ubiquitous and taken-for-granted as the telephone."

The experts were apparently less sure of this impact. The five responses were spread from "+" through "-". Hepatitis and Mental Workload indicated "+". "-" is reported by the NLS group which commented that users denied this, and by OICS which notes that face-to-face communication remained at the same level. COM indicated very mixed responses to this item.

New Sources of Stress

It introduces new sources of stress as traditional lines are blurred, workdays expand, priorities change, and new social networks connect people in new ways. Family life might be strengthened with more potential time together, easier access to the extended family, and flexible schedules especially for child care:

> Telecommuting would enable the parent responsible for child care to have a flexible schedule. Since this is usually the wife, it would mean that women could work without the constant crisis of what to do if the school closes for holidays or the child is sick or the baby-sitter does not come. Moreover, with the main wage earner working in or near the home, he or she can spend more time with other family members, and conceivably perform a greater share of the household maintenance tasks (Hiltz and Turoff, 1978b:481-482).

Instead, there might be increased domestic strain, violence, and divorce. The ability to work from home could mean that family life would not be a refuge from office pressures. People could be more vulnerable to intrusions from bosses via their terminals, or less so because they controlled the frequency of signing on line. New norms are likely to develop, analogous to the circumstances under which it is acceptable to phone people at home rather than at work.

Reactions of the spouses and children of current members of these systems to use of the terminal at home range from supportive acceptance to jealous resentment and a major source of tension if they do not accept or are threatened by the new networks. These attitudes and their consequences can change over time. Qualitative observations and anecdotal information represent the only source of data in this area at the moment.

The experts generally supported with impact with four "+" responses and only one "-" from the Futures group. NLS, although not examining this item, comments that "indications do suggest this."

Lack of Feedback Frustrating

Negative affect can change over time. New users are frequently frustrated by the absence of immediate feedback which accompanies asycnronous interactions (Vallee et al., 1978:123; Johansen, DeGrasse, and Wilson, 1978:94-95; Umpleby, 1980:5). But the data indicate that:

> ...the desire to have truly synchronous conferences seems to almost totally disappear as experience is gained on the system. What seems to happen is that many new users like the immediate feedback and replication of face-to-face conversational conditions that the synchronous conference provides. Experienced users, however, find it most annoying to have to interact at a time and pace of somebody else's choosing! (Hiltz, 1979)

The panel of experts was asked if users sometimes feel a lack of group interaction and interpersonal feedback, such that those who need or want immediate feedback might be frustrated, at least in the short run. Positive responses were received from five of the EIES groups, with a sixth reporting no observed relationship. Representatives from the other systems surveyed are more mixed in their responses (one positive, one negative, one "0"), suggesting that system features may play a role in this impact.

Supports Self-Presentation
Enhances Candor of Opinion

The medium can support self-presentation and emotional subtleties, as well as enhance the candor of opinions (Vallee and Askevold, 1975), in part because users alone at their terminals may feel freer to express themselves (Hiltz and Turoff, 1978b:27-28). Day (1974:60) reports that anonymity permits the frank but less emotional discussion of issues: "This interpersonal forum removes some of the 'threats' associated with normal human interaction. Individuals try out 'dumb' ideas without fear of their judgment being questioned by superiors or subordinates." Turoff (1972:162-163) observes that pen names "could be quite useful when someone desires an uninhibited exploration of a touchy issue" and extends this to the possibility of sensitivity sessions. And Hiltz and Turoff (1978b:144) in applying this feature to managerial styles, suggest that while executives may be reluctant to introduce very new or different ideas into a face-to-face conference for fear of losing face or swaying decisions by virtue of rank, no such inhibiting factors need be present in the computerized conference. Adriansson's data on COM suggest that even within the same system, the medium can make some users feel more candid, but others do not have this reaction. Sixty percent of experienced COM users agreed that use of that system makes it "easier to express unconventional views." However, about thirty-eight percent disagreed.

The panel of experts agreed with both issues. Three of four responding indicate that self-presentation and emotional subtleties are supported. Parnes, speaking for CONFER, comments that this is true for any written medium. Umpleby tempers his "+" finding for General Systems, saying that it does not prevent the impact, rather than actually supporting it. Bair reports an absence of a discerned relationship but suggests that it is indicated and may be found in the longer run.

Seven of eight responding to the candor of opinion item indicate that it was enhanced with a "+". Only the Hepatitis group offers conflicting evidence with a "-" answer.

Increases Status

It can increase status or prestige compared to peers who do not have access to the technology. Housman (1980:2) notes that at GTE "It has become something of a status symbol for an executive to have his own terminal." Panko and Panko (1980) report increased status as one of the benefits cited by the users of an electronic mail system. And the JEDEC evaluation report included the observation that several questionnaire respondents "noticed the emergence of cliques of EIES users at JEDEC face-to-face meetings and that use of EIES conferred something of a special status not held by non-EIES users" (Johnson-Lenz and Johnson-Lenz, 1980b:70). The panel reports seven instances of positive relationships and one (CONFER) of a negative relationship.

Increases Affective Ties

It can increase affective ties and the sense of personal interaction, and can allow some to bypass typical social protocols and become intimate more quickly. Johansen, Vallee, and Spangler (1979:22) quote Richard Bach's observation in a computer conference:

> We are convention bound to comment on the weather, current events, where do you live, what do you do for a living, et cetera. In computer conferencing I can say, and delight in it, 'M. Baudot, what for you is real?' ... You can draw preliminary conclusions about a person in minutes that take long times to draft face to face, occluded as face-to-face is with appearance, manner, speech patterns...

Reviewing a number of systems, Kleiner and Davis (1979:118) note:

> Lots of electronic mail ends up being as personal as face-to-face talk. People form friendships, have arguments, crack jokes. Good writers and more literate people have the same social advantage that good-looking people have face-to-face.

Hiltz and Turoff (1978b:28) add:

> There have been many cases observed or reported by the participants of the most intimate of exchanges taking place between persons who have never met face-to-face and probably never will. Revelations about personal inadequacies, deviant preferences, past love affairs, and serious personal problems that the sender may have told no one else except his/her psychiatrist have passed through the EIES system as private messages to 'strangers' who were 'met' on the system.

Supportive evidence is also supplied by Spelt's evaluation of a computer conference held in preparation of a face-to-face meeting in which social messages predominated (Spelt, 1977:89).

The panel was unanimous in reporting ten positive findings. But the comments qualify this somewhat. Parnes, reporting for CONFER, says that "all communication media will do this," Bair for NLS says that it is "by virtue of some contact vs. none as the alternative," and McCarroll of the Devices for the Disabled group points to the special applications for the disabled.

Friendships Endure Longer

Friendships can endure longer, or even resolidify to counter residential mobility, because it is simpler and less expensive to keep in touch with people at a distance (Hiltz and Turoff, 1978b:205-206), and because it is possible to maintain a strong sense of personal interaction (Vallee et al., 1978:123-124). Kleiner (1980:534) explains the process:

> Computer networks are best used for keeping in touch with people. Far away colleagues coordinate long-range projects, people with similar interests substitute computer networks for newsletters or telephone trees (and end up keeping in touch more personally as a result), and soul-searching friendships develop between those who have never met in person. Some members log on to get a sympathetic response in an emotional crisis. Others make long distance trips to meet in person those they've only seen on the network. There have been typed flirtations which developed into full-fledged romances and idle dreams which suddenly became high-committment businesses.

Although the nature of the friendships is real, there is sometimes a shock when relationships built up by teleconferencing have to deal with the complication of face-to-face interaction. The communication patterns are sufficiently different that people who have worked very well together electronically may be completely ineffective in the face-to-face mode (Theobold, 1980:17).

Three of the five groups responding report positive findings that friendships can endure longer; for two there is no empirical support.

Friendships Terminate Differently

In the future, terminated friendships could be more a function of changed interests than of distance, as people are able to maintain close contact despite geographical distance. Kerr (in Hiltz and Turoff, 1978b:206) hypothesizes that:

> 1. The mean duration of friendships will be longer in a 'computer conference society' than at present.
> 2. Friendships terminated in a 'computer conference society' are more likely to be a function of changed interests than distance.

Only five responded to this item, again perhaps because it is more long-run than most of the other suggested impacts. Three groups (Futures, General Systems, and NLS) indicate "+" for support; OICS reports neither empirical confirmation nor denial; and CONFER comments on the economic constraints ("Seems to be more a function of ability to pay for use of the system.")

Friendship Ties Resolidify

Friendship ties resolidify to counter residential mobility. This impact also is futuristic, and perhaps because of that could not be located in the literature. Only two panelists responded, both indicating agreement with "+".

New kinds of personal relationships are made possible:

> One of the more popular computer-based conferencing forms is the 'online cocktail party.' This is used principally by new groups to practice use of conferencing and to establish personal ties much in the way conventional cocktail parties are used to initiate a personal gathering:

> Members across the country have the drink of their choice ... As might be expected, with time the jokes become bluer, the output is noticeably slurred, and the wise discreetly depart early. The form has reached its highest expression in annual New Year's Eve parties which enable some conferencers to toast in the New Year each hour from Maine to Hawaii (Bezilla, 1980a).

Strengthens Support Systems

It can increase the number and strength of support systems, with the communicatory proximity of physically dispersed family, friends, and professional help. The delivery of social services could be improved by regional and national coordination of services to clients receiving aid from multiple agencies, as well as data-base directories, referral services, and eligibility requirements for specific programs. On-line counselling would not only be more convenient, but might allow people to be more open and candid. Legal or accounting consultation could be delivered more rapidly and conveniently, as could other professional and para-professional services (Turoff et al., 1978:59-60; Hiltz and Turoff, 1978b:177-180,201-202).

There were seven responses to this item, five of which affirmed it with "+" and a "0" from NLS which offers the comment that it is indicated but not yet supported by relevant data. Only the Mental Workload group produced "--" contradictory evidence.

SUMMARY

The summary table below again presents these findings by sample size and amount of agreement. Interestingly, the positive impacts tended to be supported by the panel, whereas the potential problems produced disagreement. Impacts at the level of individual affect are concerned with changes in the nature of social interactions. At the same time, there is the potential for new sources of stress to emerge.

TABLE 4-3
INDIVIDUAL AFFECTIVE IMPACTS

	MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
AGREE	Increases affective ties (10+) Friendships endure longer (3+;2=0)	Friendship ties resolidify (2+) Friendships terminate differently (3+;1=0) Supports self-presentation (3+;1=0)
DISAGREE	Potential for addiction (1++;8+;1=0;1-) Increases status (1++;6+; 1) Enhances candor of opinion (7+;1-) Lack of feedback frustrating (2++;4+;2=0; 1-) Strengthens support systems (5+;1=0;1--) New sources of stress (4+; 1-) Creates isolation (2+;1=0; 2-)	

BEHAVIORAL IMPACTS ON INDIVIDUALS

Behavioral impacts on individuals refer to actions and doing. They include individual communication patterns and styles, and the effectiveness of such communication or work patterns.

These were the hypothesized behavioral impacts:

It can blur the distinctions between work and leisure if users telecommunicate to work from home.

It creates opportunities for flextime and changes in personal time management.

Changes in leisure time activities are possible with more time spent at home and less time watching TV.

It creates the opportunity for communicating at the time of one's own choice.

It creates the opportunity to be "in the center of the action" without regard to geography.

Greater freedom of residence and a shift to rural areas are possible.

It creates opportunities for communicating and joining groups without regard to sex, race, physical appearance, or other credentials.

It allows time for reflecting on the topic being considered.

It increases the degree of personal connectedness with others, in terms of expanding the status set, the number of social participations and the scope of social relationships; it leads to increased collegial contacts, an increase in the number of contacts that can be maintained, and creates the opportunity for regular connectedness with many people.

It increases the quality of work and contact with others' work.

It increases the speed of interaction.

Because it is a written medium, it increases the explicitness of communications with more precise text.

It can reduce travel.

It can reduce the need for paper files and change methods of filing output (more files in the short run but fewer in the long run with easier on-line searches).

Participants can get more deliberate responses to technical questions, backed by written facts and with less delay.

Choice of When to Communicate

Self-generated and self-paced participation rates create opportunities to communicate at the time and pace of one's own choosing rather than at the discretion of others:

> One participates...when convenience, need, and 'mood' create optimum conditions. Because it is considered impolite to interrupt a speaker at a face-to-face meeting, other members are a 'captive audience' ... How many participants in staff meetings...begin to exhibit signs of boredom, frustration, desire to get up and walk around ... Non-participation by group members...adversely affects group productivity. In computer conferencing no participant need sit through such tedium. He/she is free to make comments and contributions at any time; skip or only briefly skim entries in which there is no interest; get up and walk around or get a cup of coffee without being deviant (Hiltz, 1976:7-8).

Turoff (1974b:136) labels this "time dispersion":

> Since the conference dialogue is stored, it is not necessary for individuals involved to be on the computer terminals at the same time. A person may go to the terminal at a time that is convenient to him... He may then receive any messages he had not previously seen, make his additional comments, and sign off. The next person to sign on will find these additional comments also, and anything else he had not seen previously. The individuals engaged in this random mode of conferencing may now control the use of their time to a much greater degree than is possible when a group must simultaneously meet for a discussion.
>
> The computer, therefore, not only allows a person to control his rate of interaction when he is participating in the conversation, but also when he wants to start or stop engaging and to trade that off with other demands on his time. He is no longer a 'slave' to the demand of having a time for communication which corresponds with every other individual in the group.

The panelists were asked about the opportunity for communicating asynchronously. All but one responded. Seven report "+" findings and five "++". For instance, more than ninety percent of COM users agree that the system increased their ability to "participate when it suits you best." This clearly is one of the most strongly supported hypotheses.

Increases Connectedness

It increases the degree of personal and social connectedness with others, in terms of expanding the status set, the number of social participations and the scope of social relationships. It leads to increased collegial contacts, an increase in the number of contacts that can be maintained, and creates the opportunity for regular connections with many people.

It increases connections by widening professional and social circles. Frequent users experience an exponential expansion of their contacts, with the intensification of relationships through continuous interaction, proliferation of new contacts, membership in new networks, and linkages with diverse people who otherwise would not have been known (Bezilla and Kleiner, 1980; Bezilla, 1979).

Public user directories function as cueing aids and substitutes for the absence of nonverbal cues, as well as a means of connecting people for social and collegial contact. This is especially important as the size of the network expands. Using the directory, one can unobtrusively check those attributes of other users that they have chosen to enter. Shared statuses can then become the topic of introductory messages, and groups as well as ongoing conferences may be located. Directory searches can provide indirect cueing as users become aware of shared interests and perspectives (Kerr and Bezilla, 1979:6).

Vallee et al. (1978:111,115) report questionnaire data in which a majority of the respondents said that the ability "to keep in touch with others" was one of the major strengths of the medium.

Strong support for this impact was received from the expert respondents, eight of whom report "+" and one "++". Comments from users are cited to explain these findings. COM users with more experience using that system were more likely to agree than were less experienced users.

Opportunity to be in the Center of Action

It increases the opportunity to be "in the center of the action" without regard to geography, and affects with whom people work. Researchers significantly increased their contact with distantly located colleagues during the course of their computer conferencing (Johansen, DeGrasse, and Wilson, 1978:54-61). Spelt found:

> A universally expressed benefit was the great motivation for small-college scholars to engage in conferencing. Many of the participants expressed...the developmental benefits of being part of the group. In this period of reduced faculty mobility and the corresponding need to find other ways of communicating with scholars on remote campuses...the computer conference appears to provide a new alternative (Spelt, 1977:91).

Six report "+" findings and three "++" findings for this impact.

Speeds Interaction

It can increase the speed of interaction. The experts agreed, with two responding "++", six "+", and two "0". The JEDEC participants indicated in response to a follow-up interview that the use of EIES resulted in decisions being made more quickly and that it accelerated exchanges in general (Johnson-Lenz and Johnson-Lenz, 1980b:64-65). Experienced users of the COM system were considerably more likely to agree with this than were inexperienced users. But the other comments to this item indicate that this is conditional upon other variables and therefore a potential more than a current reality. Depending on factors such as the regularity of signing on line, the task, and individual preferences for the various communications media available, it can increase the speed of interaction but may not necessarily do so.

Able to Join Groups More Freely

It creates opportunities for communicating and joining groups without the instrusion of sex, race, physical appearance, or other irrelevant but intrusive characteristics. This is especially likely in those systems which include the ability to send messages or enter conference or notebook comments with a pen name or anonymously:

> The pen name and anonymity features can counteract the tendency of conventional face-to-face meetings to be ruled by dysfunctional and irrelevant criteria. People can communicate in a computer-mediated meeting without distraction by irrelevant attributes, such as physical appearance or auditory quality. Ideas and achieved statuses become more relevant to the written exchange of

> issues, rather than ascriptive characteristics over which the individual has no control. Conferees can disguise cues irrelevant to professional and scientific dialogue which are influential in informal collegial communications, such as age, race, beauty, physical size, loudness of voice, body language, mannerisms, assertiveness, social class, and organizational position. Cues which could distract more than enhance the quality of group communications can be hidden (Kerr and Bezilla, 1979:8).

One of the many advantages of computerized communications over face-to-face meetings is the reduction of social inequalities as it affects groups such as minorities, women, and the handicapped. Users may elect to mask particular status cues. They may choose to reveal or hide, accentuate or ignore, certain personality, social, and cultural characteristics which would be readily apparent in communication by any other media (Kerr, 1978:74).

The six panelists responding to this item all voted "+" or "++".

Reduces Travel

It can reduce travel by replacing some face-to-face meetings and by providing a continuous link without the financial and human costs of travel. Some users, however, enjoy travel rather than feeling overburdened by it, while others actually increase their travel to explore the new contacts and working relationships developed through the medium. Hiltz (1980) found that travel, whether for attendance at meetings of professional societies or for personal reasons, was as likely to increase as to decrease at all levels of system usage. But "anecdotal evidence suggests that among those who interact a great deal on line but have never met in person, there is a tendency for curiosity to prompt extensions to business or personal trips made for other purposes, in order to meet with one's on-line acquaintances." The substitution of communication for travel, then, appears to be dependent on a number of factors (Johansen, DeGrasse, and Wilson, 1978:74-75; Hiltz and Turoff, 1978b:235-236).

The panelists agreed, with three reporting "++" strong empirical confirmation, four responding with "+", and one "0". Kerr (1980) offers empirical data, with respondents to the post-use questionnaire saying that use of EIES for WHCLIS resulted in decreased travel.

Blurs Distinction between Work and Leisure

The distinction between work and leisure can blur as people telecommunicate rather than commute to work, from home, from neighborhood office centers, or from other flexible work locations. The automated office of the future may well be an office without walls or with very loose walls and flexible working hours, as the need for a central physical location is minimized or eliminated by access via terminals to information and communication. Possible benefits include the cost savings and efficiencies inherent in the reduction of travel time and energy consumption, changes in family interactions, and concomitant changes in life styles (Hiltz, 1976:24; Johansen, DeGrasse, and Wilson, 1978:66-67; Martino; 1979:99; Turoff et al., 1978:54-55; Vallee et al., 1975:134; Vallee et al., 1978:84-87; and Winkler, 1975:2).

The six experts who examined this area each agreed with a "+" or "++". The OICS evaluator reports users taking terminals home with them on evenings and weekends.

Changes in Leisure Time Activities

Changes in leisure time activities are likely, with more time spent at home in active entertainment rather than passively watching television. Martino (1979:97) predicts:

> Telecommunications will invade the household ... TV games...will be much more sophisticated than those in use today, incorporating a built-in computer with the existing TV display ... CATV games will...permit individuals to play against a computer at the CATV head-end or against human opponents elsewhere in the service area of the cable system ... Since the game 'software' will be owned by the CATV system, each user can have access to a far greater variety... The potential for playing against other human opponents in different households will make possible the organization of tournaments and similar activities.

In addition to games, the exchange of information about a variety of hobbies, interests, and other leisure-time activities is also likely. Turoff (1974b:142) suggests:

> Some day we should reach the point where the citizen can have the option of phoning from his home a catalog of on-going conferences and then dial and join a particular conference on a topic of interest to him--stamp trading, a new book, a group therapy session, marital problems, etc. When this happens people will have an efficient method for finding others of similar interests in the society. That type of capability will, in its own way, change and influence the very structure of the society itself. At the very least it would offer an active form of entertainment as opposed to the passive nature of broadcast TV.

The panel of experts was less sure of this impact. Of the three responses, only General Systems reports "+". Hepatitis has no supportive data, and OICS, which did not examine this factor at all, comments "Don't know yet!" This appears to be a futuristic impact now almost devoid of empirical support.

Freedom of Residence

Greater freedom of residence and a shift to rural areas are possible as people are no longer dependent upon a centrally located office. Greater variation in where people live and work is a projected impact. However, the shift in population distribution from urban to nonurban areas since 1970 creates an increasingly dispersed population that seems well suited to use of the new media (Johansen, McNulty, and McNeal, 1978:48-50). Four of the experts confirmed this with "+" reports. Parnes of CONFER observes that access to Telenet (and other network technologies) is a constraining factor.

Creates Opportunities for Flextime

Although it can create changes in when people work, including "flexibility in working hours, whether or not one must work simultaneously with others, and new ways to accommodate a heavy workload outside normal working hours," this was not consistently supported by data from users of the PLANET system (Johansen, DeGrasse, and Wilson, 1978:61-66). Edwards' (1977-99-100) study of NLS, however, found this to be one of the discerned impacts of that system.

More people may find themselves free from organizations as sources of employment, with the self-employed, consultants, and freelancers offering their services to a variety of geographically-dispersed clients. The panel was asked if the medium can create opportunities for flextime and changes in personal time management. They responded positively, with five "+" and three "++".

Better Responses to Technical Questions

Users can obtain more deliberate responses to technical questions, with less delay and backed up by written facts (Vallee and Askevold, 1975). The availability of a written transcript permits explicit review of earlier discussions as well as skimming by those familiar with or not needing the information (Turoff, 1972:164). Again, the experts confirmed this impact, with six "+" and two "0" responses.

Increases Quality of Work

It increases the quality of work, in part because it increases contact with the work of others. By permitting rapid and relatively inexpensive access to remote resources, including colleagues, data bases, meetings, research in progress, and published works, the heightened speed of interaction permits people to keep both informed and connected.

An evaluation of the use of EIES for the development of standards by members of the Joint Electron Device Engineering Council found that it has "a positive effect on the quality and speed of decisions and on the effectiveness of JEDEC face-to-face meetings," as well as increasing the amount of information available for decisions (Johnson-Lenz and Johnson-Lenz, 1980a).

Qualitative evidence of increased productivity and job satisfaction has also been presented by Bezilla and Kleiner (1980) and Turoff and Hiltz (1980) who conclude that the quality of managerial and professional work, as measured by the accuracy, completeness, and timeliness of information brought to bear on decisions, as well as the morale of workers who experience increased autonomy, participation, and variety and challenge of their work, are likely to be positively affected by a well-designed computer-based communication system.

The medium evidently improves the self-assessed quality and quantity of work for some, but by no means all, of its scientific users. It seems to accomplish this both by yielding specific leads or information, and by increasing the general stock of ideas. It also changes their perceptions of the nature of their specialities and of the activities of other scholars within that specialty (Hiltz, 1979).

Such impacts of the EIES system upon individual productivity were measured by users' subjective responses to post-use questions probing the effects of EIES. The quality of work was somewhat more likely to be affected than the quantity, and by means such as increasing the stock of ideas, providing leads, and improving connectivity. The more time spent on line, the more likely were positive impacts (Hiltz, 1980).

The panel of experts was asked about the impact on quality of work and contact with the work of others, and the response was mixed. There are three "++" reports, indicating strong quantitative evidence, from the Hepatitis group, WHCLIS, and OICS. The Futures group indicates a confirming "+". Three groups (Devices for the Disabled, Mental Workload, and Legitech) explored this area but produced data which neither confirmed nor denied the impact ("0"). And NLS indicates a "-" negative finding with the comment that contact rather than quality increases.

Allows Time for Reflection

The quality of work is also positively affected by the medium's allowing time for reflection on the topic being considered before responding or after consulting off-line references (Vallee et al., 1978:113; Ferguson and Johansen, 1975:12; Turoff, 1974b:135-136). The subjects of another study indicated that the computer conferencing experience increased their ability to think about problems (Spelt, 1977:90). The respondents supported this impact, with two "++" and seven "+" votes. Only the Mental Workload group had refuting "--" evidence.

Increases Explicitness of Communication

Because it is a written medium, it increases the explicitness of communications with more precise text. Davis (1971) compared face to face and teletype for the communication of factual information, and found teletype to be the more effective mode. Touissant (1960) among others found that comprehension is improved with the written word. This may be because the written channel allows the possibilities of rereading or checking difficult passages (Short, Williams, and Christie, 1976:84). Four respondents checked "+" in agreement with this impact. Two (Devices for the Disabled and NLS) found no empirical support and indicate "0". Again, the "-" exception is for the Mental Worload group.

Changes Filing Methods

It can reduce the need for paper files and change methods of filing output, with more files in the short run but fewer in the long run as easier on-line searches become feasible. The literature made no mention of this area. And the expert respondents were very mixed in their replies. OICS reports "++", and CONFER "+". "0" was checked by two groups (Devices for the Disabled and NLS). Hepatitis replied "-" and General Systems a firm "--". This impact, then, is very unsure. However, the comments indicate that it could be feasible in the long run, if the technology were made more reliable and storage space increased.

SUMMARY

The behavioral impacts of computer-mediated communication systems upon individuals are summarized below. The dimensions encompass freedom of interaction, quality of life, and quality of work. Choices and opportunities are expanded and new lifestyles become possible.

TABLE 4-4
INDIVIDUAL BEHAVIORAL IMPACTS

	MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
AGREE	Choice of when to communicate (5++;7+) Opportunity to be in the center of action (3++;6+) Increases connectedness (1++;8+) Creates opportunities for flextime (3++;5+) Able to join groups more freely (1++;5+) Blurs distinction between work and leisure (1++;5+) Speeds interaction (2++;6+; 2=0) Reduces travel (3++;4+;1=0) Better respones to technical questions (6+;2=0)	Freedom of residence (4+) Changes in leisure time activities (1+;1=0)
DISAGREE	Allows time for reflection (2++;7+;1--) Increases quality of work (3++;1+;3=0;1-) Increases explicitness of communication (4+;2=0;1-) Changes filing methods (1++; 1+;2=0;1-;1--)	

GROUP IMPACTS

Groups, organizations, and communities constitute the second level at which impacts are investigated. Groups consist of sets of individuals who share some unifying relationship; organizations have functional and administrative structures; and communities represent larger less structured groupings. Each indicates some relationship or ordering among people and an underlying structure.

Relationships among geographically-dispersed users of computer-mediated communication systems result in the creation of on-line groups, organizations, and communities. The individual users may already be members, or when linked electronically may become members of temporary or permanent groups or organizations. Included are groupings such as committees; professional, academic, research and development groups or organizations; interorganizational networks; and neighborhood community groups.

The word "group" will be used to represent all these various kinds of structures. A group may consist of all users, some users and some non-users, or all non-users, and may created through the computer-based communications medium itself:

> The interpersonal structures, processes, and phenomena, some of which correspond to non-electronic communications and some of which are unique to the electronic mode, are the foundation of a new social entity: electronic social groups. Computerized conferencing is an electronic technology from which a social system is emerging. Such electronic groups are theoretically and substantively very new social forms, rather than simply extensions...or replications of existing interactional patterns and processes (Kerr and Bezilla, 1979:3).

In addition, individuals may belong to more than one such electronic social group at a time.

COGNITIVE IMPACTS ON GROUPS

The group level of cognitive impacts refers to purposes and goals; ideas, information processing, and intellectual resources; and values about knowledge as well as social definitions of truth.

These were the hypothesized impacts:

> It creates group resources as individuals join on the basis of verbal output rather than traditional credentials.
>
> It improves the quality of group decisions.
>
> It increases understanding and appreciation of knowledge-based authority rather than hierarchical authority.
>
> Greater awareness of the global situation changes organizational goals.
>
> The creative process is more abstract.
>
> It provides a common framework and experience (a node for networks).
>
> It creates opportunities to develop communities of interest rather than those based on geography, discipline, etc., and a redefinition of the meaning of "local."

Creates Group Resources

It increases group resources as individuals join on the basis of verbal output rather than traditional credentials. There is a potential for increased access to both human and electronic sources of information. A group's available resources may be planned and intentional, including their members, consultants, and data bases, or unplanned and accidental, such as locating new information sources as a byproduct of network membership.

Computerized groups are likely to be able to attract new members in part by the ongoing existence and activity of the group, rather than by more traditional devices. Movement in and out of conferences and groups on EIES has been largely based on interest in the topics under consideration. In some instances, people are offered membership based on their qualifications, and in others invitations are extended to those expressing an interest. The medium can, on the other hand, simplify the exclusion of potential group members when that is desired, since membership access is selective and the very existence of an electronic group can easily be kept secret.

The panel of expert respondents seemed to hesitate about this impact. There were only four responses. Two (General Systems Theory and OICS) report observing this impact in the predicted direction with a "+". The Devices for the Disabled group indicates a "0" for the absence of empirical support. And Bair of NLS, while not studying this issue, observes that organizational roles, rather than verbal output or traditional credentials, determine membership.

Improves Group Decisions

It improves the quality of group decisions. Techniques such as the Delphi and nominal group processes have been developed to structure group communication processes so that it is efficient for a group to pool and coevaluate their knowledge about complex problems (Hiltz and Turoff, 1978b:18).

The medium can be a rich information environment, with interactive structuring tools providing groups opportunities to solve problems and make decisions. A full written transcript is available for reference. Voting mechanisms can be used for directing the agenda, reaching consensus, identifying divergent viewpoints, or collecting and displaying other feedback from participants. On-line questionnaires permit convenient, accurate, and relatively inexpensive data collection and feedback. The results of data base searches can be presented for consideration, broadening access to information resources (Johnson-Lenz, Johnson-Lenz, and Scher, 1978:15-17).

Other structuring and decision support aids to increase a group's ability to reach consensus without sacrificing the quality of solutions can be included for problems such as budgeting resource allocations or contract negotiation. The computer can aid in gathering subjective estimates within a group and then facilitating the discussion necessary to focus on and resolve the differences that emerge (Turoff and Hiltz, 1980).

Turoff and Hiltz (1979:13) maintain that a larger number of options can be considered and that there is less pressure toward a forced consensus and more commitment to agreement when it occurs. Moreover:

> A new area, yet to be fully explored, is the incorporation of communication oriented games where individuals can play out the potential consequences of their decisions after agreement has been reached... The interesting aspect of computer conferencing is that one can simulate real world communication conditions... This is not possible in the usual co-located strategy, corporate planning or war game without tremendous overhead investment in physical facilities and support people.

Scher (1980b) also argues that the medium can bring about more effective decision making. Elsewhere, he explains how the computer can be integrated into the decision-making process by continuously examining decision-making activities in the target application audience and identifying those activities whose performance could be significantly enhanced through the introduction of interactive computer-based supportive tools:

> Our notion of support, however, is not restricted to the augmentation of existing processes, but is broad-based enough to include the capturing of additional processes which, when 'blended' with the current processes yield positive, synergistic effect (Scher, 1980a).

Controlled experiments on problem solving provide empirical evidence that groups can reach at least the same quality of solution utilizing this technology as they can with face-to-face discussions:

> Small groups of five individuals who were first time users of the computer conferencing technology were able to arrive at solutions that were just as good as the solutions arrived at by the face-to-face groups; they used only about one-third the number of words of communications (Turoff, 1980b; see also Hiltz, Johnson, and Turoff, 1981).

Lipinski, Spang, and Tydeman (1980:158-159) consider the task-focused communications required by groups involved in joint problem solving, and suggest that computer-based communication systems are appropriate in the structuring, evaluating, and documenting phases of problem solving, since time delays are acceptable, written responses are appropriate, and face-to-face contact is not essential. They believe that the implementing, searching, and conceptualizing stages of problem solving are less amenable to this technology. In another context, they maintain that the use of computerized conferencing for problem-formulation tasks allows a greater variety of perspectives with all members able to contribute their views equally, and that this broader scope of input improves quality. Problem formulation in a computer environment may encourage more precise and systematic contributions than in ordinary face-to-face sessions (Tydeman, Lipinski, and Spang, 1980).

Johansen, Vallee, and Spangler (1979:21-22,131) reflect that although the increased number of perspectives provided with a large electronic meeting can provide more alternatives for untangling knotty problems and fuller support for the collective decision, it may also mean more conflict. They caution that a false sense of group consensus is possible, and that the failure to recognize and reconcile differences in perspectives may screen out divergent ideas and produce decisions of low quality.

The panel of experts was less sure of this potential impact and the votes are quite mixed. JEDEC offers strong empirical support with a "++" and both the Hepatitis group and OICS report a "+". On the other hand, the Mental Workload group votes "--" for strong contradictory evidence, and the Devices for the Disabled group notes a "0" for the absence of confirming data. CONFER, although not examining this issue, indicates agreement.

Increases Knowledge-Based Authority

It increases the understanding and appreciation of knowledge-based rather than hierarchical authority. This refers to orientation to the contents of communication rather than to the prestige or organizational position of the speaker. Although the evidence is inconclusive, and this issue could not be located in the literature, contact with peers external to the organization and awareness of other experts could under certain conditions reduce the automatic acceptance and deference to existing hierarchical structures.

This hypothesized impact elicited only three responses. General Systems Theory and OICS report a "+", and Devices for the Disabled indicates a "0". There are no comments or explanations to clarify these views.

Greater Awareness of the Global Situation

Greater awareness of the global situation can change organizational goals since the volume of information exchanged is increased, the scope of knowledge is presumedly broadened, and awareness is enhanced as people, groups, and organizations are electronically connected.

An evaluation of the use of the medium by legislative researchers concludes that the use of intelligent terminals and microprocessors "can further enhance policy makers' access to information about factual matters and about new approaches to the process of policy making, as well as new ways of thinking about old (and new) problems" (Johnson-Lenz and Johnson-Lenz, 1980d:111).

There were only two responses to this item. OICS attributes a "+" to it. General Systems Theory reports a "0" for the absence of a discerned relationship and comments "not yet." This is an impact we may expect in the future, as use of the medium becomes more widespread and a larger number of groups and organizations gain familiarity with it.

More Abstract Creative Process

The creative process is more abstract. Large groups can work together and cooperate electronically far more easily than is feasible in face-to-face situations, and they can contribute more diversified and complex kinds of information. Remote, asynchronous interaction also allows more time for reflection and for referring to other sources of information. For example:

> An important facet of FORUM conferences lies in the ease with which the participants have access to services outside of the discussion itself: they can, for instance, submit a prepared statement to the rest of the group or insert parts of the discussion into a personal file. They can also draw responses from a data-base system and enter them into the general discussion. Clearly, the level of interaction thus reached is one not found in face-to-face meetings where experts are cut off from their files and personal notes (Vallee and Askevold, 1975:55).

Bair (1974:33-35) observes a sense of creative freedom and flexibility of both content and work rate among the users of NLS. He notes:

> Increased efficiency permitted the individual to exercise more control over the development of his own ideas on paper... the subjects did state that their thinking was enhanced, that the structure added a new dimension to their thinking, and that the System provided mnemonic assistance (Ibid:76).

Remote coauthorship becomes feasible. The joint preparation of manuscripts by geographically separated authors is greatly simplified when the collaboration is electronic and with the use of word processing capabilities. Material is composed asychronously in a joint notebook, disagreements are resolved in private messages, and the final document is produced on line.

Computer-based communication systems are unique in allowing a group as part of its communication process to modify, update, and reorganize what has transpired, with members automatically kept informed of such changes. (Hiltz and Turoff, 1978b:38).

Price (1975:542) observes that:

> For the management of innovation, the stimulation of creativity, and the diffusion of innovations achieved, it would appear practical to augment the capabilities of...small organizations or organizational units by adding to their working equipment...computerized conferencing resources.

In considering impacts upon institutional innovation, and specifically applications to organizational suggestion systems, Snyder (in Turoff et al., 1978:29) observes:

> A key factor in the success of suggestion systems...appears to be the process by which suggestions are approved for submittal and evaluated. Typically, productive suggestion systems flow rapidly, require no approval prior to submittal, and must be definitively assessed within a short period of time. A (computer conference) would be ideally suited to such a process... Further, such a system would have the advantage of permitting a dialogue between the suggestor and the evaluators.

This too is futuristic and essentially unconfirmed by the respondents. OICS reports an "0". Only NLS responds with "+", attributing it to the unqiue structuring abilities, high speed displays, and hypertext features of that system.

Provides a Common Framework

It provides a common framework and experience, or a node for networks. It can facilitate an electronically-joined community of members whose ties grow beyond topic-oriented exchanges of information and who exhibit a high degree of interpersonal interaction, group cohesiveness, and personal involvement. Members become committed to each other and to the purposes of the group (Johansen, DeGrasse, and Wilson, 1978:34).

There can be a marked improvement in communications:

> The network becomes a 'place' in the thought processes of those attached to each other via computer communications and this makes it possible to bring people together more frequently who are normally separated by travel time, time zones, and conflicting schedules (McKendree, 1978:14).

Thompson observes that the medium:

> Increases (virtually to infinity) the size of the common 'information space' that can be shared by communicants (and provides a wider range of strategies for communicants to interrupt and augment each other's contributions).
>
> Raises the probability of discovering and developing latent consensus. (The enriched information base and heightened interconnectedness increase the chances that each conferee can receive unexpected and/or interesting messages) (Gordon Thompson quoted in Price, 1975:499-500).

Four groups responded, each indicating a "+" for agreement and the presence of weak quantitative or qualitative evidence. McCarroll comments for the Devices for the Disabled group that the "sense of community seemed to endure among many members."

Develops Communities of Interest

It creates opportunities to develop communities of interest rather than those based on geography or discipline, and a redefinition of the meaning of "local." People are able to locate others with similar interests, including highly specialized groups who otherwise would be disconnected. Scientists located at small and isolated institutions or who have specialties not shared by their colleagues are able to communicate on a daily and routine basis with those who share their professional interests (Price and Kerr, 1978:20).

EIES users can browse through the membership directory to identify others with similar interests. In an informal environment conversations are easy to initiate and new relationships are frequently formed. "Local" can be defined as simply belonging to the same conferencing system. Networks with large and diverse memberships, and access of all users to each other, facilitate the formation of new friendships and the evolution of new temporary or enduring groups.

Kochen (1978:23) notes that "The current concept of 'community' may acquire a different meaning. Already people who do computerized conferencing daily want to establish contact in other ways."

A group located in the mid-Pacific islands concerned with educational uses for computers coordinated the use of EIES, PLATO, and the NASA PEACESAT satelite network to share information about current experiences, replacing slow and inefficient traditional methods:

> Educators located in institutions isolated by limited communications are using (these) techniques to meet with resource people and with each other to develop educational opportunities for island populations in areas of computer science. The potential for linking these islands...offers unanticipated opportunities for the island educators to introduce modern instructional methods to enhance educational opportunities for their students (Southworth, Flanigan, and Knezek, 1981).

Johansen, DeGrasse, and Wilson (1978:56-60) found the impacts on those with whom people work to be inconsistent; some groups displayed an increase in contacts and others did not. They noted an increased and unplanned frequency of communicating among researchers in different disciplines, and conclude that the medium itself may not always facilitate new contacts; users must be motivated to communicate with other participants.

Seven panelists responded to this item, each indicating a "+" for agreement. Bair comments for NLS that this is "obvious from location of users." Those experiencing computer-mediated communication systems, then, are aware of and have experienced this positive feature. are aware of this positive feature.

SUMMARY

Table 4-5 summarizes these impacts at the group cognitive level, which produced fewer strong agreements from a relatively large number of studies than did the impacts at the level of the individual:

TABLE 4-5
GROUP COGNITIVE IMPACTS

	MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
AGREE	Develops communities of interest (7+)	Provides a common framework (4+) Creates group resources (2+;1=0) Increases knowledge-based authority (2+;1=0) Greater awareness of the global situation (1+;1=0) More abstract creative process (1+;1=0)
DISAGREE	Improves group decisions (1++;2+;1=0;1--)	

AFFECTIVE IMPACTS ON GROUPS

The group affective level deals with the informal structure, including feelings of liking or disliking others, group cohesion, attitudes towards purposes and goals, and the group's general emotional tone toward persons, things, and ideas.

Two impacts were offered as hypotheses:

> The use of surrogates in computer-based communication systems can inhibit levels of trust and security.
>
> The absence of nonverbal cues and possible poor response to questions increases the attention paid to supportive, encouraging, or negative statements in both computerized conferencing and face-to-face meetings. This heightened understanding facilitates general social interaction.

Inhibits Trust

The use of surrogates or shared membership slots can inhibit levels of trust and security, since some users allow subordinates to log in for them and retrieve messages or enter responses (Vallee et al., 1978:123-125). Since there is no way of knowing who has signed onto a specific account in the absence of voice identification, or who has actually read the communications, users may be concerned about the confidentiality of communicating sensitive issues, reluctant to make certain statements in writing, or even develop a general insecurity and distrust of the medium itself (Bezilla, 1978).

Johansen, DeGrasse, and Wilson (1978:50) offer these observations from the PLANET system:

> In a number of cases, secretaries or assistants actually typed in and retrieved messages for someone, though they often did so under the name of the indirect participant. This works quite well in many cases, particularly if a participant is very busy, has trouble accessing a terminal, or is simply not inclined to use keyboard devices. However, we saw several instances of confusion and trustration where other participants--not realizing that it was a surrogate and not the 'real' participant--would enter private messages and not receive responses. (Sometimes the surrogate would become flustered or embarrassed and not know what to do in response to the message.) Such a situation can easily lower trust in a group.

Johansen, Vallee, and Spangler (1979:11) add that this is generally a workable situation, but indicate that it can occasionally create some interpersonal problems.

The dependence on technology can also impact upon group trust:

> Machines have been accused of choosing awkward moments at which to fail. And in electronic meetings, there are likely to be many potentially awkward moments. A broken connection during an emotional exchange might be devastating. At best, it would probably slow the whole communication process as group members restart and try to recover their momentum. At worst, a system failure might be interpreted as an intentional act - the slamming of an electronic door. Group trust would likely deteriorate (Ibid:24).

The panel did not confirm this impact. Only the General Systems and Hepatitis groups checked "+". Mental Workload and USG-MSG responded "-" to indicate conflicting evidence. Two groups, OICS and Devices for the Disabled, replied "0" to show an absence of confirming data. The CONFER evaluator comments that this is "possible but no experiences as yet." Although the use of surrogates can lower the level of group trust, this evidetly has not generally been experienced.

In addition to the use of surrogates, there may be the fear that recipients will show messages or information to persons for whom they were not intended; or perhaps even that the system will misdirect private messages. For instance, more than a third of the COM users agreed with the statements that through using the system "information can come into the wrong hands" and "outsiders can see private messages." The majority did not agree and such fears were somewhat more prevalent among new users than more experienced users.

Perhaps awareness of the potential problem, plus communication among those sharing accounts, can prevent difficulty, although it is likely that this is also somewhat dependent on other variables such as the nature of the task and size of the group.

Facilitates Supportive Interaction

The absence of nonverbal cues and possible poor response to questions increases the attention paid to supportive, encouraging, or negative statements. This heightened understanding facilitates general social interaction both on and off line. This suggests that possible negative attributes inherent in the medium can in fact produce positive outcomes. Greater attention may be given to communications of an emotional or positive nature, producing greater group cohesion. This may be a longer-range impact than many of those already discussed.

Experienced users learn to communicate their personalities and emotions, sometimes by the use of pen names. The pen name capability may serve either as a cueing feature or as an identity mask. New role definitions and self-images can be assumed and acted out. The quality of the communications may undergo major alterations as the pen name assumes a unique personality over time. This personality may or may not reflect its human source, as users may allow abberant or exaggerated dimensions of their personalities to emerge. Aspects of the self that one might be reluctant to expose to one's professional or social peers may be revealed because of the presence of the pen name option (Kerr, 1978:73-75).

Kerr and Bezilla (1979:6-7) report their observations of the use of pen names on EIES:

> Unlike personal and other telecommunication encounters, computerized conferencing allows its users to rapidly interchange ideas and cues according to context. As a result, frequently stultifying status sets are replaced by rich and diverse role sets that allow the user to participate in groups to the fullest extent of one's own innate abilities. The role can be defined by the user or group as appropriate to the context, and the interactive emission and reception of cues and roles by several will define a richer context.

The Futures research group on EIES engaged in a heated debate about energy. But Martino and Bregenzer (1980:7) observed that "One noteworthy feature of the discussion was a series of comments on the high level of decency, kindness, and respect shown for one another despite strong differences of opinion. Computerized conferencing did not seem to dehumanize people."

Only three panelists responded to this item, each voting "+". Bair's comment for NLS that it "increases attention - yes, but social interaction merely approximates face to face" suggests that even his positive response is tempered.

SUMMARY

For consistency, these results are summarized. Clearly, more consideration of the group affective level is called for.

TABLE 4-6
GROUP AFFECTIVE IMPACTS

	MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
AGREE		Facilitates supportive interaction (3+)
DISAGREE	Inhibits trust (2+;2=0;2-)	

BEHAVIORAL IMPACTS ON GROUPS

Impacts at the group behavioral level include the nature and process of communications, the formal structure and lines of communication, the informal structure of how group members relate to each other, group effectiveness, and how the group relates to other groups, the larger organizational context, and to the community. The hypothesized impacts include:

It increases cross-group communication.

It increases lateral network linkages between organizations.

It increases lateral network linkages within organizations.

Research communities become more open (rather than encapsulated) in the long run.

Communication links increase: It can promote communication among disseminated groups which may not otherwise communicate IF the need to communicate is high enough.

It may change social structures from pyramid or hierarchical to network-shaped.

It changes the centrality of members within groups.

It creates new demands (or reallocation) for institutional support funds within organizations.

It can increase the effective limits on the size of working groups, with as many as 50 people or more able to work together on a project.

It creates new kinds of social groups, clubs, activities.

It creates new ways for organizations to advertise and otherwise promote their goals.

The understanding of groupware (software + group needs) leads to new ideas about ways of structuring face-to-face meetings.

It increases the need for strong and active leadership.

The emergence of a leader is different and less likely.

It promotes equality and flexibility of roles; roles such as moderator, groupware designer, and user consultant carry over to other social situations.

It increases the potential for "electronic elites."

The increased use of organizational consultants indicates more flexible structures.

It increases the possible span of control.

It increases the density of social networks and increases connectedness among disparate members of a user community.

It increases opportunities for decentralized communication.

The content threads of conversations increase.

Rapid communication reduces lag times. Organizations (and people) learn more and more quickly of events of interest to them.

It may increase informal communication.

It changes who talks to whom.

Questions often go unanswered.

Groups take longer to reach agreement and consensus is less likely.

It is sometimes difficult to focus discussions.

Regularity of individual participation is sometimes difficult to enforce.

There is a shift from hierarchical communication to fluid sets of teams.

There is greater equality of participation than in conventional media.

Kinship ties resolidify to counter residential mobility.

Communication Links Increase

Communication links increase since the medium can promote communication and cooperation among disseminated groups which might not otherwise interact, if the need to communicate is high enough.

Communication options expand, as users must choose which of their interactions will be conducted through computerized communications and which through more traditional channels such as face to face, telephone, or mail. Within the electronic medium, users can control their communications in terms of timing, intensity, and duration. They have choices which, depending on the design of the system, may include: synchronous or asynchronous mode; control over the readership of items written; entries with signature, pen name or anonymity; use of private or group messages, conferences or notebooks; conditional or delayed delivery of messages, serial routing, or routing with approvals incorporated; intra- or inter-group communications; self-defined commands; and alternative interfaces.

A significant growth in communication activities was observed among the operational trial groups on EIES:

> Their expanded use of the electronic information exchange system included establishing new computer conferences, increased use of existing conferences, expanded message traffic, the use of automated procedures to survey community members and to organize results, and joint authorship of papers. Research communities have also started inviting observers to participate in their conferences, thereby enhancing their discussions on particular items and providing wider exposure to electronic information exchange (Bamford and Savin, 1978:13).

Panko and Panko (1980) report that increased long-distance communication was the strongest experienced benefit cited by the respondents to their study of an electronic mail system at DARCOM.

Teleconferencing applications seem especially suited to developing nations in which the high rates and poor service of other communications media prevent researchers from interacting with their geographically scattered colleagues as easily as is done elsewhere (Ferguson and Johansen, 1975:12).

But the need and motivation to communicate must be present for this and most of the other impacts to occur:

> Computer conferencing is a communications medium which must be activated by each user; there is no ringing telephone or other strong social demand. When a participant is so motivated, he dials an access point to a computer network and joins a conference. A person's need to communicate will influence the decision to join a conference, and a lack of group motivation will lead to sporadic attendance. As one user commented: 'We had to depend on participants logging in regularly, but most didn't. For a person who is very busy, unless he has a great personal commitment to the conference, it's easy to ignore it' (Vallee et al., 1975:61).

Johansen, DeGrasse, and Wilson (1978:86-88) point out that a strong perceived need to communicate is a prerequisite to a successful computer conference:

> It is a strange medium to most people. While novelty effects may raise initial interests, the medium must become integrated with participants' workstyles if it is to have an impact. If the perceived need to communicate is not high, the medium is likely to go.

The provision of incentives for participation therefore appears to be one of the demands upon leadership.

The experts supported this hypothesized impact quite strongly, with seven checking "+" and two "++". The JEDEC evaluators comment that one of their subgroups had no existence off line and convened for special applications only electronically (Johnson-Lenz and Johnson-Lenz, 1980b:7).

Changes Who Talks to Whom

Turoff and Hiltz (1980) observe that these systems are likely to change the patterns of communication within organizations, since the total amount of communication and the average number of persons with whom each user maintains regular communications are likely to increase. Continuous working relationships among geographically dispersed groups, contact with those in other disciplines, and the reduction of isolation caused by distance (Johansen, DeGrasse, and Wilson, 1978:54-61) indicate a change in patterns of interaction.

With the exception of the Mental Workload group which checked "-", the respondents agreed with this impact. Two replied "++" and six "+". The only comment, made by Bair of NLS, was "due mostly to exclusion of non-users," suggests that the changes when they do occur may not necessarily be desirable or beneficial to the groups or organizations involved. The directions that this change can assume are unknown and represent a source of resistance to the technology.

Increases Informal Communication

It may increase informal communication. This impact is at least partially dependent on the design of the system, since it is possible to restrict interactions as well as monitor the content of exchanges. In an open democratically designed system, in which the privacy of items is protected, however, there are likely to be significant increases in informal communication accompanying the tasks of working groups. This has been frequently observed on both the EIES and PLANET systems. Umpleby (1980) reports an increase in informal communication ties for the General Systems Theory group on EIES. Informal communication can even be deliberately encouraged with devices such as the online "cocktail party."

This impact received the strongest support from the experts, with nine rating it "+" and two "++". The number of responses to this item is larger than for most.

Changes Centrality of Members

It changes the centrality of members within groups. Comparing different communications media, Vallee et al. (1978:101-105) found that the leader in one may be a supporter in another, and conclude that the relative strength of individuals within organizations may be affected.

Hiltz and Turoff (1978a:20-21) hypothesize that if totally free communication is permitted, computer-mediated networks tend to be decentralized. Centrality is defined as the degree to which an individual, group, or organization within a network can control the communication of others or is free from such control. However, if free communication among members is restricted, the medium could support centralized or hierarchical networks.

Leadership within an ongoing conference may change over time, with different members assuming that role as the focus of the discussion shifts (McCarroll and Cotman, 1980).

Only four panelists responded to this item. Two (General Systems Theory and NLS) report a "+". Hepatitis indicates "0". And the Mental Workload group disagrees with a "--". Bair comments that system knowledge rather than discipline knowledge is responsible for his positive vote, suggesting that the criteria by which membership centrality may change may not necessarily be most functional to the group's goals, and that these factors may change over time.

Greater Equality of Participation

There is greater equality of participation than in conventional media, in part because everyone can be "talking" by typing or "listening" by reading at the same time.

Whereas face-to-face groups tend to be dominated by one person, who while not necessarily more intelligent or correct, leads the discussion and decision making, this is much less likely with computer-based communications. Since those who are slower to respond or less verbally assertive can more easily participate, it is possible that intelligence and correctness might be more highly correlated with the leadership and dominance processes. The larger the group size, the less likely is the emergence of a dominant leader (Hiltz and Turoff, 1978b:107; Hiltz, Johnson, and Agle, 1978:6-8).

A series of controlled experiments on EIES produced consistent empirical evidence that there is significantly more equality of participation in computerized communications than in face-to-face conditions (Hiltz, 1978a:11; Hiltz and Turoff, 1978a:14-15; Hiltz et al., 1980; Hiltz, Johnson, and Agle, 1978:28).

Turoff (1974b:136) observed that:

> Individuals communicating through such a system tend to develop a feeling of equality with the other group members. The resulting group atmosphere is very different from a committee meeting where some one individual usually takes control (even if only tacitly) for the purpose of sequencing the discussion.

The evaluators of the PLATO system, however, found:

> While computer conferencing allows an equal amount of participation by all those involved, we have seen few examples where such equality has actually occurred. In practice, a few people usually make most of the entries -- just as a few people generally dominate face-to-face meetings ... however, the equality of participation rates can vary considerably from group to group ... some unevenness of participation rates appears normal in computer conferences (Johansen, DeGrasse, and Wilson, 1978:47).

They also note, however, that synchronous conferences seem to encourage more equal distribution of participation rates than do asynchronous conferences.

The medium, then, appears to reduce the amount of inequality rather than producing true equality.

Applications of the technology to the handicapped and other disadvantaged have sought to use these features to broaden opportunity structures for those suffering mobility and communicatory restrictions, stigma, and exclusion from full societal participation, to bring them into the mainstream of society and their chosen careers. Computer-mediated communication systems can enhance the tools of rehabilitation by increasing social contacts, since users interact at their own pace with time and space boundaries minimized, and the suppression of nonverbal cues means they may interact equally. The interactive nature of the medium can foster social connectivity (Kerr, 1979; Kerr et al., 1979; Price and Kerr, 1978).

The panel of experts could not agree. Responses included one "++", three "+", one "0", and two "-". Although contributing one of the negative responses, Parnes of CONFER comments that "the same kinds of inequalities seem to hold in practice though in theory this is very plausible." Evidently, this is a potential which is dependent on a number of other unknown factors.

Increases Need for Strong Leadership

It increases the need for strong and active leadership because of the nature of the medium, including the different kinds of group structures that emerge and the absence of pressure to sign on line and participate. The lack of adequate leadership is one of the factors sometimes responsible for conference failure; unless a moderator sets an agenda and keeps the group working toward its goal, nothing much will occur. But the presence of strong and active leadership does not guarantee the success of conferences. Leadership styles may need modification for the effective management of a group through this form of communication. Compared with traditional forms, leaders may feel more or less informed and in control of group activities. Vallee et al. (1978:153-155) maintain that "strong leadership is essential to the effective use of computer conferencing," and suggest that leaders will develop their own sets of organizing and facilitating skills.

Reporting the experiences of the Futures research group on EIES, Bregenzer and Martino (1980:68) indicate:

> Our disappointments could be summarized by saying that getting active, committed participation in a conference like ours is like pulling teeth. We do not blame the members. They are proven active, enthusiastic futures researchers. We do not here blame the technology ... We blame the structure of the conference. Perhaps properly, it began in an informal manner without clearly defined goals or an agenda. Therefore members have been communicating as one would at a cocktail party ... But the focused, goal-directed type of communication is sorely missed by some of us, and also necessary to any group.

Johansen, Vallee, and Spangler (1979:84) reach this conclusion:

> Computer conferencing provides potentially effective technical structures for controlling group interaction, but few of the familiar social structures. Training people to use the system will be technically easy but socially difficult. We believe it would be a mistake to rely on the technology to direct the communication process - either by imposing highly structured formats or simply using it as an open forum. Leadership is no less important in a computer conference than in face-to-face communication. Strong but subtle leadership appears most appropriate.

There were six responses to this item. Hepatitis and Mental Workload report a "++" and OICS a "+". Both NLS and the Devices for the Disabled group have inconsistent evidence which produced a "0". CONFER had no data for this impact, but comments that it "depends on the conference and grou goals. It really goes both ways." Perhaps there are circumstances under which the need for strong and active leadership is less than in others.

Leadership Emergence is Different

The emergence of a leader is different and less likely in the typically unstructured environment of a computerized conference.

Hiltz, Johnson, and Agle (1978:29-30) administered post-experimental questionnaires asking respondents to assign rankings on leadership behavioral dimensions. The computerized conferencing subjects were significantly less likely to be able to rank order the group than were those who operated in the face-to-face mode.

Multiple leaders, each specializing in and deferred to for a particular aspect of the problem or area of expertise, are more likely to emerge, because of the greater equality of participation and because the computer substitutes for many conventional leadership functions (Hiltz and Turoff, 1978b:107-108).

Umpleby (1980:56) relates his experience as leader of a group of general systems theory researchers on EIES:

> I for one began with the assumption that a computer conference should pretty much take care of itself. If a group of people with a common set of interests were given access to EIES, I expected that they could conduct their normal professional communication with enhanced speed and effectiveness. Alas, this was not to be. A few months into the conference, helpful user consultants began referring to previous studies of conferencing behavior which concluded that 'strong leadership' was necessary for the success of a computer conference. I strenuously resisted this suggestion. Not only did it offend my democratic sentiments, it implied more work! But the evidence seemed to support the need for strong leadership. Hence I embarked on a strategy of delegation of authority. Surely several strong leaders were better than one...

> It appears that an active moderator is necessary to keep the conference going but that as people get used to the system and initiate their own projects, several leaders begin to emerge.

McCarroll (1980:74-75) indicates that the use of EIES by the multi-disciplinary Devices for the Disabled group was successful in having individual members initiate and moderate a variety of both on-line and off-line activities.

The panel's reaction was quite varied, making it impossible to reach a firm conclusion. There was one "++", two "+", one "0", two "-", and one "--". This area clearly calls for future research.

Increases Network Density

It increases the density of social networks and increases connectedness among disparate members of a user community.

Hiltz and Turoff (1978a:19-20) note a strong tendency for computerized conferencing networks to become increasingly dense or closely knit over time with many direct ties between members. Moreover, the links are multistranded in the sense of the different kinds of role relationships existing among the members of a network.

Quantitative data on this impact on interpersonal relationships emerged from the Social Network Community's experience on EIES (Freeman and Freeman, 1980). As one of the original operational trial groups, it was composed of interdisciplinary scholars studying social networks, or the patterns linking group or community members. A social relationship checklist was administered to the loosely knit members after an initial face-to-face meeting. Seven months later, the density of ties had increased significantly. They conclude that the computer conferencing experience impacted on the group's structure, with an increased density of ties, greater mutual awareness, and tight friendship cliques merging into larger structures.

Eight respondents each checked "+" to this item. Only the Mental Workload group differed with a "-" vote.

Promotes Role Equality and Flexibility

It promotes equality and flexibility of roles; roles such as moderator, groupware designer, and user consultant carry over to other social situations. Only preliminary and qualitative evidence internal to these systems now exists for this impact, as it implies a longer time frame to be actualized than many of those already examined. Vallee et al. (1975:9) have observed the roles assumed by different users on PLANET:

> We have found, for instance, that some persons tend to introduce many new ideas, while others are best at developing them, and still others function as synthesizers. The roles can vary greatly among persons and conferences, but we have noticed an apparent tendency for the 'provocative' and 'synthesizing' roles to be mutually exclusive. The 'provoker' seems to push the discussion forward into new areas of thought, while the synthesizer ties the loose strands together.

Cross-conference behavior on EIES produced these observations:

> The unique thing about EIES or similar conferencing systems is that the same person may play many different roles in many different conferences that involve different subgroups of people. In one, he or she may be an ordinary member. Since a person is free to browse through the Directory to find compatible groups conducting conferences in related areas, and to request admission to such conferences, a person is quite likely to have the role of outside expert in some conferences; and since every member has the privilege of setting up and acting as moderator of a temporary conference on any topic of his or her choosing, every member of the system has the opportunity to play the lead or moderator role in at least one conference. Thus, we have an extremely fluid social structure (Hiltz and Turoff, 1978b:121).

Although each of these roles is played in effective face-to-face meetings, the electronic medium requires that they be played more explicitly for maximum effectiveness (Price, 1975:550). Software has been designed to facilitate and support specific roles such as facilitator, coordinator, moderator, monitor, editor, gatekeeper, negotiator, and disseminator of information. While users may belong to multiple groups, they maintain separate identities while playing diverse roles.

There were only four responses to this item, two "+" from the Futures research group and General Systems, and a "0" from Hepatitis. Again, the Mental Workload group differed from the others with a "-" vote.

Fluid Teams vs. Hierarchy

There is a shift from hierarchical communications to fluid sets of teams. This hypothesized impact appears to be derived from the relative equality of participation within the electronic medium.

Users who had never before worked together have been observed forming temporary teams and small groups have cooperated on tasks for which they discovered a mutual interest.

The panelists supported this impact with five of the six respondents reporting a "+". Only the Hepatitis group reported a "0" for the absence of either supporting or refuting data. This raises the question of whether the fluid sets of teams are more likely to be found in groups created in the electronic media or whether they instead change previously existing organizational patterns.

Groupware Changes Meeting Structures

The understanding of "groupware" (software plus group needs) leads to new ideas about ways of structuring face-to-face meetings. The concept of groupware is discussed in detail in Chapter V. This again is an idealistic potential rather than a currently documented phenomenon.

There were only three responses, but all were supportive. McCarroll offers this comment for the Devices for the Disabled group: "Have used EIES to plan and prepare for face-to-face meetings - found to be better prepared and further along by the time of the meeting. Also, agenda is usually different than if no computer conferencing beforehand." It appears that groups will need considerable experience using these new media before such groupware spillovers are widely realized.

There are, however, a number of potential problems at the behavioral level, or potentially negative consequences:

Content Threads Increase

The content threads of conversations increase and multiple topics abound, since autonomous users determine their own participation rates and topics. Turoff (1974b:135-136) describes the process:

> One finds in such a discussion a number of separate discussion threads becoming interleaved, and...there is not the same pressure to restrict the discussion to a sequential flow with respect to the specific topic of the moment. Therefore, individuals who wish to think about what they will say on a particular matter may wait for a time before making their remarks, and the fact that some of the others in the conversation may have moved on to another topic does not detract from the ultimate impact of the comments. Furthermore, since the computer assigns a unique sequence number to each message... , a later message referring to an earlier one need only begin with 'Ref. ms. #101.' This is in sharp contrast to a verbal discussion where a typical comment referring back usually begins: 'In regard to what John was saying awhile back about such and such ... A group communicating in this manner becomes accustomed to this oscillating form of communication... Individuals quickly learn to refer back in their remarks to the specific earlier comment they are discussing and the written form fosters a degree of compactness on the remarks. Furthermore, the sorting capability of the computer could be used to regroup the discussion into its separate threads.

But there are consequent problems:

> With no norms about 'sticking to the subject,' participants tend to develop several different topics or ideas at once and reading the transcript can be confusing. A question may be asked in, say, statement number 119, and an answer may not appear until entry 130 or even 150 (Hiltz and Turoff, 1978b:29).

The transcript allows specific discussion topics to be tracked over time and labelled, although such ties are often implicit and difficult to follow (Vallee et al., 1975:9). A combination of software and leadership structuring can help maintain order. For example, a conference moderator may force a vote or a response to a particular item before allowing further action, or may delete items that are irrelevant to the topic.

There was mild agreement from the panel, with a "++" response from Devices for the Disabled, "+" from three other EIES groups (General Systems, Mental Workload, and Hepatitis), and a "0" from OICS.

Difficult to Focus Discussions

It is sometimes difficult to focus discussions, since multiple content threads abound as users participate at their own rates. Vallee et al. (1975:7; 1978:112) note the difficulty of compelling users to direct their comments and point out that "it is the price one pays for the flexibility of asynchronous communication." Leadership practices which emphasize clear organization and take advantage of some of the moderating control features offered by the computer, such as keywords, sequences of associations, or calling for a vote, can offset this problem and possibly lead to greater clarity than might be the case if single-issue discussions were enforced.

One user offered this comment:

> One problem with this week-long conference is that it often loses continuity. Everyone is busy and comes and goes. If four or five interested parties could all sit at the keyboard for the same two hours with a tight agenda, it might more nearly approximate a brief conference (Cartter in Ferguson and Johansen, 1975:39-40).

This issue appears as a tradeoff between single-issue clarity and a rich multiplicity of ideas.

The panel of experts responded with six "+" and one "++" votes. There was only one dissenting "-" from OICS which included no explanatory comment, but suggests that either system features or leadership styles may offset this problem.

Irregular Participation

Regularity of individual participation is sometimes difficult to enforce (Vallee et al., 1978:112). This is a byproduct of the self-pacing and asynchronous characteristics of the medium, since those whose work style is 'interrupt-driven' will not participate much in the absence of scheduled time periods. Explicit expectations and deadlines can to some extent offset this, but at a cost.

Spelt (1977:87-88) found this to be characteristic of the conference that he evaluated, since:

> The activity carried little social pressure to participate, and was in addition to the regular duties of the participants. As a result, the degree of participation by the members ranged from very little to a lot ... the normal constraints of time and space are largely

> eliminated, and participants are free to join and leave the discussion as their schedules permit. This freedom poses some problems for ongoing activity, because unless a participant chooses to activate his terminal and join the conference, there is no way for other conferees to reach him except by some other medium.

Johnasen, DeGrasse, and Wilson (1978:95) include this as one of the problems of the medium:

> Organizers often suggest a minimum frequency of participation as a guideline, and this approach proves very useful. However, it may still be necessary to prod some participants further. While the problem may seem to be one of self-discipline, it may simply reveal doubts that a participant had about the purposes of the meeting in the first place. Those who participate frequently will become increasingly frustrated as others fall further behind. Once such a situation develops, it can easily get out of hand, with some participants getting so far behind that they have no hope of catching up. The conference organizer must keep constant readings on the participation of the various group members.

Protocols, norms, and sanctions specific to participation in computerized communications media are likely to evolve over time to help the group and its leader more easily enforce expected levels of participation.

The respondents strongly agreed with this, responding with three "++", six "+" and only one "0". Kerr (1980) documents the irregular patterns of participation within the WHCLIS group, and Lamont comments for Legitech that even minimum participation goals were difficult to meet.

Questions Often Unanswered

Questions often go unanswered. The asynchronous nature of the medium means that users can take as much time as needed or desired to read, contemplate, and formulate replies to questions. This advantage is counterbalanced by the reduction of the need for immediate responses to questions or other kinds of issues for which feedback is desired by other participants. It is easier to ignore comments or questions than when communicating face to face (Hiltz, 1978:5-6). A new source of frustration can emerge, as well as new challenges for leadership practices to deal with it. Vallee et al. (1975:6) observe:

> Freedom from the constraints of time and distance can naturally reduce the obligation to communicate. In computer conferencing, the balance between motivation and lack of demand to communicate is different from face-to-face interaction.

The EIES groups supported this item quite strongly, with one "++" and four "+". But the three other respondents (CONFER, NLS, and OICS) each checked "-". The comment from CONFER modified this somewhat: "True of any medium. But they often get answered as well. Depends on who is answering." If the EIES/non-EIES split is not spurious, there may be some unexplained system factors at work here. Clearly, more research is needed to explain the conditions under which this does and does not occur.

Consensus Less Likely

Groups take longer to reach agreement and consensus is less likely. Controlled experiments conducted on EIES found that, compared with face-to-face groups, computer conferencing groups needed more time to reach a decision (because the quantity of communications exchanged was less) and were less likely to reach a unanimous decision for complex problems (Hiltz, 1978a:11; Hiltz et al., 1980; Hiltz, Johnson, and Agle, 1978; Hiltz, Johnson, and Turoff, 1981). This difference in the ability to reach consensus is related to the likely absence of dominant leadership in the electronic mode. Voting routines can be used to facilitate consensus.

However, Siegel (1980) reports the successful experiences of the Hepatitis group on EIES, in which physicians utilized the system to validate and update by consensus the National Library of Medicine's Hepatitis Data Base. Controversial items were identified, discussed, and successfully resolved, and it is anticipated that other data bases will be added to this pilot study.

Similarly the Joint Electron Device Engineering Council (JEDEC), an industry group for the standardization of hardware and software microprocessor products, developed definitions and standards on EIES in conjunction with quarterly face-to-face meetings. They found that supplementing the meetings with on-line communications sped the process of reaching consensus on decisions, whereas previously the component may have already become obsolete by the time the standard had been set (Johnson-Lenz, Johnson-Lenz, and Hessman, 1980).

The panelists were about as mixed as the literature review for this issue. The Mental Workload group and OICS supported the hypothesis that groups take longer to reach agreement and consensus is less likely with "++" and "+" respective responses. But both the Futures and Hepatitis groups had contradictory evidence and replied "-". The Devices for the Disabled group studied this impact and found no significant impact ("0").

Reduces Lag Time

Rapid communication reduces lag times. Group members can maintain constant communication with one another, on a daily or weekly basis and at their own convenience. Snyder maintains that "the replacement of a traditional institutional message system with (computerized conferencing) should substantially accelerate the pace of data flow and information mobilization within the organization (in Turoff et al., 1978:30).

McKendree (1978:14) notes that organizations can experience reduced turn-around time on urgent decisions or actions, ranging from one or two days in many cases to one or two weeks. And it shortens the time required for all group members to be in the same place at the same time.

Martino and Bregenzer (1980:5) found that:

> The visits of two foreign Futures Researchers to the U.S. were greatly facilitated by private messages on the EIES system. Here it became evident that the system was better than the telephone because of its ability to overcome the problems of dealing with different time zones.

The experts strongly agreed. With eleven responding, there were two "++" and eight "+" votes. The Devices for the Disabled group checked "0" and reported inconsistent evidence. The medium will usually reduce lag times, but there evidently can be circumstances under which this is not the case.

Expands Group Size

It can increase the effective limits of the size of working groups, with fifty or more people able to work together on a project, since every participant can be "talking" or "listening" at once and it is impossible to interrupt. Hiltz and Turoff (1978b:9) describe the possibilities:

> Group size can be expanded without decreasing actual participation... A single computer can accommodate from hundreds to thousands of users, whereas the mechanisms of finding a comfortable room and getting everyone together for a face-to-face meeting of such a group are expensive and discouraging. Specific conferences can accommodate from 2 to 100 participants, depending on its purpose and the communication structure provided by the computer software.

Turoff notes that it is possible to have thirty to fifty people engaged in a computerized discussion, comparing it with conference telephone calls which are cumbersome with more than five people participating (1972:163; 1974a:5). "We have had numerous examples on the EIES system of groups of up to 15 individuals jointly working on the same document and report preparation" (Turoff, 1980b). PLANET supports synchronous conferences of up to thirty-six people (Vallee et al., 1978:64). Computers can easily accommodate 300 to several thousand users, whereas the mechanics of organizing such a face-to-face meeting are difficult and expensive (Hiltz, 1976:4).

Strong and positive agreement with this issue was obtained from the respondents, who checked one "++" and six "+". Interestingly, experienced users on the COM system were more likely to agree with this issue than were inexperienced users.

It is apparent even to new users. For instance, seventy percent of the less experienced COM users and eighty percent of its more experienced users agreed that "work in larger groups is possible."

Increases Lateral Network Linkages within Organizations

It increases lateral network linkages within organizations:

> Inherently, these systems do encourage lateral communications. They make it possible for an individual to have a much larger number of people in regular and frequent communication than is otherwise possible. One can impose constraints on this freedom of communications but as yet there has been little experience with attempts at this sort of design. The experience in a number of organizations has been a greater tendency to increased coordination laterally on at least an informal basis (Turoff and Hiltz, 1980).

Housman (1980:2) describes a current application on GTE's Telemail electronic messaging system:

> In companies like GTE, which has subsidiaries spread out on a world-wide scale, terminals are appearing in many executive offices to coordinate corporate-wide activities and to maintain a continuous dialog with peers in other divisions.

The OICS study found that "the time spent in communication among peers" increased, and that "the percentage of attempts to contact fellow workers that failed (e.g. from busy phone lines) decreased. Reductions in such shadow functions carry measurable cost-benefit implications" (Tapscott, 1980:12).

The respondents confirmed this, with two "++" and five "+" votes. Only the Devices for the Disabled group reported "0" for the absence of a significant finding.

Increases Cross-Group Communication

It increases cross-group communication. There are new opportunities to meet people with channels for electronic mobility and migration. An open system such as EIES includes a searchable directory, the ability to address messages to those who specify an interest in a topic as well as to individuals and groups, human user consultants for facilitation and connectivity as well as teaching system features, and public conferences including one in which private conferences open to new members are announced. This permits and encourages more cross-group communication than does a system such as PLANET which prohibits these kinds of introductions and interactions. People can discover each other's existence and connect on the basis of shared interests, rather than by job title, organizational purpose, or personal introduction (Price, 1975:514). Some managers or organizations may not want their members engaging in cross-group communication, however. For example, the Banker's Trust group on EIES instructed its members not to enter any information about themselves into the public directory.

Members of research communities have been observed joining the deliberations of other communities (Turoff, 1980b; Bamford and Savin, 1978). Bezilla (1979) labels this "a transitive network," allowing relatively free interactions among all members, rather than being restricted to either broadcasting or centralized communication paths.

The expert panelists, with the exception again of the Mental Workload group which voted "-", agreed. Two reported "++" and seven "+". The comments here are widely dispersed, ranging from strong quantitative evidence to observations of group behavior.

Creates New Kinds of Groups

It creates new kinds of social groups, clubs, and activities. Because people are able to find others with common interests, they can establish new groups and new kinds of activities not possible through other media. The electronic linkage of those who may never have met in person permits qualitatively different kinds of interactions and social forms.

Interaction within a viable social system results in the formation of qualitatively new kinds of primary and secondary relationships to supplement or replace traditional groups. The most frequent users of EIES, for example, report a strong sense of on-line community, with close friendships and collegial ties, as well as a sense of loss when unable to access the system.

Support was received from the panel, which reported four "+" and a "0" from OICS.

Increases Lateral Network Linkages between Organizations

It increases lateral network linkages between organizations. Open systems such as EIES promote or at least allow these kinds of cross-group interactions. Users are free to exchange messages with all others on line regardless of their group affiliations. They may be invited to join conferences estabslished by other groups, either as participants or observers. A public conference in which all are free to read or contribute contains unrefereed papers on a variety of topics. And the public user directory permits members to discover others with shared interests and perhaps form their own informal or formal groups as a consequence.

Members of the EIES group exploring Devices for the Disabled have "expressed their appreciation for the contact this project has made possible with persons in other disciplines who can contribute to their work but with whom they previously had no available channel of communication" (McCarroll, 1980:76).

The evolution of Politechs-Topics on EIES illustrates a system created for a group of state legislative science advisors. Since the inquiries and responses range over a very diverse set of subjects and the activity is quite high, a filtering structure allows members to choose which topics they wish to track. Politechs is a system in which more than fifty individuals representing separate autonomous organizations share and exchange specialized knowledge and resources according to need (Turoff, 1980b; Johnson-Lenz and Johnson-Lenz, 1980d). Lamont's report (1980:461) on the group's experience concludes:

> The legislative researchers...have noted in particular the timeliness and quality of the Responses they have received to their queries. Many have pointed out that the system has greatly increased their resource network with respect to other legislative researchers and the federal agencies. Most certainly the system has provided the opportunity to develop a more efficient communication system, eliminating duplication of research effort and enhancing the quality of information provided to legislatures.

Simard and Miller (1980) report the use of NOTEPAD, by sixty-four U.S. utilities and several foreign utilities as well as technical advisory groups, for real-time information exchange related to the safety and licensing of nuclear reactors. A new crisis management tool has been created in the event of a major accident.

One respondent checked "++" for this impact, and five checked "+". The one dissenting "0" was from the General Systems group was accompanied by the comment that this is potentially the case.

Decentralizes Communication

It increases opportunities for decentralized communication because it is easier to keep all those concerned with the issues informed and up to date. A higher degree of delegation of authority is possible with the capacity for accountability and reviewing decisions in a timely and orderly manner. Scheduling and action tracking facilities can be included for coordinating complex projects in which a change in one element must be reflected in others (Turoff, 1980b; Turoff and Hiltz, 1977:7).

> In some cases the technology is actively used at a peer group level to bring about agreement before raising the issue to a higher level of management. These systems also allow greater delegation of authority since they allow quick informing and review of potential actions as well as the accountability necessary for delegation of authority. The extent to which decentralization and delegation is desired should be a factor in both the design and the operational practices associated with these systems. One would suspect, for example, in organizations that thrive on competition among peer level managers that an open design might not be the most desirable or would not be very successful (Turoff and Hiltz, 1980).

The World Symposium on Humanity was a week-long event held simultaneously in London, Toronto, and Los Angeles in 1978. Rather than having a single headquarters from which decisions were dictated to other locations, a joint conference on EIES in which several people at each of the locations participated enabled a decentralized decision-making process and daily sharing of information, problems, and issues. Decentralized control was possible because the medium provides the ability to coordinate actions and to establish accountability. "We know of no other way that a dispersed project team could have worked together with the same coordination of effort that can usually only be exhibited by a co-located team" (Turoff and Hiltz, 1979:10-12).

Hiltz and Turoff (1978b:144) predict that:

> The Home Office might become simply a supplier of services to relatively autonomous units of the organization ... If decisions are being made autonomously, at the local level, they might be made much more quickly and with a better understanding of the nature of the problem. For the corporate executive himself, his real power may be usurped by the local managers, and he may become reduced to serving as nothing more than a figurehead, like modern monarchs. On the other hand, executives who adapt to the new communications tool might find that they can become much better informed and much more able to try out controversial ideas than ever before. Computerized conferencing allows the lateral coordination necessary for decentralization of authority with a speed and efficiency not possible with other communication systems. Ongoing transcripts of all conferences among middle managers permit monitoring of and/or intervention if an unwise decision seems imminent.

On the other hand, centralization could actually be made more viable because of the ability to gather information from and quickly disseminate it to other points. Frequent contact and remote leadership become more feasible.

The panel supported this impact with all eight respondents reporting "+".

Increases Possible Span of Control

It increases the possible span of control as a corrolary of the possibilities of decentralization. Within organizations, it allows more centralized control over geographically dispersed units. Within more amorphous fields, such as scientific disciplines or invisible colleges, it expands the size of the groups which may be directed or influenced.

There were only three responses to this hypothesized impact, but all were positive. NLS reports a "++" and attributes it to increased vertical communication. Both OICS and the Hepatitis group responded with "+".

Increased Use of Organizational Consultants

The increased use of organizational consultants indicates more flexible structures. This is another long-range potential of the medium rather than an impact for which we have firm data. Johansen, Vallee, and Spangler (1979:20-21) offer these comments:

> Teleconferencing provides an opportunity to organize groups in a nonparochial fashion, to tap resources that may be far away. Decisions about whom to consult or what information to use do not have to be constrained by what is closest. Distant experts can consult with a group more effectively: they can avoid tiring travel which may leave them less 'expert'; and they can remain close to their own resources.

But they also point out that an overemphasis on the opportunities for easy access could encourage too narrow a view of experts. "The expert could become someone 'out there' who is available to solve all of the problems if only he or she could be reached. The expert's facts and figures might be viewed as the 'truth' when they are only limited truths at best; at worst, they might not even be accurate information."

There were only two responses to this item, from the General Systems and WHCLIS groups, both of which reported "+". The White House Conference was able to utilize a number of consultants in the planning and coordination tasks that were conducted through EIES.

Changes Social Structures

It may change social structures from pyramid or hierarchical to network-shaped. Given that varying group structures are simply accommodated or reflected in the medium, it could be used to revise conventional structures, at least experimentally, and possibly in the direction of the open democratic characteristics towards which these systems tend.

> Because EIES is dedicated to information exchange anyone on the system...is free to message anyone else on the system. It would certainly be possible in such a system to have set up restrictions on who could communicate with whom and even make these restrictions asymetric. Certainly, in some commercial systems being designed today, the assumption is that one will reflect the organizational structure in the message sending privileges (e.g. employees can only send to members of their own organizational unit and their immediate supervisor). Such designs could have the potential impact of further placing in concrete current organizational structures and inhibiting the possibilities for improved lateral communications that in turn could lead to new approaches to meeting organizational objectives (Turoff, 1979).

This item produced only a few positive responses, with one "++" and three "+" votes.

New Ways to Promote Goals

It creates new ways for organizations to advertise and otherwise promote their goals. New capabilities for advertising and promotion can reach more people, more selectively, and at reduced costs. Software for an information marketplace can be included within these systems so that recipients are protected against unwanted "junk mail," and so that equitable arrangements can be made for the exchange of goods, services, or information for either cash or barter (Turoff et al., 1981). These features apply to commercial and non-profit service groups and organizations, as well as to individuals.

There were five affirmative replies to this essentially futuristic impact, and the Devices for the Disabled group documents that this is already beginning to occur.

Creates New Demands for Funds

It creates new demands or reallocation for institutional support funds within organizations. There is as yet no material in the literature bearing on this impact. However, Vallee et al. (1978:161) outline some of the possible strategies that may develop for dealing with this kind of budgeting decision:

> The costs of computer conferencing can be charged in different ways. A conferencing budget may be established for each individual project, with the cost of terminals, computer usage, and support services charged to the project. Or all computer conferencing expenses may be viewed as part of general overhead, much like the telephone and letter correspondence are in many organizations. Of course, a halfway approach is possible, too: the cost of terminals, for example, may be charged to overhead while the computer usage costs must be covered by individual project budgets.

The type of interorganizational communications made possible with regular working relationships among researchers at different institutions could challenge current administrative institutional structures for the allocation of research funds. Requests for alternative funding structures for work and resource sharing with remote groups would confront institutional barriers and possibly create new and independent group forms (Johansen, DeGrasse, and Wilson, 1978:106-107).

Six of the groups reported "+" findings for this issue, evidently reflecting their own experiences since the comments attached refer to the problems experienced by their users.

Increases Potential for Elites

It increases the potential for "electronic elites." The realization of this impact would be ironic, since the EIES system in particular was designed in part to offset the exclusive nature of communications. Prior to the development of computer-based communication systems, interaction could only occur by personal visit, telephone call, or use of the mails. The number of people who could simultaneously communicate was reduced usually to two except for meetings, or more with considerable difficulty or expense. Yet those with access to this new technology may emerge as a new elite precisely because their access better connects them with those with whom they need to communicate.

There were four "+" responses to this impact, and one "++" from the Mental Workload group, but OICS dissented with a "-".

Research Communities Become More Open

Research communities become more open rather than encapsulated in the long run. This is the reverse possibility. The operational trials of EIES were formulated to test impacts on "invisible colleges" of eminent groups of scientists engaged in and dominating the resources of research specialties. These trials, sponsored by the National Science Foundation, hypothesized that members of such "colleges" would communicate more productively and efficiently, and in the long run be more open to new members (Hiltz, 1976:18-22).

Johansen, DeGrasse, and Wilson (1978:60,82,102) recognize that the medium, on the other hand, could actually encourage more closed communications among a select group of people who form an electronic barrier between themselves and other potential participants and exclude others from their deliberations. Invitations to join a particular computer conference could become as prized as positions at prestigious institutions. But they also indicate that one of the outcomes of group usage has been the provision of more diverse contact for junior researchers who can gain status very quickly by building their own collegial networks.

This impact, then, will evidently depend on other factors such as group needs, values, and structures.

Most of the respondents agreed with the likelihood of this impact. COM responded with a "++" and there were five supporting "+" replies. Only the Devices for the Disabled group had conflicting evidence leading to a "-" response. The comment was that users "may communicate more outside of their usual circles, but don't seem to become more open in their communications."

Kinship Ties Resolidify

Kinship ties resolidify to counter residential mobility. This is another long-range hypothesized impact for which there is no support in the literature. Hiltz and Turoff (1978b:205-206) predict:

> Computerized conferencing can make it very easy to keep in touch with family and friends and colleagues who are located some distance away. A person could generate the equivalent of a 'Dear Everyone' newsletter a few times a month, for instance, adding a few sentences at the beginning or end specifically directed to each person. In this manner, it would not be much of a time-consuming chore at all to keep in touch ... computer conferencing provides a convenient and low-cost channel of communication for staying in touch with friends and family who no longer live nearby, and who can enlarge the effective support network available to individuals.

This was the only listed impact which produced no responses at all from the panel of experts. In part, this may be because it now appears to have been incorrectly placed and perhaps should have been included among the impacts at the individual or group affective level. This also is clearly a factor that cannot yet be tested by data.

Other Impacts

An open-ended question was included in the data-gathering instrument asking the respondents if there were other outcomes of computer-mediated communication systems that had been omitted. Ten such outcomes were offered. Some, such as asychronocity and self-paced participation, are characteristics of the medium rather than impacts or outcomes. The others are either suggested or included in this chapter. For completeness, however, these suggested additions are listed below, with their sources:

Timeless. No problems getting rapid access to Hawaii or France (FUTURES: +)

Unlike the phone, you can answer this when you feel like it (FUTURES: +)

May increase ability to adapt to different mental models (used in designing different computer-based communication systems), not only within these systems but in other contexts (LEGITECH: NS)

Users become more proficient in using more complex system features with increasing experience (WORKLOAD: --)

It increases amount of information available for decisions (JEDEC: +)

It improves continuity between meetings (JEDEC: ++)

Intellectual effectiveness (the creation, organization, and exposition of ideas in written form) is enhanced. This is considered "communication with self," and takes all the forms of communication with others. It is caused primarily by the hypertext structure of the communications (NLS: ++)

Less risk that important factors are forgotten in decision-making (COM: +)

Easier to disseminate information to more people (COM: +)

Larger groups of people can influence decisions (COM: +)

SUMMARY

Table 4-7 summarizes these impacts at the group behavioral level by agreement and sample size. The dimensions unifying this section appear to be increased connectivity, changes in communication processes, and changes in the nature of social structures. Interestingly, the impacts which could be either negative or problematic produced disagreement among the panelists, whereas the positive impacts all appear within the two strong agreement cells. Those impacts in the bottom left cell, for which the data conflicted, represent the most pressing need for further research.

TABLE 4-7
GROUP BEHAVIORAL IMPACTS

MANY STUDIES (5 or more)	FEW STUDIES (less than 5)
Increases informal communication (2++;9+)	Changes social structures (1++;3+)
Communication links increase (2++;7+)	Groupware changes meeting structures (1++;2+)
Decentralizes communication (8+)	Increases possible span of control (1++;2+)
Expands group size (1++;6+)	Increased organizational

AGREE	Creates new demands for funds (6+) New ways to promote goals (1++;4+) Reduces lag time (2++;8+; 1=0) Irregular participation (3++;6+;1=0) Increases lateral linkages within organizations (2++; 5+;1=0) Increases lateral linkages between organizations (1++;5+;1=0) Fluid teams vs. hierarchy (5+;1=0) Content threads increase (1++;3+;1=0) Creates new kinds of groups (4+;1=0) Increases need for strong leader (2++;1+;2=0)	consultants (2+)
DISAGREE	Increases cross-group communication (2++;7+;1=0; 1-) Changes who talks to whom (2++;6+;1-) Increases network density (8+;1-) Difficult to focus discussions (1++;6+;1-) Research communities become more open (1++;5+;1-) Increases potential for elites (1++;4+;1-) Greater equality of participation (1++;3+;1=0; 2-) Consensus less likely (1++; 1+;1=0;2-) Questions often unanswered (1++;4+;1=0;3-) Leadership emergence is different (1++;2+;1=0;2-; 1--)	Promotes role equality and flexibility (2+;1=0;1-) Changes centrality of members (2+;1=0;1--)

SOCIETAL IMPACTS

A list of impacts at the societal level was also generated by the working group. However, since we only have the most projective kinds of evidence for these impacts, we did not attempt to collect data for this level. They are presented below, however, both for completeness and for the beginnings of a list which will be capable of being documented sometime in the future.

COGNITIVE IMPACTS UPON SOCIETY

Continuation of shift from time-binding (traditional, religious) to space-binding (political, pragmatic, instrumental) societies.

Ease of communication brings news from greater distances, awareness of more events, increased cultural diversity, and new conceptual universes, leading to more complex world views and more humane social systems.

Libraries transcend current computerized discussions and past discussions from books and history.

Access to information becomes a political issue; e.g. computerized information retrieval systems raise the question of paying for library services.

Growth of information sector leads to reexamination of economic policies; e.g. reindustrialization policy.

Reduction of illiteracy.

Automated language translation creates norm for correct spelling.

Information becomes more culturally valued.

Impacts on privacy, confidentiality, and anonymity.

Issues such as copyright, subpoena of computer message tapes, and liability change.

Increased pressure for unbreakable codes.

Better information for decision makers.

New jokes, cartoons, stories, plays, novels, music, art.

AFFECTIVE IMPACTS UPON SOCIETY

Growth of shared metaphor for people in many walks of life.

Decline of geographically-defined communities as source of identity, and increased attention to shared interest (including professional) affiliations.

Changes in the prestige of organizations.

Changes in etiquette, social conventions.

Greater preponderance of achieved vs. ascribed statuses with shift to judging people by ideas vs. appearance, position, etc.

Use of computer conferencing by prisoners aids rehabilitation.

Electronic job mobility promotes the maintenance of communities.

BEHAVIORAL IMPACTS UPON SOCIETY

Governments attach tariffs (such as per character charges) to international data flow to prevent their telephone systems eliminating their telegraph systems.

New kinds of clandestine operations and covert warfare (e.g. international computerized conferencing combined with the electronic typesetting of newspaper copy makes it easier for the CIA or KGB to run propoganda, disinformation and destabilization campaigns in developing countries.

Sabotage of communication links is a countermeasure, as both subversive groups and the foes of revolution become more efficient.

Clever new ways of disseminating information and disinformation can be thought of as "information weaponry."

International contexts for teleconferencing lead to market preference for hard copy, since text is much easier to translate than is voice.

Cross-cultural dissemination of information, including impacts on third-world nations, and computerized conferencing is used to manage international projects.

International communication is easier for people with limited foreign language abilities, especially as computerized language translation becomes available.

Simpler for governments to monitor communication traffic and message content if not encoded.

Social structures may be more fragile and vulnerable because of the potential devastating effects of power failures, computerized support worker strikes, etc.

Increases the potential for democratic capitalism.

Increases the potential for the centralization of power.

Greater interagency collaboration and citizen participation in hearings, regulations, and legislation.

New ways to organize and operate political campaigns.

The rate of social change increases with more rapid dissemination of knowledge, higher quality of work, and less duplication of effort.

Improved contacts between scientists, businessmen, and government officials.

Unbreakable codes eliminate a major constraint to government and business use of public networks, resulting in fewer independent networks for the wealthy and more support for public networks.

Increase in direct personal selling via electronic classified ads that can be searched automatically.

Increased share of family income allocated to information goods such as terminals and connect time.

Reduced traffic lessens petroleum consumption and auto expenses.

Computer industry grows faster than the economy.

Electronic universities increase the number of faculty members who are either self-employed or employed at another university.

Publishing industry becomes an "output device" or summarizer of the computerized working media.

Continued growth of software "cottage industry" and work-at-home programmers.

Neighborhood work centers fill the gap between working at home and office.

Greater need for back-up power systems.

Opportunities for old people with knowledge and experience but reduced mobility are enhanced, but may not be realized until current users grow old.

CONCLUSIONS

A comprehensive literature review plus responses from a panel of experts provided the data from which we attempted to project cognitive, affective, and behavioral impacts of computer-mediated communication systems for individuals and groups. On the basis of projections from observed impacts at the individual and group levels, it is possible to make "informed guesses" about probable societal-level impacts. Such a list was generated by the participants in the project. However, until and unless these systems are in much more widespread use, it is not possible to test these societal impacts. Reviewing the summary tables presented in this chapter produces a picture of the current state of knowledge in this area.

The strongest support was achieved at the level of individual behavioral impacts, where nine of the fifteen, or sixty percent of the hypothesized impacts produced unanimous agreement from a relatively large number of studies. The group behavioral level achieved the next highest support, with forty-seven percent strong agreement. The fact that behavioral impacts are more observable than are those at the congitive or affective levels probably accounts for this.

Of the total of seventy-nine hypothesized impacts, only two (at the group behavioral level) yielded disagreement from a small number of studies. Further research is called for in those areas producing either agreement from only a small number of studies or disagreement from a larger number of studies, since these are the impacts likely to be conditional upon such variables as the nature of the task, the design of the system being used, and the characteristics of the group.

The impacts were classified according to their desirability or postive attributes, rating them positive, negative, or neutral, and the results are presented below:

TABLE 4-8
IMPACTS BY LEVEL, CONSENSUS, AND DESIRABILITY

	Positive	Negative	Neutral	Total
Many Studies Agree	25	1	6	32
Many Studies Disagree	15	8	5	28
Few Studies Agree	13	-	4	17
Few Studies Disagree	2	-	-	2
Total	55	9	15	79

An interesting pattern emerges in which the positive impacts of the medium exhibit much stronger support than do the negative ones. Twenty-five of the fifty-five impacts classified as essentially positive produced solid support from a large number of studies. On the other hand, it is reassuring that eight of the nine impacts with undesirable consequences yielded disagreement from a large number of studies. For the most part, the negative outcomes appear to be conditional upon other factors, since they are sometimes observed and sometimes absent.

These are clearly encouraging results. Further research should concentrate not only on the areas of disagreement, but on those conditions likely to enhance the positive impacts and reduce the negative ones.

CHAPTER V

CONSIDER THE GROUPWARE: DESIGN AND GROUP PROCESS IMPACTS ON COMMUNICATION IN THE ELECTRONIC MEDIUM

by

Peter and Trudy Johnson-Lenz

The broad purpose of evaluating computerized conferencing and other forms of computer-based human communication is to assemble, organize, and make available in systematic form information about the variety of experiences of users, designers, developers, and evaluators of such systems. This information can then be used by those considering potential applications and impacts of the medium, as well as by those interested in its further evolution and development.

Most evaluations to date have either focused on the use of a particular system, such as EIES or PLANET, or on those impacts or conditions of acceptance which exist for all such systems. However, the particular design characteristics of a given system and how an individual or group uses that system may result in some of the most significant impacts. By knowing about such specific impacts, a designer or facilitator can exert some control over the impacts on users by making choices about how the system functions and is used. This paper addresses some of the impacts of computerized conferencing design and group process characteristics.

There are two major aspects of the design of computerized conferencing systems: the user interface and the communications structure. The user or human-machine interface of interactive systems has been the subject of much of research and experimentation. However, the communications structure, or social interface if you will, has been much less studied. It determines how groups of people work together on different kinds of tasks in the electronic medium and thus provides an exciting potential for further development of electronic group work. Ultimately, structuring the communications process involves the design of social systems and may even result in new cultural forms within this highly adaptable, plastic medium.

Structured Communication

For a group to use a computerized conferencing system effectively, it must have some explicit, intentional procedures to follow. These procedures set out the purpose of the group and its tasks, who can communicate with whom and when, how decisions are made and disagreements resolved, the sequence of activities to be used in accomplishing the task, and so forth. The procedures may be norms or rules enforced by the group or they may include software enforcement. Such procedures constitute a communications structure, without which the group's work will be neither effective nor efficient.

> Group work is about: Individuals bound together through communication to get something done taking into account how people function together in a social system and taking into account how people relate to one another as individuals using procedures to organize and systematize the work with leaders who help train group members and select procedures in group meetings (Stech and Ratliffe, 1976:xiii)....Completing a task effectively involves INTENTIONALLY designing the group's work so that the end product will help them achieve their purpose and INTENTIONALLY working together in ways that insure effective interpersonal relationships. Seldom, if ever, do task or interpersonal aspects of group work just "happen" if maximum group effectiveness is desired. Members must intentionally function in ways that cause them to happen effectively (Ibid:199).

There are many different communications structures being used in the electronic medium. For example, computerized conferencing systems support both messaging (electronic mail) and conferencing. Each of these capabilities represents a different structure and consequently different impacts. Even the particular structure of conferencing is different on various systems. The CONFER conferencing structure is more interactive than EIES, for example, while conferencing on PLANET is deliberately kept very simple. Each system has structuring characteristics which best suit different purposes. In addition, new communications structures beyond conferencing are being developed and used. These include subsystems on EIES such as TOPICS which supports a variety of inquiry/response exchange processes, TERMS for collective glossary development, and TOUR which is an interactive hypertext system with participatory activities. (All three of these subsystems were designed and developed by the authors with the involvement and feedback of interested users.) The problem-solving experiments conducted by Hiltz and Turoff to compare the effectiveness of computerized conferencing with face-to-face group work represent another highly structured use of the medium.

> If we can accept as a valid objective of computerized conferencing the goal of creating collective intelligence capabilities, then these can only emerge via structures within which a group can effectively demonstrate an ability to produce results and to make better decisions than any member of the group acting as an individual (Hiltz and Turoff, 1978b:290).

Groupware

A group working together in a computerized conferencing environment, following certain procedures, can be greatly aided by software which supports and facilitates those procedures. However, software procedures are only one component of structured communication. The other major component is the processes and procedures used by the group. The most effective use of the medium comes about when a group uses processes and procedures specifically designed to meet its needs, plus computer software which supports and facilitates those procedures. The group process without computer support may be inefficient and cumbersome. Software without a group which can make effective use of it is a wasted resource. Effective group work in the electronic medium thus requires BOTH explicit and intentional group processes/procedures AND the computer software to support them. This union of GROUP process and computer softWARE support we call GROUPWARE to distinguish it from either process or software alone. Furthermore, a particular software system can often support different processes, while a specific procedure can be followed using a variety of software tools. The most effective results are achieved when the groupware is carefully matched to the group's needs and preferences.

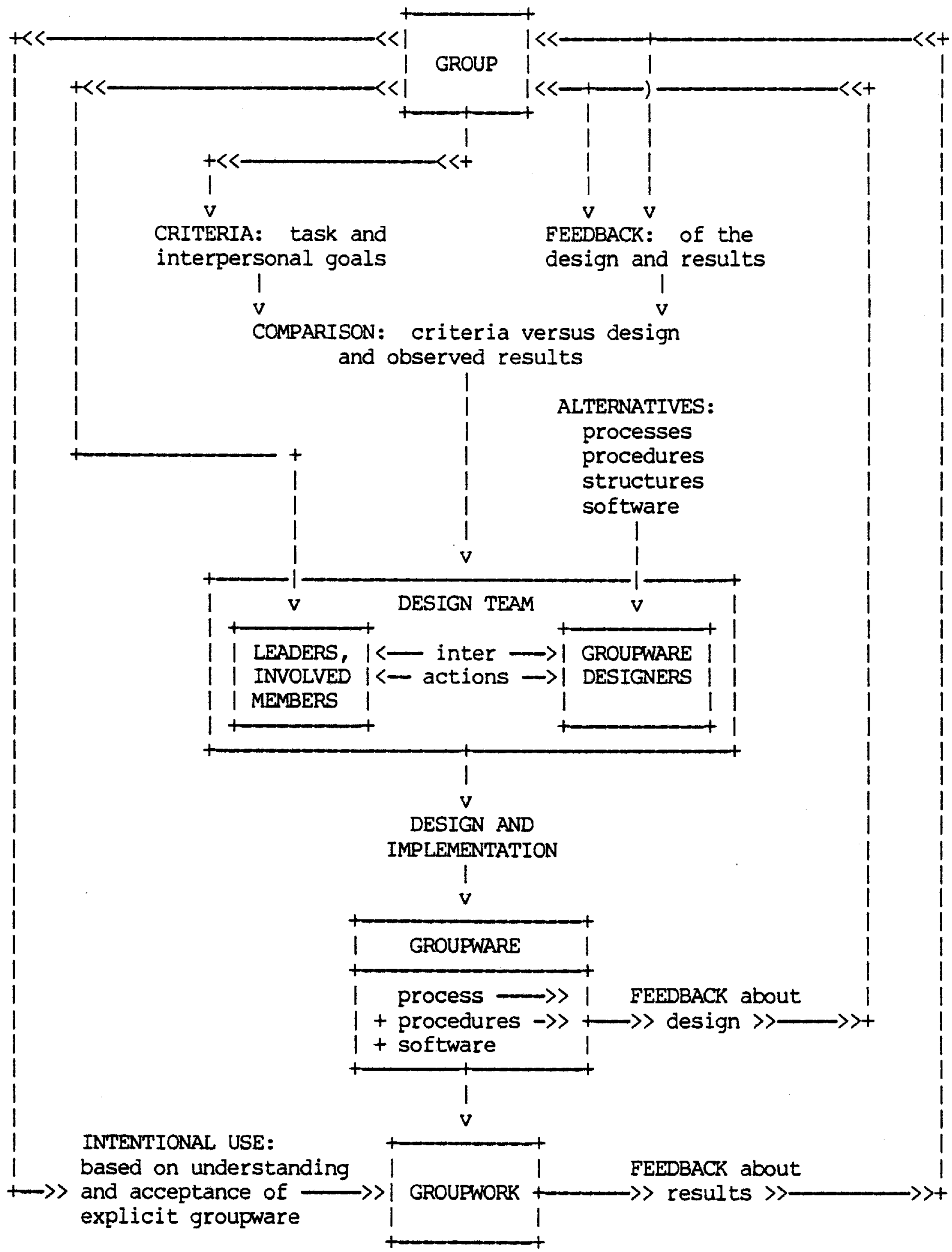
GROUPWARE = intentional GROUP processes and
procedures to achieve specific purposes
+
softWARE tools designed to support and
facilitate the group's work

The design of computerized conferencing systems is considered an art, and this is even more true of the design of groupware. Selecting the appropriate design elements in concert with a group's needs and processes requires sensitivity and a certain amount of intuition. It is too early is this developing field to organize groupware elements and design processes into a methodology, taxonomy, or even technique. Any evaluation of groupware must take this into account by recognizing varying individual reactions to given designs. The traditional experimental method may not be as appropriate an evaluative framework for groupware as one which includes the users as evaluators as well. Thus, a "second order cybernetics" approach (Umpleby, 1976), incorporating the multiple realities of the users as observers/participants, should be considered in evaluating groupware.

The Design Process

The process of groupware design begins when a group articulates its needs for groupware by making explicit its purposes, the particular process characteristics it wants to follow, and potential difficulties to be overcome. Usually, only a few people representing the group's interests are involved in this phase, and often only the leader, facilitator, or manager of the group is concerned with its processes and procedures. In response, the groupware designer suggests specific structures and procedures to meet the group's needs. Such procedures are specified at first without regard for the computer system; they must make sense as group procedures in and of themselves. Then, after discussion and selection of the appropriate procedures, the groupware designer either uses existing software tools or develops new ones to support the chosen group procedures.

TABLE 5-1
DIAGRAM OF GROUPWARE DESIGN PROCESS



Depending on the interest of individual group members, they may be actively involved in the design process, but most often it is left to the facilitator(s) or project manager(s) and the groupware designer.

However, the process does not stop there. Unless the group's task is fairly simple and of short duration, the group's needs will evolve over time as they do their work and gain experience with the communications structures they are using. Process evaluation may show the need for adjustments in the groupware structures or the need for new ones. Thus, for ongoing group work, the design process must be dynamic and evolve with the group's needs and activities. A case study of the evolution of the TOPICS system can be found in Johnson-Lenz and Johnson-Lenz (1981).

SEE TABLE 5-1

Often, people think that there isn't much that can be done to help a group work together more effectively, even if some members are not satisfied with the atmosphere or procedures of the group. Many groups are not intentional and explicit about their processes, and so meetings are neither effective nor efficient. However, the development and adoption of groupware can change the social system and functioning within the group and improve its task products and interpersonal relationships.

> Group structure, process, and atmosphere need not be static and inflexible. Each can be changed. Since the group is a social system, social rather than individual change strategies are required to implement changes. While an individual can decide to change or can be trained, a group cannot be induced to change simply because one person wants to make a change. The entire social system, the whole group, must accept the change and work to implement it (Stech and Ratliffe, 1976:93).

Stech and Ratliffe (1976:95) present a model of the functions involved in changing the group structure, process, or atmosphere. The process of groupware design and evolution as shown above is similar in many respects to the model of social change in a group.

SEE TABLE 5-2

However, both the process of groupware design and the underlying social change within a group implied by the evolution of groupware to meet the group's ongoing needs are neither quick nor magic. Design is an art, and social change takes time.

TABLE 5-2

A MODEL OF THE FUNCTIONS INVOLVED IN
CHANGING THE GROUP STRUCTURE, PROCESS, OR ATMOSPHERE
(adapted from Stech and Ratliffe)

```
CRITERIA:  How a group                          FEEDBACK:  information
should function; desired                        on inputs, processing,
feelings, values, results                       and outcomes <<-------+
           |                                               |          |
           +------------------>>+    +<<-------------------+          |
                                |    |                                |
                                v    v                                |
                         COMPARISON:  of                              |
                         actual input, processing                     |
                         and outcomes to criteria                     |
                                     |                                |
ALTERNATIVES:  various ways          |                                |
of operating, optional               |                                |
procedures, different norms          |                                |
and values                           |                                |
           |                         |                                |
           +------------------>>+    |                                |
                                |    |                                |
                                v    v                                |
                         IMPLEMENTATION:  ability to                  |
                         change group activities and                  |
                         functioning, methods of  ,                   |
                         inducing change                              |
                                |                                     |
    +<<-------------------------+------------------------->>+         |
    |                           |                           |         |
    v                           v                           v         |
INPUT FUNCTION:          PROCESSING FUNCTION:      OUTPUT FUNCTION:   |
tasks, social norms      discussion, interaction   results, decisions,|
cultural values          procedures, meetings      programs, solutions,|
    |                           |                     activities      |
    |                           |                           |         |
    +---------------------->>+------------------------->>+-------->>+
```

> Social change takes time. Just because a problem has been defined, new methods of functioning have been recommended, and the group is eager to try them, the group will not necessarily begin to operate differently. It may take weeks to months or even years for a group to shift norms, values, roles, standard processes, and atmosphere. Therefore, both the leaders and members must be patient with each other and with themselves. Sudden and dramatic shifts simply will not occur. Gradual, effective changes can be group as a whole (Stech and Ratliffe, 1976:97).

Previous Work in Aspects of Groupware

Before proceeding to discuss forms and characteristics of groupware, we would like to mention briefly the substantial body of work done by others in designing and experimenting with various groupware structures, both with and without computer support. The literature on group process and dynamics is vast, and we only mention those references that are most directly applicable to the topics under discussion here.

Although this paper emphasizes group communication structures within the electronic medium of computerized conferencing and hence includes computer software support within the definition of groupware, it is our belief that the concept of groupware extends to any deliberately designed and implemented ("programmed" if you will) set of procedures and group processes which facilitate group work. Thus, groupware in this larger sense applies to face-to-face meetings and workshops, as well as larger social systems, including structures for governance.

Non-computer-based methods and techniques are discussed in a variety of sources. Stech and Ratliffe (1976) present an excellent synthesis of information about the basics of group work and the details of well-established group processes and procedures, as well as the circumstances under which each procedure is most appropriately used. The U.S. Department of Transportation (1976) has published an analysis and catalog of tested group processes and procedures for citizen participation, with and without computer support, including relative strengths and weaknesses of each. Stevens et al. (1974) discuss group procedures involving large numbers of people in public decision-making processes, including feedback balloting, interactive television, and electronic voting. An innovative approach to synergic group work can be found in Craig and Craig (1974). Theobald (1976) discusses the development of problem/possibility focusers as a way of structuring agreements, disagreements, implications of various approaches, and resources for policy issues.

Perhaps the best source to date on some of the potentials for structured communication in a computerized conferencing environment is "The Network Nation" (Hiltz and Turoff, 1978b). It includes a discussion of computer implementation of several group processes, including nominal group process and the Delphi method. The latter is described in more detail in a series of articles in "The Delphi Method" (Linstone and Turoff, 1975), which includes an article on computerized conferencing. Some of the research on the use of computerized conferencing and other electronic forms of meetings is discussed in Johansen, Vallee, and Spangler (1979). Johnson-Lenz and Scher (1978) mention several modeling methods, including policy capturing and interpretive structural modeling, as well as group voting and feedback processes which can be used in a computerized conferencing environment. Examples of specific applications of groupware are discussed in Johnson-Lenz and Johnson-Lenz (1980d).

Characteristics of Groups and Group Work

There are a number of different kinds of groups and group purposes, but our focus here is task groups and activities such as management, decision-making, goal attainment, and so forth. The process a group follows will depend on the characteristics of its task and the phases of its activity. Specific procedures are appropriate for different tasks and activities. The impacts of the use of computerized conferencing for group work are, in part, determined by the choice of processes, quite apart from the specific procedures, structure, or software support.

Tasks can vary on the following dimensions (Stech and Ratliffe, 1976:39-41):

simple vs. complex

conjunctive vs. disjunctive (several people's coordinated efforts vs. individual efforts)

routine vs. developmental

certainty vs. risk

information processing vs. action oriented

Phases in project/program management, decision-making, problem solving, and goal attainment consist of specific tasks which may vary on the above dimensions. For example, goal setting in project management can be simple or complex, routine or developmental, etc., depending on the project. A complex task of goal setting would require different processes and procedures than a simple one. Stech and Ratliffe (1976:43,158-160) list the phases of project/program management as goal setting, problem solving or decision-making, planning, implementing, and assessing and evaluating. Decision-making phases are further delineated as problem definition, solution generation, criteria setting, solution selection, solution implementation, and group process assessment. This is very similar to the problem-solving process phases of perceiving the problem; definition and analysis; planning, predicting the results, and the development of alternative plans if necessary; action or implementation; and evaluation. Different procedures are appropriate for each of these phases, as discussed below.

In addition, the characteristics of the group itself may vary:

- demographic composition and balance
- individual orientation vs. collective orientation
- stratified roles vs. equal status
- distant relationships vs. close relationships
- fixed group membership vs. open and changing membership
- broadly participatory vs. unequal participation
- task vs. support or social function
- ongoing vs. ad hoc purpose
- long duration vs. together for short, fixed time
- geographically dispersed vs. in same place
- regular vs. irregular meeting schedule
- synchronous vs. asynchronous meetings
- face-to-tace activities vs. activities via various media

Furthermore, the group is a social system which has its own particular characteristics. Described in social network terms, the network of relationships within a group can be centralized, polycentric, or decentralized. It can have the shape of a circle, an interconnected star, or a rigid hierarchy. Group members can have specific task roles, flexible and varied roles, or no specific roles at all. There can be a leader or facilitator or no recognized leadership. However, groups exhibit a need for both task and interpersonal process leadership. This need can be satisfied by one or more people on a permanent or rotating basis, or in a computerized conferencing environment, by the computer itself to a limited degree if the leadership tasks are simple enough to be anticipated and programmed.

Characteristics of Procedures

Once the characteristics of the group and its processes are described and made explicit, the procedures and structures can be chosen. A procedure is simply a method a group can use to accomplish its task. At this stage, consideration of appropriate procedures is still independent of the computer software which supports them. The impacts of the use of computerized conferencing for group work are determined in part by the choice of procedures and structures, quite apart from the specific design of the software, which has its own impacts.

Procedures may include some or all of following characteristics:

individual work vs. group interaction

anonymity vs. identified responses

feedback of group results vs. none

aggregated results vs. unaggregated/unprocessed results

voting (rating, ranking, estimating, Y/N, etc.) vs. none

numerical processing (averages, distributions, graphs, clustering, scaling, etc.) vs. none

filtered information (to prevent overload and give access to what is of interest) vs. unfiltered

synchronous vs. asynchronous interaction

sequenced interaction vs. free/unstructured interaction

one-time access to information vs. continuous access

pattern of communication: one-to-one, one-to-many, many-to-many, many-to-one.

There are a variety of standard group procedures which have been developed and used successfully over the years with groups with different purposes and characteristics. According to Stech and Ratliffe (1976:160-189), these include reflective thinking; rational management; brainstorming; nominal group process; Delphi; action research; parliamentary procedure; PERT chart planning; scheduling, budgeting, assigning; and product and process evaluation. Hiltz and Turoff (1978b:288-289) go on to list the structuring characteristics of Delphi and nominal group processes:

anonymity

independent generation of ideas or judgments, by assuring that all participants have an opportunity to think and record their ideas or judgments before receiving the ideas of others

specification of modes of communication for some or all the communication, i.e., the use of written communications mechanisms for assuring equality of opportunity to participate

appointed facilitator(s) to assure the flow of communications in the prestructured manner (rather than reliance on informal leadership from within the group itself)

specification of allowable subjects of and forms of communications (example: voting or discussion segregated by time period)

some sort of organized feedback to the group of the "input" of each member and the aggregate "group decision" that is emerging

specification of allowable "who-to-whom" patterns of communication (i.e., no private communications)

Three additional procedures not mentioned above are policy capturing, developed by Kenneth R. Hammond (1975); interpretive structural modeling (ISM), developed by John Warfield (1976); and problem/possibility focuser generation, created by Robert Theobald (1976).

The procedure selection phase of the design process involves matching the group's processes with the appropriate procedures. This is still an art, since there is such a variety of process characteristics and hence procedures to match them. There is also some disagreement as to which procedures are most appropriate in which situations, based on designer and facilitator biases, but the following table (Stech and Ratliffe, 1976:158) shows one assessment of the effectiveness of standard group procedures for different phases of task work.

TABLE 5-3

POTENTIAL EFFECTIVENESS OF PROCEDURES WHEN USED AT VARIOUS PHASES IN THE TASK GROUP PROCESS

	Decision-Making Phases				Post-Decision Phases	
Procedures	1 Problem Definition	2 Solution Generation	3 Criteria Setting	4 Solution Selection	5 Solution Implementation	6 Group Process Assmnt.
Reflective Thinking	1		2			
Rational Management	1		1	1		
Brainstorming		1				
Nominal Group		1		2		
Delphi				1		
Action Research				2	1	1
Parliamentary Procedure				2	1	1
Pert Chart Planning					1	2
Scheduling, Budgeting, & Assigning					2	1
Product and Process Evaluation						1

Rating of "1" indicates maximum potential effectiveness.
Rating of "2" indicates potentially effective procedure.

Software Design Elements

Finally, after understanding the characteristics of the group, its purpose, process, and the procedures appropriate for its work, the groupware designer can choose the specific software tools or system which will meet the group's needs. Even at that, the software tools themselves are subject to design choices. The impacts of the use of computerized conferencing for group work are certainly determined in part by the choice of the computer system (hardware and software) and the design elements as listed below, but in many ways, these are the least interesting, most easily assessed, and most controllable impacts.

Just as groups, group process, and group procedures vary along a number of dimensions, the design of software tools is made up of many elements. The choices made by the designer are a series of trade-offs among those design elements. Hiltz and Turoff (1978b:347-353) have written about design principles at the level of concepts such as forgiveness, escape, generalizability and segmentation, variety of flexibility of interaction, etc. Consistent with these principles are choices among design elements such as the following:

menus vs. commands

simple commands vs. more complex/powerful interface

friendly/cordial interface vs. terse commands and diagnostics

choice of words (metaphors) used in referring to the software and the commands/actions

tailorable interface different for different users

guided/tutorial mode vs. terse/rapid mode

human user support vs. print or on-line documentation

use of keywords for organization vs. retrieval by item numbers only

storage of text vs. none

structured database of interactional results vs. unstructured

automated delivery of waiting items

use of markers to keep track of what has been delivered before

use of graphics vs. text only

format for entry of material

format for presentation of results

choice of computational algorithms if needed

human actions vs. machine actions for different functions

Examples of Specific Communications Structures

Design elements are combined to form tools, structures, and systems, each of which has different characteristics and consequently different impacts. In addition, one group's use of a particular structure may be different than another's, as discussed below, and this difference will make evaluating the impacts of a use of a given communications structure even more difficult.

Here are descriptions of some generic software structures or systems. These come almost entirely from the authors' experience with EIES. Other systems, such as CONFER and PLANET, have communications structures with slightly different characteristics. Again, evaluating the impact of a group's use of a computerized conferencing system must take into account the characteristics of the software tools it is using and the group process and procedures for which those tools are employed.

MESSAGING:

This is the simplest form of electronic communication, often called "electronic mail." On EIES, the length of a message is limited to 57 lines or about one page of text. Messages may be sent to one or more people or to a defined group. They may be signed with the sender's name or sent anonymously or under a pen name. They may be "open copied" (all recipients know the names of other recipients) or "blind copied." A confirmation is sent to the author when a message has been received. Messages are put into a member's delivery "queue" in the order in which they are sent, and they are delivered in that order; there is no facility for sorting one's messages or rejecting some of them. Messages may be delivered automatically while one is on line or may be requested for delivery by the user at his or her convenience. There is no automatic provision on EIES for special disposition of messages, such as file for later reference, answer immediately, forward to someone else, etc. These actions can be taken, but the user must initiate them. Messages are stored on line for about three months, after which they are deleted. Users may store them elsewhere for a longer time. A message may be modified by the sender and copied by anyone with access to it (sender and recipients). On EIES, a message may be associated with one previous message, and up to one line of keywords may be assigned to it for later retrieval or to indicate the subject(s) of the message.

CONFERENCING:

In a computer conference, all the text items (messages, if you will) exchanged are kept in the order in which they were entered by conferees, thus forming a long, written, self-documenting transcript of the conference. The major advantage of a conference over messages for a group's communication is that all the relevant exchanges are kept in one place instead of being interspersed with other messages. Conference comments (items of text in a conference) on EIES are also limited to 57 lines. They may be signed, anonymous, or pen named. The computer keeps a marker for each conference member. When s/he goes into the conference, the system indicates how many new items are waiting and gives the user an opportunity to accept any or all of them. Members may "browse" through conferences by looking at conference comment titles they have not yet received and moving their markers to the desired place. Any conference comment (to which one has access) may be printed out, even if it has not been previously delivered. On EIES, waiting comments are delivered one right after another. In contrast, on CONFER the system asks the user for a one-line reaction or "vote" on each comment before going on to the next one and thus is more interactive in this respect. Conferences may be asynchronous or synchronous (several people on line at once).

FILTERED EXCHANGE:

If one is a very active user at all, messaging and conferencing can produce information overload very quickly. If one is in a ten-person conference, there is the potential for receiving nine comments for every one comment one sends. Thus, there is the need for structures which will automatically filter out those items not of interest and deliver only those which one wants. On EIES, the TOPICS subsystem, developed by the authors, has several features for reducing information overload. (This same subsystem is used by the Politechs-on-EIES Exchanges under the name POLITECHS.) First, topics of interest or inquiries for which one is requesting responses are introduced in a brief, concise format, limited to 3-5 lines (depending on the particular exchange). Only these short topic raisers/inquiries are delivered to everyone in the exchange. Second, members are given the opportunity to select those topics or inquiries of interest to receive additional background information (if any) and associated responses entered to date. The user's selection of topics also governs which responses in the exchange will be delivered in the future. Third, there are a series of delivery options so that users can get topics and responses in "batch," by keywords, by topic, and so forth, depending on their needs and preferences at a particular moment. Fourth, there is a keyword index and retrieval mechanism.

Another pair of features on EIES for reducing information overload is SUBMIT and READ. A user may compose a long text item or set of items with a shorter abstract. The abstract is then sent to appropriate others or put in a conference. Those recipients who are interested in the entire text item or paper, based on the abstract, then READ the rest of it with a single command. This is similar to the short topic raisers and selection of items of interest in the TOPICS system, except that there is no length restriction on SUBMITted abstracts. The EIES news network uses the SUBMIT and READ features in a public conference to share news items of interest without imposing long text items on everyone.

Another example of filtered exchange on EIES is the INTERESTS feature. Users indicate their interests by keywords and thus "join" interest groups on line. Members of an interest group are then free to message among themselves or form a conference. This is a way of quickly finding others on line with whom one wishes to exchange.

RELATIONAL STRUCTURES:

Conferences and discussions within TOPICS are generally linear in form; that is, comments or responses are arranged in the order in which they are entered in one, long sequence. However, the information can be arranged so that similar ideas or facts are grouped together. On EIES, textual material can be arranged this way in the TOUR system, with up to nine branches at the end of each item for related material. "Tourists" can go through the material in sequences of their own choosing, based on which branches they take. In addition, there are participatory activities within the tour: response/tallies for anonymous ratings or questionnaires and discussions or mini-conferences about the material itself. There is also a relational keyword index and retrieval system so users can get those items of primary interest without having to take the tour. A special command mode in the TOUR system also allows users to move around at will. TOUR was designed and developed by the authors.

Another relational structure, called COLLECTIONS, has been designed for EIES but is not yet operational. It allows users to collect text items and arrange them in a hierarchy in outline form. This would provide users with a tool for creating their own private databases of information which could also be made accessible to others.

VOTING:

To get a group's opinion or to see whether consensus is emerging, it is useful to have voting capabilities. In EIES conferences, an author can make any item votable and specify scales on which users are to vote. The built-in scales have been designed to support Delphi method voting, and there is the option for a user-defined scale as well. Feedback of the results can be restricted until a specified number of people have voted. The results are not automatically included in the conference transcript. Voting is anonymous, and respondents can change their votes.

Dynamic value voting routines are available on CONFER which include computational support for ranking exercises, including feedback of the best fit of the group ranking, similar to that used in recent experiments by Hiltz and Turoff as discussed below.

One user group on EIES has devised its own simplified voting routines with defined commands to operate within a conference. Only three responses -- yes, no, and abstain -- are included, but those meet the needs of the group and its tasks.

Voting in TOPICS and TOUR takes place in response/tallies. Any question which can be expressed with up to nine alternatives (e.g., on a scale from 1 to 9, multiple choice questions, etc.) can be posed in a response/tally. As soon as someone has voted, the results to date are printed out. Voting is anonymous, and responders can change their votes. In TOPICS, a tally can be associated with a topic, in which case it will be printed out every time new responses are delivered, or it can be attached to a specific response, where it will be printed out only once. A topic/tally is useful for ongoing process feedback, and a tally associated with a specific response is most appropriate for feedback on a particular idea, proposal, or whatever.

QUESTIONNAIRES, SURVEYS, AND ON-LINE DATA COLLECTION:

Although there is no general feature on EIES for conducting on-line surveys, several prototype systems have been used. The RESPOND system supports numerically scaled questions, with one open-ended question or opportunity for comments at the end. Responders can get the results after a specified number of people have responded, responses (except for the open-ended question) are anonymous, and answers can be changed. In contrast, the ANSWER system supports a mix of numerically scaled and free-response questions. The results are only available to those who are conducting the questionnaire.

Answers are identified, and they cannot be changed once entered. RESPOND has been used for on-line surveys and ANSWER has been used for on-line data collection. Neither system is a generally available feature of EIES, since they were designed for limited experimental use only.

Two more complex and sophisticated systems have also been used for special on-line data collection on EIES. The NETWORK procedure asked a series of questions about the relationships among a group of people who were involved in the analysis of social networks. It supported nested questions; that is, some questions were asked only if particular answers were given to previous questions. It also had a rigorous checking routine to make sure that the answers people gave were internally consistent. Another elaborate, automated procedure was developed to support an experiment in recall of communication. On a random basis, participants in the experiment were asked to recall with whom they had communicated on EIES during a given period of time. Data were collected automatically about their reported communication patterns and their actual communications. Checking routines were included to insure the accuracy of the data collection, and participants were also allowed to make comments about their experiences with the procedure or any special circumstances which applied to the period of communication under consideration. They could also remove themselves from the experiment if they wished. This procedure was highly structured; participants were not allowed to get their messages or do anything else on line until they answered the questions. Fortunately, the procedure only "took control" on a random basis, but even at that, it was dubbed "the mad robot."

DECISION-SUPPORT TOOLS:

An area which is wide open for research and development is the design and implementation of decision-support tools which would be available to groups and individuals in a computerized conferencing environment. In a sense, many of the software tools and systems mentioned above support decision making, but decision-support tools are usually considered to be those procedures which aid a group in any or all of the phases of decision making: problem definition, solution generation, criteria setting, solution selection, solution implementation, and group process assessment. Decision-support tools can be divergent or convergent or a combination. For example, solution generation is a divergent activity, solution selection is convergent, and criteria setting is a combination of both.

The experiments Hiltz and Turoff have been conducting to compare the use of computerized conferencing with face-to-face sessions in reaching decisions are a combination of decision-support tools and on-line data collection. The experimental procedure is highly structured with a series of "gates"; the next step can only be followed when all participants have reached the proper stage. One version of the experiment involves a synchronous session in which participants attempt to come to consensus on their rankings of fifteen items. To test out several conditions, the experiment can be run with feedback of individuals' and the aggregated group's rankings or without, as well as with human or computer leadership designed to help the members of the group discuss their differences in a logical manner. The feedback and leadership conditions use decision-support tools; the data from the experiment are also automatically collected.

The TERMS system is a tool for collective development of glossaries of terms and definitions. Members can enter terms, as many definitions as they like, and comments on those definitions. They can also vote on which definition they think is most appropriate, if the purpose is to converge on only one definition per term. The TERMS system has been programmed in a general way so that it could also be used for discussion of issues and positions, if the names were changed from terms to issues and definitions to positions. It has features for "batch" entry of items, as well as a command structure that is designed for rapid and intensive work. TERMS was designed and developed by the authors.

INTENSIVE EXCHANGES: One of the major advantages of computerized conferencing for group work is its asynchronous nature; group members can enter and read material at times of their own choosing. However, it is sometimes advantageous to have synchronous or more intensive exchanges at particular points in a group's process. For example, the members of the TRANSFORM exchange on EIES wanted to focus their attention on their goals and hopes for the future of their work together, so the HOPES intensive was held over a period of ten days. The software tool used for the intensive was a special procedure designed to operate within the TOPICS exchange used by the TRANSFORM group. It asked four questions of participants at the beginning and then fed back all the answers to the questions as they were entered.

Participants did not have to answer the questions at first, but they were reminded each time they joined the intensive if they hadn't yet answered the questions. The procedure provided a very simple structure: participants were given an opportunity to receive all the waiting responses and then were asked directly to compose a response. The response/tally feature mentioned above was also used to see if there was consensus on various proposals which were developed during the intensive.

Another project used a similar activity on two occasions to create interest in computerized conferencing in their local communities. Members held local gatherings and then tied them all together with an on-line "party" using the same software tool as the HOPES intensive. In this case, the party was held over a period of five hours, with participants in different time zones and half a dozen states. A series of short questions about each community were asked at the beginning to "break the ice" and no response/tallies were used.

A different kind of party was the 1978 New Year's Eve party on EIES, with partygoers celebrating the new year during the evening in four different time zones. A simplified version of conferencing was used, with many pennamed and anonymous comments.

GAMES:

Group work can also involve the use of games for task and interpersonal purposes. There is great potential for the development of simulation games in computerized conferencing for educational and planning activities. There are also more light-hearted games which are fun and create group solidarity. The STORY procedure on EIES allows a group of people to write a collective story with each person adding one line in turn. Group norms could be used to focus the story on a particular subject or plot line, or it can be at the creative whim of the individual as is currently the case. ANIMAL is a game in which players teach the computer new animals based on questions which distinguish one animal from another. It is an example of a general teaching and learning tool which gains in collective knowledge of animals as more and more people play the game.

Examples of Groupware in Action

The examples of communications structures described above were all developed to meet particular needs of users. They are structures, systems, procedures, and tools comprised of and optimizing various design elements to provide specific features and capabilities. One might think that these are the groupware, since most of them were developed with user involvement. However, groupware also includes the ways in which tools or software support are employed to further the group's process and help them achieve their goals. To evalate many of the impacts of the use of computerized conferencing on group work, one must consider the groupware: the group, its perceived needs, process, sequence of activities, choice of procedures, and structured communications. To illustrate, here are some examples of different uses of the same software structures by various groups. The impacts are different for different uses.

CONFERENCES:

There have been hundreds of conferences on EIES, all using the same software. One conference was an informal encounter group in which the members wished to get to know each other better so they could work together over a long period of time. Pen names were sometimes used so members could play different roles in the evolving psychodrama. In contrast, another conference was a participatory soap opera conducted entirely with pen names. In a third conference in which members were attempting to illustrate "super-literacy" where the product would be better than any individual could produce, one phase of the conference was entirely anonymous so that individual's identities or pen named roles/masks did not intrude on the quality of the ideas.

Several conferences have been devoted to software specification and design. These had a strong task orientation and in several cases specific and rather immediate deadlines. Similarly, a conference for designing a workshop process and materials for a series of face-to-face meetings had focus, a deadline, and was of short duration. Other longer range planning conferences have lasted for many months, with many tasks to be accomplished. Still other conferences without a clear task focus moved from subject to subject, based on conferees' interests.

These are by no means representative examples of the range of conferences, but they do show that conferencing can take many forms and hence can be perceived to have different impacts. One impact of the experience of the encounter group or soap opera conference might be that computerized conferencing allowed one to express feelings and different aspects of one's personality without fear of disclosure. However, this probably would not be an impact for those who used conferencing for task group work with tight deadlines. Similarly, a group which used voting in a conference might have a different perception of how easy or difficult it is to come to consensus in a computer conference than one which relied on a more informal sense of the group's preferences.

TOPICS/POLITECHS:

Some of the features of the TOPICS subsystem on EIES are described above. In brief, TOPICS can be used to support a series of mini-conferences or an inquiry/response process or a mix of both. Each group using TOPICS has an exchange in which brief topics or inquiries (usually 3-5 lines) are delivered to members who can then select those of interest to receive associated responses then and in the future. There is also a keyword index and keyword retrieval of both topics and responses. A series of exchange options, including pen named and anonymous topics and responses, tallies for topics or responses, relational keyword index, and others, allow the system to be configured to meet particular group needs and prcesses. There are also levels of access which govern what kinds of action a user can take, including raising topics, editing items, editing the index, admitting others to the exchange, and changing the exchange options.

One group might want to be very restrictive about who can become a member of the exchange and have one person control access, while another might make everyone capable of admitting anyone s/he likes.

The Politechs-on-EIES Exchanges (currently Publictech, Legitech, Brieftech, and Nettech) use TOPICS under the name POLITECHS. Politechs information sharing networks are coordinated by Participation Systems Inc. The Publictech and Legitech Exchanges on EIES are examples of an inquiry/exchange process. Members raise brief inquiries (no more than three lines), and interested others answer those inquiries in subsequent responses. Legitech is for legislative researchers and resource people and focuses on inquiries and responses of concern to the researchers as they relate to proposed state legislation. Legitech is a private exchange. In contrast, Publictech is open to anyone on EIES and has a more diffuse focus, although its inquiries and responses generally concern scientific, technical, and public policy matters. It is the most open of the Politechs-on-EIES Exchanges from which more specialized Exchanges can be spun off as needed. Neither Legitech nor Publictech allows anonymous or pen named items, response/tallies, or relational keywording. In fact, various keywording approaches have been used in these Exchanges to see which are most appropriate for these groups. (Politechs-on-EIES also capitalizes Exchange in its use of language as part of groupware.)

In contrast, a group of people interested in and concerned about personal and social transformation use the TOPICS system in the TRANSFORM exchange. It is a covenantial space; that is, members must agree to a covenant of cooperation, caring, and sharing before they will be admitted to the exchange. Further, members must have a sponsor who will introduce them to the exchange, the group, and the process. In TRANSFORM, each topic introduces a mini-conference on subjects like the role of science fiction, myth, and imagery in the transformation; the transformation of neighborhoods and communities; and the convergence of science and religion. There are also a number of group process and membership topics, including a collection of short biographies of members. The purpose of the exchange is to share ideas and information about personal and social transformation and to provide social and emotional support for others in the exchange. Pen names (and "anonymous") can be used, and response/tallies are available. Since TRANSFORM is less task oriented than Publictech or Legitech and focuses on matters of concern to members at a very different level than technical inquires, experience with it will have very different impacts on members. One impact of participating in the TRANSFORM exchange might be having a greater sense of hope about the future and sense of support and camaraderie with those sharing a particular set of values and visions. An impact of participating in Legitech might be more horizontal networking and increased speed and quantity of information exchange on topics of relevance to the legislative process.

Two uses of TOPICS for community applications are worth mentioning briefly. A group of facilitators and others working with communities undergoing rapid growth in the Southwest United States used TOPICS to exchange information about the problems and possibilities of growth in their communities. They raised specific inquiries, such as what growth management tools (e.g., zoning) have been tried elsewhere, as well as shared profiles of their communities and had less focused mini-conferences on subjects of interest. Project management was also discussed in a private topic within the exchange. This group also held two synchronous computer "parties" as described above to acquaint local officials, planners, and others with computerized conferencing and the rapid growth project. A new project uses TOPICS for exchange of news of interest to community, neighborhood, and self-help groups. This application combines news items about funding sources, innovative projects, legislation, requests for proposals, etc. with inquiries where appropriate. News items are introduced in the topic raisers and members can select those topics of interest to receive the entire item. Comments or additional information about a news item are entered as responses.

HOPES, PARTY, AND BRAINSTORM:

The use of special, simplified software for intensive exchange has been described above. The HOPES intensive was conducted by the TRANSFORM exchange group over a ten-day period to share hopes for the future of the exchange and to create more of a sense of purpose and focus than had existed before. In assessing the impact of this activity, an evaluator would want to know if the goals had been achieved and if the group's activities were both more focused and satisfying to the members. In contrast, the rapid growth communities' two experiences with PARTY were to get participants more familiar with communication via computer and to give the project local exposure. There was no subject matter focus during the first party. The second included several topics of interest, but because information overload was anticipated with intense exchange among many people over a very short period of time, no one expected substantive discussion on those topics. Assessing the impact of either party would also have to take into account the much slower response time of the system because of the synchronous conversations. There has been one other use of the special intensive exchange software. A group of leaders and activists in the appropriate technology movement were interested in exploring the use of computerized conferencing for exchange of information and activities. Previous attempts to get active participation had been unsuccessful, so a synchronous BRAINSTORM session was planned to get everyone together. Unfortunately, the system was not operating the evening the session had been scheduled, and subsequent attempts to conduct the session over a week's period were disappointing. HOPES, PARTY, and BRAINSTORM all used the same software tool, just named differently. They were different experiences for the participants and had different results and impacts.

TERMS:

The TERMS system was designed and developed originally for use by a group from the electronics industry exerimenting with the use of computerized conferencing for standards work in microprocessors (Johnson-Lenz, Johnson-Lenz, and Hessman, 1980). The first step in developing many standards is agreeing on terms and definitions. This group's use of TERMS involved one acceptable definition per term. They also had a need for "batch" entry of items, since they were able to use terms and definitions from previous specifications in some instances. In contrast, the TRANSFORM group on EIES also has its own glossary of terms and definitions relating to personal and social transformation. In this case, many definitions and comments have been entered for some of the terms, since there is no need to converge on one technical definition. One very striking personal experience occurred in the TRANSFORM glossary. One member had entered the term "vision" and included a quotation as a definition about one's vision being that which one is called to do, and which if one doesn't do, won't get done. Another member was undergoing a period of confusion about his employment and "vision" of his life. A third member copied the definition of vision to him, and he found it spoke to him so profoundly that he felt God had answered his prayers and spoken to him through the terminal. In turn, he shared this experience as a comment in the glossary, which touched several others, one of whom added a comment in turn about the effect of reading about this experience. Is the potential for religious or spiritual experiences an impact of computerized conferencing?

TOUR:

Some of the features of the TOUR system are described above. To date there have been two applications of the software, each with different groupware design and impacts. The first is a tour of alternative futures prepared as an educational tool for the U.S. Department of Agriculture. In the futures tour, four scenarios of the future, material about eight driving forces, and discussions of four natural resources issues have been arranged in a relational knowledgebase. In addition, there are vignettes which show how aspects of the natural resources issues would turn out if the scenarios were to happen. All the text was written by Robert Theobald (1979). The programmed guide is given a name, and the questions she asks about where to go next are conversational in tone. The mapping of the tour -- the way the text is arranged and the participatory exercises included -- is deliberately meant to be both rich and divergent. The purpose of the tour as mapped is to open up the thinking of tourists about possibilities for the future. Some text items have as many as eight possible branches, which means that tourists have a great deal of choice of where to go next in the tour. Some tourists like this and others have complained about overchoice. The futures tour is also mapped so that tourists are given a small to moderate number of opportunities to interact with the material through response/tallies and discussions. If the futures tour were to be used as a policy planning tool, it would need to be remapped to emphasize the projected impacts of various policies under the different scenarios and to allow tourists more chance to be actively involved in the tour process.

In contrast, the visions&tools tour is composed of visions of community energy alternatives in the future written by many different people. After each vision, tourists are asked to rate it on several different scales and to make comments. They are also asked to contribute tools and to even write their own visions. The guide is not named, and the guide questions are in a menu format. The mapping of the visions&tools tour is less complex than the futures tour, and the purpose of the tour is to share and refine visions&tools for the future so that people can begin to make them happen in their own communities. It is mapped to be much more participatory than the futures tour. If the visions&tools tour were to be used to help a particular community group envision a specific future and then devise strategies for realizing that future, it would need to be remapped to emphasize negotiation of compatible visions and development of action plans for implementation.

Evaluating the Impacts of Groupware

Groupware often involves combinations of processes and procedures in sequences that meet the group's needs. There are a variety of potential group processes and communications structures, and assessments of existing groupware have generally been informal or focused on only some of its aspects, so there is no validated, empirically based evaluation of the impacts of various groupware designs at this time. Furthermore, it may turn out that different groups prefer different groupware approaches for what will appear to be arbitrary, situationally determined reasons, much as individuals prefer certain cultural norms and forms over others as a matter of taste. Certainly a given group's use of groupware can be evaluated in a scientific manner, testing to see whether its products and processes are effective, efficient, satisfying to its members, and so on. But the development of a taxonomy of groupware forms and their applicability to various group situations must wait for much more research, development, and use.

Since the design, evolution, and evaluation of groupware is in fact the design, evolution, and evaluation of social systems, the final word must come from the users themselves. Effective groupware must include its users in the design and evaluation process as much as their interest allows. Murray Turoff, designer of EIES, has said:

> We are now beginning to realize that when we design a communication structure to operate within an interactive computer system for a group of humans, what we are really designing is a human system. It is an electronic social system where the properties or behavior of the group are a result of an inseparable combination of human psychology, group sociology and the characteristics of the design....One advantage EIES has over other interactive systems is that it is primarily a communication system. Therefore, the human involvement in the process can be made an integral part of the system. In terms of EIES, this means that the design and implementation group, the user consultants, the evaluators and the user community at large form elements of both a formal and informal communication network governing the evolution of the system (Turoff, 1980a:113,115).

The Impacts of Effective Choices

Groupware begins with the group and its work. The groupware designer, working with group members, must sensitively choose processes appropriate for the group and its purposes and characteristics, procedures to support the group's process, and the communications structures and software tools which will make those procedures easy to follow. All of these taken together influence the impacts of the use of computerized conferencing for group work. If the overall process chosen is not appropriate, the group will be neither effective nor efficient in its activities. If the group does not support the process, it will not work. If the tools and procedures are inappropriate, either they will not be used or they will get in the way. How many of the apparent impacts of computerized conferencing are the result of inappropriate or outdated choices in the design and conduct of groupware? How many apparent impacts are specific to particular groupware? When evaluating the impacts of computer-based human communication, consider the groupware. It makes a difference.

CHAPTER VI

ISSUES IN COMPUTER CONFERENCING EVALUATION AND RESEARCH

by

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I. INTRODUCTION

The task of this paper is to discuss evaluation in computer conferencing research, in light of the recent increase in such research (major reviews of which will be referenced). We note right away that CC (Computerized Conferencing) is only a specific example of computer-mediated communication as well as of teleconferencing; the implication is that there is considerable literature from these two fields which bear on CC evaluation, and that the contexts of CC use are many (from group communicating to information retrieval).

Initially the focus was to be the kinds of evaluation methods in such research. However, after considerable debate, several serious flaws in, and issues related to, this approach became evident. These flaws and issues are, recursively, also flaws and issues relevant in much evaluation research itself.

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First, it's quite clear that we cannot address the field of evaluation in this paper. We are not evaluation experts, but, like most researchers and users of computer conferencing, people from a variety of backgrounds with our own and differing perspectives and experiences. Evaluation as an activity is an entire field in itself, and encompasses several traditions and philosophies as well as perhaps the whole range of social science and some of engineering methodology. Evaluation flora and flauna thrive in various subspecies in a wide range of academic and applied niches, from education to social service agencies to engineering systems. Thus, we would simply like to discuss a few major issues and provide a few classic references to the true experts in section II.

Second, because we cannot address the entire field of evaluation, it seemed fairly sterile to simply describe methodological tools -- even if we could, in a few pages. We will, in section VI, however, describe some brief case examples of SPECIFIC evaluation APPROACHES (particularly those appropriate to computer conferencing) from our own research, to provide some flavor of the range of approaches possible.

Third, and perhaps a more fundamental issue that arose in our discussions, was the notion that not only are tools sterile (and dangerous) instruments for one without familiarity with the field of evaluation, but that evaluation AS AN ACTIVITY is sterile (and misleading, we feel) for one without a thorough understanding of the purpose and target of the particular evaluation effort. We thus view evaluation, in the very widest sense, as contextual. To drive home the point that CC is "political" and purposeful, we will note and briefly describe in section III the range of STAKEHOLDERS who either fund, direct, or await evaluation and its results. Computer conferencing researchers can turn this around: knowing who the stakeholders are or might be for their evaluation, they can plan, document and disseminate the results more appropriately. Thus: who or what is the evaluation process and its results speaking to?

From the above issue areas, we can generate a matrix which the CC evaluator should reference as a guide in the actual research process as well as a guide to other potentially fruitful research. This matrix would be STAKEHOLDERS X GOALS/CRITERIA X ANALYSIS DOMAIN. If a cell has little to show in the way of past computer conference evaluation, we might well ask whether that cell is just uninteresting, or we are lazy, or support for research on that cell is not forthcoming for some (perhaps interesting) reason. Once the evaluator understands which cells are being considered in the evaluation effort, some approaches and methods become quite appropriate and even elegantly suited to the topic at hand. We therefore recommend that EVERY CC evaluation report state explicitly the stakeholders, goals, domains and approach of the analysis.

This conception of the evaluation effort highlights the EXISTENCE and the INTERACTION of these elements. We warn against concentrating conceptually on only one cell, however; what should result is a SYSTEMIC approach to evaluation. A SYSTEMIC approach considers the existence of the entire relevant environment of a computer conferencing system, involving all the relevant stakeholders, goals and domains. A systemic evaluation may require several evaluators on one project, or several projects over a period of time, in order to characterize and evaluate a given system or application adequately. After all, as Kling (1980) perceptively explains, "computing [in general] is more accurately viewed as a 'package' that includes many complex social and technical elements."

Fourth, we will also note and briefly describe in section IV what we see as the range of evaluation GOALS or CRITERIA. We use the word criteria in a wide sense -- not as the significance level or decision rule (although evaluators would do well to be better informed and more explicit about these) -- but as guides to the focus of evaluation. Some evaluators have consolidated all possible goals or criteria under the headings, EFFECTIVENESS, EFFICIENCY and IMPACT. The study of each of these criteria sets may be motivated by the stakeholders involved, and may motivate the choice of evaluation tools. On the other hand, the approach taken by the evaluator affects how well these criteria are considered to have been met and perhaps even the DEFINITION of the criteria.

For this reason, we feel that much of the information about impacts and usage summarized in prior CC literature is integrally bound up in, and confounded with, the evaluation process. We will emphasize this when appropriate. Thus we ask: What is being described, measured, evaluated? What is it that evaluation can tell us we are or are not achieving in the use of computer conferencing?

Fifth, it has often happened in research in general that the specific level of analysis, or evaluation domain, is lost sight of in the actual process of evaluation. The particular domain may be dictated (idealistically) by the stakeholder and the goals the evaluator would like to (or must) address, (more realistically) by the exigencies of data availability and participant support or (most unfortunately and usually unknowingly) by incompetence. We note in passing that the domains and criteria relevant to the stakeholders may differ from those relevant to the researcher; thus it is useful to distinguish between the service context (what the analyst does for the stakeholder) and the research context (what the analyst does for the general increase of knowledge) (Elton and Carey, 1980). The two often overlap considerably, of course. In any event, a clear awareness of the evaluation domain eliminates whole classes of methodological tools and evaluation difficulties (though others may be generated).

II. ISSUES IN THE STAGES OF EVALUATION

Here we offer a few useful references to more expert discussions of many evaluation issues, and consider a few issues of particular relevance to computer conferencing evaluators. Awareness of these considerations, followed by selective reading, will improve CC evaluations and our subsequent understanding of CC. Fink and Kosecoff (1980) present a straightforward evaluation primer. Cook and McAnany (1979) provide a readable and useful general discussion of major issues in evaluation. They also extend Suchman's (1967) stages in the evaluation process. A combined and extended summary follows.

First, we should distinguish between formative, or process, evaluation, and summative, or impact, evaluation. Not only are these different activities with different goals, but the stakeholders (particularly administrators or implementors) may be threatened by formative evaluation, for, (if well done) it strikes deeply at the management of the project itself. Formative evaluation and research (see a cogent description of this process in media message design, by Palmer, 1981) acquires information useful in designing and improving project components, and provides feedback to the implementors during the design and implementation process. Formative evaluation in computer conferencing may be useful in designing the particular system (as is the case in EIES, where user consultants constantly restructure system language and documentation as old and new users encounter new and different needs), or may be useful in aiding the implementation process within an organization (as in INFOMEDIA's services). Indeed, both EIES and the Institute for the Future's FORUM, PLANET and HUB systems have been developed as research tools and used in numerous series of trials, and have then provided data from which analysis could improve those tools and our understanding of CC.

Such questions as why are you doing this? or, these users find this approach difficult! or, what is the goal of this evaluation? are clearly political and quite different in character than the questions of summative evaluation. In an ongoing series of evaluations, the series may profit from a formative analysis which asks such questions as what are the effects of evaluation itself? Will CC be revalued or devalued after the evaluation recommendations are implementated? When users become aware that certain kinds of data can be captured automatically, will the user's behavior change? Will cooperation vary according to the kinds of data collected on-line or the time it takes to complete on-line questionnaires?

Summative evaluation, when done appropriately under ideal circumstances, summarizes how the project affected the subjects; i.e., both the intended and the unintended impacts. This is the more familiar conception of evaluation, which aims to develop "valid information about causal consequences", particularly for use by policy makers.

The stages, or main categories of issues, in evaluation, as described by Cook and McAnany, include the following:

A) Which projects are worth evaluating? We have indicated that the stakeholders, the goals, and the domain of analysis must be considered. The issues an evaluation addresses are influenced by all these. However, the authors suggest that often there is a 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, etc.) being evaluated will be widely implemented, then the resources may well be better spent elsewhere.

B) Who should formulate the evaluation questions? Who should conduct the evaluation? The askers usually determine what is being asked, so this is not a trivial question. Also, the design and scope of the evaluation is determined here, so the sources and intents of the questions and questioners must be analysed. Good sources for the questions include both claims of possible effects and theory or experienced-based analysis of possible positive and negative effects (and side-effects). Who should have the opportunity to ask what questions?

Evaluator bias, as affected by both the political (or pragmatic) process of choosing the evaluator and the role of the evaluator who participates in the project itself, must be considered. The potential dangers when the evaluator is involved are clear, although there is a running controversy within the evaluation literature as to the disadvantages of being either too remote or too close to the project. Danger of bias is clear when the evaluator "is dependent on the project being evaluated or the funders...not only for access to data [permission to observe, etc.] but also for the continuation of employment" (Cook and McAnany, 1979). A review of studies showed that "no difference" results were far more likely when the evaluation was independent of such resource control!

Occasionally "meta-evaluation", or the evaluation of the evaluation and evaluators may be performed. Traditional evaluation requires such torturous data collection that rarely are evaluators contracted to assess the procedures and behavior of the actual evaluators, except perhaps in terms of general approaches, methods, analysis, interpretations or recommendations. With automated data capture, it is much more feasible to fully replicate evaluation results. What effects on the community of evaluators are likely to occur? The ethics of CC evaluation may not differ from those of other projects, but the possibility of automated, unobtrusive and complete data capture suggests heightened attention to ethical issues in CC research. And, does the potential for CC users to be anonymous or assume identities other than their "own" alter the evaluation?

Finally, and very importantly, the evaluation questions must be explicit and focussed. What is the treatment? What is the population? What specifically is being tested? What constitutes a "yes" or "no"? What constitutes a convincing answer?

C) Whether and when random assignment to treatments is possible, acceptable or necessary. Cook and Campbell (1979) treat this evaluation issue (as well as others) exhaustively, and we will not dwell on the issue here. Suffice it to say that in addition to the reasons for and against randomization, as well as the practicality or costs incurred by randomization, there are also ethical issues, such as who (randomly) gets the treatment? Do those who do not receive the treatment continue to suffer from a problem which the treatment is supposed to solve? Then, too, there is the question whether there can ever be a true randomized control group when researchers or organizations are using communication technologies such as CC for their ongoing work. In specific decision-making in small groups, control groups using different media may be possible.

D) Which quasi- or non-experimental designs can be implemented? Again, Cook and Campbell (1979) should be consulted for the analytical and statistical problems and solutions involved. This issue also involves the planning question of the effort invested in the project: how many should actually receive what treatments for how long, with consideration of different group usage patterns (Suchman, 1967). The design of the evaluation research also determines to a great extent the possible answers to the next issue.

E) Stakeholders differ in their criteria, goals, finances, political security, constraints and expertise. For some stakeholders, causality may be of interest on a local level only, because funding decisions are largely political anyway. For others, insight from a case study may be useful and generalizability is of little concern (this is particularly true for most proprietary office automation studies). Flay and Cook (1981) describe major evaluation models which speak to such differences. For example, the research model requires detection of small effects and thus demands rigourous designs and statistical analysis. The descriptive model may be applied to situations where evaluation is satisfied by describing basic usage and satisfaction impacts, perhaps for in-house reporting requirements. The marketing model often hopes to show indirect impact due to increased exposure and awareness by certain subjects or audiences. Each model solves some problems and answers some needs for a particular audience, but, of course, has its own disadvantages. Some stakeholders (such as organizational managers, for example), because their needs are seldom addressed in CC evaluation reports, remain an uninterested audience (but see Bair, 1979, for productivity evaluation designs).

F) To what extent was the promised treatment actually delivered? To what extent was this delivery effective? What unexpected results occurred? In addition to reality, the choice and rigor of the research design, data collection instruments and analysis all clearly affect and reveal the answers. As noted above, the questions and the measures used must really relate to the evaluation criteria; they must be reliable; they must be relevant. For example, immediate, "close" measures (such as "how many hours did you use the system today?") may measure greater impact, but have less social significance. Thus, the timing of measurements is also an issue: what are the long-term impacts, after novelty or resistance has worn off?

G) The extent to which findings can be generalized. This is a function of randomization and design, above, but has its own meaning for a specific evaluation in its specific context. 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 impact. Effect is the (statistical) analysis of significant effects, by subgroup. Very large groups will almost always provide significant effects; no significant effects in small groups may not indicate no impact. Thus the "results", even when statistically defined, may not indicate generalizable policy. Adequacy is the meaningfulness, generalizability and duration of the impact. A valid and significant effect may not be very relevant to the stakeholders or the researcher. Poor design may make generalizability risky or misleading. Short term impacts may disappear overnight, or other important effects (such as the change in users' attitudes toward computers and the appropriateness of computer conferencing for certain tasks with increased usage) may only develop in the long run. Process is Suchman's term for specification or contingency analysis: the social and psychological factors that mediate or impede effects, including actual content(s) of actual treatment(s).

H) Finally, cost. The econometrics and engineering-economics literature (Thompson, 1980) provides good guides to cost analyses, at various levels. It is not enough to determine impacts, but also the cost, cost-effectiveness and cost-benefits of the treatment and its associated impacts. This is a growing topic in office information technology evaluation, for costs are central to the stakeholders there. (Bair, 1979 and 1980, suggests weighted values for over 75 potential changes in five benefit areas of office information technologies, and offers assessment strategies designed to consider productivity impacts.) Many an implementor has gone awry by developing, buying or installing a system which in some way is shown to save money, but may not be cost-effective nor may bring the desired benefits, much less inexpensively. For example, it seems clear from much of the PLANET (most field trial participants paid for usage) and EIES evaluations that some subsidized users evaluate the systems positively, but decline to continue usage when they must bear the full costs. Or, on another dimension, they may have declined to use the system much in the first place because they derived greater benefits from their limited time and energy using other media and channels. Another cost aspect is that real costs and perceived costs change as use develops from demonstrations through initial familiarization to established activity.

III. STAKEHOLDERS IN COMPUTER CONFERENCING USE AND EVALUATION

Here, we provide an outline of potential stakeholders and how they might be relevant to your evaluation activities. By stakeholders, we mean, generally, actors who have a stake in the outcome of the specific evaluation, and, specifically, actors or agents who initiate and/or fund given evaluation activity. We might suggest that Amara (1974) has provided a fine discussion of stakeholders in the evaluation of computer impacts. In fact, much of that report discusses how forecast analysis was used to prioritize the potential computer impact areas and their associated stakeholders. In general, those impacts and stakeholders which are likely to have greatest significance should be evaluated first. For example, the three major groupings reported by Amara, incorporating 19 high-priority areas, are, 1) computers as tools in decision-making, 2) computers as components in operational systems, and 3) computers as shapers of perceptions, behaviors and attitudes.

Many stakeholders reject "theoretical" components of evaluation. The proper balance between theory and practice is, of course, a very subtle and complex issue. Perhaps the main difficulty is assuming 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. Planning for appropriate and insightful evaluation requires a long-run, at least quasi-theoretical approach. Otherwise, no one knows what to do BEFORE the system arrives. The evaluator 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.

Even more importantly, as Kling (1980) brilliantly explains (his paper is required reading) and documents, "All studies of computing in social life make important assumptions about the social world in which computing is embedded." Most assumptions are never made explicit. Here, Kling portrays a variety of theoretical orientations, grouped broadly into "systems rationalism" and "segmented-institutionalism". Any perspective influences what is analysed and how the results are interpreted, and affects the very design and implementation which is later evaluated. Some perspectives (usually unknowingly held) result in successful or inappropriate applications, or steer the evaluation carefully past relevancy. Thus the theoretical basis is critically influential;

neither the stakeholder nor the evaluator can afford to ignore this issue. Hornik (1980) also "sheds some light" on evaluation myths, particularly on the political and practical realities which affect the character, function, design and methods of evaluation.

An outline of potential stakeholders, with brief comments, follows.

O Policy Actors

.macro-supporters: (agencies supporting development and evaluation of computer conferencing for governmental or policy-related purposes, such as NSF, DOD, etc. For example, the early development of computer conferencing (see Hiltz & Turoff, 1978b; Rice, 1980a) and packet switching (Roberts, 1978) were both stimulated by requirements for defense and national emergencies. The general design, and the subsequent assessments, of the products were first seen in light of stakeholders' requirements. Bamford and Savin (1978) discuss the role of NSF in supporting evaluations of such systems.

.regulators

--of resources: (such as FCC, FTC, WARC, ITU, etc.) Price et al. (1980) suggest that because of the convergence of computer-mediated communication media, information and communication are merging. This creates a "new meaning for regulation" particularly for publishing.

--of rights and laws: (Issues include who should have access, who should be funded for use; the role of legislatures, trade treaties and dataflow regulations, personal privacy and secrecy, social accountability, etc. (See Bezilla (1978) and Hiltz and Turoff (1978b). Rule (1974) and Westin and Baker (1972) offer very different analyses of the role and effects of databases.)

.social/cultural activists: (those generally interested in the social uses and effects of CC or telecommunications generally, either as opponents or proponents, or as technological forecasters; or social planners, those of humanistic and artistic concern for our cultural environment; see Rice (1980b) for reviews of these issues in the context of a developing information society. Noted authors in this context are Branscomb, Bush, Hltz & Turoff, Moshowitz, Martin, Wessell, et al.)

O Industry and Designers (These stakeholders may overlap, depending on product, size of company, region, market. For needed research on programming languages, software, operating systems, databases, communications, etc., see Ellis and Nutt, 1980. Panko's (1980a) encyclopedic analysis and description of the "electronic mail revolution" is the single best source for an overview of services, equipment and market trends. Price et al. (1980) provide a table of market forecasts for computer-based communication technology and services, and a list of of converging technology NOW available. SCIENCE (August, 1980, p. 663-668) also provides insight into Bell's increasing interests in personal computer-mediated communications services. The journal Performance Evaluation [Elsevier/North Holland, NY] considers technical issues, such as system reliability, modelling and analysis, system architecture, monitors and their measurement techniques, network routing and control, etc. A primary reference for performance measurement and evaluation is Svoboda's 1976 book. Also, of course, there are numerous magazines and bulletins, etc.)

.software: (see full discussion of one approach by Turoff in Hiltz & Turoff (1978b); also see Rice (1980a) for references to discussions by other authors. What are the tasks the software should support, what human needs and factors should the prompting, flow, commands and structure of the software address? What does the competition or other media offer?)

.hardware

.network providers: (involving load requirements, standardization, priority of access, security, etc.)

.node and service providers: (service hours, service comunity, amortization, distributions, efficiency, etc.) community, amortization, distributions, efficiency, etc.)

.content provider: (UPI's text to The Source, Community Computer Bulletin Boards, free information flow (see Gunter, ed., 1979), censoring, validity, libel; see Kiechel)1980) for descriptions of on-line data bases and their providers.)

.broker: (training, regulations, supply and feedback, medium of distribution, access to on-or off-line data, text, indexing, abstracts, graphics. The need for libraries to play an increasing role as electronic information brokers is becoming stronger, as is support for legislation mandating such activity.

O Administrators

.program or system directors: (budget, time frames, organizational goals, management policies and mandates, prioritization of use and support)

.programmers and support staff: (error statistics, new services, custom support, flexible and forgiving language, documentation, informed uses...)

.usage facilitators: (as, computer conference moderators; effects on group decision-making, participation, access to textual record, sychroneity, desired mode usage, technical obstacles...)

Atwood (1979), while a comprehensive integration of concepts, past research, theoretical foundations, and mathematical models in designing man-computer interfaces appears in an article by Rouse (1975).)"

IV. GOALS/CRITERIA

O Resource distribution: (We emphasize the POLITICAL aspects of use, equity, participation. I.e., use is always relative -- to other uses and users, modes of access, media and sharing; notions of equity, participation as absolute in terms of access or relative in terms of group decision...)

O Function: (What is the user doing, or what does the user want/have to do? Minimal sufficient functions, or maximum functionality? Both FOR and TO the user. As, for an organization, consider its climate, efficiency, productivity, innovation, responsiveness, behaviors, etc.)

O Political process: (i.e., what role does/could computer conferencing play, in creating an informed public, providing access to representatives, distributing community information and stimulating grass roots activity, progress, development of resources and society, etc. One example is the widespread use of Community Computer Bulletin Boards.)

O Knowledge: (how does CC 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?)

O Cost: (who pays? how much? on what basis? relative to what? for how long? with what consequences? when does effectiveness become too costly? what is being bought?)

O Actualization: (well-being, religion, spirit, human potential, life styles; the Japanese are the trend-setters in evaluating impacts of information and its technologies on the quality of life -- see Edelstein, Bowes and Harsel, 1979, and especially Bowes, 1980; also note the use of CC by international religious groups or isolated communes such as FINDHORN)

O Information .Processing Skills: (how individuals, groups, organizations, etc represent, encode, transmit and decode information. Some aspects: information load/stress management, asynchronous processing performance, alterations of semantic/syntactic mapping functions, multi- task/modal processing, reflexivity, development of "computer literacy" (Barney, 1981))

O Problems: (involving CC in cognitive, behavioral and social processes in handling and solving individual, group and social problems and tasks [Paisley (1980)])

O Structure: (magnitude, distribution and relations among nodes or users, affecting roles and behavior, in one's group, in groups, in families, communities, in organizations, in society)

O Sensation: (physical and emotional arousal, pleasure and pain, including direct effects of CC as well as indirect effects on other activities. Example of the latter is the use of CC as a modulator of metabolic/sensate functioning, such as the use to relieve tension arising from other activities, or stimulation of biological organism to compensate for information from other experiential domains; alteration of primarily physiologically-rooted recreational activities, from sports to sex, and the use of drugs.)

V. DOMAINS

If we can define the basic process in computer conferencing in a very general way -- computer-mediated nodal communication -- then we are led to consider the domains of activity in which this process occurs. By domain we mean the level of complexity or organization at which the computer-mediated communication relationship takes place. We use "domain of activity" rather than "level of analysis" to emphasize the sphere of communication behavior under analysis, rather than just the analytical unit as chosen by the researcher. Evaluation efforts should be explicit about which domains are of concern. A single domain, the boundary between domains, the behavior through a node's domains, the interaction of domains across two or more nodes, etc., constitute the kinds of research areas possible. The meta-study of the existence and forms of these domains is one of the possible goals of analysis -- defined as STRUCTURE in section IV. Thus possible domains and particular examples include:

O The communicating society: (Community Computer Bulletin Boards' integration into their communities' activities and politics, a Network Nation, the wired city).

O The organization or institution: (say, the handicapped community, a corporation, service providers and receivers).

O A group (down to a triad): (research or interest groups, decision-making bodies, task forces).

O Roles: (transmitter, receiver, isolate, group member, gatekeeper, leader, occupation or social position).

O Dyads: (processes of interaction, reciprocity, amount and directions of communication flow).

O The individual node: (psychological, emotional, physiological and behavioral being.)

Because these domains are influenced by, interact with, and may be artifacts or the mediating communication technology, CC as a particular medium is, then, a constant "treatment" or "intervening variable", and must, at least implicitly, be related to media variation (such as telephone, memo, face-to-face, letters and reports, video, non-verbal, psychic, etc.) Analyses taking this "treatment" into account have led to the considerable knowledge we now have in cross-media comparisons at various domains (Johansen, 1977; Rice, 1980b; Short, Williams and Christie, 1976; Johansen, Vallee and Spangler, 1979).

The use of the word "communicating" also leads analyses to consider CONTENT variation. Different contents predominate across domains AND are differentially portrayed across media. Such considerations should influence evaluation design and the evaluation tools used. Possible communication content will vary across the use of different media. When evaluating the use of computer conferencing for a specific task, the contents necessary for that task must be determined first, and then the effects upon the contents, and thus the task within a domain, must be determined for the CC use. For example, an individual using a system for personal reasons can imbue the content with markers (sufficient ones?) to satisfy the individual's needs for say, personal files, reminders, contextual associations for text preparation, etc. These markers may very well be totally meaningless at the organizational level, or may lead to confusion and frustration at the small group level.

These brief comments about the need to consider and describe explicitly the domain of analysis have been in the context of computer conferencing evaluation; the intent is to clarify WHAT DOMAIN is being considered. However, in a more rigorous sense, the need to specify domain is absolutely crucial for statistical and analytical reasons. This is not the place to explain common mistakes such as the "ecological fallacy", but mixing domains in a particular analysis can be worse than mixing metaphors in a dramatic speech. The evaluator needs to know at which level each aspect of the analysis is operating.

VI. A FEW EXAMPLE APPROACHES

In this section, we note a few of the common approaches to CC evaluation, and provide a slightly lengthier mention of a less traditional approach.

First we should say that there has been considerable work not only in evaluating CC already, but also in developing the process of evaluating CC. A fairly comprehensive schema or typology of evaluation approaches and variables has been provided by Johansen, Miller and Vallee (1974) and are elaborated by Johansen, Vallee and Spangler (1979). The 1974 typology of approaches includes 1) controlled lab experiments, 2) quasi-experiments, 3) directed field trials, 4) open-ended trials, 5) survey research, and 6) impact assessment such as scenarios, simulations and models. These are standard alternatives open to evaluators, but the authors cross-reference the numerous evaluations of which they were aware by these alternatives, in the 1979 text (pp 166-191). Their typology of variables, which was developed from the pioneering work of Bailey, Nordlie and Sistrunk (1963), consists generally of five sets of group communication attributes -- medium, task, rules, person and group (Johansen et al., 1974: 16) -- and has evolved into a very detailed and useful schema which incorporates changes over time (Vallee, Johansen, Randolph and Hastings, 1974: 25). Bair (1979) also incorporates time in a practical design. Other research plans and variable sets are noted by Rice, 1980b.

More generally, researchers and administrators in the field of on-line information systems have conducted a wide range of system/user evaluations, many of which have used system-monitored data. The single best review of the research, methods and systems involved is be Penniman and Dominick (1980). We will briefly summarize their article to give a flavor of this literature. Their basic point is that on-line systems are now evolutionary, not static, and their development, within an organization and within the system, must be allowed to continue. Thus evaluations are necessary to guide these developments, and such evaluations should use not only the traditional (but still seldom applied) sources of data (such as literature reviews, questionnaires about attitudes and individual's attributes, interviews, experiments, observation, etc.) but also computer-monitored data. In an attempt to provide a programmatic approach to the collection and use of such data in evaluation, the authors first review earlier monitoring methods and results, involving over 20 studies. Then current monitoring techniques are described, and include collecting general session variables, traces of functions (or states the user and system are in), or even the complete protocol. From this background, the article presents a systematic flow chart detailing a monitor-based evaluation process. This includes (1) the potential uses of monitoring (improving system efficiency and interfaces, and system/user interfaces), (2) general methodology in designing and implementing evaluation and consequent system improvements, and (3) potential goals (or analyses) of the monitoring (comparing system versions, data structures, system configuratis, usage of system and data, user success and satisfaction) to aid the system and data base administrators, the users, and to identify relevant parameters for future evaluations and improvements. The potentially appropriate theoretical foundations of such evaluations include conversational interaction, information theory, systems theory and cybernetics, and computer performance analysis. Finally, statistical tools and graphic display possibilities are summarized. Keeping this wide array of prior research and methods from a more general field in mind, we here discuss a few examples from computer conferencing evaluation.

The first example takes a predominantly theoretical approach, involving modelling and testing of hypotheses. This is not to say that this approach does not have utility or relevance for the more applied stakeholders; sometimes theory can lead to utilities previously unknown. Freeman (1980) looked at the change in communication patterns among a group of researchers using EIES over 18 months, and, using the algebraic-topological theory of Q-analysis, was able to show that the not surprising increase in linkages over the period followed very structured paths, almost completely in accord with the expectations of Q-analysts. The one exception to the predicted pattern could then be interpreted to suggest that computer conferencing may, at times, allow the development of very close friendships, the type that otherwise would be constrained by social structures.

Another approach may be considered a neat contrast to the theoretical approach; this may be called a predominantly applied approach. Danowski (unpublished) evaluated content associations in Community Computer Bulletin Board messages to suggest applications of discussion leadership which could lead to optimal convergence of participants around a topic or around a participant. Automated content analysis reveals linkages of topics across messages, such linkages are scaled via metric multidimensional scaling, and possible easily associable topic clusters are extracted. The goal is to be able to train group leaders to recognize these clusters, or sequential patterns, and perhaps steer discussion back to the task via "close" topics. Clearly, different stakeholders would hold very different opinions as to the utility or even ethics of such evaluation.

The controlled experiment, among other approaches, is used by Short, Williams and Christie (1976) and by Hiltz and Turoff (1978b) in evaluating CC uses and impacts. Many "electronic" laboratory experiments have already been performed which vary the complexity of task, communication channel, prior familiarity of subjects, time to decision, consensus reached, satisfaction, etc. The results tell us a lot about how different media affect certain variables in controlled, if possibly artificial, conditions.

The fourth approach may be called qualitative, internal evaluation. Here, 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 evaluator bias looms large, but system designers and potential managers of CC use are keenly interested in the kinds of insights possible from this approach.

One of our own pet approaches involves the evaluation of communication patterns in organizations. For organizations, managers, the organizational workers, and researchers interested in communication behaviors and impacts, the study of communication structure (magnitude, distribution and relations) speaks to one element of the stakeholders' interests. We might point out at this point that in general few of these stakeholders have REALIZED that such analysis can speak to their interests. Recently, however, the internal impacts, including, but not limited to, productivity and effectiveness of computer-mediated communications in the office and organization (universities as well) have received considerable attention. Managers and organizational planners have begun funding research on such systems, both from the point of view of successfully implementing their product or new purchase, and from the point of successfully matching the system with their goals and the needs and abilities of their employees. Rice (1980b) provides references to excellent research guides which emphasize or at least include the flows of communication in the data collected. Lowenstein (1979) is the most detailed of these. Bair (1980) provides an overview of a very comprehensive approach to evaluating productivity impacts from the point of view of information and communication flows.

The evaluation methodology appropriate to communication flow analysis has come to be known in the communication field as, not surprisingly, network analysis. Rice and Richards (1980) have provided a comprehensive review/critique of the methods available for network analysis, in terms suitable for interested practitioners. Other texts noted in that book provide considerably more sophisticated and theoretical treatments. Major texts on organizational communication which consider networks and the use of network analysis are by Farace et al. (1977), Rogers and Agarwala-Rogers (1976), Aldrich (1979), and Goldaber et al. (1978). These provide illustrative examples of the use of communication network analysis to describe (or "audit") the communication flows within an organization, to associate and predict desirable organizational and employee traits using network variables, and to place organizational analysis within helpful theoretical perspectives (see, for instance, Aldrich, 1979). Some available and useful articles on organizational networks are provided by Tichy and his colleagues: Tichy (1980a, b), Tichy & Fombrun (1979) and Tichy et al. (1979).

We should point out that network analysis has a quite lengthy tradition in sociology as structural analysis, and a lengthy application history in organizational analysis. There was much early work starting with Moreno in the 1930's, and during and after WWII in improving communication in service groups, as well as in predicting effective and enduring combat groups. Later, the human relations school of organizational analysis adopted such approaches and produced concepts and research which led to inter- and intra-group activity indices of understanding, normative and affective conformity, satisfaction, atmosphere, structure, etc., and to other useful measures of organizational interaction. Weiss and Jacobson (1960) and Jacobson and Seashore (1951) provided early insights into the relations between individual/organizational variables and network measures.

Thus, a network-oriented evaluation would measure communication flows (in various ways, with various indices in mind) before, during and after the implementation of a new electronic messaging system, for example, to determine whether the technology assists the development of desired communication flows, whether other organizational media (memos, face-to-face conversations, meetings, dictations, telephone calls, conference travel, etc.) 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, whether decision-making is centralized or decentralized (and the desirability of either of these) depends on a variety of variables. We might note that not only is the FLOW of communication particularly appropriate to evaluate in relation to new communication technology, but the FLOW and CONTENT (within confidentiality and policy limits) may be captured and analysed DIRECTLY by the computer, without obtrusive and politically divisive human observers or record-keeping. Thus, network analysis as one evaluation tool seems to provide helpful insight into important goals, at a variety of domains, to inform a number of stakeholders, and to be appropriate for the technology being studied.

CONCLUSION

In conclusion, we would like to emphasize that some evaluation or research tools are SPECIFICALLY appropriate to computer conferencing. One of these is the ability of the computer to collect usage statistics and experimental results, and to monitor actual communication behavior. (See a tentative list of computer-collectable variables in Johansen et al., 1974:12. Although the Institute for the Future set the precedence for this approach, it has not been picked up too widely except by EIES.) These data, once pre-processed, may be directly analysed to provide evaluation research results. Often, this approach reduces much of the problem in traditional evaluation, such as the obtrusiveness of the observer and experimenter, subjective interpretation and coding, difficulties in coding and entering large datasets, etc. These usage statistics provide particularly precise measures of communication flow, and maintain the structural form of interaction via computer. In addition, the computer itself can be used to construct and execute the controlled experiment. Content of messages, once confidentiality regulations are met, can be accessed, stored and analyzed by the computer and available content analysis programs. These programs are amazingly flexible, often offering tailored "dictionaries", and even able to evaluate the affective realm of the messages. Finally, full census data may be collected, rather than only sample data, thus paving the way for the use of communication network analysis as an evaluation tool.

CHAPTER VII

CONCLUSIONS

We have attempted to synthesize the current state of research on computer-mediated communication systems. This raises a large number of questions and suggests some of the directions that should be taken by future research. With a wealth of frequently conflicting evidence it is difficult to reach firm conclusions, much less predict the future with any certainty.

The experiences of many of the groups reported here have been experimental, in terms of both the evolution of system facilities and the nature of the individuals and groups using them. Compared with future users, these pioneers probably exhibit greater technical curiosity and are more intellectual, innovative, and task oriented. A large number have had their usage subsidized through government grants or their employing organizations. In addition, we know that usage patterns change markedly over time, while user profiles have not yet been collected for more than four-year periods.

Our findings represent a mixture of largely unreplicated quantitative and qualitative evidence. Yet we are, tentatively and conscious of the extrapolative considerations, attempting to project them onto a broader future universe of users so as to maximize positive outcomes and avoid or minimize negative ones.

Because it is likely that the most successful or enduring computer-based communication systems will always have an evolving nature, it is quite possible that firm answers to many of the questions raised will never be achieved. But more objective data needs to be gathered. We hope to have offered the beginnings of well designed and conceptually strong research from which the relevant variables and their mutual interactive effects can be determined.

Plans Vs. Reality

The project did not proceed as initially planned. First, several of those who had originally agreed to participate, particularly from the Institute for the Future, cancelled their attendance at the face-to-face workshop because of competing demands on their time. Although the proposal presenting the plans for the division of labor had been circulated with the invitation, many participants appparently either did not read it or did not take it seriously. They seemed to feel that their attendance at the face-to-face workshop was sufficient, and claimed they did not have time for further work on the project. In the case of the EIES social networks group this included the failure to complete a data report form; the only tangible contribution from the group's representative was a bill for attendance at the meeting.

Approximately half the attendees did agree to draft and review portions of the document. The initial idea was that the principal investigator (Hiltz) would simply integrate the sections written by others and reviewed and revised by the subgroup members. With the exception of those cited in the credits as contributors, this did not occur. It became obvious that the two coauthors had to draft the bulk of the material. We were also unable to obtain some data report forms, notably the Acceptance and Impacts modules for Planet, and the System module for NLS. And although we asked for return of the data report forms within a few weeks of receipt, some took as long as three months and five or six reminders by telephone and mail in order to obtain them.

Another disappointment was the low rate of active participation on the second round of the Delphi process. Although all respondents were requested to review their initial responses to the data report forms, compare them with others and change their responses or estimates where appropriate, only two or three actually did so for each module. We do not know whether this means they neglected to review and reconsider their responses or if they did not have any additions or changes to offer.

Conclusions about the Process

At an early stage of research in a new area, this type of procedure is probably the only way to accelerate a synthesis of the nature of the emerging findings, compared to the five years or more that it might take if one relied upon the various researchers to spontaneously find one another's research results, compare them, and reach conclusions. However, the Delphi procedure is not an easy one which occurs without much effort by a study director. Although advice and participation from a variety of experts is needed in formulating the framework used to organize the emerging findings, one cannot actually depend upon a "committee" approach to report writing, unless the participants are adequately paid for their work or have some other source of motivation to contribute significant effort. It is also not a quick process. If one is to use the group of experts to help to generate and review the framework, review the derived questionnaire and respond to it, complete at least a second round of review of results of the questionnaire and opportunity to change responses, and review the draft manuscript, a year is probably the minimum reasonable time frame.

In sum, we feel that both we and the participants learned a great deal. Hopefully, the results were worth the effort expended.

Feedback from the Participants

Systematic feedback from the active participants was obtained through a questionnaire probing benefits derived from the project and suggestions on how to "do it better next time." Included were only those who had attended the face-to-face workshop, completed data report forms, and participated in the on-line drafting and review processes. Most of the active participants, thus defined, returned the questionnaire.

One assumption of the Delphi technique of pooling expert opinions is that the participants learn from and benefit from the process, as well as contributing to it. This seems to have been the case for this project, as seen from the summary of responses shown in Table 7-1. Most did find new ideas for future research, get some fresh ideas for completing current research projects, become more familiar with the work of others, and become more connected to the emerging "invisible college" in this area of research. THe only participant who disagreed with the statement that project participation had aided in the completion of other current work noted that he felt it represented a set of competing demands on his time.

In terms of what might have been done differently and better, the main themes were:

1) To have planned from the beginning to have the work done by the co-investigators (as actually occurred);

2) To provide more realistic funding levels and arrangements for the other participants, and

3) To have held a second face-to-face meeting.

In regard to the first theme, one participant commented:

> The workshop and subsequent lack of post-meeting activity confirms my belief that all successful committee reports are, in reality, drafted by one or two hard working people. Even with the honorarium, most folks lack the commitment and time that you have to devote to the effort, especially given the press of their own local demands.

In terms of the funding arrangements (five days at $150/day for active participants), it was really only a token honorarium and was quite inadequate to cover the time requested, considering that the travel to and from the meeting plus the meeting itself took three days of the five. In effect, the participants were being asked to contribute their time. As one put it:

> The barrier for me was not being able to displace my job responsibilities with the NSF work. The only way to do this (in addition to the meeting which at least got us away from the office) is to fully fund the contributors, i.e. pay their salaries while they're on the project.

Finally, the participants were asked, "Would you recommend that this kind of pre-meeting/post on-line work format be repeated for other groups in the future?" As one of them offered:

> I found this format quite useful and enjoyable. I would suggest one other face-to-face meeting sometime during the work period. I concentrated only on my section and therefore did not check out the work of others. This could be done in a face-to-face meeting plus tighter organization and meeting of deadlines would be encouraged. Writing on-line particularly useful because I knew someone was waiting to see my material and if it wasn't on-line, I would get a message. Therefore this helped to keep me to a schedule.

We agree that a second face-to-face meeting should be scheduled for such a group process, to provide a deadline and occasion for a group critique of draft materials and emerging conclusions. Although such activities could be conducted on line, without the motivation of paid and therefore high priority participation, the task tends to be indefinitely postponed. A second meeting would have provided some time pressure and motivation not to have to face one's peers without having completed one's assignment. However, a face-to-face meeting for participants distributed throughout the United States is an expensive luxury for such projects.

Table 7-1

RESULTS OF FEEDBACK QUESTIONNAIRE

TO EVALUATE THE WORKSHOP

Question	Strongly Agree	Agree	Neither	Disagree	Strongly Disagree
1. Attending the workshop and participating in the project has:					
1. Given me new ideas for future research	3	3	2	0	0
2. Made me more familiar with the work of others in this area	5	3	0	0	0
3. Aided me in completing current projects in this area	3	3	1	1	0
4. Connected me to a viable community of researchers in this area	2	3	2	1	0
5. Been a waste of my time	0	0	1	1	6

REFERENCES

Adriansson, L.
(1980)."Group Communication through Computer: Social Psychological Studies of Attitudes to and Experience with the Effects of COM System on the Work Environment," Department of Psychology, University of Gothenburg, Sweden.

Aldrich, H.
(1979).Organizations and Environments. Prentice-Hall, Englewood Cliffs, New Jersey.

Amara, R.
(1974).Toward Understanding the Social Impact of Computers. Research Report R-29, Institute for the Future. Menlo Park, California.

Bailey, G., Nordlie, P., and Sistrunk, F.
(1963)."Teleconferencing: Literature Review, Field Studies and Working Papers," RP P-133. Institute for Defense Analysis, Washington, D.C.

Bair, J. H.
(1974).Evaluation and Analysis of an Augmented Knowledge Workshop: Final Report for Phase I. Rome Air Development Center, RADC-TR-74-79. Griffiss Air Force Base, New York.

(1979).Productivity Assessment of Office Automation Systems, Vol. I, II. Stanford Research Institute. Palo Alto, California.

(1980)."An Analysis of Organizational Productivity and the Use of Electronic Office Systems," in A. R. Benefeld and E. J. Kazlauskas, eds., Communicating Information, Proceedings of the 43rd ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York.

Bamford, H. E.. and Savin, W.
(1978)."Electronic Information Exchange: The National Science Foundation's Developing Role," Bulletin of the American Society for Information Science, 4, 12-13.

Barney, C.
(1981)."Computer Superliterates," Creative Computing, forthcoming.

Bennett, J. L.
(1972)."The User Interface in Interactive Systems," Annual Review of Information Science and Technology, 7, Knowledge Industry Publications, White Plains, New York, 159-196.

Bezilla, R.
(1978). A Discussion of Selected Aspects of Privacy, Confidentiality, and Anonymity in Computerized Conferencing. Research Report No. 11, Computerized Conferencing and Communications Center, Newark, New Jersey.

(1979). "Computerized Communication Systems: An Overview," Presented at the Association for Computing Machinery, Detroit, Michigan.

(1980a). "Computer-Based Conferencing -- A System Approach to the 'Officeless Office'," Presented at the Information Management Conference, New York, New York.

(1980b). "The Impacts of New Technologies Upon Children in the 1980s," Presented at the National Council for Children and Television, Princeton, New Jersey.

(1980c). "On-Line Messaging and Conferencing Systems," Presented at the Online '80 Conference, San Francisco, California.

Bezilla, R. and Kleiner, A.
(1980). "Electronic Network Addiction," Presented at the National Computer Conference, Anaheim, California.

Bowes, J.
(1980). "Japan's Approach to an Information Society: A Critical Perspective," University of Washington School of Communications, Seattle, Washington.

Bregenzer, J. and Martino, J. P.
(1980). "Futures Research Group Experience with Computerized Conferencing," in M. M. Henderson and M. J. MacNaughton, eds. Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 65-70.

Cartwright, D. and Zander, A.
(1968). Group Dynamics: Research and Theory. Harper and Row, New York, New York.

Cook, T. and Campbell, D.
(1976). "The Design and Conduct of Quasi-Experiments for Field Settings," in M. Dunnette, ed., Handbook of Organizational and Industrial Psychology. Rand McNally, Skokie, Illinois.

(1979). Quasi-Experimentation: Design and Analysis Issues for Field Settings. Rand McNally, Chicago, Illinois.

Cook, T. and McAnany, E.
(1979)."Recent U.S. Experiences in Evaluation Research with Implications for Latin America," in R. Klein et al., eds., Evaluating the Impact of Nutrition Health Programs. Plenum, New York, New York, 39-97.

Craig, J. H. and Craig, M.
(1974).Synergic Power: Beyond Domination and Permissiveness. Proactive Press, Berkeley, California.

Danowski, J. A. and Sacks, W.
(1980)."Computer Conferencing and the Elderly," Experimental Aging Research, 6, 125-135.

Davis, M.A.
(1971).Communication Effectiveness as a Function of Mode. Unpublished M.A. Thesis, University of Waterloo.

Day, L.
(1975)."Computer Conferencing: An Overview," in N. Macon, ed., Computer Communication: Views from ICCC '74. International Council for Computer Communication, Stockholm, Sweden, 53-70.

Edelstein, A., Bowes, J., and Harsel, S.
(1978).Information Societies: Comparing the Japanese and American Experiences. University of Washington Press, Seattle, Washington.

Edwards, G. C.
(1977).An Analysis of Usage and Related Perceptions of NLS-- A Computer Based Text Processing and Communications System. Bell Canada H.Q. Business Development, Montreal, Canada.

Ellis, C. and Nutt, G.
(1980)."Office Automation Systems and Computer Science," Computing Surveys, 12, 1, 27-60.

Elton, M. and Carey, J.
(1980).Implementing Interactive Telecommunication Services. Alternative Media Center, New York, New York.

Farace, R., Monge, P., and Russell, H.
(1977).Communicating and Organizing. Addison-Wesley, Menlo Park, California.

Ferguson, J. and Johansen, R., eds.
(1975).Teleconferencing on Integrated Data Bases in Postsecondary Education. Institute for the Future, Menlo Park, California.

Fink, A. and Kosecoff, J.
(1980).An Evaluation Primer. Sage, Beverly Hills, California.

Fisher. B. A.
(1974).Small Group Decision-Making: Communication and the Group Process. McGraw Hill, New York, New York.

Flay, B. and Cook, T.
(1981)."Evaluation of Mass Media Prevention Campaigns," in R. Rice and W. Paisley, eds., Mass Communication Campaigns. Sage, Beverly Hills, California.

Freeman, L. C.
(1980)."Q-Analysis and the Structure of Friendship Networks," International Journal of Man-Machine Studies.

Freeman, L. C. and Freeman, S. C.
(1980)."A Semi-Visible College: Structural Effects on a Social Networks Group," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52. Westview Press, Boulder, Colorado, 77-85.

GMD
(1979)."KOMEX: An Experimental System for Computer Conferencing," Presented at the Working Group on Implications of Computer Conferencing for Developed and Developing Countries, WFSC, Berlin. Gesellschaft fur Matematik und Datenverarbeitung, Bonn, Germany.

Goldhaber, J., Yates, M., Porter, D., and Lesniak, R.
(1978)."Organizational Communication: 1978," Human Communication Research, 5,1,76-96.

Guillaume, J.
(1980). "Computer Conferencing and the Development of an Electronic Journal," Canadian Journal of Information Science, 21-29.

Gunter, J. (ed.)
(1979).The United States and the Debate on the World Information Order. Academy for Educational Development, Washington, D.C.

Hammond, K., Stewart, T.R., Brehmer, B., and Steinmann, D.O.
(1975)."Social Judgment Theory: Applications in Policy Formation," in M.F. Kaplan and S. Schwartz, eds., Human Judgment and Decision Processes: Applications in Problem Settings. Academic Press, New York, New York.

Hare, A. P.
(1976).Handbook of Small Group Research. Free Press, New York, New York.

Hiltz, S. R.
(1976)."Computer Conferencing: Assessing the Social Impact of a New Communications Medium," Presented at the annual meeting of the American Sociological Association, San Francisco, California.

(1978a)."Controlled Experiments with Computerized Conferencing," Bulletin of the American Society for Information Science, 4, 11-12.

(1978b)."Social and Psychological Aspects of Teleconferencing," Presented at the annual meeting of the American Association for the Advancement of Science, Washington, D.C.

(1978c)."Using Computerized Conferencing to Conduct Opinion Research," Presented at the annual meeting of the American Association for Public Opinion Research, Roanoke, Virginia.

(1979)."The Social Effects of Human Communication Via Computer," Presented at the Irvine Conference on Social Issues and Impacts of Computing. Irvine, California.

(1980).The Impact of a Computerized Conferencing System on Scientific Research Communities. Final Report to the National Science Foundation.

Hiltz, S. R., Johnson, K., and Agle, G.
(1978).Replicating Bales Problem Solving Experiments on a Computerized Conference: A Pilot Study. Research Report No. 8, Computerized Conferencing and Communications Center, Newark, New Jersey.

Hiltz, S. R., Johnson, K., and Turoff, M.
(1981)."The Quality of Group Decision Making in Face-to-Face Vs. Computerized Conferences," To be presented at the annual meeting of the American Sociological Association, Toronto, Canada.

Hiltz, S. R. and Turoff, M.
(1978a)."Electronic Networks: The Social Dynamics of a New Communications Medium," Presented at the annual meeting of the American Sociological Association, San Francisco, California.

(1978b).The Network Nation - Human Communication Via Computer. Addison-Wesley, Reading, Massachusetts.

Hiltz, S. R., Turoff, M., Johnson, K. and Aronovitch, C.
(1980)."Equality, Dominance, and Group Decision Making: Results of a Controlled Experiment on Face to Face Vs. Computer Mediated Discussions," Presented at the ICCC. Atlanta, Georgia.

Hornik, R.
(1980)."Shedding Some Light on Evaluation's Myths," Development Communication Report, 29, 1-15.

Housman, E. M.
(1980)."Online Communication by Electronic Mail and Computer Conferencing," Presented at the 4th Online Meeting. London, England.

Jacobsen, E. and Seashore, S.
(1951)."Communication Practices in Complex Organizations," Journal of Social Issues, 7, 3, 28-40.

Johansen, R.
(1977)."Social Evaluations of Teleconferencing," Telecommunications Policy, 1, 5, 295-454.

Johansen, R., Miller, R. and Vallee, J.
(1974)."Human Communication through Electronic Media: Fundamental Choices and Social Effects," Educational Technology, 7-20.

Johansen, R., DeGrasse, R., Jr. and Wilson, T.
(1978).Group Communications through Computer, Vol. V: Effects on Working Patterns. Institute for the Future, Menlo Park, California.

Johansen, R., McNulty, M., and McNeal, B.
(1978).Electronic Education: Using Teleconferencing in Postsecondary Organizations, Report R-42. Institute for the Future, Menlo Park, California.

Johansen, R., Vallee, J., and Spangler, K.
(1979).Electronic Meetings: Techological Alternatives and Social Choices. Addison-Wesley, Reading, Massachusetts.

Johnson-Lenz, P. and Johnson-Lenz, T.
(1980a)."Case Study: JEDEC/EIES Project - Use of Electronic Information Exchange in Developing Standards in the Electronics Industry," Submitted to the National Science Foundation.

(1980b).Final Report: JEDEC/EIES Project: Standardization in Minicomputer/LSI Products Via Electronic Information Exchange. Final Report to the National Science Foundation.

(1980c)."Groupware: The Emerging Art of Orchestrating Collective Intelligence," Presented at the First Global Conference on the Future, Toronto, Canada.

(1980d)."LegiTech/EIES: Information Exchange among State Legislative Researchers," in M. M. Henderson and M. J. MacNaughton,. eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52. Westview Press, Boulder, Colorado, 103-111.

(1981).The Evolution of a Tailored Communications Structure: The Topics System. Research Report No.14, Computerized Conferencing and Communications Center, Newark, New Jersey.

Johnson-Lenz, P, Johnson-Lenz, T. and Hessman, J.F.
(1980)."JEDEC/EIES Computer Conferencing for Standardization Activities," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52. Westview Press, Boulder, Colorado, 97-102.

Johnson-Lenz, P, Johnson-Lenz, T. and Scher, J. M.
(1978)."How Groups Can Make Decisions and Solve Problems through Computerized Conferencing," Bulletin of the American Society for Information Science, 4, 15-17.

Kerr, E. B.
(1978)."Identities and Role Definitions in Computerized Conferencing," in R. Bezilla, A Discussion of Selected Aspects of Privacy, Confidentiality, and Anonymity in Computerized Conferencing. Research Report No. 11, Computerized Conferencing and Communications Center, Newark, New Jersey, 72-84.

(1979). "Computer-Mediated Communications with the Mobility-Limited Aged and Cerebral Palsy Children: An Application of the Electronic Information Exchange System," Presented at the Conference of the World Future Studies Federation, Berlin, Germany.

(1980)."Conferencing Via Computer: Evaluation of Computer-Assisted Planning and Management for the White House Conference on Library and Information Services," in Information for the 1980s: A Final Report of the White House Conference on Library and Information Services, 1979. U.S. Government Printing Office, Washington, D.C., 767-805.

Kerr, E. B. and Bezilla, R.
(1979). "Cues and Clues: The Presentation of Self in Computerized Conferencing," Presented at the National Computer Conference, New York, New York.

Kerr, E. B., Hiltz, S. R., Whitescarver, J., and Prince, S.
(1979)."Applications of Computer Conferencing to the Disadvantaged: Preliminary Results of Field Trials with Handicapped Children," in R. D. Tally and R. R. Deultgen, Information Choices and Policies - Proceedings of the ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York, 149-158.

Kiechel, W.
(1980)."Everything You Always Wanted to Know may Soon Be Online," Fortune, 226-240.

Kleiner, A.
(1980)."Life on the Computer Network Frontier," The Next Whole Earth Catalog. Stewart Brand, ed., Rand McNally, New York, New York.

Kleiner, A. and Davis, W.
(1979)."Personal Computer Networks: Better than the Next Best Thing to Being There," Coevolution Quarterly, Summer, 114-119.

Kling, R.
(1980)."Social Analyses of Computing: Theoretical Perspectives in Recent Empirical Research," Computing Surveys, 12, 1, 61-110.

Kochen, M.
(1978)."Long-Term Implications of Electronic Information Exchanges for Information Science," Bulletin of the American Society for Information Science, 4, 22-23.

Kowitz, A. C. and Knutson, T. J.
(1980).Decision-Making in Small Groups. Allyn and Bacon, Boston, Massachusetts.

Lamont, V. C.
(1980)."Computer Conferencing: The Legitech Experience," in L. A. Parker and C. H. Olgren, Teleconferencing and Interactive Media. Extention Center for Interactive Programs, University of Wisconsin, Madison, Wisconsin, 457-461.

Landweber, L.
(1979)."Theory Net: An Electronic Mail System," Abstracted in A. Martin and J. Elshoff, eds., Proceedings of the 1979 Annual Conference, ACM, 29-31.

Lasden, M.
(1979)."Will You Love Electronic Mail or Hate it?" Computer Decisions, 2, 47-60

Linstone, H. A. and Turoff, M.
(1975).The Delphi Method: Techniques and Applications. Addison-Wesley, Reading, Massachusetts.

Lipinski, H., Spang, S. and Tydeman, J.
(1980)."Supporting Task-Focused Communication," in A. R. Benenfeld and E. J. Kazlauskas, eds., Communicating Information - Proceedings of the 43rd ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York, 158-160.

Lowenstein, R.
(1979). Office System Studies. IBM, White Plains, New York.

Lynch, C. A.
(1980). "Practical Electronic Mail through a Centralized Computing Facility," in A. R. Benenfeld and E. J. Kazlauskas, eds., Communicating Information - Proceedings of the 43rd ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York, 34-37.

McCarroll, J. H.
(1980). "EIES for a Community Involved in R&D for the Disabled," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 71-76.

McCarroll, J. H. and Cotman, L.
(1980). "Evaluation Report on a Trial Application of Computer Conferencing by the Placement Trainers Consortium," Human Resources Center, Albertson, New York.

McKendree, J. D.
(1978). "Project and Crisis Management Applications of Computerized Conferencing," Bulletin of the American Society for Information Science, 4, 13-15.

McQuillan J. M.
(1980). "A Retrospective on Electronic Mail," SIGOA Newsletter, 1, 8-9.

Mailman, F., Hubbard, D., and Canache, P.
(1981). A Computer Conferencing Directory. American Society for Cybernetics, Washington, D.C.

Martin, J.
(1973). Design of Man-Computer Dialogues. Prentice-Hall, Englewood Cliffs, New Jersey.

Martino, J. P.
(1979). "Telecommunications in the Year 2000," The Futurist, 13, 95-103.

Martino, J. P. and Bregenzer, J.
(1980). Report on an Experiment with an Electronic Conferencing System within a Scientific Community. Final Report to the National Science Foundation.

Mettee, D. R. and Riskind, J.
(1974). "Size of Defeat and Looking for Superior and Similar Ability Competitors," Journal of Experimental Social Psychology, 10, 333-335.

Myers, I. B.
(1962).The Myers-Briggs Type Indicator. Consulting Psychologists Press, Palo Alto, California.

Neisner, U.
(1964)."MAC and its Users," Project MAC, Memorandum MAC-M-185.

NSF 76-45
(1976)."Program Announcement: Operational Trials of Electronic Information Exchange for Small Research Communities," National Science Foundation, Division of Science Information.

Open Systems
(1981). "Case History, Into the Wild Blue Yonder," Newsletter, 2, 1: 6-7.

Paisley, W.
(1980)."Information and Work," in B. Dervin and M. Voigt, eds., Progress in Communication Sciences, Vol. II, Ablex, New York, New York.

Palme, J.
(1979).A Human-Computer Interface for Non-Computer Specialists. Swedish National Defense Research Institute, FOA Report C 10128-M3 (E5,H9), Stockholm, Sweden.

Palme, J., Arnborg, S., Enderin, L., Meyer, C., and Tholerus, T.
(1980).The COM Teleconferencing System Functional Specification. Swedish National Defense Research Institute. FOA Report C 10164-M6(H9), Stockholm, Sweden.

Palmer, E.
(1981)."Shaping Persuasive Messages with Formative Research," in R. Rice and W. Paisley, eds., Mass Communication Campaigns. Sage, Beverly Hills, California.

Panko, R. R.
(1980a)."The EMS Revolution," Computerworld, 19, 45-56.

(1980b)."Electronic Message Systems: A Survey". University of Hawaii, College of Business Administration, Working paper 80-83.

Panko, R. R. and Panko, R. U.
(1981)."A Survey of EMS Users at DARCOM," Computer Networks, forthcoming.

Parnes, R., Hench, C. and Zinn, K.
(1977)."Organizing a Computer Based Conference," Transnational Association, 10, 418-422.

Penniman. W. D. and Dominick, W.
(1980)."Monitoring and Evaluation of On-Line Information System Usage," Information Processing and Management, 116, 17-35.

Price, C. R.
(1975)."Conferencing Via Computer: Cost Effective Communication for the Era of Forced Choice," in M. Turoff and H. A. Linstone, eds., The Delphi Method. Addison-Wesley, Reading, Massachusetts, 497-516.

Price, C. R. and Kerr, E. B.
(1978)."Electronic 'Connectedness': Its Meaning for Personal and Social Disabilities," Bulletin of the American Society for Information Science, 4, 19-20.

Price, C. R., Turoff, M., and Hiltz, S. R.
(1980)."Electronic Mail and Teleconferencing: 'Information' or 'Communication'?" Conference on Innovation in Primary Publication, Brussels, Belguim.

Ramsey, H. and Atwood, M.
(1979).Human Factors in Computer Systems: A Review of the Literature. Office of Naval Research, Technical Report SAI 79 111 DEN, Englewood, Colorado.

Reichwald, R.
(1980)."New Office Systems and Acceptance Problem," Telecom Report, 3, 5-8.

Rice, R. E.
(1980a)."Computer Conferencing," in M. Voigt and B. Dervin, eds., Progress in Communication Sciences, Vol. II, Ablex, White Plains, New York.

(1980b)."Impacts of Organizational and Interpersonal Computer-Mediated Communication," in M. Williams, ed., Annual Review of Information Science and Technology, 16. Knowledge Industry Publications, White Plains, New York.

Rice, R. E. and Richards, R.
(1980)."Quantitative Network Analysis Methods," Presented at the International Communication Association, Acapulco, Mexico.

Roberts, A.
(1980)."MACC'S Computer Mail System -- Its Features, Usage Statistics and Costs". In L. A. Parker and C. H. Olgren, eds., Teleconferencing and Interactive Media, Proceedings of a Conference Sponsored by the University of Wisconsin Extension Center for Interactive Programs, Madison, Wisconsin, 472-481.

Roberts, L.
(1978)."The Evolution of Packet Switching," IEEE Proceedings, 66, 11, 1307-1314.

Rogers, E. and Agarwala-Rogers, R.
(1976).Communication in Organizations. Free Press, New York, New York.

Rouse, W.
(1975)."Design of Man-Computer Interfaces for On-Line Interactive Systems," Proceedings of the IEEE, 63, 6, 847-857.

Rule, J.
(1974).Private Lives and Public Surveillance: Social Control in the Computer Age. Schocken Books, New York, New York.

Scher, J. M.
(1980a)."Distributed Decision Support Systems: An Overview," Presented at the Joint Meeting of the Operations Research Society of America and the Institute of Management Sciences, Milwaukee, Wisconsin.

(1980b). "Higher Educational and Managerial-Organizational Uses of Computer-Based Human Communication Systems: Some Futures and Opportunities," in F. Festher, Through the 80s: Thinking Globally, Acting Locally. World Future Society, Washington, D.C., 317-322.

Seabrook, R. H. C.
(1978)."PANALOG: Shaking the Foundations," Bulletin of the American Society for Information Science, 4, 21.

Shaw, M. E.
(1976).Group Dynamics: The Psychology of Small Group Behavior. McGraw-Hill, New York, New York.

Shneiderman, B.
(1980).Software Psychology: Human Factors in Computer and Information Systems, Winthrop Computer Systems, Cambridge, Massachusetts.

Short, J. Williams, E., and Christie, B.
(1976).The Social Psychology of Telecommunications. John Wiley, New York, New York.

Siegel, E. R.
(1980)."Use of Computer Conferencing to Validate and Update NLM's Hepatitis Data Base," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 87-95.

Silverthorne, C. P., Chelune, G. and Imada, A.
(1974)."The Effects of Competition and Cooperation on Levels of Prejudice," Journal of Social Psychology, 92, 293-301.

Simard, R. and Miller, R.
(1980)."Computer Conferencing to Enhance Nuclear Reactor Safety," in Communicating Information: Proceedings of the ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York, 161-162.

Southworth, J. H., Flanigan, J. M., and Knezek, G. A.
(1981)."Computers in Education: International Multi-Mode Node Electronic Conferencing," Presented at the Pacific Telecommunications Conference, Honolulu, Hawaii.

Spelt, P. F.
(1977)."Evaluation of a Continuing Computer Conference on Simulation," Behavioral Research Methods and Instrumentation, 9, 87-91.

Stech, E. and Ratliffe, S. A.
(1976).Working in Groups: A Communication Manual for Leaders and Participants. National Textbook Co., Skokie, Illinois.

Sterling, T.
(1974)."Humanizing Computerized Information Systems," Communications of the ACM, 17.

(1975)."Humanizing Computerized Information Systems," Science, 190, 1168-1172.

Stevens, C. H.
(1980)."Many-to-Many Communication through Inquiry Networking," World Future Society Bulletin, 14, 31-35.

Stevens, C. H., Barwig, F. and Haviland, D.
(1974).Feedback: An Involvement Primer. Rensselaer Polytechnic Institute, Troy, New York.

Suchman, E.
(1967).Evaluative Research. Russell Sage Foundation, New York, New York.

Svoboda, L.
(1976).Computer Performance Measurement and Evaluation Methods. Elsevier, New York, New York.

Tapscott, D.
(1980)."Investigating the Office of the Future," Draft manuscript, to appear in TELESIS.

Theobald, R.
(1976). Beyond Despair: Directions for America's Third Century. The New Republic Book Co., Washington, D.C.

(1979). Challenges in Renewable Natural Resources: A Guide to Alternative Futures. U.S. Department of Agriculture, Washington, D.C.

(1980). "The Communications Era from the Year 2000," National Forum, 60, 17-20.

Thompson, M.
(1980). Benefit-Cost Analysis for Program Evaluation. Sage, Beverly Hills, California.

Tichy, N.
(1980a). "A Social Network Perspective to Organizational Development," in T. Cummings, ed., Systems Theory for Organizational Development. Wiley Interscience, New York, New York.

(1980b). "Networks in Organizations," in W. Starbuck and P. Nystron, eds., Handbook of Organization Design. Oxford University Press, Oxford, England.

Tichy, N. and Fombrun, C.
(1979). "Network Analysis in Organizational Settings," Human Relations, 32, 923-965.

Tichy, N., Tushman, M., and Fombrun, C.
(1979). "Social Network Analysis for Organizations," Academy of Management Review, 4, 507-519.

Toussaint, J.H.
(1960). "A Classified Summary of Listening 1950-1959," Journal of Communication, 10, 125-134.

Turoff, M.
(1972). "'Party Line' and 'Discussion' Computerized Conferencing Systems," in S. Winkler, ed., Computer Communication Impacts and Implications. International Conference on Computer Communication, Washington, D.C., 161-170.

(1974a). "Computerized Conferencing: Present and Future," Intellect, 54-57.

(1974b). "Computerized Conferencing and Real Time Delphis," Proceedings of the International Conference on Computer Communications, Stockholm, Sweden, 135-142.

(1979). "On the Design of Human Systems - or Confessions of a Designer," Presented at the National Computer Conference, New York, New York.

(1980a)."The Designer's View," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 113-120.

(1980b)."Management Issues in Human Communication Via Computer," Presented at the Stanford Conference on Office Automation, Stanford, California.

Turoff, M. and Hiltz, S. R.
(1977)."Computerized Conferencing: A Review and Statement of Issues," Presented at the NATO Telecommunications Symposium, Bergamo, Italy.

(1978).Development and Field Testing of an Electronic Information Exchange System: Final Report on the EIES Development Project. Research Report No. 9, Computerized Conferencing and Communications Center, Newark, New Jersey.

(1979)."Information and Communication in International Affairs," Presented at the International Studies Association, Toronto, Canada.

(1980)."Structuring Communications for the Office of the Future," Presented at the NCC Office Automation Conference, Atlanta, Georgia.

Turoff, M. and Linstone, H. A., eds.
(1975).The Delphi Method: Techniques and Applications. Addison-Wesley, Reading, Massachusetts.

Turoff, M., Enslow, P., Hiltz, S. R., McKendree, J., Panko, R., Snyder, D., and Wilcox, R.
(1978).Research Options and Imperatives in Computerized Conferencing. Research Report No. 10, Computerized Conferencing and Communications Center, Newark, New Jersey.

Turoff, M., Whitescarver, J., Leurck, A., Howell, J., Moulton, T., and Voyce, B.
(1981)."On the Design of an Information Marketplace," To be presented at the annual meeting of the American Society for Information Science, Washington, D.C.

Tydeman, J., Lipinski, H., and Spang, S.
(1980)."An Interactive Computer-Based Approach to Aid Group Problem Formulation," Technological Forecasting and Social Change, 16, 311-320.

Uhlig, R. P.
(1977)."Human Factors in Computer Message Systems," Datamation, 120-126.

Uhlig, R. P., Farber, D. J., and Bair, J. H.
(1979).The Office of the Future: Communication and Computers. North Holland Publishing Co., Holland.

Umpleby, S. A.
(1976)."Second Order Cybernetics and the Design of Large Scale Social Experiments," Presented at the annual meeting of the Society for General Systems Research, Boston, Massachusetts.

(1980)."Computer Conference on General Systems Theory: One Year's Experience," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 55-63.

U.S. Department of Transportation
(1976).Effective Citizen Participation in Transportation Planning, Vol. I, II. U.S. Government Printing Office, Washington, D.C.

Vallee, J.
(1976)."There Ain't No User Science," Proceedings of the ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York.

Vallee, J. and Askevold, G.
(1975)."Geological Applications of Network Conferencing: Current Experiments with the FORUM System," in P. Lykos, ed., Computer Networking and Chemistry. American Chemical Society, Chicago, Illinois, 53-65.

Vallee, J., Lipinski, H., and Miller, R.
(1974). Group Communication through Computers Vol. I: Design and Use of the FORUM System. Institute for the Future, Report R-32, Menlo Park, California.

Vallee, J., Johansen, R., Randolph, R., and Hastings, A.
(1974). Group Communication through Computers, Vol. II: A Study of Social Effects. Institute for the Future, Menlo Park, California.

Vallee, J., Johansen, R., Lipinski, H., Spangler, K., and Wilson, T.
(1975).Group Communication through Computers, Vol. III: Pragmatics and Dynamics. Institute for the Future, Menlo Park, California.

(1978).Group Communication through Computers, Vol. IV: Social, Managerial, and Economic Issues. Institute for the Future, Menlo Park, California.

Vogler, R. E.
(1968)."Possibility of Artifact in Studies of Cooperation," Psychology Reports, 23, 9-10.

(1969)."On the Definition of Cooperation," Psychology Reports, 25, 281-282.

Walker, D. E.
(1971). Interactive Bibliographic Search: The User/Computer Interface. AFIPS Press, Montvale, New Jersey.

Warfield, J.
(1976). Societal Systems: Planning, Policy, and Complexity. John Wiley, New York, New York.

Weiss, R. and Jacobson, E.
(1960). "A Method for the Analysis of the Structure of Complex Organizations," in J. Moreno, ed., The Sociometry Reader, Free Press, Glencoe, Illinois, 522-533.

Westin, A. and Baker, M.
(1972). Databanks in a Free Society: Computers, Record-Keeping, and Privacy. Quadrangle Books, New York, New York.

Winkler, S.
(1975). "The Quiet Revolution," in N. Macon, ed., Computer Communication: Views from ICCC '74. International Council for Computer Communication, Stockholm, Sweden, 1-4.

Zinn, Karl L.
(1979). "Computer Aided Communications: New Directions for Higher Education," Abstracted in A. Martin and J. Elshoff, eds., Proceedings of the 1979 Annual Conference, ACM, Detroit, Michigan.

APPENDIX I

CASE STUDIES

INTRODUCTION

Underlying the generalizations made in this report are observations of user groups using specific systems for particular applications. Summaries of five of the case studies are included here to provide a sample of the kind of evaluation activities and results that produced the summary data that have been generated.

The first three case studies are condensations of final reports of the experiences of groups which used EIES. They were chosen to illustrate very different applications of the same system. The first, the futures research group, was an "invisible college" of scientists using the system to improve communications. It had no goal or task other than the discussion of topics of interest.

The advisory committee of the White House Conference on Library and Information Services used EIES for a specific task: planning the national conference. Once system use was decided upon, no further face-to-face meetings were held.

The final EIES case study is of JEDEC, the Joint Electron Devices Engineering Council. Several JEDEC groups used EIES to supplement quarterly face-to-face meetings in developing standards. Some specific decision-support structures were evolved to aid them in their work.

The case study of HUB includes seven groups, all fairly small, engaged in a variety of activities. It details how "formative evaluation" was used to guide changes in the structure and functioning of the system itself.

The final case study describes some characteristics of the simplest of the computerized communication systems: the CBBS, Community Bulletin Board Systems. For about $50 in software, any home computer owner can establish a conference and allow other computer owners to phone in. There are already over 50 such systems which have sprung up around the country. The study proposes and illustrates a type of evaluation methodology which can capture and analyze the content of conference entries, not only for CBBS, but for any computer mediated communication system.

A TRIAL OF COMPUTERIZED CONFERENCING AMONG A GROUP OF FUTURES RESEARCHERS

by

Joseph P. Martino and John M. Bregenzer

The National Science Foundation (NSF) funded the experimental establishment of an electronic conferencing system known as the Electronic Information Exchange System (EIES) at New Jersey Institute of Technology. Once the system was established, the NSF funded a series of experiments in which the EIES would be utilized by various scientific research communities.

The purpose of our experiment was to determine what changes in the behavior of the participants would take place as a result of having the electronic conferencing capability made available to them. Thus the intent of the moderator and of the assessor was to observe the participants in action, as unobtrusively as possible, in order to determine what uses they made of the system and how the availability of the system led them to alter their previous activities. This report is intended to present the findings which resulted from that observation.

The research community that took part in this experiment can be described as the Futures Research community. The identifying characteristic of this community of researchers is that its members are concerned with estimating the rate and direction of change in society, estimating the future states of technology and society, and estimating the consequences of changes in technology and society. In particular, many of the members of this community are specifically engaged in developing improved methods for making these estimates.

The members of this community know one another, and generally view themselves as working in a common research area. However, the members of the community are located in widely dispersed organizations. Most are in academic posts, although some are in not-for-profit research organizations, and some are performing planning or analysis work in industry or government.

There are no major centers for research in Futures methodology, although some small centers (usually less than half a dozen people) have been established at four or five universities. However, the field has nothing to compare with the research centers that are common in certain fields of the physical sciences such as high-energy physics. Moreover, there are not even any "strong departments" such as are found in many of the social sciences. Thus, few members of the Futures Research community are associated with colleagues in this discipline in their own institutions, although they are often involved in interdisciplinary activities with other members of their institutions. Their orientation is primarily cosmopolitan (towards their research community) rather than local (towards their institution). All members of this community have come from some other discipline. Many, in fact, had established careers and significant areputations in their original discipline before entering the Futures Research community. In most cases, they initiated work in Futures Research to solve some problem they were working on in their original discipline, and found Futures Research so interesting that they did not return to their original discipline. The situation is highly similar to Operations Research in its early days, before schools and departments were established for training Operations Researchers.

EXPECTED BEHAVIOR OF THE COMMUNITY

Our expectations regarding the ways EIES would be used by the Futures Research community were based on our perceptions of the needs of that community. In particular, we saw what appeared to be a lack of communications within the community, and expected to see EIES used to make up for that lack.

This perception that the community lacked certain types of communications led us to expect certain kinds of behavior when members of the community had access to EIES. However, in most cases the actual uses to which EIES was put deviated from our expectations. This led us to draw certain inferences about the nature of the Futures Research community, and the nature of communications within that community.

The Futures Research community is a well-defined research community whose members recognize each other as having similar research interests. However, the flow of communication within this community has been hampered by lack of the channels commonly found in other research communities. Under these circumstances, we expected that EIES would significantly enhance communication within the community. We expected it to allow interaction which:

- is more frequent than meetings or conferences;
- allows more time for reflection or thought than does a telephone call;
- permits more rapid turnaround and transmission than the mail.

In analyzing the effect of increased communication on the Futures Research community, we planned to use a framework based on work by H.G. Barnett, as presented in his book INNOVATION: THE BASIS OF CULTURAL CHANGE (McGraw- Hill Book Company, 1953). Barnett developed a set of generalizations about the innovation process. This framework had the advantage, from our standpoint, that it dealt with constructs which could be observed readily in the written communications exchanged through EIES. The five major factors involved in Barnett's generalizations, and the way in which EIES was expected to enhance their operation, are as follows:

a. THE ACCUMULATION OF IDEAS

The innovativeness of any group is influenced by the accumulation of ideas available to that group, since a sizeable inventory of ideas allows for more new combinations and permits more avenues of approach than does a small one. We expected EIES to provide each participant with a wider range of ideas than he would otherwise have access to, since EIES would allow more information exchange than ordinarily takes place in the Futures Research community.

b. THE CONCENTRATION OF IDEAS

Accumulation of ideas in a group is not sufficient for innovation. If these ideas remain in individual minds and are not communicated, the advantage of a large inventory of ideas can be lost. The ideas must also be concentrated in a single mind. We expected EIES to facilitate the concentration of ideas by allowing each participant to describe ongoing work, to state problems and difficulties encountered, and to request help of one kind or another. EIES would permit these activities to be carried out more readily than do the existing but limited means of communication in the Futures Research community.

c. THE COLLABORATION OF EFFORT

The likelihood that innovation will take place is increased if several persons are simultaneously and cooperatively exploring the same possibility. Thus, collaboration not only pools the ideas of several participants, it also enhances the likelihood of success. Moreover, the interaction among the collaborators stimulates new ideas, new combinations of old ideas, and division of labor in testing possible approaches. We expected to see EIES used for collaboration among researchers working on parallel or related activities. In particular, we expected to see communication of partial results as soon as they were available, communication of suggestions for new or alternative approaches, and alterations in previously-established procedures as soon as the need for alterations became evident.

d. THE CONJUNCTION OF DIFFERENCES

The apposition of alternative ideas, approaches, and concepts can bring about entirely new concepts which are distinct from any of the alternatives. Moreover, the conjunction of differences can be a stimulus for the emergence of new ideas derived from, but not necessarily in opposition to, the original ideas. We expected EIES to enhance the opportunity for conjunction of differences, by allowing the participants to exchange ideas on specific topics. The Futures Research community does have members with differenct ideas on proper approaches for solving specific problems. We expected the enhanced communication potential of EIES to increase the likelihood of group members being confronted with different ideas, approaches, and concepts.

e. THE EXPECTATION OF CHANGE

A factor that can significantly enhance or inhibit innovation is the degree to which change is expected. In a group in which change is neither expected nor desired, internally-generated change is unlikely to take place. In a group in which change is desired and anticipated, innovativeness is fostered and innovation is more probable. The Futures Research community not only expects and desires change in the object of its members' research efforts, it actively fosters such change. However, the possibilities for innovation are limited by the restricted communication means available to the Futures Research community. We expected EIES to allow the expectation of change which already exists within the Futures Research community to be more effective since greater communication would be possible.

Within this five-part framework, we expected to see the following kinds of communications among the participants in the conference:

- descriptions of ongoing research;
- descriptions of interim results, on a frequent basis;
- requests for data;
- requests for references to sources of specific information;
- requests for suggestions or help with specific problems;
- submission of drafts of papers for comments or criticism; and
- answers to the above requests

We believed that if the conference were successful, the individuals comprising it would begin to interact as a group which is conscious of its own existence. We therefore expected to see the following aspects of group activity.

Activity as a Social Group

This might have included the appearance of "in-group" jokes, terms and expressions. Other aspects of development as a social group which we thought possible included shifts in forms of address, reference to other conference members in transmissions, and critical comments on the activity or work of conference members.

Activity as a Research Group

If the conference members began to function as a research group, we expected to see certain kinds of behavior. Some of these have been listed above as specific types of communications we expected to see. In addition, we expected to see collaboration between group members on specific research projects or the writing of articles, the appearance of conflict/competition of the type described by J. D Watson in THE DOUBLE HELIX (Atheneum, 1968), and the defense of previously held ideas of positions despite contrary arguments or evidence, in the manner described by I. I. Mitroff in THE SUBJECTIVE SIDE OF SCIENCE (Elsevier Press, 1974).

Impact on the Futures Research Community

The members of the conference were selected from among the leading members of the Futures Research community. The conference members would normally be in contact with other members of the community by those channels which already exist. We expected the operation of the conference to have some effect on the remainder of the community. We expected to see evidence of this impact in some or all of the following forms:

- appearance of new concepts and technical terms introduced into the conference from outside or originating in the conference and diffusing outside;

- shifts in the definition of technical terms as these were used by conference members;

- shifts in "hot research topics" as the conference progressed;

- paradigmatic shifts in Futures Research;

- changes in topics, issues or questions which were discussed by conference members (because of solution, redefinition, or paradigm shift);

- changes in the ways conference members interacted with those outside the conference;

- shifts in what constituted the field of interest (i.e., what is included in or excluded from Futures Research).

OBSERVED BEHAVIOR

To a very great extent, the observed behavior of the group departed from our expectations. We do not fully understand the reasons for this. However, the results were quite clearcut. Some behavior that we expected to see was absent or nearly so. Conversely, some behavior we had not anticipated did take place. The effect of this departure from expected behavior was that many of the measurements we had planned to make turned out to be impossible. Instead, we found that analysis of what actually took place in the conference required sensitivity to interpersonal behavior rather than objective measures of small-group activity. Fortunately, the presence of a social scientist as "assessor" made it possible to carry out this type of analysis instead of the "count-and-measure" type of analysis we had originally planned.

Factors Affecting Innovativeness

Since the obvious function of any scientific research community is to generate new knowledge, behavior related to innovativness is of great importance. That is why we developed a framework for analysis which was based on factors affecting innovation.

The "concentration of ideas" of course occurs within a single mind. There was no direct way we could measure this. We had hoped to observe the "accumulation of ideas" and then infer their concentration. However, most of the interchange of information in the conference took place via messages rather than conference comments. While the assessor from time to time requested that he be included as an addressee on all messages, we have no way of knowing the extent to which his request was honored. We believe that in most cases he was not included as an addressee. Reasons for this include oversight, forgetfulness on the part of senders, and desire for privacy by senders.

Despite our inability to observe message traffic, we did observe the presentation of many ideas in the various conferences. The exchanges will be discussed in more detail below. However, in general it can be said that many ideas were made available to persons participating in the conference. The reactions to these ideas indicated many were new to at least some of the participants. Hence the accumulation of ideas was definitely taking place.

The "conjunction of differences" was one of the most prominent features of the various conferences. Prior to the start of the conference, the moderator had been aware of some of the wide differences in opinions to be found within the Futures Research community. Nevertheless, it was often startling to see the variety of views presented, and the vigor with which they were both attacked and defended. The conference probably made all participants much more aware than they had been previously of the variety of opinions held by Futures Researchers, on a great many topics.

"Collaboration" represented the area with widest variation in behavior among the conference participants. We had anticipated formal collaboration between geographically separated persons, in such activities as the joint authorship of papers. Because of this expectation, we were disappointed with the results. However, there was considerable collaboration of a less formal nature which was quite successful.

EIES is definitely capable of supporting geographically separated collaborators in the joint authorship of papers. The most successful demonstration of this, however, was its use by the moderator and assessor in preparing the quarterly reports required under the grant. Prior to preparing these reports, we would exchange messages regarding the topics to be covered in the next report. This continued until we reached agreement on an outline. We then decided which portions of the report each of us would write. After each of us had prepared a draft of our portions, we then "edited" the portions written by the other. When we were both satisfied with all portions of the report, it was transmitted to the National Science Foundation via EIES. We utilized this method of "electronic collaboration" despite the fact that we were both located on the same campus. We found it easier to write the reports jointly via EIES than to write them in a more conventional fashion involving meetings and written drafts. Despite this evidence of the potential of EIES for facilitating joint authorship, it was not widely used for this purpose by conference participants.

Two deliberate attempts at collaborative writing were made, with mixed success. Both of these involved jointly-authored book reviews. The books selected were two which had been published recently, and both were of considerable interest to the Futures Research community. The reviews were to be carried by TECHNOLOGICAL FORECASTING & SOCIAL CHANGE. In both cases the participating reviewers were those who responded to a conference comment which announced the book review projects. In both cases the reviewers were knowledgeable members of the Futures Research community. Any one of them should have been capable of writing an adequate review by himself. However, both book review projects suffered from various problems. Perhaps the most significant problem was that the reviewers did not always seem motivated to get the review written. They did not seem to have a personal commitment to completing the review in a timely manner. Moreover, there were wide divergences of opinion among the reviewers about how the reviewing process should take place, and the manner in which the review should be written.

Both reviews were undertaken in private conferences devoted solely to that purpose. In one case, the moderator wished to produce a composite review which synthesized the views of the several reviewers. To do so, he had to edit severely the comments from the reviewers, merging several comments on the same portion of the book. Where the reviewers were in general agreement, this merely required summarizing. Where there was disagreement, it required some "on the one hand, on the other hand" writing. The composite review prepared by the moderator was not entirely acceptable to all participants, particularly because some thought it did not portray enough of the dialogue which went on during the conference. However, no other participant was able to undertake rewriting it, and the moderator's version was published. In the other case, the moderator simply edited the dialogue and prepared a review showing some of the exchanges among the participants. This was more faithful to the dialogue which took place during the review, but did not provide as much of a summary for the reader of the review.

Both reviews were successful in one important sense. They brought out a wider range of opinions about the books being reviewed than was likely to have been the case for a conventional review by a single person. In this sense, collaboration benefitted from the accumulation of ideas and from the conjunction of differences. However, the book reviews definitely failed to make full use of the potential for collaboration that EIES possesses. For this full potential to be realized, it appears that the participants must have a personal commitment to producing a result by a deadline, as was the case when moderator and assessor prepared the quarterly reports.

There were other instances of collaboration, less formal than the joint authorship of papers, which were highly successful. Two of these occurred in connection with international meetings of the World Future Studies Federation (WFSF). One of these meetings was held in Cairo, Egypt in September 1978, and the other in Berlin, Germany in May 1979.

In preparation for the Cairo meeting, the conference members attempted a moderately elaborate project. The initial concept was to carry on discussion, within the conference, of a set of topics generated at a preliminary WFSF meeting in Mexico City. To supplement the members of the the Futures Research community already on EIES, letters were sent to prominent European Futures Researchers inviting them to participate (provided they could find the funds to cover the EIES costs). The response to this letter was quite disappointing. Only five Europeans responded, and only one became really active. However, there was some discussion of the topic list in the main conference. The results of that discussion were carried to the WFSF Cairo meeting by one of the participants in the Futures Research Conference.

The results of efforts to involve our participants in the WFSF Cairo meeting were a bit discouraging. However, we hoped to become involved in the WFSF Berlin meeting, although our intentions were more modest as a result of our experience on the Cairo meeting. To the surprise of everyone, collaboration regarding the Berlin meeting was one of the major successes of the entire experiment. One participant in the conference was scheduled to chair a session at the Berlin meeting. He introduced the topic of his session into the conference. In part because the topic was interesting, and in part because the individual himself was a skillful discussion leader, this portion of the conference really "took off." More comments were entered into the conference in the quarter prior to the Berlin meeting than in any previous period. The discussion was lively, with considerable interaction among the participants. A large fraction of the participants actually contributed one or more comments, rather than being passive spectators of the debate.

Collaboration with regard to the Berlin meeting was fostered because another EIES user, not a member of the Futures Research conference, was a major figure in planning the meeting. He established a private conference that included many members of the Futures Research conference. We were not able to gather any statistics from that private conference, but did observe that many of "our" members made significant contributions as well. That is, the activity in the Futures Research conference alone was not a true measure of the participation of our members in the total activity centered on the Berlin meeting.

Finally, collaboration during the Berlin meeting was further fostered because several EIES users attended the meeting and arranged to communicate the results via EIES. They entered summaries of the day's activities at the end of each day, including comments by speakers, draft postion papers, etc. Because of the time difference between Berlin and the U.S., the asynchronous feature of EIES proved very helpful. After the day's activities in Berlin, it was morning in the U.S. Participants in the conference could read the summary of activities for "yesterday," react to individual items, and send their responses back in time for "today's" session. Thus EIES allowed world-wide collaboration during the WFSF Berlin meeting. The degree of collaboration actually achieved was remarkable considering that our initial aspirations for the Berlin meeting were so modest.

Types of Communication Observed

As explained above, we did not have the opportunity to observe message traffic to any great extent. Hence our observations here are based largely on the analysis of conference comments. We did observe some of the kinds of communication we had anticipated, but some other kinds simply did not appear.

a. DESCRIPTIONS OF ONGOING WORK/INTERIM RESULTS

One of the greatest surprises (and disappointments) associated with the conference was the complete absence of any discussion of ongoing work and interim results. This type of discussion is the lifeblood of most scientific fields. However, Futures Researchers normally do not carry out this type of discussion. Furthermore, they apparently see no need for it. When given anopportunity to discuss current work via EIES, they did not do so.

There was considerable discussion of completed work. This was particularly true in the "private" conferences devoted to specific topics. The participants in these conferences frequently presented results which they were in the process of incorporating into final reports. The conference did serve to speed up dissemination of these results, but only by a few weeks. The final reports, when they appeared, would normally have been sent to the other participants in the special-interest conferences anyway, since these represented the peer group of those presenting the results.

b. REQUESTS FOR DATA AND REFERENCES

There were few of these requests, as we had expected. It was not possible for us to judge the extent to which requests were satisfied, since the responses (if any) were by message, which we did not see.

One request for data was quite successful, which we believe indicates the potential of EIES for satisfying this type of requirement. One participant entered a list of significant events in the history of the field of Futures Research, and asked for nominations for additional items. This request produced many responses. The other participants suggested other items for the list, and engaged in discussion about the relative importance of particular items. The result was not only a list of significant events, but also a collection of opinions about the significance of these events and the roles played by various individuals in the history of the field.

c. REQUESTS FOR SUGGESTIONS OR HELP

There were virtually none of these. It is hard to know why the participants did not ask for help with their research. Since most Futures Researchers are used to working in an isolated situation, it is possible that they do not think of asking colleagues for ideas about how to overcome problems in their research. On the other hand, they may not have perceived EIES as a suitable medium for soliciting help. Finally, there may have been requests for help sent by message to specific individuals. We would not have been aware of these unless the participants told us about them, and none mentioned doing this. A small number of requests for help were placed in the main conference. Some responded to these by message to the requester, and others placed responses in the conference. No pattern of response was discernable in the few cases we had a chance to observe.

d. REQUESTS FOR CRITIQUES OF DRAFTS

There were a satisfyingly large number of drafts submitted. However, not all participants used this potential of EIES. Some submitted drafts regularly, while others never did.

Types of drafts submitted for critique varied widely. Several single-author book reviews were submitted for critique prior to being sent to a journal. Several papers intended to be presented at meetings were submitted by the authors, with specific requests for critique prior to the meeting date. One participant utilized EIES for writing a book. As each chapter was completed, he submitted it as a paper, with the request that other participants read it and comment on it.

The major advantage of using EIES to compose a document (over and above its word-processing capability) is the ability to submit it as a paper and seek critiques from others on the system. Early drafts can be transmitted to interested reviewers much more rapidly than they could be sent by mail. The responses can be obtained much more rapidly than by mail, as well. Finally the responses can be incorporated as they are received. We concluded that this potential application of EIES was used effectively, even though many participants made no use of it at all. The results of this application of EIES met our expectations.

There was one aspect of the submission of drafts which did not meet our expectations, however. Our initial expectations included the possibility of an "on-line journal." The editor of TECHNOLOGICAL FORECASTING & SOCIAL CHANGE was specifically recruited to serve as the on-line editor. We envisaged the on-line journal serving a pre-publication function. Papers could be disseminated to participants more rapidly than by regular journal. Authors would also receive comments and critiques before submitting to a regular journal. However, the on-line journal never was launched. As it turned out, there was no point to it. Any would-be author could gain the same effect simply by submitting his paper as a draft. The services of an editor, and refereeing by other participants, would gain him nothing. Hence the on-line journal never got started.

Activity as a Group

We had anticipated that the participants in the conference would begin to act as a social group and as a research group. We planned to observe certain specific indicators of this activity. However, it turned out that the indicators we expected to see did not appear. Nevertheless, we believe the conference did achieve cohesion as a group.

a. ACTION AS A SOCIAL GROUP

We saw very little of the kind of "in-group" communications we had expected to see. There were a handful of items intended to be humorous, including some doggerel. Some of the limericks were slightly "blue," and these were entered anonymously.

Despite the lack of signals we had expected to see, it was apparent that the conference eventually achieved cohesion as a social group. One of the most surprising features of this was the degree of politeness exhibited by the participants, even when disagreeing vigorously with one another. Several participants remarked on the degree of respect and consideration shown even in the heat of debate. There was some concern at the outset that a computer conference would be "impersonal" or "cold." Whether this politeness and consideration resulted from a deliberate effort to overcome the perceived coldness of a computer conference we cannot say. It was clear that the lack of "body language" and other aspects of face-to-face social interaction did not lead to the treating of other participants as machines. This was expecially notable since, although most of the participants were known to one another by reputation, many had never actually met. Even though they were "meeting" for the first time via computer conference, they were friendly.

This social cohesion did not come about immediately. It took nearly a year for it to grow to the point that it was noticeable. We believe this is a necessary element of computer conferencing. People who are not already well acquainted are going to need time to achieve cohesion as a social group. As long as a year may be necessary in the case of a computer conference.

b. ACTION AS A RESEARCH GROUP

We had expected the Futures Research conference to act as a research group. We expected to see a great deal of interaction with regard to ongoing research, with people modifying their research programs in response to what they learned from others in the conference. Except for the requests for data and references mentioned above, there was none of the type of activity we expected to see. Nevertheless, we believe the participants in the conference achieved cohesion as a research group.

Rather than exchange information on current research, the participants discussed the basic nature of the field in which they were involved. For instance, there was an extensive discussion/debate carried on in preparation for the World Future Studies Federation conference in Berlin. There also were extensive debates on freedom and on energy. All these debates were rooted in notions of what the field of Futures Research was all about. Their activity as a research group, then, involved a debate about the common enterprise in which they were engaged. For a field such as Futures Research, this may be of greater importance than the details of current work. It is unlikely, for instance, that the results of one researcher's work are going to have a major impact on the research program of a colleague. It is more likely that the activities of a Futures Researcher will be determined by his fundamental ideas about the nature of Futures Research. A debate within the community about the nature of the field itself will thus influence the work of the participants, although this influence may be difficult to trace. But the work of one researcher is not going to be affected by some "hot data" out of a colleague's program, as might be the case in high-energy physics, for instance. Thus, in retrospect, the kind of behavior we saw is the kind of behavior that is appropriate to the subject area the conference participants were working in.

Cohesion as a research group was not achieved until about a year after the start of the conference. Probably the cohesion as a research group is not distinct from cohesion as a social group. After about a year, the participants began to see themselves as a coherent group with both social and professional aspects to their interaction. This suggests that group cohesion will take time to achieve in a computer conference, but that when it is achieved it will involve both the purpose for which the group was formed, and the social norms which the group observes in its interactions.

An important point regarding group cohesion is that the specific indicators we expected to see did not appear. The fact of group cohesion would not have been recognized had we depended solely upon a mechanical search for certain types of communications. We were able to recognize group cohesion after it appeared because we were sensitive to the interactions among the participants. The moderator was observing the group from the viewpoint of an active member of the field, and the assessor was viewing it from the standpoint of a social scientist studying group behavior. Active participation was essential for providing a "feel" for what was actually taking place.

c. PRIVATE CONFERENCES

The Futures Research conference had another kind of impact on the entire Futures Research community. This impact originated from the private conferences established to discuss particular specialized topics. While these involved only people already participating in the Futures Research conference, their effects will be felt throughout the entire community.

Two of these conferences were highly successful. These were the conferences on Structural Models and on Cross Impact Models.

Structural Models are a class of mathematical models which is widely used in the Futures Research community. They are intended to deal with situations in which structure is more important than absolute magnitudes. Systems involving feedback, in particular, exhibit this type of behavior. The feedback dominates the behavior of the system, regardless of the actual magnitudes of inputs or flows through the system.

Cross Impact Models are another important class of models used in the Futures Research community. They are employed when several entities are forecast independently, but the future behavior of the system will depend upon the interactions among the entities. Then the forecast of any of the entities must take into account the forecasts of all the others. Clearly this is an impossible task. Thus, in practice, each entity is forecast on an "all other things being equal" basis. Then the "cross impacts" among the individual forecasts are identified. A Cross Impact Model, then, takes as input the set of forecasts for the individual entities, and the set of cross impacts. It produces a "future history" by simulating the passage of time. As each individual forecast does or does not occur, the proper impacts on the others are accounted for, and these modified forecasts are then incorporated in the simulation from that point onward.

The most important point about both Structural Models and Cross Impact Models is that work on these techniques was in the past carried on by several individuals who were strongly involved with one of these techniques, for one reason or another. However, while each of these individuals was aware of most or all of the others working in the same area, there was little communication among them. They worked in isolation from one another, refining their own work but having little interchange of ideas with others doing similar work. This lack of interchange revealed itself almost immediately when the two conferences were started. Individual workers had been calling markedly different concepts by the same name, or on the other hand using different terms for essentially a single concept. This led to a great deal of confusion in the early stages of each conference. Perhaps the most significant effect of these two conferences was to indicate the degree of confusion which prevailed. During the course of the conferences, some degree of agreement was reached on proper terminology, although there were still some disagreements remaining. More important than agreement on terminology, however, was agreement on the very nature of the topic area involved. For instance, those in the Cross Impact conference started with radically different notions of what a Cross Impact Model was. The result of the conference was not to reach a single definition, but to recognize that Cross Impact Models were a class of related items. By the time the conference wound down, there was fairly general agreement on a taxonomy for Cross Impact Models. Each participant was able to see where his type of model fit into the overall scheme, and how it related to all the other Cross Impact Models the other participants were using. The same sort of agreement on taxonomy was reached in the conference on Structural Models.

This agreement on the nature of the area in which the conferees were working is bound to have a major impact on the remainder of the Futures Research community. Once the isolation between individual workers has been broken down, it is likely that the understanding reached will spread through the Futures Research community by other channels. However, it has to be recognized that these other channels are sparse and slow, hence it may take some time for the full impact of the two conferences to be felt.

While the Cross Impact and Structural Models conferences were highly successful, some others were unsuccessful. Perhaps the least successful was that on "Teaching Futures." This included several persons who were engaged in teaching Futures Research courses at various universities. The conference was started in the hope that it would provide a channel for exchange of ideas, discussion of successful and unsuccessful approaches, and exchange of course materials (for most futures courses, there are no adequate textbooks, hence each instructor must develop his or her own course materials). The conference did lead to exchange of course outlines and reference materials, but did not develop to the extent we had expected.

About the only accomplishments of this conference were the exchange of course outlines and exchange of some specific course materials. There was very little discussion of successes and failures, or of approaches found to be effective or ineffective. This conference, then, will have virtually no effect on the remainder of the Futures Research Community.

In terms of impact beyond the participants themselves, the results of the private conferences represent a mixed bag. Some were highly successful, and their success will be propogated beyond the immediate participants. Others were unsuccessful, and will have little or no effect beyond the immediate participants. The degree of success or failure seemed to be correlated with the activity of the conference moderator, and to some lesser extent, with the enthusiasm of the other participants.

USE OF EIES TO REPLACE OTHER COMMUNICATIONS MEANS

Initially, it had been assumed that EIES would be used to take the place of communications channels that were lacking in the Futures Research community. However, many of the participants made use of the system for communications that would have taken place by other means in the absence of EIES.

One frequent use of EIES was the arrangement of meetings and visits. When one of the participants was anticipating a visit to the same city as another paticipant, a meeting schedule was worked out via EIES. Ordinarily this would have been done by mail or telephone. We had not expected to see EIES used for this purpose. But most arrangements of this sort can be made "asynchronously." There is no need to have both parties on the telephone simultaneously. On the other hand, mail may be too slow if a trip is scheduled at the last minute, or if frequent changes in schedule are necessary. EIES handles both problems nicely. Hence use of EIES for this purpose is quite natural. In retrospect, we can see that this was simply a way of taking advantage of the natural superiority of EIES for this particular type of communication.

Another use of EIES, already mentioned, was to transmit book reviews to a journal for publication. In the absence of EIES, this would have been done by mail. However, EIES presented the possibility of having these reviews critiqued by other participants before submission to the journal. Some participants took advantage of this capability of EIES, and used it in place of the more conventional means of communication.

Related to use of EIES for book reviews was the use of EIES for drafts of articles (also mentioned above). This offered the same advantages as did use of EIES for transmitting book reviews. It allowed critique by interested and knowledgeable participants prior to publication.

The uses of EIES in place of more conventional means of communication always took place in circumstances in which EIES offered some advantage. The two advantages which seem to have been most important in the substitution of EIES for conventional means of communication were the advantages of asynchronous communication (especially across time zones), and the opportunity for critique by others. We believe this indicates that EIES has unique features which make it not strictly comparable with other forms of communication. In particular, it has advantages which will cause it to be preferred to more conventional means of communication for certain applications.

Some Inferences

We had anticipated that EIES would be used to make up for what we saw as shortcomings in the communications channels available within the Futures Research community. This led us to expect certain behavior on the part of EIES users. In the main, we did not see the behavior we expected. Nevertheless, we did see behavior that indicated the existence of group cohesion. The deviation of actual behavior from expected behavior leads us to draw certain inferences about both the Futures Research community and about EIES.

First, the Futures Research community does not have a felt need for the infrastructure which is a standard feature of most other scientific communities. Futures Researchers are used to working in isolation, and do not seem to need the frequent interaction with their peers which is standard practice in other research communities. Despite the lack of a felt need for interaction, however, we infer that the Futures Research community actually suffers from lack of communication. This is evident from the behavior in two private conferences, Structural Models and Cross Impact Models, which led to considerable interchange of opinion and the resolution of many unsettled items. Specialists in these two topics did in fact make heavy use of EIES to present their views and debate the views of others.

Second, collaboration on research by members of the Futures Research community is virtually nonexistent. Whether this is because of lack of communication, or whether the lack of communication reflects the lack of felt need to collaborate, was impossible for us to determine during the course of this experiment. Nevertheless, some participants demonstrated that EIES was well suited to permit collaboration. Despite this demonstration, most participants failed to take advantage of EIES for writing of joint papers. However, they did take advantage of EIES for certain specific activities such as preparation for meetings.

Third, we infer that the members of the Futures Research community do feel a need to communicate on a variety of topics, whether or not these are closely connected with their research interest. This is indicated by the large number of conference comments actually generated. The total output of the participants represents a significant amount of activity. Some participants were, of course, more active than others, but in general most participants remained "active even if at a modest level. The participants were investing their own time in composing and reading comments. This time was actually more valuable than the EIES connect time which was being paid for under the grant and therefore not charged to the individual users. The participants would not have put in that much time had they not felt they were receiving a commensurate benefit.

QUANTITATIVE ANALYSIS

A popular article about the EIES trials discussed them as "superliteracy." Participants often used the phrase "information overload," particularly in the early months. One of the most salient facts about our experiment with computerized conferencing is that a tremendous amount of reading and writing was accomplished by all the active participants. As one way of depicting the immense volume of communication that took place, the assessor cut the 8 1/2 inch wide paper that emerged from his terminal into 11 inch lengths, then stored each day's printout in a file folder. By the end of the 27 month trial period he had over 3 feet (36 inches) of files.

There is virtually no limit to the kind and depth of analysis which could be carried out on the wealth of material we gathered. In view of our limited resources, we have concentrated on the qualitative analysis that is found in other sections of this report.

Nonetheless, we have done some experiments with quantitative analysis, principally in the form of content analysis. We developed one form of content analysis tailored to our particular conference, and tried another that has been widely used over the past 30 years.

Analysis by 'Tailored' Coding Categories

In our "tailored" scheme, 13 coding categories were developed simply by starting at an arbitrary point in the conference and, for each succeeding comment, determining the intent of the commenter. The process was stopped after 21 comments were analyzed. The coding categories were:

1. Summarizes previous discussion.
2. Adds statistical or factual information.
3. Poses a related question.
4. Evaluative comment on EIES and/or the conference.
5. Calls for clarification of previous statement.
6. Expresses general view with logical but not empirical support.
7. Agrees with previous position.
8. Personal note.
9. Response to call for clarification.

10. Disagrees with previous position.

11. Agrees and provides more detail.

12. Poses new question.

13. Provides bibliographical reference.

The table below shows the results of the analysis. Each comment ("Comment No.") represents an instance of participation, and may include more than one sentence. Each participant ("Member") is represented by a letter of the alphabet. Each coding category ("Code") is represented by its number.

ANALYSIS OF 21 COMMENTS IN THE FUTURES RESEARCH CONFERENCE
USING "TAILORED" CATEGORIES

COMMENT NO.	MEMBERS	CODE
1	A	1,2,3
2	B	4,5,6,7,5
3	C	4,8,4
4	D	4
5	E	5,9,5,5,5
6	E	10,5,7
7	E	9,9,5
8	E	7,5
9	C	7,2,6,6
10	F	7
11	C	4,6
12	G	11
13	A	10
14	C	4,8,4
15	C	4
16	H	12
17	H	13
18	E	4
19	E	9
20	E	5
21	E	11

This brief analysis indicated some things that otherwise were not readily apparent. The most frequent category was 5: Call for clarification of previous statement. This characteristic of the communication in the conference distinguishes it from other types of communication such as letters to the editor, and also supports the notion that science is more a matter of refining, testing, and falsifying ideas than generating new ones. In this sample there were nine calls for clarification but only four responses to calls for clarification. If this sample is representative of the conference as a whole, the communication that occurred here was similar to what anthropologist Ray Birdwhistle has found in U.S. family interactions. Requests are very frequently ignored. In the sample analyzed there was considerably more agreement with positions taken than disagreement. New questions were posed infrequently (only once in these 21 comments). There seemed to be more evaluative comments about the conference than our subjective awareness indicated.

CONCLUSIONS

We have drawn the following conclusions regarding EIES from our experiment with its use by the Futures Research community.

First, the high level of usage by a self-selected subset of those initially invited to participate indicates that EIES has a great deal of potential for communication within a scientific community. We believe that in this experiment EIES clearly demonstrated that it has potential, even though some of that potential was not fully exploited. Indeed, we conclude that computer conferencing is not going to disappear. The only real question is how rapidly it will spread.

Second, despite its ultimate potential, EIES is largely still in the "technological toy" stage. This is in part due to its limited degree of spread. The situation is much the same as that of being the first person in town to have a telephone. Whom do you call? At present, many of the persons with whom the participants might have wanted to communicate with were not using EIES (or had already become dropouts). Only when a system like EIES becomes more widespread will it realize its full potential. In the meantime, the glamor of EIES as a technological toy may tend to obscure some of its potential. It will not fully realize its potential until people quit being fascinated by it and start using it as a tool instead of a toy.

Third, despite the problems, this experiment did demonstrate the utility of EIES for many of the uses to which a scientific community might wish to put it. It can satisfy communications needs which no existing medium can satisfy. Moreover, it even demonstrated that it could supplant certain conventional means of communication for applications in which it offered a competitive advantage.

EVALUATING THE ROLE OF COMPUTER CONFERENCING IN PLANNING THE WHITE HOUSE CONFERENCE ON LIBRARY AND INFORMATION SERVICES: A CASE STUDY IN UNEVEN RESULTS

by

Elaine B. Kerr

This is a report of the application of computer-mediated communications to the planning, reporting, and implementation of a national conference.

The White House Conference on Library and Information Services was formally convened in Washington, D.C. in November, 1979. But the meeting was preceded by many months of planning, decision making, discussion, and review. Beginning about six months before the delegates actually gathered, the last stage of planning involved the use of the Electronic Information Exchange System. With resources provided by the National Science Foundation, Texas Instruments Corporation, and volunteers on the EIES network, key members of WHCLIS used electronic communications for much of their pre-Conference work.

At the Washington meeting the system was used to record much of the Conference activity for those on-site and elsewhere around the nation, and after the Conference was over, it was used to coordinate implementation activities.

WHCLIS' use of EIES was the first application of this computerized conferencing system to the planning and management of a large-scale national meeting. As such, the results of this exercise are of interest to those directly involved, those responsible for implementing the results of the Conference, designers and other concerned users of EIES, and those considering using computer conferencing for similar purposes.

This forty-one member group was composed of an Advisory Committee, Staff, and consultants located in seventeen states. It was a well-educated, older, and egalitarian group, spanning a wide variety of professional backgrounds. The Advisory Committee, unlike many, was legally mandated to actively participate in the decision making processes.

Since the great pressure of time in which to accomplish the work was a tension-producing factor, it was concluded that the earlier introduction of EIES into the WHCLIS planning effort would have been advantageous to both goal achievement and a more relaxed learning atmosphere.

From the perspective of EIES, WHCLIS represented a somewhat unusual user group, both because it was task oriented rather than exploratory, and because it operated with tight deadlines and closely defined goals. On the other hand, it did resemble other user groups in terms of size, geographic dispersion, and mixture of staff and advisory group.

No special interface was used, and little use was made of advanced features available on EIES. Communication exchanges were essentially limited to the messaging and conferencing segments of the system.

Because of these kinds of factors, the author of this report, as an experienced user of the EIES system, assumed the task of facilitating the effort. Responsibilities included coordination, basic training and general orientation, monitoring all conference and notebook proceedings, documenting system usage, linking the implementation and programming staffs, time management and allocations, participating in policy decisions as to the usage of the electronic medium, demonstrating the system at the Conference in November, and evaluating the overall effort. This was a very specialized, intense, and focused kind of user consulting compared to that which is offered general users of the EIES system.

METHODOLOGY

This report is essentially a chronicle of the process. It uses both participant and non-participant observations, records of on-line monthly traffic, usage statistics, and pre- and post-use questionnaire surveys of the participants to illuminate the impact of the medium.

A number of usage statistics are automatically collected and stored in the EIES computer. Users can access data about themselves, and the group coordinator and evaluator additionally can access information about both the group and specific members. Data presented here and elsewhere, however, reflect usage made either by the group as a whole or categories of users, rather than individuals, since the latter information is considered private and confidential. Data about individual users for this report were examined only for aggregate purposes; the text of private messages was not and cannot be examined.

This is more a compendium of "lessons learned" than a documentation of a formal experiment in which precise hypotheses are tested under controlled conditions. Since both the Conference and the use of EIES were innovative applications of an evolving technology, it seemed more reasonable to offer a detailed account of what transpired, with sensitivity to unexpected events and what can be learned from hindsight.

QUALITATIVE FINDINGS

Both the initial mode in which the concept of computerized conferencing is presented and the initial training experience impact upon future acceptance and use of the system.

A presentation of the system was made to a meeting of the Advisory Committee and Staff in Washington, D.C. prior to the beginning of the project. Following a brief introduction to the nature of computer conferencing, nine representatives of EIES demonstrated the system to training groups of four or five people. At a Texas Instruments session in which terminals were distributed, two EIES members supplemented terminal instructions with orientation to EIES. Face-to-face tutorials were later held with most of the Staff members and with two Advisory Committee members; several lengthy phone sessions were conducted when electronic connection was a problem; and these efforts were supplemented by considerable on-line facilitation and consulting.

But the pattern of initial usage was very uneven, such that the group's initial startup experience was sporadic and difficult. Seven of the eight staff members were on line by mid-June, whereas the members of the Advisory Committee signed onto EIES for the first time during a period extending from mid-June through the end of the summer. At least two of the seven months of the project represented its starting point, during which users acquired terminals, first signed on line, and began learning the basic mechanics of using the system. This time lag impeded the initial operation, since the WHCLIS staff and EIES observers came on line well before the members of the Advisory Committee; yet the real work of the group could not begin until the Committee had come on line and become acclimated to using the system.

An expected and normal amount of fumbling, typical of new users learning a different mode of communicating, was largely responsible for the slow start. System malfunctions, many "normal" in the sense that EIES is an evolving research effort rather than a more fixed and predictable commercial system, also contributed to some user problems. An additional factor was the relatively low usage of EIES by a few key people in the WHCLIS effort, such that there was a lack of positive role modelling.

Users had significant problems in actually beginning to use EIES. The initial training session on May 9 was held almost two months before most received their terminals and signed on line. By that time, much of the training itself and the explanatory materials distributed at that session had been lost or forgotten.

Adjusting to the intricacies of intelligent terminals was a major problem, impeding effectiveness and making access to EIES more difficult. The capabilities of the Texas Instruments Model 765 Memeory Terminal far exceeded the requirements of the EIES system. Although it offered the opportunity for off-line composition, which if facilely used could have saved both connect time and costs, in fact only four WHCLIS members learned any of these routines and none became adept at them. The presence of these advanced technological features ironically acted as an impediment, since beginners tended to confuse the features and requirements of the terminal with those of the computer conferencing system. The recommendation therefore is that "dumb" rather than intelligent terminals be used whenever possible for new users.

The presence of a dedicated User Consultant, coupled with face-to-face training, was a major factor in overcoming many of the initial problems and barriers.

An on-line file was maintained with questions and responses to user problems. These questions ranged from the simple mechanics of how to use the system to various kinds of facilitation, teaching advanced features, and policy decisions relating to the group's work. 535

items were entered in eight months, representing 901 separate requests for help which included in order of frequency: general usage problems, how to use the conferencing system, how to use the messaging system, features of the text editor, how to use the notebook system, and the use of special features. Many of these requests for help contained multiple questions and others included unsolicited suggestions to users when problems were spotteed of which they had been unaware. Tabulation was by number of user requests. Often each request involved two or more communications: one with the original question, one in response with the answer, and frequently further questions or applications suggested afterward. Both the length and time span, then, varied.

Scanning the range of requests within each category provides an overview of the kinds of problems experienced. It should be noted that "general usage problems," such as difficulties with terminals or logging on, were far more characteristic of the earlier than later users. For example, terminal interface problems, or problems of adjusting to the complexities of the intelligent terminal, were generally overcome within the first month of use. Similarly, the category of "help in getting started for new users, general facilitation" required the facilitator to work intensely with novices who only occasionally needed this kind of aid after becoming used to the system. Some of the problems indicated, such as setting the network to half duplex, signing off line, modifying conference comments, and adding members to an existing conference, were of a mechanical nature. Others involved coordination, linkage, and policy, as in establishing new conferences, suggesting general organization and norms such as messaging etiquette, and linking with non-group users on line.

The pattern of requests for assistance and facilitation was very uneven. There was a lag of several weeks before new users felt sufficiently comfortable with the basic mechanics of using the system to be aware of just what questions they wished to ask and which paths they chose to explore. The number of requests for assistance resembles a normal distribution curve, with a slow start, gradual buildup hitting a peak at the end of August, and then a rather steady decline.

Almost half the members used relatively little of the on-line help available to them, whereas others were disproportionately heavy in their requests for assistance. The mean number of requests was 30.3.

Help was needed, given, and used, but the reasons why some took greater advantage of it than others cannot be completely determined. To this researcher, the six users requesting the most help were also the most enthusiastic about EIES as a communications medium, but this impression might be spurious in that I became best acquainted with those who communicated most with me on line.

The number of requests for help varied directly with the amount of time spent on line:

TABLE 1
AMOUNT OF TIME ON LINE BY NUMBER OF REQUESTS FOR HELP

	Number of Hours on Line		
Number of Requests	1-15	17-29	Total
12- 30	17 (94%)	8 (44%)	25
33-104	1 (6%)	10 (56%)	11
Total	18(100%)	18(100%)	36

While most of those spending relatively little time on line made comparatively few requests for help, those with more time on line were more evenly divided, suggesting that time on line alone is not a complete explanation. Some users prefer requesting human help, others choose the documentation, and some opt for a mixed mode of getting help. Requests declined after the basic learning mechanics were mastered. Further questions began to lead the users into more advanced applications of the EIES system.

QUESTIONS:

What can be done to shorten the learning and adjustment period for this kind of user group? Given that the mean age was somewhat higher than average, and that it was accompanied by a discomfort with computers, it appears that a more efficient learning protocol might be determined.

What incentives can be found to motivate regular usage of the system, since the uneven pattern of usage especially by key members within the group produced problems and decreased the optimum impact of the computer conferencing medium?

The question of measuring effectiveness has been a major issue in evaluation research, stemming in large part from determining which criteria are appropriate to use.

In terms of goal achievement, three of the six definite goals initially held by the group were achieved, as well as one of the four tentative goals.* But, was this a 75% or a 40% success rate? How can this kind of measure be used in comparison with other groups? Are cross-group goals comparable?

On a cost-effectiveness basis, the project was clearly successful, since the cost of using EIES were clearly below the more frequent use of telephone, mail, and meetings which preceded their use of the system.

These questions cannot be answered in a simple "yes or no" manner. Surely, the White House Confeerence would have been planned and held even without the communication capabilities of EIES. There are strong indications, however, that the Conference pre-planning was made more efficient and less expensive because of the presence of EIES.

This is not to say that if we could redo the effort, changes would not be made. There was no need for terminals with built-in memories for off-line composition; simpler terminals and therefore simpler and shorter training sessions would have encouraged greater use of the system by more participants. The initial training should have been more intensive and more face-to-face, rather than largely on line to repeat basics and undo misunderstandings stemming from the training sessions. Refraining from supplementing EIES training materials by phone calls and mail to those not choosing to sign on early and regularly might have motivated those diffident members to be more active on-line. Since the key to effective results from any computerized communications system is regular usage, providing incentives for greater participation would have been helpful. Finally, the earlier introduction of EIES into the WHCLIS effort would have increased the effectiveness of the system.

*The initial goals of WHCLIS for using EIES included:

1. Linking the Advisory Committee members with each other and the Staff;

2. Internal Staff communications, especially when travelling;

3. Gathering resolutions from the preparatory state-level conferences;

4. Handling the selection of the national delegates: processing nominations, linking the subcommittees and establishing guidelines;

5. Possibly commissioning, drafting, and editing position papers;

6. Possibly establishing an on-line newsletter;

7. Possibly recording resolutions and votes during the Conference;

8. Demonstrating interactive computer conferencing as a communication and information tool at the Conference;

9. Possibly establishing an automated inquiry-and-response-type application for library and information science concerns;

10. Follow-up after the Conference to aid in implementing the recommendations.

QUANTITATIVE FINDINGS

PRE-USE QUESTIONNAIRE

A number of cross-tabulations were run to determine if the attitudinal responses to the pre-use questionnaire were correlated with actual usage of the EIES system. The cumulative time used on line was used as the dependent variable.

No relationships were found with amount of use and reading speed, feeling more persuasive when speaking rather than writing, and attitudes towards computers.

There was a strong and positive relationship between perceived typing skills and amount of time spent using EIES, with those rating their typing skills as casual to excellent spending considerably more time on line. This suggests that typing, as a component of perceived ease of using the system, had both an attitudinal and mechanical impact as an enabling factor on actual usage:

TABLE 2
TYPING SKILLS BY TIME USED ON LINE

Question: How would you describe your typing skills?

	Number	Hours on Line
(1) None	1	19.7
(2) Hunt and peck	3	20.9
(3) Casual (rough draft with errors)	7	42.6
(4) Good (can do 25 w.p.m. error free)	3	31.8
(5) Excellent (can do 40 w.p.m. error free)	6	37.1
Total	20	34.9

Previous use of computers and terminals was also related to the amount of EIES use, suggesting a second factor incorporating both attitudes and skills:

TABLE 3
PREVIOUS USE OF COMPUTERS AND TERMINALS BY TIME USED ON LINE

Question: Have you ever used computers or computer terminals before?

	Number	Hours on Line
(1) Never	8	28.5
(2) Seldom	7	40.4
(3) Frequently	5	38.2
Total	20	35.2

Pre-use attitudes about the anticipated worth of EIES to their work produced the strongest relationship with actual use:

TABLE 4
ANTICIPATED WORTH OF EIES BY TIME USED ON LINE

Question: "Which of the following best describes your anticipation of the System's worth?"

	Number	Hours on Line
(1) I think it will be useless	-	-
(2) I think it is useful for others, but not for WHCLIS	-	-
(3) I am skeptical about it but willing to try it+		
(4) I am basically indifferent or netrual+		
(5) I think it will have limited, but some worth for WHCLIS	6	19.8
(6) I think it will be useful in many respects	8	25.4
(7) I think it will revolutionize WHCLIS's work/ communication process	6	63.5
Total	20	35.2

And those who expected using EIES to save them time rather than cost them time were far more likely to use the system extensively:

TABLE 5
ANTICIPATED RELATIVE TIME BY TIME USED ON LINE

Question: "Compared to the conventional means of communicating with the WHCLIS Advisory Committee and Staff, do you expect EIES to:

	Number	Hours on Line
(1) Involve less of your time	8	45.3
(2) Involve more of your time	9	29.3
TOTAL	17	36.8

POST-USE QUESTIONNAIRE

For only two variables, no significant changes were discernible for the group as a whole:

o The proportion feeling they were more persuasive when writing than when speaking (perhaps they had not been on EIES long enough for this to have an impact).

o About half expected and about half found the private message and group conferencing systems to be the most useful aspects of EIES. (As a group, they did not explore the more complex features available on the system.)

Nine questions measured their impressions of the perceived overall utility of the system:

o Far more agreed than disagreed that EIES had a positive impact on the quality and quantity of their work, as well as their "stock of ideas" and group effectiveness.

o Supportive evidence for the cost effectiveness of computerized communications is provided by the majority who said it had decreased their use of telephone, travel, and mail.

o Twelve of 17 perceived an impact on their general modes of thinking and working.

o Eleven of 15 felt they had received more than they had contributed.

There was a positive change over time in the group's attitude toward computers in general, with an increase from 75% to 85% of positive ratings.

Impressions of the degree of group cooperation and cohesion increased, with 32% rating it as strong or very strong at Time 1 and 42% at Time 2. There is, of course, no way of knowing how much of this increase was a function of the group's working together over time and how much would have taken place even in the absence of EIES.

The number considered to be professional colleagues increased over time. When the data are confined to those responding at both points in time and abstentions are eliminated, this was found to vary directly with total time used on line. Those interacting on EIES more intensely with their group members were more likely to experience an increase in the number they perceived to be colleagues:

TABLE 6
COLLEGIAL RELATIONSHIPS BY TIME ON LINE

	Number	Hours on line
Increased in Number	5	47.1
No Change	8	36.3
Decreased in Number	1	4.2

The number of personal friendships also increased substantially over time, with a similar pattern according to time spent on line:

TABLE 7
PERSONAL FRIENDSHIPS BY TIME ON LINE

	Number	Hours on Line
No Change	4	16.3
Increased by 1	2	28.1
Increased 2 - 6	10	39.7

The expected mode of working with EIES, by either typing the material oneself, having it entered by someone else, or a combination of these two, was with two exceptions carried out. Those who did their own typing spent much more time on line than those who did not, suggesting that the experience of interacting with the system itself was reinforcing in leading to activities other than those that had been anticipated when first signing on line:

TABLE 8
MODE OF INTERACTION BY TIME ON LINE

	Number	Hours on Line
Typed it themselves	15	37.9
Both	3	20.1
Had it typed	1	6.6

Overall evaluation of the worth of EIES increased over time. With possible scores ranging between a low of 1 and a high of 7, the mean score at Time 1 was 5.7 and at time 2 was 6.0. Those who responded to both questionnaires, with one exception, were more favorably disposed toward the system's worth as time passed:

TABLE 9
CHANGES IN EVALUATION OF SYSTEM OVER TIME

	TIME 1				
	Skeptical	Neutral	Limited Worth	Useful	Revolu-tionary
TIME 2					
Limited Worth	-	-	2	2	-
Useful	1	1	-	1	-
Revolutionary	-	-	2	3	3

As was true of pre-use attitudes toward the worth of EIES, post-use attitudes were also directly related o the total time spent on line:

TABLE 10
EVALUATION OF SYSTEM BY TIME ON LINE

	Number	Hours on Line
Skeptical	1	9.4
Limited Worth	5	31.4
Useful	6	27.1
Revolutionary	8	46.9

At both Times 1 and 2, the group was about evenly divided as to whether EIES would or did involve more or less of their time than conventional means of communicating. However, many switched their positions over time:

TABLE 11
CHANGES IN COMPARATIVE TIME OVER TIME

	TIME 1			
	Less Time	More Time	Same Amount	Total
TIME 2				
Less Time	1	3	-	4
More Time	3	2	1	6
Same Amount	1	2	-	3
Total	5	7	1	13

Those who at Time 1 had expected EIES to save them time were more likely to use the system frequently. At Time 2, however, those who felt that EIES had involved more of their time had in fact spent considerably more time on line:

TABLE 12
COMPARATIVE TIME BY TIME ON LINE

	Number	Hours on Line
EIES involved less time	7	23.0
EIES involved more time	6	60.7
Same amount	3	16.0

The impact of the system on perceived productivity was considered in terms of both quality and quantity of "work recently completed or underway." Although the group's "vote" was favorable to EIES in both cases, the two components of productivity were not completely correlated with each other:

TABLE 13
IMPACT ON QUALITY BY IMPACT ON QUANTITY OF WORK

	Quality Increased			
	Agreed	Neither	Disagreed	Total
Quantity Increased				
Agreed	6	3	-	9
Neither	-	5	-	5
Disagreed	-	1	2	3
Total	6	9	2	17

Perceptions of the effect on both quality and quantity were also related to time spent on line, suggesting that the positive impact of EIES increased linearly with use:

TABLE 14
IMPACT ON QUALITY OF WORK BY TIME ON LINE

Quality Increased	Number	Hours on Line
Agreed	7	46.9
Neither	9	25.6
Disagreed	2	31.2

TABLE 15
IMPACT ON QUANTITY OF WORK BY TIME ON LINE

Quantity Increased	Number	Hours on Line
Agreed	9	39.2
Neither	5	27.9
Disagreed	4	25.0

Although there was strong agreement that "use of EIES has increased my effectiveness as a member of the WHCLIS group," (13 to 2), this was not related to average time spent on line. This was also the case for increasing one's "stock of ideas" (13 to 1). Although 11 of 15 felt they had received more from EIES than they had contributed, this too was unrelated to time spent on line.

The responses to inquiries about the effects of the system on use of telephone, travel, and mail were positive and interrelated:

TABLE 16
EFFECTS ON TELEPHONE, MAIL, AND TRAVEL

	TELEPHONE: Decreased		TELEPHONE: No Effect	
	MAILS: Decreased	MAILS: No Effect	MAILS: Decreased	MAILS: No Effect
TRAVEL				
Decreased	4	1	3	1
No Effect	1	1	-	4

All except four users saw at least some increase in cost-effectiveness. The dissenters used an average of 26.9 hours of time on line, compared with 33.6 for the others responding to this questionnaire, suggesting that perhaps in fact for them it was less cost-effective. The four finding the system most cost-effective (saying that it had decreased use of all three other media) averaged 61.0 hours on line.

Those who found that EIES had had an impact "on the way in which you think and work, in general" had spent twice as much time on line compared with those who reported no impact:

TABLE 17
IMPACT ON THINKING AND WORKING BY TIME ON LINE

	Number	Hours on Line
Reported an Impact	12	40.5
Reported no Impact	5	22.6

CASE STUDY

JEDEC/EIES PROJECT

USE OF ELECTRONIC INFORMATION EXCHANGE IN DEVELOPING STANDARDS IN THE ELECTRONICS INDUSTRY

by

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INTRODUCTION AND PROJECT BACKGROUND

The Joint Electron Device Engineering Council (JEDEC) Solid State Products Council, under the aegis of the Electronic Industries Association (EIA), is an association of firms concerned with the manufacture of solid state electronic components. JEDEC's standardization activities are conducted by a series of numbered committees (e.g., JC-42 Committee on Semiconductor Memories) and decimal numbered task groups within the larger committees. The numbered committees generally meet quarterly in various locations around the U.S. Members of task groups communicate to varying degrees between meetings by phone or mail or both.

After a newly proposed standard is formulated in a task group and discussed in committee, a (mail) letter ballot is then issued for approval (comments optional), disapproval (comments required), or abstention. After the letter balloting process has eliminated nearly all errors and controversies, a JEDEC Council ballot is issued as the final step before publication of the standard. JEDEC operates under EIA administrative and legal procedures.

From September, 1978 through April, 1980, several JEDEC committees and task groups used EIES, the Electronic Information Exchange System, as a test facility to see if the use of electronic information exchange would facilitate and make more productive regular JEDEC committee/task group standardization activities, particularly in the areas of microcomputer/large scale integration (LSI) products, with special attention to microprocessors.

The project proposal to the National Science Foundation suggested that greater facility and/or productivity might be achieved in the following ways:

Less elapsed time in arriving at standarization decisions

A broader base of relevant information on which to base standardization decisions

Less need to reconsider issues due to inadequate initial formulation of questions for discussion and voting

More timely input from groups affected by industry standardization (e.g., customers); that is, before, rather than after industry decisions

More effective advancement of the state-of-the-art in related technologies because of greater awareness of interface considerations

Reduced need for face-to-face meetings, associated travel and time away from other duties

Unlike some of the other electronic information exchange (EIE) operational trials groups, the JEDEC group had a history of regular meetings and tasks and so presented an interesting opportunity to see if task-oriented groups use the medium differently than those with broader communications needs.

Participants

During the twenty months of the project, 77 members were provided with EIES accounts. Of these, 58 members (75.3%) used the system at least once. Over half (53%) of the members were established on the system during the first two months of the project. Some inactive members were replaced throughout the twenty-month period, but 19 (24.6%) members never used the system at all. At times there was a shortage of available accounts, and some JEDEC task group members who wanted accounts never got them.

With the exception of two female assistants to J. F. Hessman who used the system briefly at the beginning of the project, all participants were men. Information about other participant attributes came from the 34 members who returned baseline questionnaires. These members had an average age of 41, 57.9% had graduate degrees, and 62.5% were managers or supervisors of departments or groups within the corporations and institutions they represented. Almost all of them had used a computer terminal before, and those who used EIES the most (based on number of hours on line) had used terminals for text editing, information retrieval, and data entry primarily, rather than for programming and data analysis, and only occasionally for games. Only 18% had used an electronic mail or messaging system before.

Using electronic information exchange requires at least minimal typing skills and access to a computer terminal. Two-thirds of the members (66.6%) described their typing skills as hunt and peck or casual; no one said he had no typing skills at all. Three-quarters (75.7%) had to share a terminal with others, 21.2% had their own terminals at their offices or places of work, and 1 person who completed the baseline had no terminal at that time. In addition, 45.4% of the members had terminals at home or which they could take home.

Members were asked about why they were participating in JEDEC and in the JEDEC/EIES project. Taking first and second mentions of reasons, 23 people said they were participating in JEDEC because it was part of their job in some way, and 11 said they wanted to work with others on standards. Other reasons had only one or two mentions. Twelve people mentioned participating on EIES because of a belief that EIES would help or that they believed in the medium, 8 wanted to learn about computer conferencing, 6 wanted to participate in standards work, and 5 wanted to see if it would work. Other reasons had one to three mentions.

Interestingly, when asked whether they expected EIES to take more time, about the same amount, or less time when compared to the conventional means of communication with their group, members were evenly divided.

Members had been working on 0 to 50 (mean = 4.2) JEDEC committees or task groups for 0 to 168 months, with a mean of 27.3 months. They had attended an average of 5.6 meetings in the previous year, at an average cost of $468.56 (standard deviation of $342.24).

As part of the baseline questionnaire, participants were asked to list hindrances to good standards decisions. The most frequently mentioned (by 11 members) was "unwillingness to discuss products (proprietary interests)."

Project Activities

The members of the JEDEC project were not a homogenous group; rather, they were members of many smaller task groups and projects, with only modest crossover between groups. During the course of the project, the following activities were begun:

- revision of MIL-STD-1331
- revision of MIL-STD-1313A
- development of designs for and standardization of memory chip carriers
- task group work for JC-42 committee on semiconductor memories
- top-down standardization work and IEEE backplane bus standardization
- revision of EIA #82
- other glossary/terms and definitions work
- introduction of computer conferencing within the international standardization community

A few of these will be described below, to give a feeling for the kinds of activities undertaken.

REVISION OF MIL-STD-1331

The first activity undertaken during the project was the revision of MIL-STD-1331, a military specification document on microcircuits. This work was to be done by JC-13.4, a task group from the JEDEC committee concerned with liaison with the military. The project facilitator and evaluator attended a face-to-face meeting of this committee in San Diego in December, 1978 to introduce them to computer conferencing and to begin work on the new terms and definitions for this document. Special software was developed for such glossary work (see section on DECISION-SUPPORT TOOLS below), and many terms and single definitions for those terms were added to the MILSTD glossary over several months. However, only a few people participated in the work, and the task leader found that most of the regular JC-13.4 members had no interest in the task. The project editor and longtime member of JC-13, suggested working instead on another military specification document which would be easier and would provide an early success on EIES. This led to work on MIL-STD-1313A.

MEMORY CHIP CARRIER STANDARDIZATION

The goal of this activity, led by Bob Vernon of Texas Instruments, was to define a family of chip carrier packages that are specifically designed for memory circuits, optimized for efficient board-matrix layout, and consistent with the families of chip carriers which have been submitted for registration by JC-11.3.1. The group was developing standards for something which doesn't yet exist, so the activity was a joint design exercise as well as the negotiation of a standard.

This group only existed as a group on EIES; they held no face-to-face meetings, and this activity brought together people from different disciplines who didn't know each other previously. In retrospect, Mr. Vernon believes that a face-to-face meeting would have been helpful to introduce members to each other and give the group a sense of identity.

Mr. Vernon also developed his own decision-support tool, +CHIPCHEK, for members to use in the evaluation of various proposed memory chip carrier configurations. This routine recorded anonymous data only, and there were eighteen configurations proposed and analyzed. (Since the data were anonymous, it is impossible to know how many people participated.) Mr. Vernon reports that important information came to light through this method of anonymous data collection.

In May, 1980, a standard for a pair of memory packages compatible with JEDEC leadless type C packages was initiated. A letter ballot was prepared at EIA/JEDEC headquarters during the summer. Mr. Vernon expects the letter balloting process to be completed during the first quarter of 1981.

TOP-DOWN STANDARDIZATION AND IEEE ACTIVITIES

Hermann Schmid (General Electric) has been working on the PROCESS of standardization by proposing a new approach: top-down, technology-independent, monolithic processor standardization. Working with several others, including Professor J. D. Nicoud (Swiss Federal Institute of Technology, Lausanne), Schmid began with the peripheral processor interface bus as a sample subject, and a special PPI glossary was set up for this purpose. Some sample specification modules for the S-100 bus write function (timing diagrams) were also developed.

Most recently, this group has been working on applying the approach of top-down standardization to the IEEE P-896 backplane bus standard. This activity has included European participation which has been important. As a result of this work, the IEEE has budgeted some funds to experiment with EIES as a working tool for subcommitee work.

PROJECT FACILITATION

Facilitation of the JEDEC project on EIES included managing the accounts with changes only being made with approval from the Principal Investigator, allocating time, welcoming new members and helping them find the proper JEDEC activities on line, user consulting, moderating most of the groups and conferences in the sense of acting as a gatekeeper, assisting members using intelligent terminals or microcomputers, sharing members' perceptions of the project from the evaluation data with all project members, and developing special software tools where appropriate.

Decision-Support Tools

Using INTERACT, the high-level programming language available on EIES, the facilitators developed several special programs during the project, and one member, Bob Vernon, created a design evaluation routine for those involved in the chip carrier activity.

+ANSWER

The +ANSWER program was developed so that members could answer the baseline questionnaire on line if they wished. The same questionnaire was sent out in the mail. It is interesting to note that 47% of those who responded to the baseline questionnaire used the +ANSWER program on EIES, rather than the mail version. Those who responded via EIES also were much more active users of the system (77.3 hours average use as compared with 13.9 hours average use for those who responded by mail).

+TERMS

The +TERMS system was developed to meet project members' needs to have a structured way to create a glossary of terms, alternative definitions, and comments, and to be able to vote on which definitions should be adopted. A software design conference, C646, was set up for those project members who wished to comment on the design of +TERMS and make suggestions for its features. About midway in the project, +TERMS was redesigned, again with participation from interested project members, to better meet their needs, especially for batch input of many terms and definitions composed off-line and for linking several glossaries together. Unfortunately, after the redesign and basic reprogramming, there was little use of +TERMS, so certain features, such as voting and linking glossaries, were never finished.

(In contrast, +TERMS was opened up to a non-technical group on EIES on an experimental basis by the facilitators. This second group used the software actively with little user consulting and no documentation. Perhaps their particular interest in developing a glossary with many alternative definitions was stronger than some JEDEC members' interest in specific, structured glossaries. It would be interesting to compare a divergent glossary process with a convergent one using EIES.)

+CHIPCHEK

Designed and programmed by Bob Vernon, the +CHIPCHEK routine was developed for the chip carrier group to use in the evaluation of various proposed memory chip carrier configurations. All data are recorded anonymously. The routine preloads a set of slightly conservative design ground rules based on multilayer package structures, although users can also use their own ground rules, and users then enter parameters for specific package design options. The routine then calculates and evaluates the parameters in light of the ground rules to check the fit of the die in the proposed package. Users are also given access to the anonymous data (with +CHPDAT) consisting of the numeric values of the parameters proposed. During use by C66 members, eighteen sets of data were produced using +CHIPCHEK. As reported above in the section on memory chip carrier standardization activity, Mr. Vernon reported that important information came to light as a result of using +CHIPCHEK that wouldn't have been available otherwise.

GRAPHICS

The ability to share diagrams and drawings is important in electronic standardization, particularly to engineers. In the baseline questionnaire, 12% of the respondents mentioned the difficulty of sharing graphics as a potential disadvantage of using EIES for JEDEC work, while 16% mentioned it as a disadvantage in the final evaluation interview. Of those who said there were changes or improvements to EIES which would make its use more effective for JEDEC work, 24% mentioned graphics features.

It is possible to do character or "typewriter" graphics on EIES, using the standard characters available on most computer terminals. Bob Vernon created a series of diagrams of chip carrier package options for C66. He also used material directly from EIES as vufoils for presentations that he made to JEDEC and other groups. Ken Weir created a sample specification module for a memory write-timing diagram (S-100).

Since EIES sends ASCII characters back and forth, it would be possible to exchange more sophisticated graphics between users with similar graphics terminals which use the same ASCII-coded graphics commands, such as Tektronix graphics terminals. There was no opportunity during the project to experiment with special graphics terminals. This would be worthy of future research.

Feedback of Evaluation Baseline Results and Quarterly Reports

The project facilitators were also the project evaluators and thus approached the project as a "second-order cybernetics social experiment" (Umpleby, 1976) in the sense that those studying the project were also intimately involved in it. Rather than complicating matters, the close coordination and exchange between these roles made possible a richer, more appropriate facilitation effort and a more grounded and sensitive evaluation. Because of this dual role, the facilitators involved as many members as were interested in project planning and design, including design of the evaluation process. In addition, some of the evaluation baseline results were shared with project members midway through the project, and all quarterly reports were made available to project participants via EIES.

Data Collection and Analysis

Baseline questionnaires were sent to 83.1% of the 77 project members, and 44% of those receiving them returned them (N = 34), with 47% answering the questions on line and 53% using the mails. The baseline questionnaire was in five parts: goals, motivations, and expectations of using EIES for JEDEC work; personal communications skills and facilities, including access to and experience with terminals; prior participation in JEDEC standardization activities; perceptions of and experience in attending JEDEC committee meetings; and a few demographic questions.

The final evaluation questionnaire was conducted by telephone. Calls were placed to all project members with the exception of one member in England who had never used the system. J. D. Nicoud called the evaluators from Switzerland and was interviewed. Interviews were completed with 67.5% of the members (N = 52). The interview asked about participants' perceptions of the results of using EIES for JEDEC committee work; the effects of EIES on the face-to-face meetings; perceived advantages, disadvantages, and osbtacles to using EIES for JEDEC work; level of satisfaction with EIES for specific communication tasks; suggested changes to EIES; effectiveness of +TERMS; and other comments. Those who did not use the system were asked what prevented them from using it. Questions were worded to be comparable with the baseline questionnaire and other EIES evaluation data.

The evaluators collected usage statistics at eleven points in the project, including total time used; number of times on; numbers of various types of text items composed and received; group, conference, and glossary memberships and levels of activity; when established; when first active; whether withdrawn from project; and whether continuing on EIES after the end of the project.

PARTICIPANT PERCEPTIONS OF EIES USE FOR JEDEC WORK

During the final evaluation interview, those who participated in any activities on EIES which contributed to new JEDEC published standards or to standards still under discussion were asked how using EIES affected the quality of decisions, the amount of information available, the speed of decision making, the amount of discussion, and the amount of participation. Respondents said that using EIES had a generally positive effect on the quality, amount of information available, speed, and amount of discussion. The amount of participation was rated with about equal frequency as more, about the same, and less. However, several people qualified their answers that fewer people participated by saying that the "right" people participated or that those who did participated more. Slightly more than half said that using EIES resulted in an increase in their own participation in JEDEC activities.

Everyone interviewed was asked about what possible advantages they saw in using EIES for some of their JEDEC committee or task group work. First and second mentions were coded. The most often mentioned advantage (35.2%) regards speed: it accelerates the exchange, the process is faster, instant feedback saves time. Other advantages included ease of communication (15.6%), and having a documented record of the exchange (9.8%).

Similarly, interviewees were asked about possible disadvantages in using EIES for JEDEC committee or task group work. The disadvantage most often mentioned (16%) was that not enough other people participated. Other disadvantages included not enough time, reluctance to learn EIES, and "ignorance" (12%); the lack of face-to-face contact and non-verbal cues on EIES (10%); limited terminal access (10%); and the difficulty in exchanging graphics and other visuals (8%). The ratio of disadvantages to advantages mentioned is about 5:3, even though most people had positive attitudes toward EIES use.

Those interviewed were also asked about what obstacles they saw to effective use of EIES for JEDEC committee work. Up to three mentions were coded. The major obstacle mentioned was cost and lack of funding, including cost of equipment (32.6%); the fact that not everyone participates and that it is difficult to get everyone involved (25%); and the lack of a terminal (21.1%).

Those who had used EIES were asked how satisfactory EIES was for giving and receiving information, giving and receiving opinions, and resolving disagreements. EIES was rated favorably for giving and receiving information and opinions and close to neutral for resolving disagreements. Some of those who answered the question about resolving disagreements said that had never come up during their use of the system and either rated it neutrally or said they didn't know.

Finally, those who used EIES were asked if there were changes or improvements to EIES which would make its use more effective for JEDEC work. Slightly over half (59.5%) said yes. Three mentions of changes were coded. The most often mentioned change (14.2%) was the capacity to do graphics, followed by making it easier to get just what you want quickly (9.5%). Faster response time, "quickstart" materials for specific tasks, making the system easier to learn quickly, and making batch transfer easier all were mentioned next often (7.1% each).

NON-PARTICIPANTS

Near the beginning of the final evaluation interviews respondents were asked if they had ever participated in any activities on EIES which contributed to new JEDEC published standards or to standards still under discussion. Twenty people indicated that they had not participated in any such activities on EIES. One person said he was not sure. Of the 21 people who reported not participating in JEDEC activities on EIES, 5 never used EIES at all, 4 used it for less than 5 hours, 8 used it for from 5 to 16 hours, and 4 used it for from 17 to 64 hours. Six respondents used EIES to work on top-down standardization and an IEEE standard; they were among the 21 people not participating in JEDEC activities. Some of the others apparently used the system here and there but never became involved in any real standards work via EIES.

All 21 of the non-JEDEC activity participants were asked what prevented them from participating in JEDEC activities on EIES. The first two mentions were coded. Eight mentioned lack of time. Six said they were working on the IEEE top-down standards task. Four said that the JEDEC activities on EIES were of no interest to them. Three said lack of terminal. Two said they were not officially members of JEDEC. The only person who reported anything about EIES itself as a reason for non-participation said that it was hard to use EIES if it was used only infrequently.

(SEE TABLE)

OVERVIEW MODEL OF EVALUATION

Boxes represent domains of variation
Arrows represent relationships investigated

```
+------------------------------------------------------------------------+
|                           PARTICIPANTS                                 |
|  +-----------------+  +--------------------+  +---------------------+  |
|  | motivations and |  |    situations and  |  | perceptions of and  |  |
|  | expectations of |  |     backgrounds    |  |   involvement in    |  |
|  |    using EIES   |  |                    |  |     JEDEC work      |  |
|  +---+----+--------+  +---------+----------+  +----------+------+---+  |
|      ^    |                     |                         |      ^      |
|      |    +------------->>+    |   +<<--------------------+      |      |
|  +---+-------------+      |    |   |      +-----------------------+---+  |
|  | perceptions of  |      |    |   |      | impacts of EIES use  |  |
|  |      EIES       |      |    |   |      |    on JEDEC work     |  |
|  +-----------------+      |    |   |      |   as perceived by    |  |
|      ^    |              |    |   |      |     participants     |  |
|      |    +------------->>+    |   |      +------+------+--------+  |
|  +---+-------------+      |    |   |             |      ^           |
|  |   changes in    |      |    |   |             |      |           |
|  |  perception of  |      |    |   |             |      |           |
|  |      EIES       |      |    |   |             |      |           |
|  +----+------+-----+      |    |   |             |      |           |
|       ^      |            v    v   v             |      |           |
|      [3]    [2]          [2]  [1] [4]           [4]    [5]          |
|       |      +--------->>+    |   +<<-----------+      |           |
|       +<<---------------+ |    |   |  +--------------->>+           |
+-----------------------|---|----|---|---|------------------------------+
                       [3] [2]  [1] [4] [5]
+-----------------------|---|----|- -|---|------------------------------+
|                       |   v    v   v   |                              |
|                +-------------------------------+                     |
|                |        selection of most      |                     |
|                | appropriate measure of use    |                     |
|                +---------------+---------------+                     |
|                                ^                                     |
|                                |                                     |
|                    +-----------+---------+                           |
|          +--[0]---->>|    HOURS   USED   |<<----[0]--+               |
|          |         +---------------------+           |               |
|          v                                           v               |
|      +------------------------------------------------------+         |
|      | Times on          Other EIES            Why didn't  |         |
|      | Items composed     activity              use the    |         |
|      |  or received     Whether continuing      system     |         |
|      +------------------------------------------------------+         |
|                            EIES USE                                  |
+------------------------------------------------------------------------+
```

RELATIONSHIPS INVESTIGATED:

[0] What are the relationships among various measures of EIES use? Which measure is most appropriate as the focus for evaluation?

[1] What factors in participants' situations and backgrounds are related to EIES use?

[2] How do participant motivations and expectations affect EIES use?

[3] How do perceptions of EIES change with use?

[4] How do perceptions of and involvement in JEDEC work affect EIES use?

[5] How does EIES use affect JEDEC wok as perceived by participants?

[0] RELATIONSHIPS AMONG MEASURES OF USE

There are several ways to measure levels of activity and use of EIES. The total number of hours connected to EIES seems to be the most logical measure to use, since it is the most general measure and since the data on it are complete. Other measures include the number of times logged on and the number of different kinds of text items (e.g., private messages, group conference comments, notebook pages, etc.) composed and received. Analysis of these measures showed that number of hours used correlated highly to other use measures.

SELECTING THE APPROPRIATE OVERALL MEASURE OF USE

It would appear that the total number of hours used would be the most appropriate measure of use of EIES for comparison with other measures of expectation, background, perception, and so on. However, the distribution of hours used in the project was extremely skewed, with a large number of people with a very small number of hours and a very small number with a large number of hours. This is not unusual; participation followed the "Zipf curve," a common usage pattern for systems of this type. It should be noted that anyone who ever used the system at all, even for a minute, was coded as having used 1 hour rather than zero just to keep the zero category only for those who really NEVER used the system at all.

Since the evaluators planned to compare the average number of hours used by people with different backgrounds, perceptions, and motivations for using EIES, a variable with a flatter, more approximately normal distribution was desired for its statistical characteristics. If total hours was used as a measure those few people with very large total time used would tend to have an unfair influence. Since occasional use of Pearson correlations between use of EIES and other ordinal variables was also planned, the most appropriate measure would need to retain its ordinal and metric characteristics as well.

The problem was solved by computation of a new measure, called LEVEL OF USE, which ran from 0 through 4. It was computed from total number of hours used by making partitions between 0-1 hours, 4-5 hours, 16-17 hours, and 64-65 hours. This yielded a new variable, which by virtue of the location of the partitions, was in effect the power of four which corresponded to the total hours used, so the metric qualities were retained. Thus, the LEVEL OF USE measure had five categories: 0 hours used, 1-4 hours, 5-16 hours, 17-64 hours, and over 64 hours used.

Not only did this measure have a better distribution, but it also corresponds fairly closely with the breakpoints in EIES use that other research have shown to be critical. First is the obvious difference between use and no use at all on the first level. Second, experience has shown the four-hour mark to be a point beyond which people seem to understand the basics of the system. Third, somewhere around 15 to 20 hours there appears to be another point at which people begin to feel really at home with the medium and start understanding the social norms and subtleties of use. Finally, somewhere around 50 to 100 hours people seem to become "expert" with the medium by having mastered many of the various features available.

[1] WHAT FACTORS IN PARTICIPANTS' SITUATIONS AND BACKGROUNDS ARE RELATED TO EIES USE?

It appears that use of EIES is highly correlated with access to a terminal (significant at the .01 level) and somewhat related to prior experience with a computer terminal for playing games (significant at the .05 level). All other hypothesized relationships were not supported by the data. Some of these results are surprising and may be due to the technological sophistication of project participants in comparison to more typical users of the medium.

HYPOTHESES SUPPORTED BY THE DATA:

EIES use is related to:

1.1 prior experience with computer terminals (for playing games)

1.3 access to a terminal

HYPOTHESES NOT SUPPORTED BY THE DATA:

EIES use is related to:

1.2 prior experience with electronic mail and computerized conferencing

1.4 knowing people on the system

1.5 skill in writing

1.6 skill in English

1.7 reading speed

1.8 typing speed

1.9 age

1.10 education

1.11 occupation

[2] HOW DO PARTICIPANT MOTIVATIONS AND EXPECTATIONS AFFECT EIES USE?

JEDEC members' use of EIES is highly correlated to positive expectations about the system, positive perceptions of the medium as used for JEDEC work, and a belief in the medium (all significant at the .05 level). In particular, use of EIES is related to both the expectation and the perception that its use for JEDEC work will improve the quality of decisions.

HYPOTHESES SUPPORTED BY THE DATA:

EIES use is related to:

2.1 positive expectation that EIES will help with JEDEC work (particularly by improving the quality of decisions)

2.2 perception that EIES is helpful in JEDEC work (particularly by improving the quality of decisions)

2.3 belief and/or interest in EIES as a communications medium

HYPOTHESES NOT SUPPORTED BY THE DATA:

EIES use is related to:

2.4 more well-formed and/or detailed opinions about EIES

[3] HOW DO PERCEPTIONS OF EIES CHANGE WITH USE?

The use of EIES is highly related to significant changes in perception of the system and to using it for more activities and tasks. Furthermore, while these changes are related to the simple use of EIES without regard to amount of use, they are also related to the actual level of use in that the more people use the system the more these effects seem to be observed (all significant at the .01 level).

HYPOTHESES SUPPORTED BY THE DATA:

EIES use (as measured first by any use of the system and then also by level of use) leads to:

3.1 changes in perception of EIES (particularly with regard to perceived impacts on face-to-face meetings)

3.2 use of EIES for activities besides JEDEC work (perceptions of more uses for EIES)

[4] HOW DO PERCEPTIONS OF AND INVOLVEMENT IN JEDEC WORK AFFECT EIES USE?

Frequent JEDEC communication between meetings is related to EIES use (significant at the .05 level). Somewhat surprisingly, EIES use does not seem to be related to more direct measures of participation in or positive perception of JEDEC.

HYPOTHESES SUPPORTED BY THE DATA:

EIES use is related to:

4.5 frequent JEDEC communication between meetings

HYPOTHESES NOT SUPPORTED BY THE DATA:

EIES use is related to:

4.1 seeing JEDEC activity as normal part of job (rather than as an extra-curricular activity or something special)

4.2 level of participation in JEDEC

4.3 neutral or negative perception of JEDEC face-to-face meetings

4.4 history of being involved in JEDEC committee work

4.6 a sense of community in JEDEC work

[5] HOW DOES EIES USE AFFECT JEDEC WORK AS PERCEIVED BY PARTICIPANTS?

In summary it appears that use of EIES for JEDEC standards work has a positive effect on the quality and speed of decisions and on the effectiveness of JEDEC face-to-face meetings. Not all of the hypotheses to be investigated were supported by the data. However, two were supported in their most rigorous form. Not only did use of EIES affect JEDEC work, but those who used it more felt that it improved the quality of their decisions and continuity between meetings as well (significant at the .05 level).

HYPOTHESES SUPPORTED BY THE DATA:

EIES use (as measured first by any use of the system and then by level of use):

5.1 speeds the standards process

5.2 improves the quality of decisions (effect related to LEVEL of use as well)

5.3 increases amount of information available for decisions

5.5 makes for better, more effective meetings

5.6 improves continuity between meetings (effect related to LEVEL of use as well)

5.7 increases amount of discussion

HYPOTHESES NOT SUPPORTED BY THE DATA:

EIES use:

5.4 lowers total cost of decisions

5.8 increases participation

EVALUATION SUMMARY

The overview model of the evaluation presented above shows five primary areas of investigation:

[1] What factors in participants' situations and backgrounds are related to EIES use?

[2] How do participant motivations and expectations affect EIES use?

[3] How do perceptions of EIES change with use?

[4] How do perceptions of and involvement in JEDEC work affect EIES use?

[5] How does EIES use affect JEDEC work as perceived by participants?

In each of these areas, significant relationships were found, as summarized.

The primary purpose of this project was to assess the usefulness of EIES and systems like EIES for standards work in the microelectronics industry. The evaluation analysis focused first on both aspects of the relationship between perceptions of EIES and EIES use, and then on both aspects of the relationship between perceptions of JEDEC work and EIES use for JEDEC work. Both of these proved to be strong relationships.

Analysis and interpretation of results in areas [2] and [3] above show that there is a strong two-way relationship between positive motivations, expectations, and perceptions of EIES and EIES use: a positive expectation of EIES leads to use of the system, and use of the system leads to a positive image of the system. It may be that there is a positive feedback loop involved such that once people either get a high expectation of EIES or gain enough experience to get beyond the initial fumblings, they get positive feedback from the experience and use EIES more. It might be said that perceptions of EIES and EIES use are BOTH causes and effects of each other.

Similarly, analysis and interpretation in areas [4] and [5] show that there are strong two-way relationships between a positive attitude towards JEDEC work and EIES use and between the perceived impact of EIES use on JEDEC work and EIES use. The more that people used EIES for JEDEC work, the more they came to see that there were definite advantages and positive impacts on JEDEC work which in turn motivated them to use EIES more.

It appears that once these feedback loops become operational people will use the system and be satisfied. The major problems discovered during the project had to do with getting the activity up to a level of "critical mass" needed to make it work. First and foremost is the problem of access to a terminal, and second is getting the right others on line. Once these barriers are overcome EIES seems to be quite useful for some aspects of JEDEC standards work.

Overview of General Reactions

In general the evaluators were struck by the high overall ratings that participants gave to EIES. Not only were their expectations of how useful and helpful the system would be very high, but in general these high expectations continued throughout the project as people gained more experience with the system, even though the system was not very actively used during the project.

At the end of the final evaluation interview, respondents were asked if they had any other comments. The first three mentions from each respondent were coded. The three most frequently mentioned were "good project/useful idea/has potential" (mentioned by 10 people), "EIES is wave of the future" (mentioned by 9), and "very positive about EIES and cc" (mentioned by 9). In spite of the fact that the project had participation problems, in spite of the fact that only a small proportion of project members ever used EIES very much, nearly everyone came away from the project feeling that EIES did indeed have great potential for use in standards work.

Boxes represent domains of variation
Arrows represent relationships supported by the data

```
+--------------------------------------------------------------------------+
|                              PARTICIPANTS                                |
|  +-----------------+  +-------------------+  +-------------------+       |
|  | motivations and |  |   situations and  |  | perceptions of and|       |
|  | expectations of |  |    backgrounds    |  |  involvement in   |       |
|  |   using EIES    |  |                   |  |    JEDEC work     |       |
|  |.................|  |...................|  |...................|       |
|  |2.1:expect EIES  |  |1.1:prior experience| |4.5:communicate in |       |
|  |    to improve   |  |   with terminals  |  |   between meetings|       |
|  |    quality of   |  |1.3:terminal access|  |                   |       |
|  |    decisions    |  +---------+---------+  |                   |       |
|  |2.3:belief and/or|            |            |                   |       |
|  |    interest in  |            |            |                   |       |
|  |    EIES and cc  |            |            |                   |       |
|  +---+----+--------+            |            |                   |       |
|      ^    |                     |            |                   |       |
|      |    +------------->>+     |            +---------+-----+---+       |
|  +---+-------------+      |     |                      |     ^           |
|  | perceptions of  |      |     |    +<<---------------+     |           |
|  |      EIES       |      |     |    |             +---------+---+       |
|  |.................|      |     |    |  | impacts of EIES use |        |
|  |2.2:EIES improves|      |     |    |  |    on JEDEC work    |        |
|  |    quality of   |      |     |    |  |   as perceived by   |        |
|  |    decisions    |      |     |    |  |    participants     |        |
|  +---+----+--------+      |     |    |  |.....................|        |
|      ^    |               |     |    |  |5.1:faster process   |        |
|      |    +------------->>+     |    |  |5.2:better decisions |        |
|      |                    |     |    |  |5.3:more info. avail.|        |
|  +---+-------------+      |     |    |  |5.5:better meetings  |        |
|  |   changes in    |      |     |    |  |5.6:better continuity|        |
|  |  perception of  |      |     |    |  |5.7:more discussion  |        |
|  |      EIES       |      |     |    |  |                     |        |
|  |.................|      |     |    |  |                     |        |
|  |3.1:related to   |      |     |    |  |                     |        |
|  |    amount of use|      |     |    |  |                     |        |
|  |3.2:use EIES in  |      |     |    |  |                     |        |
|  |    more ways    |      |     |    |  |                     |        |
|  +----+------+-----+      |     |    |  +------+--------+-----+        |
|       ^      |            v     v    v         |        ^              |
|      [3]    [2]          [2]   [1]  [4]       [4]      [5]             |
|       |      +-------->>+ |     |  +<<---------+        |              |
|       +<<-----------+    |     |  |   +------------------->>+          |
+--------------------+----+-----+--+---+-----------------------------------+
                     |    |     |  |   |
                    [3]  [2]   [1][4] [5]
                     |    |     |  |   |
                     |    v     v  v   |
```

(continued on next page)

```
                            ^   |   |   |   ^
                           [3] [2] [1] [4] [5]
                            |   |   |   |   |
+---------------------------|---|---|---|---|-----------------------------+
|                           |   v   v   v   |                             |
|                          +------------------+                            |
|                          |   LEVEL OF USE   |                            |
|                          +--------+---------+                            |
|                                   ^                                      |
|                                   |                                      |
|                          +--------+---------+                            |
|       +--[0]------>>|    HOURS  USED        |<<-----[0]--+               |
|       |                  +------------------+            |               |
|       v                                                  v               |
|    +------------------------------------------------------------+        |
|    | Times on              Other EIES             Why didn't    |        |
|    | Items composed         activity               use the      |        |
|    |  or received          Whether continuing     system        |        |
|    +------------------------------------------------------------+        |
|                              EIES USE                                    |
+-------------------------------------------------------------------------+
```

SOME OTHER RELATIONSHIPS SUPPORTED BY THE DATA

[1] Perceptions of EIES change with use.

Specifically, as JEDEC members used EIES more, their perceptions of the relationship between their regular face-to-face meetings and EIES use for continuous on-line meetings changed. Many more effects of using EIES on the face-to-face meetings were mentioned during the post-project interviews, and those who had used EIES more reported different effects than they had anticipated in the pre-project questionnaires. In addition, those who used EIES more used more features of the system and participated in more non-JEDEC activities. It appears that the perceptions of what EIES is and what it can do change and expand with more use of the system -- people begin to see more of the variety of ways EIES can help in their work and begin using it in those ways.

After experience with EIES, participants tended to rate the system as somewhat less effective for increasing participation, moving from a mean of 1.55 in the pre-measure to 1.90 in the post-measure (1 to 3 scale, with 1 being an increase in participation, 2 no change, and 3 a decrease).

There was a generally low correlation between participants' expectations of EIES from the pre-project questionnaire and their perceptions of EIES from the post-project interview.

[2] EIES use affects JEDEC work as perceived by participants.

Specifically, EIES use was highly related to a perception that EIES use improves the quality of decisions and the continuity between meetings. EIES use was also perceived to speed the standards process, increase the amount of information available for decisions, make the face-to-face meetings more effective, and increase the amount of discussion about standards.

Increased participation and lower total cost of decisions were not related to EIES use.

HUB: A COMPUTER-BASED COMMUNICATION SYSTEM TO SUPPORT GROUP PROBLEM SOLVING

by

Richard P. Adler and Hubert M. Lipinski

For nearly a decade, the Institute for the Future has been actively involved in the development and assessment of computer-based communication. In the early 1970s, the Institute created a pioneering computer-conferencing system called FORUM. This was succeeded by an improved version called PLANET that, by now, has been used by over 1000 individuals. The Institute's current research has focused on the communication needs of groups involved in joint problem-solving activities. Under a grant from the National Science Foundation, the Institute has developed a new system called HUB, specifically designed to support these task-focused needs. This report will briefly explain how HUB works, describe a series of field trials of the system, then summarize the results to date from the formative and summative evaluation of the trials.

How HUB Works

HUB provides its users with five types of services, each of which fills a different role in group communication:

-- Sending Messages. The basic component of HUB is a conferencing system that allows participants to send and receive two types of messages -- public and private. Public messages are available to the entire group, while private messages are sent only to one or more people specified by the sender. The "proceedings" of the conference discussion consist of all the public entries numbered sequentially and the private messages to and from each participant. Both are stored for later retrieval. The conferencing system draws heavily from the PLANET design.

-- Writing Documents. HUB provides a set of services, called the document workspace services, that can be used by a group to write and edit a document jointly. The document might be a report, an article, a newsletter, a proposal, the source code of a program, a directory or list, etc. The document can be written and edited by any member of the group. All editing changes are automatically recorded and are available for later review. Users can also enter comments on the editing changes, which are stored with the changes they refer to.

-- Running Computer Programs. HUB also provides a set of program workspace services that enables a group to run computer programs and discuss them during or after each run. The programs might be data bases, model, simulations, or other programs for processing information analytically.

-- Drawing Graphic Images. The system's graphic workspace services allow a group to draw graphic images -- flow charts, graphs, simple schematics -- to complement other group activities. Participants can also modify images prepared by others.

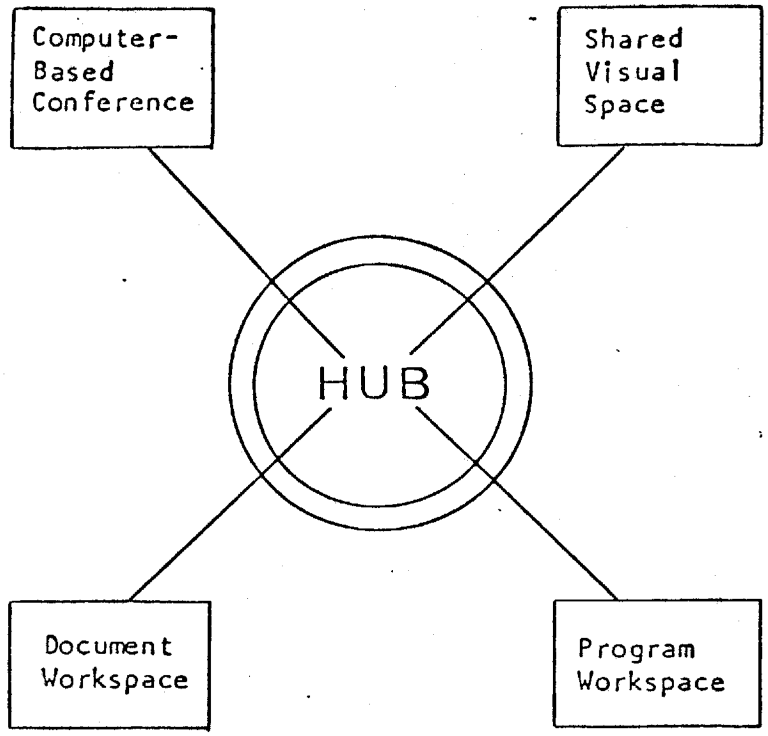
-- Asking Questions. The question workspace services allow participants to ask questions of the group in a structured manner. The response format may be either a yes/no/abstain vote, one or more numerical values, a list of items, a free-text essay, or a programmed format. In the latter case, HUB will use a computer program to elicit responses, store the answers, and finally use another computer program to process the responses and display the results.

HUB was designed to be used in different ways for a variety of different purposes. It can be used for synchronous communication (two or more people on line at the same time) or for asynchronous communication (only one person on line). It supports both unstructured communication -- through the conferencing system -- and structured communication -- through the document, program, graphic, and question workspaces.

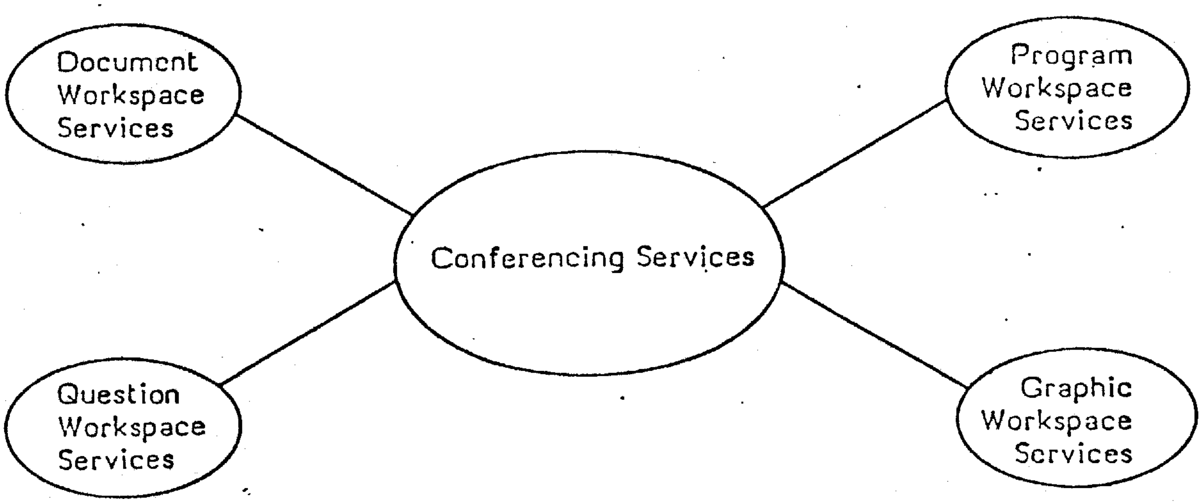
A HUB user group can create separate activities for specific tasks or group projects with the appropriate participants. For example, one activity can be designated as a plenary session for the entire group, while other activities might be used only by subgroups. Or one participant may create an activity to use as a private workspace. However, participants have access to all five basic types of services in all activities.

FIGURE 1

Structure of Old HUB and New HUB



a. Old HUB



b. New HUB

HUB Field Trials

To test the acceptance and effectiveness of HUB, the Institute sought out groups that were willing to use the system as part of an actual project. Participants would have to supply their own terminals and pay the computer and network charges incurred in running HUB. Eventually, seven different groups agreed to use HUB. Several of the groups included Institute staff members as active participants, but all contained outside participants as well.

The number of participants in the activities ranged from three to several dozen, while the time span of the activities ranged from a few weeks to more than two years.

1. Midwest Software -- A small software company used HUB as a communication link among a group working together to translate a computer language developed for one computer to make it compatible with a different computer. This activity involved four people -- two located in the Midwest, one on the East Coast, and one on the West Coast. The company also used HUB (through separate activities) as a means of keeping in touch with user groups as new releases of the language were implemented. HUB enabled users to raise problems and ask questions and enabled the company to provide answers and inform users of changes. The company's use of HUB has gone on for more than two years and is expected to continue in the future as well.

2. Technical Article -- A member of the Institute staff, located in California, was collaborating with a colleague living in the Midwest. After an initial draft of the article had been written, they used HUB over a one and a half month period to work jointly on a second draft. In addition to working directly on the article in the document workspace, the authors discussed their ideas via conference messages.

3. Satellite Forecasting -- The Institute was commissioned by a private company to prepare a forecast of the demand for certain kinds of satellite services through a Delphi-type study. The Institute solicited a group of 45 experts to provide estimates of demand by filling in a questionnaire sent via mail. Their responses were entered and tabulated on a computer, and these results were made available through HUB's program workspace services. Participants were then given an opportunity to review the first-round results and enter comments or revisions and to discuss the results with both Institute staff members and other participants. Approximately one-third of the first-round participants also took part in the HUB activity.

4. International Conference on Computers and Employment -- Beginning in early 1981 and continuing at present is a discussion among a widely dispersed group of experts concerned with the impact of computers and office automation on employment. There are eight active participants located in the United States, Canada, Australia, and Europe.

5. Southwestern University -- A HUB system was set up in October 1980 for faculty and students in the university's computing programs. The purpose of using HUB was to facilitate communication among individuals with varying schedules and commitments. Several different activities were established, including a discussion of the LISP language, a forum for beginners to get help in using the program's DEC 2060, as well as a general discussion of HUB itself. The number of participants in the activities has varied, but approximately six individuals have been active users of the system.

6. Western University -- Again, the motivation for using HUB was to increase the ease of communication among faculty and students with different schedules. However, little use was made of the system.

7. Government Laboratories -- In this final trial, HUB was made available to staff members at nine governmental laboratories to discuss the implementation of a new computer network. Here, too, little use of HUB developed.

Evaluations of HUB

A. Indicators of HUB Use

Because the Institute wished to test the effectiveness of HUB in supporting actual projects, it was not possible to randomize the selection of participant groups or to compare them with nonuser control groups. Nonetheless, HUB was used to support a variety of applications and achieved varying kinds of use. In general, trials 3 through 5 produced mixed results; and trials 6 and 7 were largely failures.

Though identifying detriments of use was not part of the formal evaluation of HUB, informal analysis of the field trials suggests the following characteristics are important in determining use:

1. Group membership is well defined.

2. The group is focused on a specific problem or task with a deadline for completion.

3. Group members are geographically dispersed.

4. Group members have had at least some experience with computers if not with computer conferencing systems.

6. HUB provides group members with access to each other that would not otherwise be possible.

These findings are generally consistent with the results from experiments with other computer-based communication systems. However, rather than attempting to replicate earlier results, the HUB trials focused primarily on gathering data for developing and refining the system (formative evaluation) and for determining its impact on group problem-solving processes (summative evaluation).

B. Formative Evaluation

Formative evaluation has been defined as "any research designed to provide guidance for educational planners in facilitating the development of appropriate, attractive, and effective educational and community programs. It is also used for monitoring and modifying the progress of the educational program over time." (Macoby and Solomon, 1981). This kind of research has been used in the creation of educational television programs (Sesame Street) and in the development of a multimedia health promotion campaign (Stanford Heart Disease Prevention Program). As far as we know it, it has not been used previously in the development of computer services.

Data for formative evaluation was gathered in two ways -- through continued monitoring of the HUB activities and through periodic interviews with HUB users. Because HUB was a new and untested system, this data was extremely useful in locating problems and identifying ways in which the system could be improved. As a result of this feedback, a number of changes -- some minor and some major -- have been made in HUB over the course of the project. Some of these changes include:

1. System structure. Feedback from the first HUB trials indicated that users were becoming confused about the relationship of the system's modules. This led to a major revision of basic architecture of the system. In the initial version, HUB was essentially a central switcher for four separate subsystems -- the conference, graphic, document, and program workspaces. Users had trouble visualizing this structure and had difficulty in moving from one module to another.

In the new version, the conferencing facility was placed at the "center" of the system. The other services -- the document, graphic, and program workspaces, and a new question workspace -- were arranged around the central conference as auxiliary resources. This arrangement proved much more satisfactory, since sending and receiving conference messages is the simplest and most "natural" of HUB's services to use.

2. Access to summaries. In the original HUB, participants who entered a conference activity would automatically receive all messages entered by participants since their previous log-in. In active conferences or when conferences included lengthy runs, this procedure tended to inundate users with more material than they wanted or could digest. The new HUB includes a summary that informs entering users of the number of unseen messages, their authors, and their length in lines. The user is then permitted to choose which entries he wishes to see, giving him a greater degree of control over his participation.

3. Access to private messages. In the original HUB, private messages to a user were automatically displayed when that user entered a HUB activity. However, once a private message was delivered, it "disappeared" and could not be accessed again. Participants in the early trials discovered that unless they accessed HUB via a hard-copy terminal and saved the conference transcript, they sometimes lost private messages with important content. In the later version of HUB, participants can review private messages in three ways: "to" (another participant); "from" (another participant);

or "with" (messages to and from another participant). In addition, the protocols for sending private messages were changed to permit the same message to be sent privately to more than a single individual.

Other feedback from the formative evaluation process suggested other changes. Due to the limitations of time and expense, not all these changes and improvement could be implemented within the scope of the project. However, the feedback has led to formulation of a series of design principles for future development. One such principle is that computer communication systems to support group problem solving must be structured yet flexible. As noted above, a clear structure is necessary to prevent participants from becoming confused, especially during group interactions. However, too much structure can inhibit individual work styles. Creating a system that works well in a variety of settings for a variety of purposes must strike a delicate balance among a number of conflicting priorities such as this.

C. Summative Evaluation

After the field trials were completed, all users were surveyed by means of a structured interview by telephone. (Participants were sent copies of the interview questions by mail in advance, but interviews were conducted by phone to permit clarification and elaboration of answers.) The interviews sought to elicit participants' overall evaluation of HUB, as well as to identify specific effects of using the system, problems encountered, and final recommendations for changes.

Analysis of interviews is being carried out at the time of this writing. However, preliminary analysis of interviews indicates that a majority of users reported that HUB increased ease of access to others in their groups, shortened the time needed to complete their task, and improved documentation of group communications.

Finally, a content analysis of the transcripts of all HUB trials is being carried out. The transcript entries are being coded into categories based on an analysis of the steps involved in the process of problem solving (Lipinski, Spang, and Tydeman, 1980). When completed, this analysis should indicate which aspects of group problem solving are most effectively supported by computer communications.

The development, testing and refinement of HUB has been a four-year process, which is now reaching a conclusion. For those interested in learning more about HUB, a series of papers describing the system's development is available from the Institute for the Future. A final project report will be available in fall 1981.

AN EVALUATION METHODOLOGY FOR COMPUTER CONFERENCING:

An Illustration with a CBBS Conference

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This is a chapter appearing in "Studies of Computer Mediated Communication: A Synthesis of Findings." Starr Roxanne Hiltz and Elaine B. Kerr. Final Report in the National Science Foundation, NSF IST-801077, 1981.

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INTRODUCTION

This case study chapter is different from others in this book in two main ways. First, the other chapters are concerned with evaluating a particular computer conference, such as among medical specialists, handicapped equipment designers, or general systems researchers. In contrast, the aim of this chapter is to develop a general evaluation methodology, usable for a wide range of computer conferences. Nevertheless, to illustrate the general methodology, a particular conference is in fact investigated. This leads to the second main difference.

While the majority of the other cases are conferences on EIES, the conference analyzed in this chapter is on a CBBS, short for Computer Bulletin Board System. These are mini-computer based, free, public conferences that operate in many areas in the United States. The general features of CBBS are similar to most conferencing systems; yet the differences are noteworthy and will be discussed later in this chapter.

Readers interested in a general methodology for evaluation of any conference, and also those particularly interested in CBBS, will find this chapter useful. It is organized by the following topics: a) special features of conferencing, b) scope, c) basic procedures, d) illustration of the evaluation methodology: Boston CBBS case, e) paths to refining the method, f) problems and issues.

SPECIAL FEATURES OF CONFERENCING

As Rice and Danowski discuss in the chapter on evaluation methods, the research techniques generally appropriate for evaluating computer conferencing are no different from those appropriate for evaluating most other human activity. Depending on the evaluation stakeholders involved and their perspectives, an adequate mix of methods can be chosen from a well stocked master toolkit of social science and evaluation methods. Why, then, propose a special computer conferencing methodology? Some important features of conferencing point to evaluation needs that cannot easily be met by "off the shelf" methods. Rather, as the current chapter shows, several aspects of these methods may be linked, resulting in an enhanced evaluation capability. This new methodology, however, is not intended to replace other evaluation methods. In contrast, it may be merely one element of a larger constellation of methods, constructed for a particular evaluation purpose.

Four key features of conferencing motivate the development of the enhanced method.

1) Communication networks. It is widely known that a network perspective analyzes the structure of message exchange among a set of nodes, such as individuals or groups. Separate network analyses can be performed by topics, by media, by strength of links, and by other factors. Why, then, point to this feature of conferencing as a basis for further methodological development?

Although conference users may themselves have a heightened network awareness, the main reason is not this, but concerns data collection. Conference network traffic can be efficiently gathered on most systems. This greatly reduces the barriers to network analysis of other communication behaviors, such as via face-to-face modes, for which data are typically difficult to obtain, hard to code and clean, and filled with error. In contrast, conference network traffic can be captured in an automated fashion, at low cost, virtually error free, with time sensitivity, and without extensive manual coding and data entry. Given these automated data collection characteristics, network analysis methods may be fruitfully modified for computer conferencing evaluation. How this can be done will be discussed shortly.

2) Message Content. It can be argued that the most central aspects of human communication processes are the messages people exchange and the meanings they attach to symbolic message elements, or concepts. Surely, the networks of message traffic are important, but they are, in effect, simply the accumulated traces of repeated message content exchange. As well, the medium used is important; nevertheless, the paramount reason for its use is typically to exchange message content. Certainly participants' individual differences are significant. Yet, it is message content that bridges these differences and enables the communication and recognition of them, and their increase or decrease.

In a sense, message content is closest to the communication action. It is the code directly exchanged through which senders hope to elicit the intended referents within receivers' minds. Surely, errors sometimes occur as the code elicits unintended meanings. Yet, the code is the most observable aspect of the intentions and mental workings of the communicators.

Parenthetically, the focus on message content as "windows" to relationships among a broader range of human psychological and social variables is what uniquely distinguishes the discipline of communication from sociology, psychology, or others.

In conference communication, users appear to have heightened recognition of the central importance of message content. Once a user masters access to a system, s/he soon may ask, "Now that I'm in here, what the heck do I say?" Moreover, after a time, what has previously been said to a large extent appears to shape what users subsequently say.

Perhaps conference message content has greater importance than content of many other communication modalities for several reasons. First, the form of messages is largely consistent. Each message receives a standard header including such things as sender, receiver, time, date, and subject. This fixing of format may heighten user awareness of message content. Furthermore, conference messages are visible, retrievable, and highly controllable by users. While this is the case with some other media, such as newspapers, letters, and memos, the effect seems heightened with conferencing. Perhaps the powerful, speedy, and consistent protocols for filing, search, and retrieval built into conferencing and associated software contribute. Moreover, users may view message content with sharpened perception because conference messages are typically more personal than mass media messages. In short, for both general theoretical and specific conferencing related reasons, an evaluation methodology should clearly focus on message content.

3) Time sensitivity. Users have commented that a conference seems to have a "life-cycle." It wiggles, stumbles, and crawls about at first, then grows rapidly, experiences indentity crises, later matures, and finally ages and dies. While identification of change over time in measurement and evaluation of human processes is generally thought important, in the case of conferencing, methods should be particularly resonant with the conference life-cycle experiences of users.

4) Leadership. Conferencers have often informally commented that leadership is particularly important to conference success. This may be because of greater coordination needs arising from asyncronous communication, users' reduced sensory engagement, their greater diversity, and other factors. These point to the need for a methodology that may enhance leaders' control over the course of conferences.

The methodology presented in this chapter is responsive to the four special features and needs of computer conference evaluation just described. It integrates network analysis perspectives and procedures, performs content analysis on the relationships among concepts in message pairs, represents the aggregate message content relationships with multidimensional scaling techniques, and enables derivation of optimal communication management strategies over time. The scope of application of the method is next briefly discussed.

SCOPE

The more widely applicable an evaluation methodology across theoretical and practical problem areas, the more powerful it is. The utility of the current method ranges from basic communication research applications to practical conference management. At the level of basic theory, it can enable testing of numerous scientific hypotheses about change over time in conferences and related variables. For example, it can be used to address a wide array of relatively abstract theoretical questions such as, "How is change in the message content exchanged associated with change in the communication network structure?" Or, "What are the major life-stages of conferences and to what extent are these fixed by external factors?"

More practical conference management evaluations require two general kinds of applications. One is *formative* in nature: "How can the course of a computer conference be shaped as it occurs?" This is particularly useful information to conference organizers and leaders. The second application is more *summative*. After a conference has lived out a normal life, "How well did it accomplish its objectives?" This method enables these practical evaluation applications as well.

BASIC PROCEDURES

This computer conferencing evaluation methodology has the following major components.

1) segmentation of conference activity by communication *network structure*.
2) segmentation of conference activity by *time*.

3) identification of message content elements; that is concepts.

4) identification of message pairs, stimulus and response messages.

5) tabulation of concept cooccurrence within message pairs, aggregated across all message pairs in a segment.

6) multidimensional scaling of the aggregated cooccurrence matrix to identify the overall pattern of relationships among message elements.

If derivation of communication strategies for changing the course of the conference is desired, then additional steps follow:

7) identification of which concepts should be moved closer to or further from other concepts.

8) derivation of optimal messages (combinations of concepts) to achieve the desired change.

9) entry of optimal change messages into the conference.

After step 7, the process cycles back to begin again with step 1. Comments about some of the above steps are in order.

Segmentation. For decades, it has been known that different social groups communicate differently. Because of this, communication participants, typically audience members in mass communication, have been divided or segmented into subsets that are homogenous within but different across. The first sorts of segmentations, starting in the 1930s, were based on demographic or structural locator variables such as income, education, age, sex, race, and so on. For example, a communication audience was segmented into sub-audiences of low, middle, and high socio-economic status. Today, demographic segmentation remains an oft used approach. Yet, during the 1960s and 70s, as communication participants appeared to develop increasing lifestyle and attitudinal differences that cut across demographic factors, psychographic segmentation gained prominance. These segmentations are based on the attitude or life-style factors among communication participants. For example, segments might be based on positive-negative attitudes toward issues such as gun control, abortion, or women's movement, and so on; or on liberalism-conservatism dimensions; or by "traditionalist", "trendsetter" or other distinctions.

An even more refined method, infographic segmentation (Danowski, 1975), can be performed according to actual communication behaviors. A range of communication variables may be used for defining infographic segments. These include such things as the network structures of communicators. For example, nodes can be segmented according to their network roles, such as liaison, group member, isolate, and so on, or according to more continuous structural variables such as the density of links nodes have, or their centrality, and so on. Sometimes infographic segmentation according to the media used is appropriate. For example, "heavy" vs. "light" television viewers, or computer users, or telephone users may be usefully segmented. Or, media based segmentations can be made according to the diversity of use across several media. Infographic segmentations may also be made according to message variables, for example, exposure to content cutting across media, such as about computers, or political issues, or celebrities, and so on. Finally, information processing style variables may be used to create infographic segments, variables such as print vs. graphic orientation, linear vs. holistic processing, complex vs. simple processing, and so on.

In a particular evaluation situation, the choice of specific demographic, psychographic, or infographic segmentation strategies, or combinations of them, should depend on the evaluation objectives. For example, to the extent a communication program is concerned with disseminating information, the more useful infographic segmentation will be. If participants are grouped and analyzed according to their information reception and subsequent dissemination potential, then it is more likely that overall objectives of the program will be achieved; messages will be created and delivered that optimally appeal to segments with the highest "second-stage" dissemination potential. Thus, they are more likely to pass on intended messages.

In the case of evaluating computer conferencing, infographic segmentation according to communication network variables appears particularly useful for reasons discussed earlier. An additional segmentation variable with particular relevance to computer conferencing is time. In addition to the "life-cycle" aspects of conferencing discussed previously, reasons for time segmentation include the more general value placed on over time analysis in social science research and evaluation. It is widely thought that measuring variables over time can reveal not only the underlying causal sequencing among variables, but also more accurately reflect processual social and psychological dynamics. Computer conferencing presents unique possibilities to segment both by time and network variables because each entry is coded by conference software according to time and sender of the message.

Message Content Parsing. Content analysis of message elements, i.e. concepts, is a focal point of our evaluation procedures. The particular approach to isolating concepts in messages can be tailored to the evaluation objectives of the conference. Various computerized and manual procedures exist for performing content analysis of text.

Concept Cooccurrence. Unlike traditional content analysis, our method does not simply identify the atomistic occurrence of concepts. Rather, it indexes the cooccurrence of concept pairs. That is, it maps the relationships among concepts. Moreover, rather than selecting messages as the unit of analysis, we select pairs of messages. This choice is based on the assumption that a communication act requires at least two participants, and the communication event is constituted by a message sent and the response it triggers.

For example, consider the following hypothetical message pair. User A enters a conference message which includes concepts about an upcoming user group meeting, and also offers a new software package he wrote. Subsequently, User B responds by asking User A to send her the software, but also requests information about the User A's disk drives. There are two different concepts in message A of the pair: 1) user group meeting information, 2) offer of software, and two additional concepts in message B: 3) request for software, 4) request hardware information. Consider the cooccurrence of these concepts across the messages in the pair. Concept 1 cooccurs with concept 3 and concept 4; concept 2 likewise cooccurs. Each of these concept pairs (1-3, 1-4, 2-3, 2-4) receives a cooccurrence score of 1. If these pairs cooccur in other message pairs in the conference segment, their scores would be incremented accordingly. Note that cooccurrence of concepts within one message is not counted. Figure 1 graphically presents the basic cooccurrence procedure.

Concept cooccurrence mapping within pairs of messages, aggregated across a set of message pairs, represents two major aspects of the communication process. One, it reveals the manifest conversational structure among participants, as it appears to an external observer. One can monitor the patterns of conversation across participants and identify what concepts are more closely related to other concepts over time. Second, concept cooccurrence mapping to some extent represents the collective cognitive structure within the segment of participants.

This second aspect merits further discussion. First, it should be noted that concepts that cooccur are not necessarily those in direct response to concepts initiated in the first message of a message pair. This is exemplified by concept 4 in the above example. The ability of our methodology to measure these indirect relations presents unique opportunities to observe aspects of the underlying psychological structure among participants.

Over a number of message pairs, the appearance of the same concept cooccurrences, even if they seem unrelated at first glance, indicates that a regularity exists in the underlying psychological processes of the participants.

Figure 1. An Illustration of Computation of Message Concept Cooccurrence

Message A	Message B
Concept 1 (c1)	Concept 3 (c3)
Concept 2 (c2)	Concept 6 (c6)
Concept 3 (c3)	Concept 7 (c7)
Concept 4 (c4)	
Concept 5 (c5)	

COOCCURRENCE MATRIX

	c1	c2	c3	c4	c5	c6	c7
c1	0	1	1	0	0	1	1
c2		0	1	0	0	1	1
c3			2	0	0	1	1
c4				0	0	1	1
c5					0	1	1
c6						0	1
c7							0

NOTE: The above example analysis is for a single message pair. Note that the cooccurrence scoring is performed for each pair of messages from person A to person B and an aggregate matrix is created across the entire network or network segment within a time segment.

Perhaps there is a kind of facilitative semantic trigger effect; one concept tends to positively ellicit another concept. Alternatively, there may be a kind of compensatory trigger effect. One concept appears in response to another because the first concept does not create a positive feeling among the participants; seemingly unrelated concepts may emerge as the participants change the undesirable subject to a more pleasant one, for example, from privacy issues to the personal freedom conferencing offers.

Indeed, the extent to which the concept cooccurrences in a segment do not make sense to a panel of external observers may be an interesting aspect of computer conferencing evaluation. This lack of understanding may be a product of such factors as a high degree of diversity among participants, an early developmental period in the life-cycle of the conference, an indication of unusual environmental pressures on the participants that lead to stress, in turn leading to the abnormality of concept cooccurrence. These ideas may merit empirical examination.

MDS. Multidimensional scaling (MDS) of concept cooccurrence matrices, aggregated across message pairs in a segment, is the technique chosen to represent the overall relationships among concepts taken as a whole. There are numerous non-metric and metric scaling algorithms (Krusal and Wish, 1980) from which to choose the particular multidimensional scaling approach. If, however, an evaluation objective is to extract optimal messages for leaders to use in order to change a conference, as indicated earlier by steps 7-9, then it is advisable to use one particular kind of metric scaling procedure. This is GALILEO (Woelfel and Fink, 1981). This approach also has the Automatic Message Generator (AMG) algorithm programmed to select optimal combinations of concepts to include in subsequent messages, if one desires to change the cooccurrence of one concept with respect to another. For example, in a conference dedicated to stimulating information exchange, a leader may want to move an "information giving" concept closer to the center of the concept space or to a particular concept about which information exchange should more frequently occur. At the same time, a leader may want to move a concept about "loss of competitive advantage" away from the center, or from another concept.

If selection of optimal messages to change conferences is not an evaluation objective, then many non-metric multidimensional scaling techniques can be used for factoring cooccurrence matrices. But, the fact that cooccurrence measurement has an underlying metric or ratio scale, ranging from zero upward in interval increments for each additional cooccurrence, justifies but does not mandate metric MDS applications.

A minor problem does, however, occur with metric scaling of cooccurrence matrices. The cooccurrence scale must be reversed so that larger numbers mean less cooccurrence. In other words, if a standard distance model is assumed, the closer the elements of the concept pair through cooccurrence, the smaller the scale value should be. Just as in physical distance measurements, small numbers mean two objects are closer together in space. But, before reversal, concepts more closely related have larger rather than smaller numbers. In reversing scales, however, a problem occurs with the concept pairs that do not cooccur. Before reversal, these pairs have zero scale values. After reversal, they must be assigned very large numbers to indicate no relationship.

The procedure we suggest for assignment of large numbers to unrelated concepts is to take the pairs with a cooccurrence scale value of 1 before reversal; identify their reversed scale value, which will be a large number depending on the overall range of cooccurrence across pairs and any other transformations performed; and, multiply this largest value times 10 and assign it to the unrelated concept pairs. This will be later illustrated in the current case application.

Other methods. It should be stressed that other evaluation methods can be linked to our method to perform evaluations that are particularly suited to the evaluation objectives operating in a situation. For example, if one were interested in the perceptions and attitudes of participants, then a survey could be conducted in conjunction with the above analysis to test for expected relationships among changes in the conference network and concept structure along with users' perceptions and other behaviors. As indicated earlier, this method is simply one special tool in a well stocked master evaluation toolkit.

ILLUSTRATION OF THE EVALUATION METHODOLOGY: BOSTON CBBS CASE

CBBS

The conference we chose to study is one operating in the Boston area using a Computerized Bulletin Board System (CBBS) conferencing software package (Christensen and Suess). CBBS systems are very similar in basic features to conferencing systems such as on EIES, CONFER, and others. Users log into the conference and read earlier entries, make entries, list summary header information on prior entries, search for them, and retrieve them. There are very limited editing capabilities, the back space. But, this does not make actual use of the CBBS too different from uses of systems with much more advanced editing capabilities. Users often do not take advantage of more than the backspace key. The basic command features and sample transcripts of a CBBS appear in figures 2 and 3.

Most CBBSs use "Ward and Randy's" software, which has been available for approximately $50. Ward and Randy's Bulletin Board, located in Chicago, was the first CBBS operating in the U.S. It is still the largest CBBS conference and serves as a sort of national headquarters for CBBSs around the country. Most of the latter are used mainly by users in the local telephone dialing area in which they operate, because calling CBBSs an other areas requires long-distance telephone charges.

The hardware necessary to operate a CBBS is quite basic: a small "home computer" with a dual floppy disk drive, a modern and a normal telephone line. These simple requirements have aided CBBSs proliferation from one conference, Ward and Randy's, to over 50 operational conferences in about three years time. Someone with a home computer and the software package who wants to start a conference simply announces their telephone number and anyone can call

Figure 2

Boston CBBS Sample Transcript:
Login and Commands

```
!
#1 Terminal need nulls?  Hit control-N while this types:

               ***   Welcome to CBBS/Boston   ***
*** New Englands 1st Computerized Bulletin Board System ***
                  [System up since 12/2/78]

-----> Control characters accepted by this system:

     CTL-H/DEL  Erases last character typed. (And echos it)
     CTL-C      Cancel current printing
     CTL-K      'Kills' current function, returns to menu
     CTL-N      Send 5 nulls after CR/LF
     CTL-R      Retypes current input line (after DEL)
     CTL-S      Stop/start output (for video terminal)
     CTL-U      Erases current input line

Problems?  Try calling the following numbers:
Mitch Wolrich: (617) 753-9795 Rm. #317, 963-5578, 986-5072
Scott Marcus:  (617) 986-5078, 963-2792

Bulletins: Last updated 04/28/79, 14 lines.
<Hit multiple control-c's to skip this...>
]--> 04/28/79 Thanks to CBBS user LEO KENEN for solving a
              perplexing CPM problem...  We Now are running
              48K CP/M!
]--> 03/26/79 New IDS modem installed, while other IDS modem
              is out being repaired...
]--> 03/10/79 CBBS phone numbers moved into messages and out
              of Bulletins (were too long..)
]--> 02/24/79 Second Shugart SA800 now online..  We'll now be
              able to handle up to 540 online messages!
]--> 01/25/79 Now running with SD Systems 48K ExpandoRAM.
]--> 01/09/79 We thank Tarbell Electronics for their donation
              of a disk controller.
Note: When we say C/R, we mean your return or newline key!

Y/N: IS THIS YOUR FIRST TIME ON THE SYSTEM?N
What is your first name?rOSA;aLIZONDO

Logging name to disk...
Next msg # will be 228
You are caller #  3234

FUNCTION: B,C,D,E,G,H,K,N,P,Q,R,S,W,X (OR ? IF NOT KNOWN)
```

Figure 3

Boston CBBS Sample Transcript:
Message Entries

MSG 115 IS 08 LINE(S) ON 03/04/79 FROM ROLF ROSENGREN
TO ALL ABOUT BACKGAMMON FOR N.S. OR SOL 20

PLEASE SEND FOR A FLYER BACKGAMMON FOR N,S.OR SOL-20
TO:RR ELECTRONICS P.O. BOX 384 PARK RIDGE N.J. 07656
WILL RUN ON A CRT OR PRINTER DELUX GAME
PLACE YOUR CHIPS ANYWHARE YOU WANT UP TO 50.
THE COMPUTER PLAYS AGAINST YOU.
THE COMPUTER OR YOU CAN ROOL THE DICE
MANY FEATURES THANK YOU FOR YOUR INTERST.

MSG 116 IS 04 LINE(S) ON 03/06/79 FROM ROBERT MAAS
TO ALL ABOUT WANT GIRLFRIEND

DESPERATELY LONELY mathematician 33 wants compatible
woman 18-35. No smoking, minimal drinking.
call 415-323-0720 or write to Robert Maas,
PO BOX 6641, Stanford, CA 94305

MSG 117 IS 02 LINE(S) ON 03/07/79 FROM CHARLIE STROM
TO ALL ABOUT EXIDY SORCERER

I AM INTERESTED IN EXCHANGING EXPEIENCES,
IDEAS, ETC. WITH USERS OF THE EXIDY SORCERER.

MSG 118 IS 10 LINE(S) ON 3/9/79 FROM STEVE BROWN
TO APPLE USERS ABOUT PROGRAMS & IDEAS

WE ARE A SMALL GROUP OF APPLE USERS IN LITTLE
ROCK ARKANSAS. WE ARE ABOUT 15 STRONG NOW. WE ARE
INTERESTED IN IDEAS & PROGRAM EXCHANGE. WE ARE NOT
INTERESTED IN PIRATING PROGRAMS.
CONTACT: CHRIS JOHNSON
%DATACOPE
501-666-8588
5706-A W 12 TH STREET
LITTLE ROCK, ARKANSAS 72204
MENTION THE BULLETIN BOARD

MSG 119 IS 06 LINE(S) ON 3/9/79 FROM ALDWEN OF THYMESWOOD
TO ROBERT MAAS ABOUT GIRL FRIEND

Aren't you looking a bit far from home for the
love of your life? You might have better luck
if you look in California....Of course, there is
the case of the two computer hackers who were married
via computer (over the ONTYME network) by this wierdo

in and begin conferencing. The only cost to users is for the phone call. Some CBBSs are operated by organized local user groups, others by individuals, yet others by computer-related merchandisers who use the CBBSs as a promotional vehicle.

The message content varies some across CBBSs, but there is, overall, a high degree of similarity. We observed this as we read all entries on all the conferences operating at the time we designed this research.

There are several specific reasons why we selected a CBBS conference for the present research.

1) CBBS conferences represent "natural" forces in the developing "information society". One reason is users have no particular occupational or organizational affiliation that motivates their use. Conferencers are primarily hobbyists, the rapidly growing home computer user segment. They are motivated to use conferences simply by personal interest. Another reason for naturalness is CBBS use is essentially free, particularly if users reside in the local telephone calling areas of the conference; there is no "artificial" stimulation or dampening of use such as might occur with systems funded by government agencies or created for in-house organizational or corporate use.

2) Multiple conferences are occurring using the same CBBS software. This enables rich possibilities for studying sets of conferences, rather than solely individual users within a particular conference. Investigators can treat each occurrence of a CBBS conference, currently numbering more than 50 across the United States, as a distinct unit of analysis. There is sufficient sample size for statistical purposes to make system level generalizations and also to study variations in use due to regional and other differences. In contrast, most other conferences occur on "one of a kind" systems. Many factors of these are often unique: operating software and user interfaces, dedicated and other purposes, cost structures, user characteristics, and so on. This makes

generalization of evaluation results particularly troublesome. Not so with CBBS.

3) CBBS are public conferences. This is advantageous for our own immediate research purposes. We are able to access conference entries without privacy problems. In other situations there may be needs to obtain written agreements from users before capturing their message content. Furthermore, it is not even necessary to contact the conference managers to obtain access. There is, therefore, minimal chance for the evaluators to contaminate the conference.

BOSTON CBBS

For the current research application we chose the Boston area CBBS. We selected this particular one because we recognized the highly developed information infrastructure in the Boston area. As a result, we expected this conference would yield a sufficiently high message content diversity to enable a challenging test of the methodology. Yet, our observation of all other CBBS conferences at the time revealed that the Boston CBBS was representative. Another reason we chose it is that it had recently begun operation. We could therefore capture the conference in its earliest "life-stage". Message content diversity may be higher in earlier life-stages before more routine message patterns develop. Moreover, less message packing would have been undertaken by conference managers.

On CBBSs, most packing, the conscious deletion of messages from the conference records, appears to occur on a time criterion. For example, messages are deleted such as those offering equipment for sale that has subsequently been sold, or announcements of dates and times for user meetings that have already been held. To represent the actual, in contrast to the packed version of the conference, we logged in daily and recorded messages.

Messages later packed were thus recorded for our analysis. In essence, we circumvented the packing process.

Nevertheless, interesting questions about packing processes abound. One line concerns explanation of variations in packing criteria across different conferences. Investigation of these alternative editing rules can have basic theoretic value to the extent one links editing processes to the social psychological contexts of conferences. One approach to this is similar to the classic archeological method of analyzing a cultural group's discarded artifacts. Similarly, one can analyze the message "throwaways" of a conference community to help explain its norms and other phenomena. Analysis of electronic "junk mail" can have interesting suitability to various evaluation objectives.

Procedures

In analyzing the Boston CBBS, we executed the methods as follows:

1) network segmentation. Because the main purpose of the present research is to illustrate the kernel procedures--the content analysis and cooccurrence scaling--we analyze the aggregate network structure, rather than separate network groups. Network patterns are also very important to identification of message pairs, discussed below.

2) time segmentation. We selected the first 161 messages entered into the Boston conference. These began with its first operation on December 2, 1978; the 161st message was entered on February 23, 1979. Thus, we had a bit more than the first ten weeks of the conference life. Again, because our objective is to initially develop and present the basic methods, we chose to first test the technique with one time segment. In further research an investigator could define a series of time segments of equal width, then perform the basic content analysis scaling within each, subsequently examining changes over time in concept structures.

3) message pair identification. To identify message pairs we take each message, beginning with the last message in the series, then search backward through the earlier 160 messages to see if the message was a response to a prior stimulus message. If so, then these two messages meet a necessary but not sufficient condition to be a pair for further analysis. The identification of a stimulus message results under two conditions. One, a response message (person A's) is explicitly addressed to a particular person B. If so, we search back through message hearders and locate the prior message person B sent that triggered A's response. Two, person A may have responded to a message person B addressed to all conference users, not specifically to person A.

Once a potential message pair is so located, an additional criterion is applied to see whether it should be included in the subsequent content analysis. The two message pair candidates must have at least one common concept. This criterion fits with conceptual definitions of communication events that include the idea that for communication to occur there must be some minimal commonality in the code used by participants. Moreover, it also makes the analysis of conferences possible. Consider the conference situation in which an earlier message is addressed to all or a group of users rather than a specific person. If person A's message did not reference a specific earlier sender, then without the common concept criterion every one of these messages would be paired with person A's message. This would seriously affect the value of the resulting concept cooccurrence analyses performed. No doubt many concept cooccurrences would be identified in error, and the resulting analysis would be misleading. Generally addressed messages would therefore have to be eliminated from such an analysis. Yet, this is the very kind of message which distinguishes conferencing from private messaging.

In the Boston CBBs twenty two message pairs were identified among the first 161 messages. Thirty eight different messages were involved in these twenty two pairs. This may seem to be a rather low degree of "networking," users responding to the messages entered by others. This may be, in part, because these are the first series of messages entered into the conference. As a conference matures, the proportion of "networking" among users may increase up to a peak during the mid-life of the conference, then decline as the conference approaches the latter part of its life-cycle. These notions suggest interesting hypotheses for future research.

4) identification of message concepts. Because this was the first application of our procedures, we thought it best to use human coders in identifying concepts within messages. Automated text analysis programs are, however, available and may be fruitfully applied. In fact, we are currently exploring the use of automated text parsing in our research program.

A coder read each of the thirty eight messages in the twenty two message pairs and partitioned them into the smallest meaningful concept units. Forty three distinct concepts were identified. What there are and how they were treated will be discussed shortly.

5) computation of concept cooccurrence. The concepts identified were used to create a 43X43 concept matrix. Each cell of the matrix represents a particular concept pair. In filling the matrix, the coder took each of the twenty two message pairs one at a time and tabulated cooccurrence scores for concept pairs within it. Each time a pair cooccured, a value of 1 was added to that pair's cell in the master concept matrix. As discussed earlier, cooccurrence is constituted by a concept in one message of the pair occurring with a concept in the other message of the pair, not a concept within the same message. Again, figure 1 illustrates this process.

Once all pairs are analyzed, and the cell entries totaled, the matrix represents the aggregate cooccurrence for concept pairs across all message pairs.

The higher the score in a particular cell, the more two concepts in the pair cooccurr across all message pairs.

After we formed the 43X43 aggregate matrix, we packed it. This is necessary because the MDS program we used is limited to 39 concepts maximum. So, we were required to remove the lowest frequency concepts. We examined the matrix rows and columns on a concept by concept basis, rather than concept pair basis, and looked for concepts that had only one cooccurrence with only one other concept. There were sixteen such concepts. After these were removed, we generated a revised 25X25 concept matrix. This is the matrix we subsequently factored with MDS. It appears in table 2. Note that scores still range from zero to 8, because some of the concepts cooccurring more than once with some of the 25 concepts still cooccur zero or one time with others of them.

Before factoring the aggregate matrix, we reversed the cell scores for reasons discussed earlier so that higher numbers mean less cooccurrence and smaller numbers higher cooccurrence, just like in physical distance measurement. After reversal, the highest cooccurrence score, originally an 8, was converted to 1 and the original 1 became 8.

At this point we made a further transformation. We squared the scores. We noted that in physics the mutual attraction of two objects (of equal mass) is related to the square of the distance between them. We think a parallel concept attraction function is plausible, particularly because we are using a distance model. After squaring, a score of 1 remained 1, while the highest score became 64.

The final data preparation step is to assign a very large number to the pairs not cooccurring at all, those having zero cell values before transformation. Finding no standard yet accepted in the literature, we chose a rule: multiply the highest cell entry times 10 and assign this large number to the unrelated pairs. In the current data this results in cell values of 640 for the unrelated concepts.

This transformed cooccurrence matrix then multidimensionally scaled appears in table 2.

6) multidimensional scaling. We factored the matrix using the GALILEO metric multidimensional scaling procedure referenced earlier. Three dimensions accounted for meaningful variance in the matrix. The coordinate projections of each of the 25 concepts is represented in figure 4. It shows the x-y, x-z, and y-z planes and the 25 concepts positioned within these dimensions. The names of these concepts are listed in table 1.

7) Optimal Message generation. As we discussed earlier, for some evaluation objectives it is useful to formatively evaluate communication management strategies that can enable conference leaders to shape the course of subsequent conferencing, bringing it more closely in line with purposes and objectives. To illustrate application of the present method for this purpose, we used the Automatic Message Generator (AMG) function of the GALILEO multidimensional scaling program. The specific details as to how the algorithm operates are well documented in Woelfel and Fink (1981). To apply it, the investigator first selects a focal concept to move and a target toward which to move it. The program then examines all possible combinations of concepts with the focal concept, in pairs, triples, and so on, and measures the predicted movement of the focal concept if it were included in subsequent messages with other concepts.

AMG works according to standard vector algebra procedures, determining the length and direction of the resultant vector for the concept to be moved, as vectors of additional concepts are added. The program determines the efficiency of each possible combination so the user can select the particular combination with the highest likelihood of achieving the objectives for repositioning the concept within the larger concept space. An informal analogy

TABLE 1. Message Concept Elements

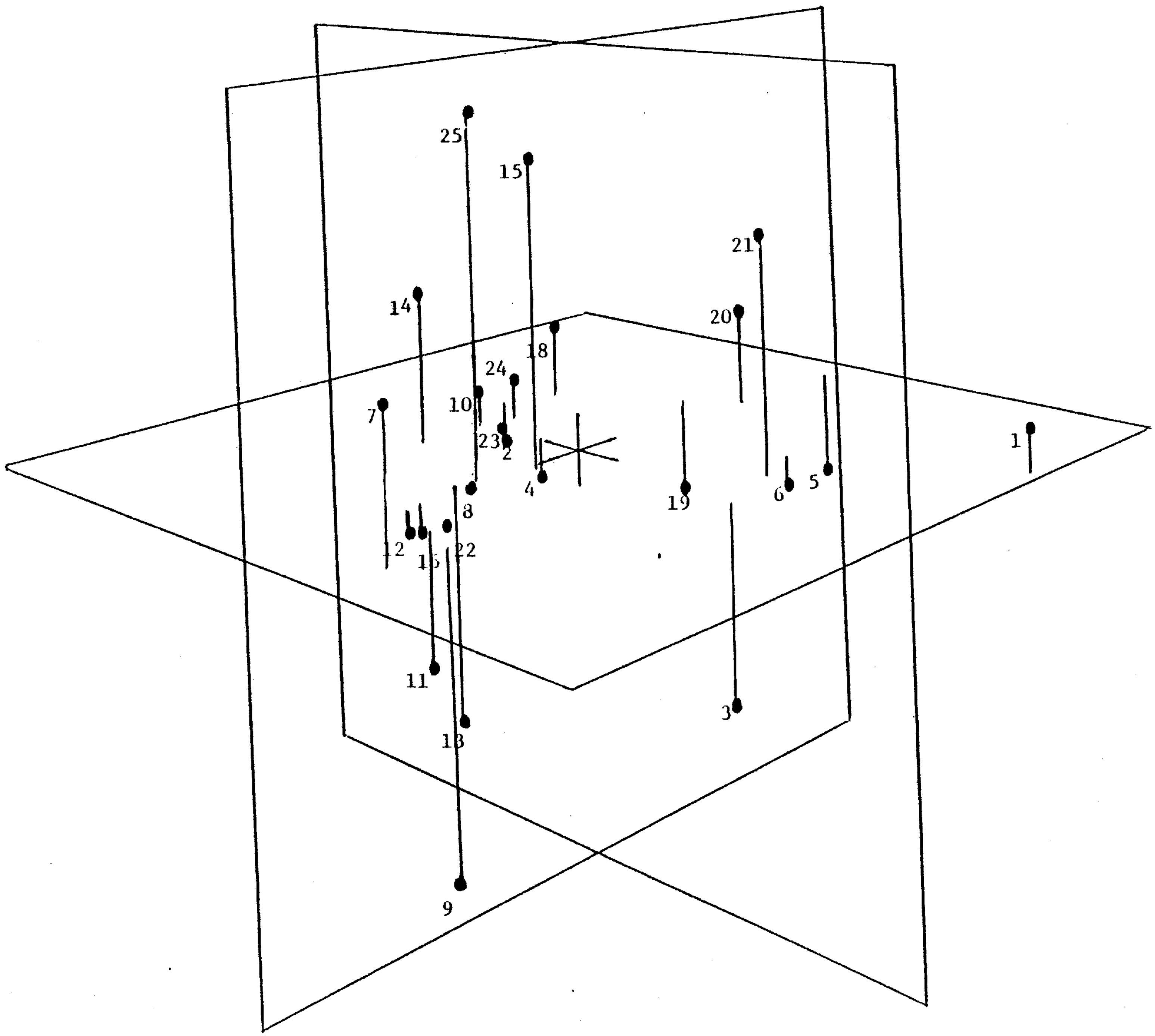
1) CBBS procedures
2) Modems/couplers
3) Request help/information
4) Give help/information
5) Offer information at future date
6) Greetings/salutations
7) Give name/address/phone number
8) Computer software
9) Discuss user groups
10) Offer computer-related service/software free
11) Computer games
12) Leave message on computer bulletin board (this or other)
13) Refer to earlier message
14) Computer for the blind
15) Express interest
16) Source listing
17) Computer system (other than CBBS)
18) Hard copy
19) Thank you
20) Acknowledge receipt of message
21) Discuss problems with own computer
22) Delete this message
23) Fantasy
24) Ask for participation in discussing topic
25) Will send information by other means (telephone, mail)

TABLE 2. Distances Among Pairs of Message Concepts.

NOTE: Cells with a value of 640, indicating no cooccurrence, are left blank for presentational convenience. The actual matrix scaled, however, includes the appropriate 640 cell values.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1																									
2																									
3	49	64																							
4		64	25																						
5		64	64																						
6	49	64	01	49	64																				
7		49	25	64		16																			
8		49	64			36	36																		
9			49				64																		
10			36			64																			
11			04				04	09	49	36															
12			09			16	25	49	64	64	09														
13			64	64		49	64	64	64	64	64														
14							49					64													
15		64	64			49	36	36				64		64											
16			25	25		25	16	64	49	49	04	25													
17			64		64	49							64												
18					64	49							64				64								
19			64		64	49		64					64					64							
20	64				64	49		64					64		64			64							
21	49	64	36			25	64	64	49		64	49			49	64	64		64						
22			49	64		49	64		64	49	64	64									64				
23			64			64				64		64										64			
24			49			64															64	64	64		
25							49	49							64					64	64	64			

Figure 4. Plot of Message Concepts in Three Dimensions



as to how AMG works is the game of billiards. The player selects a ball s/he would like to move toward a target, usually a pocket. Then, s/he examines alternative angles and forces with which to strike the focal ball with other balls. The most likely combination is selected based on the angles and necessary forces, and the player then executes the optimal strategy.

Because the current research is illustrative, the choice of concepts to be moved and target concepts is arbitrary. We selected the concept closest to the centroid of the concept space as the target, which is "giving information". The most central concept was selected because it may often be the case that conference leaders wish to move a concept closest to the center of discussion. Although, movement of concepts away from targets is as easily analyzed. We chose "user groups" for a concept to move closest to the center. Many CBBS conferences are operated by user groups, and there may be advantages to increasing the centrality of discussion about user group concepts.

The best two concept message was selected. Again, combining these two concepts with the move concept "user groups" is predicted to optimally achieve the concept change objectives: movement to the centroid of the concept space. The two optimal message concepts selected from by the AMG routine were "offer information" and "source listing". After entry of optimal messages including these concepts, the actual effects can be compared to these predicted effects by performing steps 1-6 with the next time segment, to observe to what extent the messages have achieved the predicted results. Furthermore, experimentation can determine how many repetitions of the message are necessary to achieve a particular level of movement toward the objective.

DISCUSSION

Paths to Refining the Methodology

The present case illustration demonstrates that the core content analysis and multi-dimensional scaling procedures of the conference evaluation methodology can be meaningfully applied to actual conferences. There are now several directions for refinement and elaboration of the methods and their applications.

One is to extend the present analysis to the time-series case. An stream of conference messages can be segmented into time intervals based on when messages are entered. Then, a series of content analyses and multidimensional scaling routines can be performed. The results can reveal change over time in the conceptual space of the conference.

These procedures enable the conduct of refined field experiments that can serve a range of basic theory and practical applications. For example, one may test hypotheses about the extent to which changes in message content subsequently alter the person-to-person communication network structure of the conference. Does increasing message content diversity lead to a less densely connected communication network strucutre? Might the reverse be the case depending on the kind of content (Danowski, 1980)? A more practical example is if one were interested in the effects of leaders' use of optimal (AMG) messages in a conference, one could systematically enter these messages and observe the effects on the conference content space over time.

Consider another example that ties the current method to a survey method. If one were interested in experimenting with the effects of message content on cognitive structures of users, then one could apply the methodology to the conference messages, subsequently do a survey of users to measure the direct cognitive structure with self-report proximities data on concepts, and analyze these using the same MDS programs. In so doing one can examine effects of changing message content on users'conceptual structures over a time-series. As we discussed earlier, the procedures alone without self-report surveys do measure the <u>underlying</u> conceptual structure, to the extent that psychological dynamics are translated into overt messages. This is no doubt a major portion of cognitive structure. But, there may be interesting aspects of it that do not get translated into overt messages to others, for example, perceptions of attributes of a computer or conferencing system as a whole. Users may have many attitudes and cognitions that they have no motive to express unless asked by someone, yet these psychological factors indirectly affect other variables of interest with respect to particular evaluation objectievs.

A second future extension of the method also concerns segmentation, but of a different sort. Distinct communication network groups can be identified according to structural criteria, for example nodes who share a majority of links among themselves compared to the total set of nodes in the conference. If separate network groups exist, then the basic methodology presented here can be used within each segment. Such network segmentation, a specific case of infographic segmentation, can be useful for a variety of evaluation purposes. One example is a possible need to develop different optimal communication management strategies for the various network groups, to optimize effectiveness. Or at a more basic theory level, one might hypothesize that within network groups that vary in structural features, for example in the density or connectivity within or the diversity of environmental linkage, that different patterns of message content may be exchanged (Danowski, 1980).

A third extension of the methodology is to use automated content analysis procedures. Various programs exist for computerized parsing of text. Once an appropriate program is selected and tested, then the application of the present methodology can be extended to virtual real time application. In other words, at any one time during an ongoing conference, the evaluator, or whoever has access to the fully automated method, can perform a content analysis on conference messages previously entered and immediately represent the overall relationships, perhaps selecting optimal messages for subsequent entry that will change the course of the conference as the person desires. To do this virtual real time evaluation, all that would be required is for the user to read prior conference messages into a file, select the segments for which separate analyses are desired, then call up the content analysis program, then call the multidimensional scaling program, and the statistical analysis is complete. The user can observe the graphic and/or tabular results of the MDS on his or her terminal, perhaps select the AMG optimal message option, identify the optimal message, log back into the conference, and enter the message. After entering optimal messages for a time, the user can then repeat the analysis in the same way to see what effects the "optimal" messages have actually had on the overall concept space of the conference.

Issues

The nature of the computer conferencing evaluation methodology may raise some critical issues. One issue concerns the social control aspects of the optimal message applications. Some may view the technique as too "Orwellian". Privacy *per se*, of course, is not technically an issue, provided that one applies the methodology as we have here to *public* conferences, not to private electronic mail. Still, some may feel that analysis, selection and entry of optimal messages is excessively manipulative. A counter argument can be raised that people naturally attempt to influence the course of their communication with others, regardless of whether it is face-to-face communication, telephone communication, computer communication, and so on. Attempting to influence the course of computer conferencing is qualitatively no different from influencing day-to-day communication, as it has been occuring for millenia. Furthermore, people expect control to be exercised by their leaders, provided it is not excessive and is in their best interests.

Some have countered the above counter-argument with the notion that because the techniques are mathematized and automated, it creates a much more powerful process for social influence than can be achieved without application of the techniques. It is the magnitude, not quality of control that troubles them. Moreover, it is the notion that some would have access to these content analysis procedures in a conference, but not everyone.

Nevertheless, such techniques could be made available to anyone who wished to use them in a conference. Yet, some have informally suggested that this may result in intense "message wars" among communicators, each of whom is analyzing and entering optimal messages. While the images this suggests may be entertaining, message wars are unlikely to become day-to-day practice. One may expect that the degree of message optimizing that might go on across users would be similar to that which occurs in other kinds of communication within a particular social community. The basic personalities of people will govern the overall contours of communication experiences. Still, some feel that all conferencers should know who may be using sophisticated procedures for message management. Parenthetically, the extent to which a particular user community would develop a norm for such disclosure would be interesting to examine.

All things considered, the method is merely an evaluation tool, one tool in a large assortment. Its uses and implications fully depend on the evaluation stakeholders, their objectives, their applications in conjunction with other methods, and their results in achieving these objectives. In short, the method presented here is an enhanced set of procedures linking together several bodies of methods: network analysis, content analysis, and multidimensional scaling, in such a way that these are responsive and sensitive to the special features of computer conferencing.

REFERENCES

Christensen, Ward and Suess, Randy, "Hobbyist Computerized Bulletin Board", Byte, November 1978, 150-157.

Danowski, J.D., "Group Attitude Uniformity and Connectivity of Organizational Communication Networks for Production, Innovation, and Maintenance Content", Human Communication Research, Summer 1980, 299-308.

Danowski, J.D., "An Infographic Model of Media Access for Elderly Advocate Organizations," in P.A. Kerschner, (Ed.), Advocacy and Age. Los Angeles: University of Southern California Press, 1976.

Kruscal, Joseph B., and Wish, Myron, "Multidimensional Scaling. Sage Publications: Beverly Hills, CA, 1978.

Rice, Ronald E., and Danowski, J.D., "Issues in Computer Conferencing Evaluation and Research". This is a chapter appearing in "Studies of Computer Mediated Communication: A Synthesis of Findings." Starr Roxanne Hiltz and Elaine B. Kerr. Final Report in the National Science Foundation, NSF IST-801077, 1981.

Woelfel, Joseph and Fink, Edward, The Measurement of Communication Processes: Galileo Theory and Method. New York: Academy Press, 1980.

APPENDIX II-1

BACKGROUND INFORMATION ON THE SYSTEMS AND STUDIES

COM

Jacob Palme
Senior Research Officer
Swedish National Defense Research Institute
S-10450
Stockholm, Sweden

NUMBER OF PARTICIPANTS: about 375 using the system once a month or more; 240 once a week or more. Some results based on smaller subgroups.

POPULATION: 61% below age 40; 17.9% are bosses; 54% have academic education. Most are researchers at various technical institutes.

PERIOD OF USE PRIOR TO OBSERVATION: Between 1 month and 2 years. Mean experience is about 80 sessions.

REPORTS:

UG - Published by Psychology Department, University of Gothenburg, 40020 Gothenburg, Sweden.

FOA - Published by the Swedish National Defence Research Institute, 104 50 Stockholm, Sweden

COM Teleconferencing System - Concise Manual, by Jacob Palme and Lars Enderin, FOA, 1979.

COM Teleconferencing System - Continuation Manual, by Jacob Palme, FOA 1980.

COM Teleconferencing System - Implementation Manual, by Jacob Palme, FOA 1980.

COM Teleconferencing System - Functional Specification, by Jacob Palme et al., FOA 1980.

Teleconference-based Management Information Systems, by Jacob Palme, FOA 1979.

The following are available in Swedish only (English translations may be forthcoming):

Computerized Conferencing Systems, by Jacob Palme, FOA 1978

Group Communication through Computer: Initial Social Psychological Studies of the COM system at FOA, by Lillemor Adriansson, UG 1980

Group Communication through Computer: Social Psychological Studies of Attitudes to and Experience with the Effects of the COM System on the Work Environment, by Lillemor Adriansson, UG 1980

Experience from the Use of the COM Computerized Conferencing System, by Jacob Palme, FOA 1980

General System Characteristics

HARDWARE: 4 DEC system-10 computers at different institutes in several cities. Each computer has own conferencing system, some exchange made through computer network with automatic transfer of information between systems. Same computers used for large number of other tasks; on the largest, the conference system uses 18% of terminal hours.

SOFTWARE: Assembler for DEC system 10; some utility programs in Simula

PRICING:

a. Charge: Typical hourly cost for local university users= $7. Non-local universities - $14. Lower charges for evenings and weekends.

b. Billed: Universities and public research institutes

CONFER

Robert Parnes
Advertel Communication Systems, Inc.
1030 Fountain
Ann Arbor, Michigan 48103

NUMBER OF PARTICIPANTS: over 1500

POPULATION: Wide variety of students, staff and faculty at two universities. Many not-for-profit research organizations.

PERIOD OF USE PRIOR TO OBSERVATION: 5 years

REPORTS:

R. Parnes, C. Hench, and K. Zinn, "Organizing a Computer Based Conference," Transnational Association, 10, 1977, 418-422.

K. Zinn, "Computer Aided Communications: New Directions for Higher Education," Abstracted in A. Martin and J. Elshoff, eds., Proceedings of the 1979 Annual Conference, ACM, Detroit, Michigan, 1979.

General System Characteristics

HARDWARE: Amdahl U8 at University of Michigan; Amdahl U6 at Wayne State University

SOFTWARE: Non-portable version of FORTRAN IV with many calls to assembler subroutines. Implementation of CONFER requires that system be running under MTS.

PRICING:

a. Charge: Depends on academic status of user and user site. Most costly: WSU non-academic commercial use: $0.20/minute (excluding Telenet), with small disc storage charge (few cents daily).

b. Billed: Organizations, individuals, groups on grants, some commercial use.

CAPACITY:

a. Number of users: No effective limit; each conference can accomodate up to 960 users.

b. Simultaneous users: Through Telenet, presently 14 (soon to increase to 64). By direct dialing, up to 200.

c. Average storage: As much as user needs and is willing to pay for.

EQUIPMENT: CRT, non-intelligent; Hard-copy, non-intelligent; Intelligent or specially equipped terminal

ADDITIONAL:

CONFER runs as special-applications program on a large time-sharing system under MTS. In addition to CONFER, users may easily access large number of other computing facilities including text processors, data bases, etc. Also have access to tape storage, quality output on Xerox 9700, etc.

DEVICES FOR THE DISABLED

Jane H. McCarroll

NUMBER OF PARTICIPANTS: About 65

POPULATION: Involved R&D of devices for physically disabled persons. Included rehabilitation engineers, manufacturers, therapists, clinicians, disabled persons.

PERIOD OF USE: About 2.5 years

REPORT:

J. H. McCarroll, "EIES for a Community Involved in R&D for the Disabled," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 1980, 71-76.

EIES

Murray Turoff
Computerized Conferencing and Communications Center
New Jersey Institute of Technology
Computerized Conferencing and Communications Center
323 High Street
Newark, New Jersey 07102

NUMBER OF PARTICIPANTS: 1000 (approximately)

POPULATION: varied

PERIOD OF USE PRIOR TO OBSERVATION: varies

REPORTS:

There have been about 14 research reports published by the Computerized Conferencing and Communications Center, including:

M. Turoff and S. R. Hiltz, Development and Field Testing of an Electronic Information Exchange System: Final Report on the EIES Development Project. Research Report No. 9, Computerized Conferencing and Communications Center, Newark, New Jersey, 1978.

S. R. Hiltz, K. Johnson, C. Aronovitch, and M. Turoff Face-to-Face Vs. Computerized Conferences: A Controlled Experiment. Research Report No. 12, Computerized Conferencing and Communications Center, Newark, New Jersey, 1980.

S. R. Hiltz The Impact of a Computerized Conferencing System on Scientific Research Communities. Research Report No. 15, Computerized Conferencing and Communications Center, Newark, New Jersey, 1981.

See also:

S. R. Hiltz and M. Turoff The Network Nation - Human Communication Via Computer. Addison-Wesley, Reading, Massachusetts, 1978.

General System Characteristics

HARDWARE: Perkin-Elmer 7/32, 8/32, 3220, 3240

SOFTWARE: FORTRAN, INTERACT, ASSEMBLY

PRICING:

a. Charge: CLASS 1: $75/month membership; $5/hour Telenet. CLASS 2: $25/month membership; $7/hour Telenet and fee.

b. Billed: Organizations, individuals, groups on grants, foundations. Significant number of free accounts (20%) for students, handicapped, etc.

CAPACITY:

Number of users: On 7/32: 500 Class 1, 400 Class 2

b. Simultaneous users: 32

c. Average storage: 200 57-line pages; up to 120 characters per line.

EQUIPMENT:

Hard-copy, non-intelligent (typical)

Intelligent or specially-equipped terminal (optimal)

FUTURES

Joseph P. Martino
John Bregenzer

NUMBER OF PARTICIPANTS: About 30

POPULATION: All futures researchers, mostly academics

PERIOD OF USE: Two years

REPORTS:

J. Bregenzer and J. P. Martino, "Futures Research Group Experience with Computerized Conferencing," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 1980, 65-70.

J. P. Martino and J. Bregenzer, Report on an Experiment with an Electronic Conferencing System within a Scientific Community. Final Report to the National Science Foundation, 1980.

GST
(General Systems Theory)

Stuart A. Umpleby

NUMBER OF PARTICIPANTS: About 60

POPULATION: Almost all academics

PERIOD OF USE: Varied, 0 to 2.5 years

REPORT:

S. A. Umpleby, "Computer Conference on General Systems Theory: One Year's Experience," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 1980, 55-63.

HEPATITIS

Elliot R. Siegel

NUMBER OF PARTICIPANTS: 13

POPULATION: Physicians engaged in clinical research on viral Hepatitis

PERIOD OF USE: 2 years

REPORT:

E. R. Siegel, "Use of Computer Conferencing to Validate and Update NLM's Hepatitis Data Base," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 1980, 87-95. A Final Report is now in preparation.

HUB

Hubert Lipinski
Sara Spang
Institute for the Future
2740 Sand Hill Road
Menlo Park, California 94025

NUMBER OF PARTICIPANTS: about 80

POPULATION: Telecommunications managers and consultants; corporate planners; computer scientists in an academic setting; computer analysts in a military setting.

PERIOD OF USE PRIOR TO OBSERVATION: Varies in length: 3 days to 2 1/2 years.

REPORT:

H. Lipinski, S. Spang, and J. Tydeman, "Supporting Task-Focussed Communication," in A. R. Benenfeld and E. J. Kazlauskas, eds., Communicating Information - Proceedings of the 43rd ASIS Annual Meeting, Knowledge Industry Publications, White Plains, New York, 1980, 158-160.

General Systems Characteristics

HARDWARE: PDP-10 or PDP-20

SOFTWARE: PDP-10/20 ASSEMBLY language; TOPS-20 Operating System

PRICING:

a. Charge: No royalty charged for use. Each individual or group pays for own communication and computer costs. Different rates dependent on group. NALCON group using ARPANET and ARPA computer at ISI, it is free; Speakeasy group using BBN computer pay $15-25/hour.

b. Billed: Each group makes own arrangemants with host computer.

CAPACITY (Research applications have not tested this)

a. Number of users: As many as host computer can hold; HUB does not constrain.

b. Simultaneous users: As many as host computer can hold; HUB does not constrain.

c. Average storage: Storage allocated per group and dynamically used. Most groups have upper limit of 250 pages (1 page = 2560 characters).

EQUIPMENT:

Hard copy, non-intelligent

JEDEC
(Joint Electron Devices Council)

Peter and Trudy Johnson-Lenz

NUMBER OF PARTICIPANTS: 77 people had EIES accounts; 58 used the system at least once; 34 baseline questionnaires were returned; 52 follow-up interviews were completed.

PERIOD OF USE: 20 months

REPORT:

P. Johnson-Lenz and T. Johnson-Lenz. Final Report: JEDEC/EIES Project: Standardization in Minicomputer/LSI Products Via Electronic Information Exchange. Final Report to the National Science Foundation, 1980.

LEGITECH

Valarie C. Lamont

NUMBER OF PARTICIPANTS: 24

POPULATION: State legislative researchers

PERIOD OF USE: Varying amounts of time from approximately 6 to 18 months.

REPORTS:

V. C. Lamont, "Computer Conferencing: the Legitech Experience," in L. A. Parker and C. H. Olgren, Teleconferencing and Interactive Media. Extention Center for Interactive Programs, University of Wisconsin, Madison, Wisconsin, 1980, 457-461.

C. H. Stevens, "Many-to-Many Communication through Inquiry Networking," World Future Society Bulletin, 14, 1980, 31-35.

P. Johnson-Lenz and T. Johnson-Lenz, "LegiTech/EIES: Information Exchange among State Legislative Researchers," in M. M. Henderson and M. J. MacNaughton, eds., Electronic Communication: Technology and Impacts. AAAS Selected Symposium 52, Westview Press, Boulder, Colorado, 1980, 103-111.

P. Johnson-Lenz and T. Johnson-Lenz, The Evolution of a Tailored Communications Structure: The Topics System. Research Report No. 14, Computerized Conferencing and Communications Center, Newark, New Jersey, 1981.

MACC @MAIL

Dave Brown
Network Services Manager
University of Wisconsin
Madison Academic Computing Center
1210 West Dayton Street
Madison, Wisconsin 53706

NUMBER OF PARTICIPANTS: 200

POPULATION: Professional programming staff, administrators and researchers in a major university and Education Services (EDUCOM) environment.

PERIOD OF USE PRIOR TO OBSERVATION: 3 YEARS

REPORTS:

L. Landweber, "Theory Net: An Electronic Mail System," Abstracted in A. Martin and J. Elshoff, eds., Proceedings of the 1979 Annual Conference, ACM, 29-31, 1979.

A. Roberts, "MACC'S Computer Mail System -- Its Features, Usage Statistics and Costs," in L. A. Parker and C. H. Olgren, eds., Teleconferencing and Interactive Media, Proceedings of a Conference Sponsored by the University of Wisconsin Extension Center for Interactive Programs, Madison, Wisconsin, 472-481.

General System Characteristics

HARDWARE: UNIVAC 1100/82 computer. 21 remote job entry stations. 120 timesharing terminals.

SOFTWARE: NUALGOL: an Argol compiler. 96% of code kept in high-level block-structured language to allow easy maintenance.

PRICING:

a. Charge: Run priced as sum of resources used. Mail session costs $0.05/access to file. Typical message cost: $0.50. Per hour cost approximately. $10.00.

b. Billed: All of above.

CAPACITY:

a. Number of users: less than 2000

b. Simultaneous users: 100

c. Average storage: Unlimited; user pays for amount used.

EQUIPMENT:

CRT, non-intelligent

A few intelligent terminals are starting to be used.

MENTAL WORKLOAD

John Senders

NUMBER OF PARTICIPANTS: About 40

POPULATION: Human Factors, Engineering Psychologists interested in theoretical and practical problems of Mental Workload and in testing the notion of an "Electronic Journal" on that topic.

PERIOD OF USE: 1.5 to 2 years

REPORT:

J. Guillaume, "Computer Conferencing and the Development of an Electronic Journal," Canadian Jounral of Information Science, 1980, 21-29.

NLS

James Bair

NUMBER OF PARTICIPANTS: 37 split into experimental and control groups. 17 NLS users.

POPULATION: Knowledge workers (engineers, computer programmers, managers, human factors psychologists) and 2 clerk/secretary/administrators. Mostly male civil servants. Non-random subject selection based on formal organization (2 similar departments).

PERIOD OF USE: one year

REPORTS:

J. H. Bair, Evaluation and Analysis of an Augmented Knowledge Workshop: Final Report for Phase I. Rome Air Development Center, FADC-TR-74-79. Griffiss Air Force Base, New York, 1974.

G. C. Edwards, An Analysis of Usage and Related Perceptions of NLS -- A Computer Based Text Processing and Communications System. Bell Canada H.Q. Business Development, Montreal, Canada, 1977.

OICS (OFFICE INFORMATION COMMUNICATION SYSTEM)

Don Tappscott, Manager
Morley Greenberg, Systems Staff Member
BNSR, 522 University Ave.
Toronto, Ontario, Canada

NUMBER OF PARTICIPANTS: Original Pilot Group = 19; Control Group = 26

POPULATION: Managers, professional and technical, administrative

PERIOD OF USE PRIOR TO OBSERVATION: 8 months

REPORT:

Don Tapscott, "Investigating the Office of the Future," Draft manuscript, to appear in TELESIS.

General System Characteristics

HARDWARE:

PDP-11/70-real time clock KW11-P; FP11 Smaller PDP-11/03 connected to communications network (Datapac); CPU connected via Massbus tp high-speed peripherals and by UNIBUS to low-speed peripherals; 4 RM03-disk packs; TWE16-EA tape drive; high-speed line-printer; letter-quality printer; Two DZ11-E and a DH11-AD; DR11-B connected 11/70 to 11/03.

SOFTWARE: "C"

PRICING:

a. Charge: Login per hour: $8.00; storage: $0.08 per block

b. Billed: Each group billed (may be internal, or external to company)

CAPACITY (512 kb MOS main memory)

a. Number of users: Approximately 150-175

b. Simultaneous users: 25

c. Average storage: approximately 1000 blocks per user

EQUIPMENT: VT100

PANALOG

Edward M. Housman
Manager, Information Services
GTE Labs
40 Sylvan Road
Waltham, Massachusetts

NUMBER OF PARTICIPANTS: 100+

POPULATION: All walks of life: teenagers, scientists, deaf persons, artists, secretaries, technicians, executives, professors, managers, information scientists, pre-teens ...

PERIOD OF USE PRIOR TO OBSERVATION: Varies up to 3 years.

REPORTS:

GTE Profiles

R. H. C. Seabrook, "PANALOG: Shaking the Foundations," Bulletin of the American Society for Informational Science, 4, 21, 1978.

General System Characteristics

HARDWARE: IBM 3033

SOFTWARE: VS APL under TSO

PRICING:

a. Charge: No charge to participants. Experimental testbed system.

b. Billed: Research project bears all costs.

CAPACITY:

a. Number of users: Unsure; have not hit maximum (at 100+).

b. Simultaneous users: Conference Subsystem-1; Electronic Mail Subsystem-50+ (undetermined).

c. Average storage: No measure kept.

EQUIPMENT:

CRT, non-intelligent

Hard copy, non-intelligent

Intelligent terminal

Any ASCll or APL terminal, also 3270 type.

PLANET

Richard Miller
Infomedia Corporation
530 Lytton Ave #303
Palo Alto, California 94301

REPORTS:

Johansen, R., Vallee, J., and Spangler, K. Electronic Meetings: Technical Alternatives and Social Choices. Addison-Wesley, Reading, Mass., 1979.

Vallee, J., Lipinski, H. and Miller, R. Group Communication through Computers, Vol. I: Design and Use of the FORUM System. Institute for the Future, Report R-32, Menlo Park, California, 1974.

Vallee, J. et al., Group Communication through Computers, Vol. II: A Study of Social Effects. Institute for the Future, Menlo Park, California, 1974.

Vallee, J. et al., Group Communication through Computers, Vol. III: Pragmatics and Dynamics. Institute for the Future, Menlo Park, California, 1975.

Vallee, J. et al., Group Communication through Computers, Vol. IV: Social, Managerial, and Economic Issues. Institute for the Future, Menlo Park, California, 1978.

Johansen, R., DeGrasse, R., Jr., and Wilson, T. Group Communications through Computer, Vol. V: Effects on Working Patterns. Institute for the Future, Menlo Park, California, 1978.

General System Characteristics

HARDWARE: DEC (Digital Equipment) PDP-10 processor (CPU) under TOPS-2+, TOPS-10, TENEX, TYMEX (Proprietary to TYMSHARE, Inc.)

SOFTWARE: DEC MACRO Assembly

PRICING:

a. Charge: On basis of Connect Time, CPU utilization, on-line disk storage, and number of participants. Includes telecommunication costs TYMNET. Average: $40/hour.

b. Billed: Client organization; billing breakdowns by individual or group available.

CAPACITY:

a. Number of users: Can accomodate within one client account an unlimited number; within one conference, 127.

b. Simultaneous users: No limit on number using one account; 36 may use conference.

c. Average storage: 1000 bytes per user within an account.

EQUIPMENT:

CRT, non-intelligent

Hard copy, non-intelligent

USC-MSG

James Danowski

NUMBER OF PARTICIPANTS: 38

POPULATION: Retirement community residents in a test of computer communication and the elderly

PERIOD OF USE: 9 hours over 3 weeks

REPORT:

J. A. Danowski and W. Sacks, "Computer Conferencing and the Elderly," Experimental Aging Research, 6, 1980, 125-135.

WHCLIS
(White House Conference on Library and Information Services)

Elaine B. Kerr

NUMBER OF PARTICIPANTS: 41

POPULATION: Staff (8), Advisory Committee Members (21), observers (12). It was a well-educated, older, egalitarian group, with a wide variety of professional backgrounds.

PERIOD OF USE: 7 months

REPORT:

E. B. Kerr, "Conferencing Via Computer: Evaluation of Computer-Assisted Planning and Management for the White House Conference on Library and Information Services," in Information for the 1980s: A Final Report of the White House Conference on Library and Information Services, 1979. U.S. Government Printing Office, Washington, D.C., 1980, 767-805.

WYLBUR @MAIL SYSTEM

Clifford Lynch
Manager Computing Resources
Division of Library Automation
186 University Hall
University of California
Berkeley, California 94720

NUMBER OF PARTICIPANTS: About 120, including occasional users and some outside users.

POPULATION: DLA staff-programmers, managers, administrative support.

PERIOD OF USE PRIOR TO OBSERVATION: 8 months

REPORT:

C. A. Lynch, "Practical Electronic Mail through a Centralized Computing Facility," in A. R. Benenfeld and E. J. Kazlauskas, eds., Communicating Information - Proceedings of the 43rd ASIS Annual Meeting. Knowledge Industry Publications, White Plains, New York, 34-37.

General Systems Characteristics

HARDWARE: IBM 370 or compatible (OS/360)

SOFTWARE: Group of extensions to Stanford WYLBUR coded in IBM 370 assembler language.

PRICING:

a. Charge: We don't charge, internally, for computer time.

b. Billed: This is an internal system and use is not billed. Resources allocated based on user needs and DLA organizational priorities.

CAPACITY:

a. Number of users: At least 300

b. Simultaneous users: Over 50, currently.

c. Average storage: Varies; from 10 up to 1000 tracks. (not used solely for mail) 1 track=13K bytes.

EQUIPMENT:

CRT, non-intelligent

Hard copy, non-intelligent

APPENDIX II-2

SYSTEMS FACTORS

INTERACTIVE SYSTEMS: GENERAL INTERFACE FACTORS

ACCESSIBILITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	3	Local users (included in computer network) need only switch on and give command. Others use phone and modem or international packet networks, neither of which is easy for inexperienced.
CONFER	2	3	Fair amount of effort to interact with Telenet and sign on. Easy as state of art permits.
EIES	1	2	Only name and code needed to log in. Telenet could be easier.
HUB	1	2	Some groups must use Telenet: LOGIN sequence, RUN HUB
MACC	1	1	Type @MAIL to access.
OICS	1	2	Most use ID & password, others dial in.
PANALOG	1	4	None
PLANET	1	2	System responds to user's last name & user settable password.
WYLBUR	2	3	Access has 2 components--ubiquity of terminals (fair) and complexity of procedure (moderately easy, involving 4 prompts).

Mean	1.2		
SD	0.4		

CLOSURE

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	1	Message given on completion of every user-command not asking for type-out.
CONFER	1	1	User always told whether something has or hasn't happened in simple language, no computer jargon.
EIES	1	1	Change in storage always confirmed; title printed on closure of action.
HUB	4	3	Becomes tiresome; need it if you have flaky system. Message not acknowleded; complex tasks are by next prompt in sequence.
MACC	2	2	Any user action acknowledged with prompt character for next command, or error diagnostic.
OICS	3	3	None
PANALOG	2	2	G.O.P., "DONE" after change in calendar. "SENT TO ..." when message released.
PLANET	1	1	Detailed error messages & explanation of what is expected available throughout program.
WYLBUR	2	1	Any command sending or deleting file confirmed at completion.
Mean	2.0		
SD	1.0		

CONTROL

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	2	Individually-composed menus for novices, as well as msgs telling location, etc. Experienced users drop this overhead by changing parameters (partly automatic). Any command can be given as response to any menu.
CONFER	1	1	Can break out of any interaction; system prompts for input; repeated returns
EIES	1	1	User at same level of commands anywhere in system.
HUB	1	1	Workspace modules allow access to resources on host and remote computers.
MACC	2	2	STATUS command.
OICS	1	2	Developed a menu system which guides the user.
PANALOG	NA	NA	Neither should be in control. 'Friendly dynamics'. Passive control from one to another.
PLANET	1	2	Confirmations presented after every command indicating success, failure, or impact of what was done.
WYLBUR	1	1&2	Important for naive users. Unimodal system, so no problem of place.

MEAN	1.2		
SD	.46		

FLEXIBILITY & VARIETY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	3	Too flexible means complexity for novices. User can set many personal parameters. Different kinds of conferences; message expiration time.
CONFER	2	2	Users free to approach capabilities in any order and use any modifiers to tailor command to own needs. Cannot extend what does not already exist.
EIES	2	2	Self-defined commands composed from any sequence of operations.
HUB	1	2	Workspace modules structured for effective use.
MACC	4	4	User profiles expensive and little used.
OICS	2	2	Working on additional operational tools (e.g. project tracking).
PANALOG	1	1	User-driven system. All capabilities suggested by participants, tried out, and included or rejected.
PLANET	4	4	None
WYLBUR	4	4	Can tailor some through exec files. Standardization makes simpler transitions from other system.

MEAN	2.6		
SD	1.2		

FORGIVENESS & RECOVERY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	1	Easily understood error messages; can interrupt commands; anti-commands take back previous ones. Few dangerous commands ask "Are you sure?"
CONFER	1	2	System traps errors & reports to user in English. Most mistakes prevented by structuring. Hardware-produced errors can cause problems.
EIES	2	3	Deletions request confirmation; escape command for any operation sequence.
HUB	1	1	Hopefully, all error messages are helpful, but could be improved.
MACC	1	1	User must confirm transmission; message can be edited, resent.
OICS	2	2	None
PANALOG	1	3	We try. Big machine puts limitations on this.
PLANET	2	2	None
WYLBUR	1	2	Command retry especially valuable for new users.
MEAN	1.3		
SD	0.5		

GUIDANCE & SELF-DOCUMENTATION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	3	Easy-to-understand menus. Help explanations available for most commands.
CONFER	1	1	Completely self-documenting on-line.
EIES	1	2	Use ? and ?? for short & long explanation at any point.
HUB	1	2	? help feature implemented wherever input expected.
MACC	1	1	All documentation on-line & published. Type "Explain ...". Operating system documentation on-line.
OICS	1	3	None
PANALOG	1	2	"HELP" command brings tutorial session.
PLANET	1	1	? typed at any point receives location & options available.
WYLBUR	4	5	Of use mostly to casual user. Rely on print.
MEAN	1.3		
SD	1.0		

HUMANIZATION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	1	User decides order of use and has full power. If power not exercised, system's default path is determined by previous choices. Any non-ambiguous short form of commands (by dropping final letters on one or more words) are legal.
CONFER	2	2	Use of first or last names. Commands given in simple English; must learn system's syntax-it cannot understand pure English input.
EIES	1	3	Human user consultants.
HUB	1	2	Prompts in simple English. Error msgs: system did not recognize request.
MACC	1	1	Friendly documentation, news, Directory, diagnostics.
OICS	1	3	None
PANALOG	1	1	All feel user should be treated as human being; system grew to abhor slightest dictatorship.
PLANET	2	2	English language commands; retrieval requests supplied by user in English subset.
WYLBUR	2	2	Multiple command abbreviations; heavy default use; verification prompts; free format syntax.

MEAN	1.3		
SD	0.5		

PROTECTION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	2	Nothing done can much harm system. Not protected are: conference organizer deleting it; clogging with long messages-- no problems arising from this.
CONFER	1	1	Can only get at files through program which is bug-free. New versions pre-tested extensively. Allows VALID changes to structure; content changes reversible.
EIES	2	3	One single input function which does all error detection.
HUB	1	2	User cannot damage system; shared files may be deleted.
MACC	1	1	Full error checking.
OICS	2	2	None
PANALOG	5	3	Have daily back-up and can restore original. No tampering except software improvement.
PLANET	1	3	None
WYLBUR	1	1	User should not normally be able to damage system; such a "bug" needs correction.
MEAN	1.7		
SD	1.3		

SECURITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	2	Only user and administrator can change user's data. Exception: conference organizer can move inappropriate msgs.
CONFER	1	1	Full protection; can only get at files through program which will do only valid operations on them.
EIES	1	3	File back-up of core; reporting last 10 log-ons on demand. Detection handled better than prevention.
HUB	1	1	Files automatically encrypted; users have individual passwords.
MACC	1	1	Password and full file back-ups nightly.
OICS	1	2	Log-in and file protection by individual. System errors may delete a file if power failure.
PANALOG	5	NA	Does not happen.
PLANET	1	1	Considered proprietary.
WYLBUR	2	2	Users cannot modify others' data. Extensive validity checking.

MEAN	1.6		
SD	1.3		

SEGMENTATION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	2	Need only know small subset of commands. Menus given novices contain only small selection of the most important commands.
CONFER	1	2	Text entry and text editing are segmented: users entering text need not deal with editor until so choose.
EIES	2	2	Menus and limited command set.
HUB	1	1	Conferencing module is core; other services learned as needed.
MACC	1	1	Can get along with TO and PRINT commands; learn as sophistication increases.
OICS	3	2	User can easily follow directions in menus.
PANALOG	1	2	If irregular command given, processor figures it out.
PLANET	2	2	Basic operations are such that user need never REALLY learn any commands. Default and interface such that to communicate within conference, user need only start typing.
WYLBUR	2	2	E.g.: mail system used after learning small subset of WYLBUR commands.

MEAN	1.7		
SD	0.7		

REGULARITY & PREDICTABILITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	1	Commands treated in ortagonal manner; Example: letters and conference entries treated in similar manner.
CONFER	2	2	Commands may be abbreviated to 1st character. "?" will give tutorial except when entering text. Pressing RETURN positive or negative response, depending on context.
EIES	2	4	Not good; machine too slow for advanced users.
HUB	1	2	Type ahead offered by host computer.
MACC	2	2	Keep system load under control so response time predictable.
OICS	2	2	None
PANALOG	5	5	None
PLANET	2	2	None
WYLBUR	2	2	Hard to do; many error conditions. Design well and recover gracefully from errors.
MEAN	2.2		
SD	1.1		

RELIABILITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	2	Multiple error checks at different levels so low risk of system going down.
CONFER	1	2	System usually up over 95% of scheduled operation.
EIES	2	4	Back-up file.
HUB	1	3	Depends on computer--Telenet-BBN link gives problems.
MACC	2	2	Good uptime record.
OICS	1	1	Downtime limited. Frequent backups to ensure minimal data loss which might occur when system crashes.
PANALOG	4	2	Users accept occasional lost message, especially with apology.
PLANET	1	1	None
WYLBUR	1	2	Goal: try for 24-hour availability. Volatile discs backed-up nightly.

MEAN	1.6		
SD	1.0		

INFORMATIVE

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	1	Important that users interact with program at very few points--allowed to give any command at any point and not taken into "sub-levels". If command's parameter not given, default taken.
CONFER	2	2	Short English prompt at every step; if confused user enters "?" for further information.
EIES	2	2	Notifying user at intervals of ongoing search; confirming accomplished action.
HUB	2	3	Line between informationrmative and verbose. Commands shortened to unique word.
MACC	1	1	On-line explain feature.
OICS	2	3	None
PANALOG	5	5	None
PLANET	1	1	See answers for SEGMENTATION, GUIDANCE, and HUMANIZATION.
WYLBUR	1	3	Attempt to give simple and single error message for most errors.
MEAN	1.9		
SD	1.3		

LEVERAGE & SIMPLICITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	4	3	Experienced users can complete many operations with one command; those less so use menus. Command also for typing out all news without pauses, rather than one message at a time.
CONFER	2	2	Relevant files created, protected, maintained and destroyed by system; users needn't worry about operations. Also sees that various modules are available.
EIES	1	2	Levels of interfaces from menus, commands, self-defined commands, self-programming.
HUB	1	1	Interface transparent. Instructions can be pre-entered so that only name need be entered to run.
MACC	2	2	Accepts abbreviated commands and message list ranges.
OICS	2	3	None
PANALOG	4	2	Accepts abbreviated commands.
PLANET	3	3	None
WYLBUR	2	2	Some commands very powerful; exec file used to minimize commands.
MEAN	2.3		
SD	1.1		

MODIFIABILITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	2	Try to avoid limiting message size or number, etc.; any user can start new conference.
CONFER	3	2	Users must operate within pre-existing constraints of general system; organizer of conference can create some new capabilities.
EIES	1	1	Self-defined command capability for users.
HUB	4	5	Basic structure cannot be changed. Assembly language complex to modify.
MACC	4	3	None
OICS	1	2	None
PANALOG	1	1	Always being upgraded.
PLANET	3	3	None
WYLBUR	4	5	If system meets needs, little need to modify (as opposed to tailoring).
MEAN	2.7		
SD	1.3		

RESPONSIVENESS

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	1	Instantaneous response if computer is not overloaded.
CONFER	2	2	Slack period response: instantaneous; busy periods: less than 5 seconds.
EIES	1	3	Capacity limits; assign priorities. 4 levels; composition most responsive; search, least.
HUB	1	1	Limited only by CPU cycles available.
MACC	1	2	NONE
OICS	2	1	Response time normally very high. Depends on processes being operated at any one time-e.g., if large number of people formatting reports, response time degraded.
PANALOG	N.A.	N.A.	Instantaneous; more than 10 seconds = BAD.
PLANET	1	2	None
WYLBUR	1	2	Attempt provide almost instant response for most commands; time=1 second or less.
MEAN	1.4		
SD	0.5		

COMPUTER-MEDIATED COMMUNICATION SYSTEMS: SYSTEM FACTORS
COMMUNICATION RICHNESS

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	NA	Have most facilities mentioned; statistically not highly used. If increase complexity, may do more harm than good.
CONFER	1	2	All aforementioned factors (and more) available.
EIES	1	2	Provides messages, conferences and tailored communication subsystem messaging or conferencing.
HUB	2	3	Status reports; referencing of message or entry; notification of presence.
MACC	4	4	Only operating mail system. Question loaded for EIES.
OICS	1	2	Various synchronous and asynchronous features available, e.g., "write" or "messaging".
PANALOG	1	NA	As much as possible; have conferences, mail delivery, reminders, calendars, files, voting, search, off-line printing, etc.
PLANET	2	2	Conferences limited to specified individuals; a library of ancillary programs (models, text editors, etc.) may be involved according to the privilege set by account administrator.
WYLBUR	3	4	Support mail and single-line real time messages.

MEAN	2.0		
SD	1.1		

SPECIAL-PURPOSE STRUCTURES

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	3	None
CONFER	2	2	All aforementioned factors (and more) available.
EIES	1	1	Use of computer-language optimized for structuring.
HUB	3	3	Filtering important because of large information generation by computer-based resources.
MACC	4	5	None
OICS	3	4	None
PANALOG	1	2	As much as possible; nothing complete except God. Interpretation of Robert's Rules developed.
PLANET	4	3	Of opinion that many "software" implementations of "filtering" and special structures are BETTER performed by human beings.
WYLBUR	4	5	Not important for requirements.
MEAN	2.8		
SD	1.2		

INDIRECT COMMUNICATION CHANNELS

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	5	None
CONFER	NA	NA	Don't understand; may mean don't find it important.
EIES	1	4	Only in some special structures.
HUB	NA	NA	Don't understand.
MACC	3	3	None
OICS	3	4	None
PANALOG	?	?	Sounds important; explanation confusing.
PLANET	4	3	None
WYLBUR	NA	NA	System does not address this.
MEAN	2.8		
SD	1.1		

DOCUMENT DISTRIBUTION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	2	People who do not use terminals can get print-outs instead.
CONFER	2	1	Document distribution determined by author. Text can be printed by Xerox 9700 printer, with copies by request. Users can print out portions they wish to see.
EIES	2	2	Use of SUBMIT and READ commands.
HUB	4	5	None
MACC	2	2	Can print formatted documents.
OICS	3	3	None
PANALOG	1	1	Full and selected transcripts can be requested ; produced immediately for mailing with command: PUBlish.
PLANET	3	2	None
WYLBUR	3	3	Exec files handle distribution lists. Large documents can be cumbersome.
MEAN	2.6		
SD	0.9		

VOTING

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
CONFER	1	1	Number of different mechanisms can be used; include Dynamic Value Voting, a system created for use in a computer conference context.
COM	4	2	Voting but no scales; automatic scales constrict answers too much.
EIES	3	3	9 alternative scales available to write votable comment; surveys can be implemented.
HUB	1	1	This, multiple choice, ranking and text answers can be elected and fed back.
MACC	5	5	None
OICS	4	5	None
PANALOG	2	2	Open and casual; asks for YES, NO, or ABSTAIN and any explanation. Not secret; can be anonymous.
PLANET	2	1	4 types of "questions" (VOTE, NUMBER, ESSAY, and probability estimation) can be asked; facility for aggregating and feeding back results included.
WYLBUR	NA	NA	Not addressed.
MEAN	2.8		
SD	1.5		

II. ATMOSPHERE

SENSE OF COMMUNITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	2	Membership and interest profile available to users except for certain class of protected conferences.
CONFER	2	2	Conference-specific; participants in separate conferences can't easily discover each other.
EIES	1	2	Human user consultants; on-line directory and interests.
HUB	4	5	None
MACC	2	2	On-line directories.
OICS	3	5	None
PANALOG	1	3	Bio file with description of interests; WHO command reviews.
PLANET	1	1	None
WYLBUR	NA	NA	Not an issue.
MEAN	2.0		
SD	1.1		

EVOLUTION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	2	We develop our system in continuous communication with users. One problem is that experienced users put in most requests and this may result in a system too complex for inexperienced users.
CONFER	1	1	Constantly maturing because of user-input actively solicited by designer, who sponsors conference devoted to growth.
EIES	1	1	Open conference on suggestions; implementers part of system. Groups design tailored features for selves.
HUB	1	2	Evolved on user feedback; 3rd "evolution" being installed.
MACC	1	1	Has evolved extensively over 4 yrs.
OICS	2	3	May input to Community Resources group for system and program changes.
PANALOG	1	1	Fundamental.
PLANET	4	5	None
WYLBUR	2	2	Encourage and implement user suggestions; they use mail system as feedback mechanism.

MEAN	1.7		
SD	1.0		

HUMAN HELP

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	2	None
CONFER	2	2	Each conference in hands of organizer responsible for this.
EIES	1	1	User consultants.
HUB	3	4	Each group has a contact person to help.
MACC	2	4	None
OICS	2	2	Computing Resources group and OICS group provide training and back-up on demand.
PANALOG	NA	NA	Depends on how "human" the system is.
PLANET	2	2	Implemented by "coordinator" conferences between client and staff members.
WYLBUR	4	5	Human help easily accessible directly.
MEAN	2.1		
SD	1.0		

TEXT PROCESSING FEATURES

TEXT EDITING

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	1	Now, in March of 1981, we have done it! Both word-processing machine-like screen- editors, and typewriter-oriented editors, are available.
CONFER	1	1	Full text-editor available IF user wishes to use.
EIES	1	1	Comprehensive line and printer-oriented editor available.
HUB	1	2 1/2	Text editing at current position allowed, not previous lines.
MACC	2	2	Introducing co-existent editor; error system had peripheral editor for cleaning up msgs.
OICS	1	1	UNIX operating system provides highly sophisticated text-editing.
PANALOG	1	2	Backspace and strike-over or rub-out & touch-up editing both available.
PLANET	2	2	None
WYLBUR	1	1	WYLBUR primarily text editor; mail system is add-on.

MEAN	1.2		
SD	0.4		

TEXT FORMATTING

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	4	5	Separate systems on same computer for this.
CONFER	2	2	Some automatic paragraph and margin formatting; requires skill in doing advanced, as tables.
EIES	1	1	Indirect editor similar to RUNOFF provided.
HUB	3	4	Tabbing supported.
MACC	2	2	@TEXT processor available.
OICS	1	1	Special parameters file allows users to set formatting commands or default to standard.
PANALOG	3	1	Text automatically uniform to 65 characters maximum, maintaining paragraph structure.
PLANET	3	3	Only through ancillary text-editing program.
WYLBUR	2	2	Have number of commands for this; seldom used with mail.
MEAN	2.3		
SD	1.0		

DOCUMENT FORMATTING

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	4	5	Separate systems on same computer for this.
CONFER	3	1	Choice of major document formatting systems to assist if required; one allows for typesetting operation.
EIES	1	3	Special-purpose commands for each user individually controlling output.
HUB	1	2	Document workspace allows this with own text editor.
MACC	2	2	@TEXT processor available.
OICS	1	1	Special parameters file allows user to set formatting commands or default to standard.
PANALOG	3	3	Topic is solicited, user name and date appended; remainder freeform.
PLANET	4	4	None
WYLBUR	1	2	Various commands and exec files; seldom used with mail system.

MEAN	2.2		
SD	1.3		

TEXT MOBILITY

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	1	1	One message can be sent to unlimited number of conferences and individuals; a comment on the message is normally sent to all who received commented message. Text from messages can be entered into new messages.
CONFER	1	1	Full mobility always possible; message can become item, item edited and entered into other conferences or sent as message.
EIES	2	2	"Copy" and "copy and add" commands.
HUB	2	3	Text saved as file; file moved into desired location.
MACC	1	1	Msg actually file element which can be moved, edited, filed by other utilities.
OICS	1	1	None
PANALOG	3	3	Can be done, but rarely used.
PLANET	2	2	None
WYLBUR	1	1	Copy commands.

MEAN	1.6		
SD	0.7		

TEXT RETRIEVAL & LINKAGES

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	2	"Comment" links, including commands like "retrieve all comments recursively."
CONFER	2	2	Items can be linked via different mechanisms; ordering on output can be controlled by how linked. Hypertext-like linkages not provided.
EIES	2	3	Associations among text items; key words.
HUB	1	2	Forward and backward referencing.
MACC	3	3	None
OICS	1	4	None
PANALOG	1	1	Employ rigorous system holding linkage information among messages in a conversation. We can trace "ripples" of any message.
PLANET	4	3	None
WYLBUR	2	5	Only have relatively sophisticated associative-text search.

MEAN	2.0		
SD	1.0		

VIRTUAL TEXT REFERENCING

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	4	1	"Retrieve" command can be included in message for execution at "looking" time.
CONFER	2	2	Possible, but not used much.
EIES	2	2	Use of ".GET" or ".SEE".
HUB	NA	NA	Don't understand.
MACC	4	4	None
OICS	3	5	None
PANALOG	4	5	None
PLANET	3	2	None
WYLBUR	3	3	Primarily through filename reference of actual text-copying (easily done).
MEAN	3.1		
SD	0.8		

ACTIVE and ADAPTIVE TEXT

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	4	Will be improved.
CONFER	3	3	Normally done outside mainstream of CONFER items by using ORGANIZER DEFINED COMMANDS or separate programs in system.
EIES	2	4	".replace" also able to put programs in text items; initial specs not completed.
HUB	2	2	Allows an interface allowing program to elicit information and process it.
MACC	4	4	None
OICS	1	5	None
PANALOG	DK	DK	Never used this capability.
PLANET	2	2	
WYLBUR	5	4	Can be done through exec files, to some extent.

MEAN	2.6		
SD	1.3		

SPECIALIZED SUPPORT SOFTWARE

INTEGRATED DATA STRUCTURES

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	3	5	Separate software on same computer for this.
CONFER	4	4	Do not see this as major part of general conferencing system; possible for particular applications.
EIES	3	5	None
HUB	2	1	Workspace allows for inclusion of annotated program transcripts.
MACC	3	3	None
OICS	1	1	Budgeting system being put on line soon.
PANALOG	NA	NA	No ideas.
PLANET	3	2	None
WYLBUR	3	4	Maintain control over modifications to a file; doesn't occur too often.
MEAN	2.8		
SD	0.9		

PRIVILEGES & PROTECTION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	2	2	Do not distinguish between "read" and "copy" privileges.
CONFER	4	4	Do not see as major part of conferencing system; possible for particular applications.
EIES	1	2	Commands available for setting up use privileges and passing them directly or indirectly.
HUB	4	5	None
MACC	3	3	None
OICS	1	4	None
PANALOG	3	3	None
PLANET	1	2	None
WYLBUR	2	2	Support read and write protection, not "utilize and edit" (although this would be useful).
MEAN	2.3		
SD	1.2		

USER SIMULATION

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	4	1	By a special high-level-language interface to system.
CONFER	3	2	Possible; requires skilled user. Isn't provided for in "simple user interface."
EIES	2	4	Background tasks for searches.
HUB	4	5	None
MACC	2	2	Msgs containing computer runs (including simultaneous) can be dispatched to background batch stream.
OICS	1	5	None
PANALOG	?	?	Important to "develop tailored programs." Develop these, games, budget as they are suggested.
PLANET	3	4	None
WYLBUR	5	5	Can be done through exec files, to some extent.
MEAN	3.0		
SD	1.3		

MARKETPLACE STRUCTURES

SYSTEM	IMPORTANCE	INCLUSION	COMMENT
COM	5	5	None
CONFER	2	2	Available, but thought of as being outside main computer-conferencing applications.
EIES	1	3	Development work in progress.
HUB	4	5	None
MACC	1	1	Shared files; programs generate software support charges which can automatically accrue to author.
OICS	3	5	None
PANALOG	1	5	We don't sell anything.
PLANET	5	5	None
WYLBUR	NA	NA	Not relevant in our application.

MEAN	2.8		
SD	1.8		

ADDITIONAL SYSTEM CHARACTERISTICS

SYSTEM	CHARACTERISTIC	IMPORTANCE	INCLUSION	DESCRIPTION
COM	EASY NOVICE USE			Should be easy for novices to find communication within system of most interest.
COM	FIND and SCAN	3	2	Easy to find unread material and scan new messages for current needs. Can scan first lines of msgs, n chosen by user.
COM	INTERFACE COUPLING	1	1	User interface provides natural cognitive coupling between menus, commands and short-forms. Menu items identical to commands; any command can be given for any menu. Experienced user can skip the menus when commands learned.
COM	PERSONAL CORRES-PONDENCE FILES TICKLER FILES	2	4	Unlimited number of personal correspondence files; no time-fused files.
COM	MODERATOR	4	2	In large conference, moderator can move away entries not belonging to subject.
EIES	SCANNING	NA	NA	Ability to scan condensed text version; "submit": to pass abstracts and "access" to document.
HUB	EXTENSIBILITY	1	1	Not adapt the system, but provide tools for users allowing them to accomplish task.
PANALOG	PERSONAL CORRES-PONDENCE FILES; TICKLER FILES	1	1	User has own set of files to store in/out mail messages. 1 is time-fused to return certain message on indicated date.
PANALOG	CHAIRMAN	1	3	1 Conference gives chairman power to restrict content to specified topics.

WYLBUR	SCRATCHPAD FILES	2	1	Ability to create text and send without naming file.
WYLBUR	SCANNING	1	2	User can list all waiting mail (including date sent, origin & title) and can skim individual items via associative search.
WYLBUR	INTERFACE COUPLING	5	5	For this type of system, commands should be simple enough so you don't need menu. If menus are implemented, agree that transitions should be very simple.
WYLBUR	PERSONAL CORRES-PONDENCE FILES	2	2	Have personal files for in/out msgs. While system does not have tickle files, many users implement them via exec files (you can also send mail to yourself). We are investigating an implementation of both tickle files & calendars.

APPENDIX II - 3
TASK RATINGS BY GROUP LEADERS

KEY: 1 to 5 scale
1=Low
3=Medium
5=High

URGENCY		
FUTURES	1	
GST	2	
DEVICES	3	
HEPATITIS	4	
JEDEC	3	
MENTAL WORKLOAD	1	
WHCLIS	4	
COM	1	
HUB	1	
NLS	4	
USC-MSG	2	

INTENSITY		
FUTURES	1	
GST	3	
DEVICES	3	
HEPATITIS	3	
JEDEC	4	
MENTAL WORKLOAD	2	
WHCLIS		Cannot say
COM	3	
HUB	3	
NLS	3	
USC-MSG	3	

SATISFACTION		
FUTURES	3	
GST	2	
DEVICES	5	
HEPATITIS	4	
JEDEC	3	
MENTAL WORKLOAD	4	
WHCLIS		Cannot say
COM	5	
HUB	5	
NLS	2	
USC-MSG	2	

UNIQUENESS

FUTURES	4
GST	5
DEVICES	2
HEPATITIS	5
JEDEC	3
MENTAL WORKLOAD	1
WHCLIS	3
COM	5
HUB	3
NLS	2
USC-MSG	5

NOVELTY

FUTURES	4
GST	5
DEVICES	2
HEPATITIS	5
JEDEC	3
MENTAL WORKLOAD	2
WHCLIS	2
COM	5
HUB	3
NLS	4
USC-MSG	5

IMPORTANCE

FUTURES	3
GST	2
DEVICES	4
HEPATITIS	5
JEDEC	2
MENTAL WORKLOAD	4
WHCLIS	5
COM	4
HUB	5
NLS	4
USC-MSG	2

UNPREDICTABILITY

FUTURES	5
GST	2
DEVICES	2
HEPATITIS	2
JEDEC	1
MENTAL WORKLOAD	1
WHCLIS	3
COM	4
HUB	1
NLS	4
USC-MSG	2

DURATION		
FUTURES	3	
GST	4	
DEVICES	4	
HEPATITIS	4	
JEDEC	3	
MENTAL WORKLOAD	3	
WHCLIS	2	
COM	5	
HUB	5	
NLS	2	
USC-MSG	4	

REGULARITY		
FUTURES	2	
GST		Cannot say
DEVICES	5	
HEPATITIS	3	
JEDEC	2	
MENTAL WORKLOAD	1	
WHCLIS	1	
COM	4	
HUB	3	
NLS	3	
USC-MG		Cannot say

ACCOUNTABILITY		
FUTURES	2	
GST	2	
DEVICES	5	
HEPATITIS	5	
JEDEC	2	
MENTAL WORKLOAD	1	
WHCLIS	4	
COM	4	
HUB	4	
NLS	5	
USC-MSG	2	

VISIBILITY		
FUTURES	3	
GST	2	
DEVICES	4	
HEPATITIS	5	
JEDEC	4	
MENTAL WORKLOAD	5	
WHCLIS		Cannot say
COM	3	
HUB	3	
NLS		Cannot say
USC-MSG	2	

EXPOSURE TO HAZARDS

FUTURES	1
GST	1
DEVICES	1
HEPATITIS	1
JEDEC	1
MENTAL WORKLOAD	1
WHCLIS	1
COM	1
HUB	1
NLS	1
USC-MSG	1

COMPLEXITY

FUTURES	2
GST	4
DEVICES	5
HEPATITIS	5
JEDEC	4
MENTAL WORKLOAD	5
WHCLIS	5
COM	3
HUB	4
NLS	4
USC-MSG	4

GROUP ORIENTATION

FUTURES	3
GST	4
DEVICES	5
HEPATITIS	4
JEDEC	4
MENTAL WORKLOAD	3
WHCLIS	4
COM	3
HUB	5
NLS	3
USC-MSG	4

PHYSICAL DEMANDS

FUTURES	2
GST	1
DEVICES	1
HEPATITIS	1
JEDEC	1
MENTAL WORKLOAD	1
WHCLIS	1
COM	1
HUB	1
NLS	1
USC-MSG	1

DOCUMENTATION REQUIREMENTS	
FUTURES	4
GST	5
DEVICES	4
HEPATITIS	5
JEDEC	5
MENTAL WORKLOAD	5
WHCLIS	5
COM	3
HUB	4
NLS	4
USC-MSG	5

COORDINATION NEEDS	
FUTURES	4
GST	3
DEVICES	4
HEPATITIS	5
JEDEC	4
MENTAL WORKLOAD	3
WHCLIS	5
COM	3
HUB	2
NLS	4
USC-MSG	3

EXCHANGE NEEDS	
FUTURES	4
GST	2
DEVICES	5
HEPATITIS	5
JEDEC	4
MENTAL WORKLOAD	5
WHCLIS	5
COM	4
HUB	5
NLS	5
USC-MSG	2

MANAGEMENT NEEDS	
FUTURES	4
GST	4
DEVICES	3
HEPATITIS	5
JEDEC	5
MENTAL WORKLOAD	1
WHCLIS	4
COM	1
HUB	5
NLS	3
USC-MSG	4

EFFICIENCY

FUTURES	4
GST	4
DEVICES	5
HEPATITIS	3
JEDEC	2
MENTAL WORKLOAD	Cannot say
WHCLIS	Cannot say
COM	4
HUB	4
NLS	3
USC-MSG	4

POLICIES

FUTURES	3
GST	1
DEVICES	5
HEPATITIS	4
JEDEC	5
MENTAL WORKLOAD	1
WHCLIS	2
COM	4
HUB	4
NLS	4
USC-MSG	1

COMMUNICATIONS OPTIONS AND ALTERNATIVES

FUTURES	2
GST	1
DEVICES	4
HEPATITIS	2
JEDEC	4
MENTAL WORKLOAD	5
WHCLIS	5
COM	3
HUB	3
NLS	3
USC-MSG	1

STRUCTURING AND GROUPWARE

FUTURES	2
GST	5
DEVICES	4
HEPATITIS	5
JEDEC	4
MENTAL WORKLOAD	1
WHCLIS	3
COM	2
HUB	4
NLS	1
USC-MSG	5

COMPUTER AUGMENTATION

FUTURES	2
GST	4
DEVICES	5
HEPATITIS	5
JEDEC	3
MENTAL WORKLOAD	4
WHCLIS	3
COM	4
HUB	4
NLS	5
USC-MSG	4

APPENDIX II - 4

RATINGS OF IMPORTANCE OF DETERMINANTS OF ACCEPTANCE

KEY:

++: Quantitative evidence of a strong positive relationship

+: Qualitative evidence of a positive relationship, or Qualitative evidence of a moderate to weak positive relationship

0: Evidence of no relationship; not a determinant

-: Qualitative evidence of a negative relationship; or Quantitative evidence of a moderate or weak negative relationship

--: Quantitative evidence of a strong negative relationship

NS: Not studied

ATTITUDINAL DETERMINANTS OF ACCEPTANCE

TASK IMPORTANCE

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
GST	+	0	
DEVICES	++	++	If there is a commitment to perform the task via CC.
HEPATITIS	+	+	
HUB	+	+	People may have positive attitudes and not end up with subjective satisfaction because the system does not meet their particular ideals.

LIKING FOR TASK

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
GST	+	0	
DEVICES	+	+	
HEPATITIS	++	++	
WHCLIS	NS	+	
HUB	0	+	

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
		ATTITUDES TOWARD COMPUTERS	
DEVICES	+	+	
HEPATITIS	+	++	
LEGITECH	NS	NS	In training sessions, those who were hostile towards/afraid of computers interacted the least.
WHCLIS	0	NS	
HUB	+	+	
NLS	+	0	
OICS		++	
		EXPECTATIONS ABOUT SYSTEM	
DEVICES	0	0	Inconsistent- although some won't use it much if convinced beforehand that it's not worthwhile.
HEPATITIS	++	+	
JEDEC	+	NS	
WHCLIS	++	+	Table 17 & 26
HUB	+	+	
NLS	++	NS	
OICS	NS	+	
		ANTICIPATED USEFULNESS	
GST	0	-	
DEVICES	0	0	
HEPATITIS	++	+	
JEDEC	+	NS	pp. 41-44 of final report
LEGITECH	+	NS	In telephone conversations, those able to understand potential of the system seemed to make an honest effort to participate.
WHCLIS	++	+	Tables 16 and 24
HUB	+	+	
NLS	++	++	Defined as the perceived effectiveness in terms of increased productivity. Measured as a subjective evaluation that using the system would improve performance on the job.
OICS	NS	+	

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
		ATTITUDES TOWARD GROUP	
GST	+	+	
DEVICES	0	0	
HEPATITIS	+	+	
JEDEC	0	NS	p. 63- if sense of community in JEDEC qualifies as a measure of this.
WHCLIS	NS	+	
HUB	+	+	
		(PERCEIVED) DEGREEE OF PRESSURE TO USE THE SYSTEM	
DEVICES	0	0	
HEPATITIS	++	0	
HUB	+	+	
NLS	+	NS	
		BIOGRAPHICAL CHARACTERISTICS	
		AGE	
GST	-	-	
HEPATITIS	0	0	
JEDEC	0	NS	p.38
NLS	-	-	
COM	--		
		SEX	
JEDEC	NS	NS	All users were men except two female assistants.
		EDUCATION	
JEDEC	0	NS	p.39
COM	+	NS	
HUB	+	+	In terms of education about computers
NLS	+	+	

PERSONALITY CHARACTERISTICS

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
		INTROVERSION/EXTROVERSION	
WHCLIS	+	+	
NLS	++	++	OCI used as a predictive measure. OCI generalizes to organization from personal characteristics.
		INNOVATIVENESS/RISK TAKING	
HEPATITIS	+	+	
HUB	+	+	
NLS	++	++	
WHCLIS	+	NS	
		BASIC VALUES	
DEVICES	+	0	If sharing information is involved, will use CC more... Feel obligated to try it.
NLS	++	++	Basic values correlated at .62 (p< .001) and .54 (p < .004) with satisfaction, measured as a general attitude.
		PERCEPTION OF PROFESSIONAL OR SOCIAL ROLE	
GST	+	NS	
HEPATITIS	0	0	
HUB	+	+	
NLS	+	++	

COMMUNICATION SKILLS AND PREFERENCES

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
		READING SPEED	
JEDEC	0	0	p.37
WHCLIS	0	NS	Text before Table 14
HUB	+	+	

TYPING SPEED

GST	+	+	
DEVICES	0	0	
HEPATITIS	+	+	
JEDEC	0	NS	p.38
WHCLIS	++	NS	Table 14
HUB	+	+	
NLS	0	0	

PREVIOUS EXPERIENCE WITH COMPUTERS OR TERMINALS

GST	+	+	
DEVICES	0	0	
HEPATITIS	++	+	
JEDEC	+	NS	p.31 - significant at the .05 level, but only for playing games
WHCLIS	++	NS	Table 15
HUB	++	++	
NLS	+	-	Appendix J. Surprising finding- previous experience had negative effect (on subjective satisfaction).
OICS	++	++	

ACCESS TO ALTERNATIVE MEDIA

GST	NS	-	If no access to alternative media, satisfaction increases.
HEPATITIS	-	NS	
HUB	++	++	
OICS	NS	-	

WORK PATTERNS

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS

PRODUCTIVITY

DEVICES	0	0	
HEPATITIS	0	0	
			For what it's worth, our group as a whole did perceive EIES as boosting individual productivity on assigned tasks.
NLS	++	++	
OICS	+	+	

WORKING HOURS PER DAY OR WEEK

DEVICES	0	0	
HEPATITIS	+	+	
NLS	++	++	

NIGHT OR WEEKEND WORK

DEVICES	0	0	
HEPATITIS	+	+	
JEDEC	+	NS	p. 32- significant at the p= .05 level- IF you can make the inference that access to terminal for home use leads to night or weekend work.
WHCLIS	+	+	
HUB	++	++	
NLS	++	++	

CHARACTERISTICS OF THE GROUP OR ORGANIZATION

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS

SIZE OF THE GROUP

GST	-	NS	
HEPATITIS	+	+	
LEGITECH	--	NS	In LEGITECH, 3-5 researchers contributed the majority of inquiries and responses. See EIES quarterly reports.
HUB	++	++	

GEOGRAPHIC DISPERSION

GST	+	+	
DEVICES	+	+	
HEPATITIS	++	+	
HUB	++	++	
NLS	+	+	Although not addressed in the questionnaire, geographic dispersion was reported to increase (strongly) usage and satisfaction during extensive interviews and observations.

CENTRALIZED VS. DECENTRALIZED

GST	+	NS	
DEVICES	-	-	The more decentralized, the more tendency to use CC.
HEPATITIS	+	+	Note that linkage for our group is essentially centralized.
HUB	0	0	

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
PRE-EXISTING COMMUNICATIONS NETWORK			
GST	+	+	
DEVICES	+	0	
HEPATITIS	+	+	
JEDEC	+	NS	p.62
LEGITECH	+	+	Initial core group of users from Minnesota, Massachusetts and Pennsylvania knew each other and contributed the most conference comments in the policy conference. Based on telephone conversations, familiarity of the core group in the initial stages of the project seemed to make people more satisfied with the system.
HUB	+	+	
MENTAL WORKLOAD	++	NS	
NLS	++	+	Defined as "need to communicate." Relationship derived from several variables, not a regression correlation.
LEADERSHIP ROLE			
GST	+	NS	
DEVICES	+	+	
HEPATITIS	++	+	
HUB	+	+	
NLS	+	NS	

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
		LEADERSHIP EFFORT	
GST	+	NS	
DEVICES	+	+	
HEPATITIS	+	+	
LEGITECH	-	-	Project Director contributed the majority of conference items. Private messaging indicated that this decreased enthusiasm of members to check in and contribute to the conferences. Too much leadership effort led some users to be dissatisfied -- i.e., too many conference items and private messages led first to information overload and then to feeling of dissatisfaction.
HUB	+	+	
NLS	0	NS	
		ASPECTS OF GROUP COHESIVENESS	
		SOCIO-METRIC TIES (DENSITY)	
GST	+	+	
DEVICES	+	+	
HEPATITIS	+	0	
NLS	++	++	Same as for communication network
		COMPETITIVENESS	
HEPATITIS	-	-	
HUB	+	+	
		TRUST	
HEPATITIS	+	+	
HUB	+	+	

SYSTEM	AMOUNT OF USE	SUBJECTIVE SATISFACTION	COMMENTS
		OTHER FACTORS	
		OWN VS. SHARED TERMINAL IN OFFICE	
GST	+	+	
HEPATITIS	+	0	
JEDEC	++	NS	Observed difference between those who had their own terminal and those who shared significant at .01 level. No difference between sharing and no terminal at all (pp. 32-33, final report).
LEGITECH	++	+	
NLS	++	++	
		TERMINAL AVAILABLE TO TAKE HOME	
GST	+	+	
HEPATITIS	++	+	
JEDEC	++	NS	Significant at .05 level
LEGITECH	0	0	
NLS	+	+	
		TYPE OF TERMINAL	
LEGITECH	0	0	
HEPATITIS	+	0	Nearly all of our people preferred print capability to high speed CRT.
NLS	+	+	The availability of high speed displays strongly predicted use and satisfaction.
		DIRECT VS. INDIRECT (HANDS ON) USE	
GST	NA	NA	All members were hands on.
HEPATITIS	0	0	Assuming availability of a secretary, motivation of principal to utilize EIES in performing tasks was best predictor. Did not make much difference who it was that actually operated the terminal.
WHCLIS	++	NS	Table 22
NLS	NA	NA	Use defined as hands on only.

APPENDIX II - 5
IMPACTS DATA

IMPACTS FOR THE INDIVIDUAL COGNITIVE LEVEL

Computer-based communication systems create new perceived needs for information.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	Qualitative evidence from discussions and comments - perceived need for information increased, upon realizing more is being done in the field than some individuals are aware of - primarily therapists and consumer groups affected this way
WORKLOAD	--	
CONFER	+	
COM	++	
NLS	+	Strong anecdtoal data
OICS	++	

Continuing education and Computer Assisted Instruction (CAI) expand learning over a lifetime for many.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
OICS	++	This refers to Continuing Education only (not CAI)
USC-MSG	+	

Learning occurs by the written word rather than through audio and visual media.

SYSTEM	RESPONSE	COMMENTS
GST	+	
OICS	++	Training was leader-led instruction with hands-on administration. Physical and on-line user materials provided.

It requires new skills.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	++	Data = comments in person and via EIES, and questionnaire responses
WORKLOAD	0	
HEPATITIS	+	
LEGITECH	+	Ability to do basic typing. Ability to understand the logic of the system being used
WHCLIS	+	
CONFER	+	The major skill is learning to be comfortable interacting through a computer terminal
NLS	+	Based on proficiency testing plus strong anecdotal data
USC-MSG	+	

It discriminates in favor of the literate (writers, typists, etc.)

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	0	Sometimes typing skill makes a difference, but data is not consistent
HEPATITIS	+	
JEDEC	0	pp. 36-38 JEDEC Final Report
CONFER	+	This is a tautology
COM	++	More than 80% agreed that "Those who are good at written communications are favored."
NLS	+	Strong anecdotal data
OICS	+	Knowledge of typing an asset. Looking at some regression equations
USC-MSG	+	

It increases the variety of ideas.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	-	
HEPATITIS	++	
LEGITECH	+	By its inquiry/response structure, it increased the variety of responses to questions by calling on state/federal agencies not usually approached for answers
CONFER	+	

SYSTEM	RESPONSE	COMMENTS
NLS	+	Due to unique capabilities of NLS to structure stored text (including messages) - "hypertext", and the use of high-speed displays

It may improve spelling and typing.

SYSTEM	RESPONSE	COMMENTS
FUTURES	-	
GST	+	
HEPATITIS	0	
CONFER	+	
NLS	-	Increases carelessness. Strong anecdotal data.
OICS	0	

Literacy and information processing abilities improve.

SYSTEM	RESPONSE	COMMENTS
GST	+	
COM	++	Almost all the experienced users, and almost 85% of the inexperienced users, agreed that "information is easier to disseminate."
NLS	+	Due to unique capabilities of NLS to structure stored text (including messages) - "hypertext", and the use of high-speed displays
OICS	+	This refers to information processing, not literacy

Personal goals change with greater awareness of the global situation.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
WHCLIS	+	See appendix D, Q2A, Par. 3,4
CONFER	+	
COM	+	
OICS	0	
USC-MSG	+	

It expands "effective scope": the number of alternatives, pertinent stimuli, awareness, social and cultural horizons.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WHCLIS	+	See table 31
CONFER	+	
COM	+	
NLS	+	
OICS	+	

Users are able to deal with larger amounts of information more efficiently.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	-	Information overload often occurs - seems to take a long time to learn how to deal with the amount of communications active users generally receive

WORKLOAD	--	
HEPATITIS	+	
LEGITECH	-	Users were not used to the great amounts of information coming to them. Only a few seemed to be able to organize their offices in such a way as to develop a more efficient communication system to deal with the overload.
CONFER	+	
NLS	+	Due to the unique capabilities of NLS to structure stored text (including messages) - "hypertext", and the use of high-speed displays
OICS	++	

Because the volume of information can be overwhelming, it increases the possibility of information overload.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	Many users not able to keep up with messages or conferences
WORKLOAD	++	
HEPATITIS	-	I believe the problem of overload in the sense of managing a lot of paper dealing with a lot of discrete tasks being performed simultaneously by a lot of dispersed people was helped by the formats and structuring imposed by EIES messaging and commenting. If nothing else, I had everything numbered and dated in the same typefont on the same sized paper.

LEGITECH	+	Users commented that this was a problem in messages and conferences - however, a filtering mechanism was established with the Inquiry/Response software to ease information overload
WHCLIS	+	See comment about overload in Appendix D, Par. 4
CONFER	+	
COM	++	
NLS	-	Due to unique capabilities of NLS to structure stored text (including messages) - "hypertext," and the use of high-speed displays
OICS	0	

Because information overload requires periodic reassessment of goals and priorities, there is a reduced tendency to follow traditional patterns.

SYSTEM	RESPONSE	COMMENTS
GST	+	
WORKLOAD	++	
HEPATITIS	+	
NLS	0	
OICS	0	

IMPACTS FOR THE INDIVIDUAL AFFECTIVE LEVEL

Computer-based communication systems have the potential for addiction.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	-	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	+	
JEDEC	N.S.	See p. 14 of final report for more about heavy use and "burnout" phases
LEGITECH	+	For the small number who contributed most of the interaction
WHCLIS	+	
CONFER	+	"Addiction" in the mildest sense of the term. Certainly people miss it for a while if they cannot gain access to the system. But it seems to depend on the individual conference.
COM	+	
NLS	+	User reports - very strong anecdotal data
OICS	0	

As addiction and heavy usage increase, it creates distance or isolation from close relationships outside the electronic medium.

SYSTEM	RESPONSE	COMMENTS
WORKLOAD	+	
HEPATITIS	+	

COM	0	There was mixed agreement and disagreement to this question.
NLS	–	Denied by users
OICS	–	Face-to-face communication stayed at the same level

Friendships can endure longer.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
WHCLIS	+	
NLS	0	Tested over several years
OICS	0	

Terminated friendships will be more a function of changed interests than distance.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
NLS	+	Based on observed incidents
CONFER	N.A.	Seems to be more a function of ability to pay for use of the system
OICS	0	

Friendship ties resolidify to counter residential mobility.

SYSTEM	RESPONSE	COMMENTS
GST	+	
NLS	+	Based on observed incidents

It can increase affective ties and sense of personal interaction.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	Especially for disabled themselves and others "out of the mainstream"
WORKLOAD	+	
HEPATITIS	+	
WHCLIS	+	See appendix D, Q2A, par. 7, & Q3, par. 5
CONFER	+	All communication will do this
NLS	+	By virtue of some contact vs. none as the alternative
OICS	+	
USC-MSG	+	

But participants sometimes feel a lack of group interaction and interpersonal feedback: those who need or want immediate feedback might be frustrated, at least in the short run.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	0	
WORKLOAD	++	
HEPATITIS	++	
WHCLIS	+	
CONFER	+	
NLS	0	
OICS	-	

It increases the number and strength of support systems: kin, friends, the availability of professional help.

SYSTEM	RESPONSE	COMMENTS
GST	+	
WORKLOAD	--	
CONFER	+	
COM	+	
NLS	0	Indicated, but just no significant data
OICS	+	
USC-MSG	+	

It supports self-presentation and emotional subtleties.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	It does not prevent this, rather than support it
CONFER	+	As does any written medium
NLS	0	Indicated, but implementations of NLS and other systems too immature

It introduces new sources of stress; e.g., with more potential time together, family life might be strengthened or there might be more divorce and domestic violence; new sources of stress for individuals as workday can expand, priorities change, and new social networks connect people in new ways.

SYSTEM	RESPONSE	COMMENTS
FUTURES	-	
GST	+	

HEPATITIS	+	
COM	+	
NLS	N.S.	However, indications do suggest this
OICS	+	Social networks are changing

It can enhance the candor of opinions.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
WORKLOAD	+	
HEPATITIS	-	
CONFER	+	
COM	+	50% of the users agreed with the statement "Easier to express unconventional views."
NLS	+	From context analysis
OICS	+	

It increases status compared to peers without access to computer-based communications.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
WORKLOAD	++	
JEDEC	+	p. 70
WHCLIS	+	
CONFER	-	
NLS	+	
OICS	+	

IMPACTS FOR THE INDIVIDUAL BEHAVIORAL LEVEL

It can blur the distinctions between work and leisure if users telecommunicate to work from home.

SYSTEM	RESPONSE	COMMENTS
GST	+	
WORKLOAD	++	
HEPATITIS	+	
WHCLIS	+	
CONFER	N.S.	But I agree that it "can" whether or not users telecommunicate
NLS	+	My interpretation of observations
OICS	+	Some evidence arising from taking terminals home evenings and weekends. One group member has purchased a home terminal (Apple II) and built interface to BNR system.

It creates opportunities for flextime and changes in personal time management.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	+	
WHCLIS	+	
CONFER	+	
NLS	++	Based on distribution of connect time hours
OICS	++	

Changes in leisure time activities are possible with more time spent at home and less time watching TV.

SYSTEM	RESPONSE	COMMENTS
GST	+	
HEPATITIS	0	
OICS	N.S.	Don't know yet!

It creates the opportunity for communicating at the time of one's own choice.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	++	
JEDEC	+	Asynchronous use the second most mentioned advantage (p. 113)
LEGITECH	+	Based on face-to-face and telephone conversations, majority felt this to be the case
WHCLIS	+	
CONFER	+	
COM	++	About 95% of experienced users, and almost as many inexperienced users, agreed with the statement that "you can participate when it suits you best."
NLS	++	Based on times (date/time stamp) of messages
OICS	++	

It creates the opportunity to be "in the center of the action" without regard to geography.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	++	
WHCLIS	+	
CONFER	+	
NLS	+	Observations
OICS	++	

Greater freedom of residence and a shift to rural areas are possible.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
WORKLOAD	+	
CONFER	N.S.	But access to Telenet seems to be a major factor working against this
COM	+	

It creates opportunities for communicating and joining groups without regard to sex, race, physical appearance, or other credentials.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	+	
CONFER	+	
NLS	+	Obvious

It allows time for reflecting on the topic being considered.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	--	
HEPATITIS	++	
LEGITECH	+	Based on private messages, researchers felt this to be the case for both computer conferencing and Legitech
WHCLIS	+	
CONFER	+	
NLS	+	Only to the degree it substitutes for synchronous communication
OICS	++	

It increases the degree of personal connectedness with others (in terms of expanding the status set, the number of social participations and the scope of social relationships); it leads to increased collegial contacts, an increase in the number of contacts that can be maintained, and creates the opportunity for regular connectedness with many people.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	Personal experience as well as comments from users
WORKLOAD	+	
WHCLIS	+	See appendix D, Q2A, Par. 4
CONFER	+	
COM	++	Almost 85% of experienced users and 70% of inexperienced users agreed with the statement "It is easy to get the contacts you need."
NLS	+	Based on communications diary comparing user and control group
OICS	+	

It increases the quality of work and contact with others' work.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
DEVICES	0	
WORKLOAD	0	
HEPATITIS	++	

LEGITECH	0	Based on on-line questionnaire (7 respondents) quality no different than that received by telephone and poorer than that received by mail
WCHLIS	++	See table 27-28 text before table 18 and appendix D, Q3, Par. 10
NLS	−	Definite finding that quality does not increase, but contact does
OICS	++	Synergistic impact of producing research reports very high - in fact, we couldn't have done it without the current EOS.

It increases the speed of interaction.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	0	Sometimes yes, sometimes no. Depends on whether people sign on.
DEVICES	N.A.	Depends on the medium being compared and task or purpose of communication. Some say they prefer the telephone because it provides immediate response. Some say tasks are accomplished faster because they would otherwise be done by mail and/or travel/meetings.
WORKLOAD	++	
HEPATITIS	+	
JEDEC	+	pp. 64-65
LEGITECH	N.A.	System slower than telephone and slightly faster than mail
WHCLIS	+	See Appendix D, Q2A, Par. 9 and Q3, Par. 8
CONFER	+	

COM	0	About 70% of experienced users and 55% of inexperienced users agreed with the statement "You get faster answers on your questions," but less than half agreed that "communication takes less time."
NLS	+	Based on analysis of message traffic
OICS	++	

Because it is a written medium, it increases the explicitness of communications with more precise text.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	0	
WORKLOAD	-	
HEPATITIS	+	
CONFER	+	
NLS	0	
OICS	+	

It can reduce travel.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	0	
WORKLOAD	+	
HEPATITIS	++	
WHCLIS	++	See table 30 and text before table 18
CONFER	+	
OICS	++	

It can reduce the need for paper files and change methods of filing output (more files in the short run but fewer in the long run with easier on-line searches).

SYSTEM	RESPONSE	COMMENTS
GST	--	In the short run, yes. In the long run, perhaps fewer, but have not seen this
DEVICES	0	
HEPATITIS	-	Would be true if EIES file not cleared every 3 months
CONFER	+	
NLS	0	Due to unreliable technology and system management. Demonstrated feasible, but exceptional at present.
OICS	++	

Participants can get more deliberate responses to technical questions, backed by written facts and with less delay.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	0	
HEPATITIS	+	
WHCLIS	+	See appendix D, Q2A, Par 5
CONFER	+	
COM	+	
NLS	+	Based on critical incidents and anecdotal data
OICS	0	

IMPACTS FOR THE GROUP COGNITIVE LEVEL

It creates group resources as individuals join on the basis of verbal output rather than traditional credentials.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	0	
NLS	N.S.	NLS was used to support organizations where role directed joining
OICS	+	

It improves the quality of group decisions.

SYSTEM	RESPONSE	COMMENTS
DISABLED	0	
WORKLOAD	--	
HEPATITIS	+	
JEDEC	++	pp. 65-67
CONFER	NS	But I agree that it will
OICS	+	

It increases understanding and appreciation of knowledge-based authority rather than hierarchical authority.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	0	
OICS	+	

Greater awareness of the global situation changes organizational goals.

SYSTEM	RESPONSE	COMMENTS
GST	0	Not yet
OICS	+	

The creative process is more abstract.

SYSTEM	RESPONSE	COMMENTS
NLS	+	Due to unique capability of NLS to structure stored text (including messages) - "hypertext", and the use of high-speed displays - shared hypertext
OICS	0	

It provides a common framework and experience (a node for networks).

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	+	Sense of community seemed to endure among many members
HEPATITIS	+	
OICS	+	

It creates opportunities to develop communities of interest rather than those based on geography, discipline, a redefinition of the meaning of "local".

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	+	
CONFER	+	
NLS	+	Obvious from location of users
OICS	+	

IMPACTS FOR THE GROUP AFFECTIVE LEVEL

The use of surrogates in computer-based communication systems can inhibit levels of trust and security.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	0	
WORKLOAD	-	
HEPATITIS	+	
CONFER	N.S.	Possible but no experiences as yet
USC-MSG	-	
OICS	0	

The absence of nonverbal cues and possible poor response to questions increases the attention paid to supportive, encouraging, or negative statements in both computerized conferencing and face-to-face meetings. This heightened understanding facilitates general social interaction.

SYSTEM	RESPONSE	COMMENTS
GST	+	
HEPATITIS	+	
NLS	+	Increases attention - yes, but social interaction merely approximates face to face

IMPACTS FOR THE GROUP BEHAVIORAL LEVEL

It increases cross-group communication.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	Slightly
DEVICES	+	
WORKLOAD	-	
HEPATITIS	+	
JEDEC	0	p. 10
WHCLIS	+	
COM	++	Especially for those who are not bosses at any level
NSL	++	Communications audit - Chi square significant

USC-MSG	+	By observation - most active users will respond to inquiries/messages from members outside of their group
OICS	+	

It increases lateral network linkages between organizations.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	0	Potentially
DEVICES	+	
WORKLOAD	+	
COM	++	
NLS	+	Observed
OICS	+	

It increases lateral network linkages within organizations.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	0	
WORKLOAD	+	
WHCLIS	+	
COM	++	
NLS	++	Communications audit - Chi square significant
OICS	+	

Research communities become more open (rather than encapsulated) in the long run.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	-	May communicate more outside of their usual circles, but don't seem to become more open in their communications
WORKLOAD	+	
HEPATITIS	+	
COM	++	
NLS	N.S.	Sample was business oriented, not academic
OICS	+	

Communication links increase: It can promote communication among disseminated groups which may not otherwise communicate IF the need to communicate is high enough.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	+	
JEDEC	+	p. 7 - the chip carrier group only existed as a group on EIES
WHCLIS	+	
COM	++	
NLS	++	Communications audit - Chi Square significant
OICS	+	

It may change social structures from pyramid or hierarchical to network-shaped.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
COM	++	
NLS	+	Strongly indicated by location of users
OICS	+	

It changes the centrality of members within groups.

SYSTEM	RESPONSE	COMMENTS
GST	+	
WORKLOAD	--	
HEPATITIS	0	
NLS	+	Yes, but not because of discipline knowledge, rather because of system knowledge

It creates new demands (or reallocation) for institutional support funds within organizations.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	New demands for funds to support the use of the medium!
LEGITECH	+	After project, states which wanted to remain on system had to subscribe. All felt this would be in addition to traditional communication costs.
WHCLIS	+	
CONFER	+	

It can increase the effective limits on the size of working groups, with as many as 50 people or more able to work together on a project.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
WORKLOAD	+	
HEPATITIS	+	
CONFER	+	
COM	++	This was measured by two questions: "Many people can say their meaning" (95% of the experienced users agreed), and "Work in larger groups is possible" (about 85% of the experienced users and almost 70% of the inexperienced users agreed.)
NLS	+	Indicated by a few cases
OICS	+	

It creates new kinds of social groups, clubs, activities.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
CONFER	+	
NLS	+	Numerous anecdotes
OICS	0	

It creates new ways for organizations to advertise and otherwise promote their goals.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	++	This has happened - documented in messages and conferences
WORKLOAD	+	
WHCLIS	+	

The understanding of groupware (software + group needs) leads to new ideas about ways of structuring face-to-face meetings.

SYSTEM	RESPONSE	COMMENTS
DEVICES	+	Have used EIES to plan and prepare for face-to-face meetings - found to be better prepared and further along by the time of the meeting. Also, agenda is usually different than if no computer conferencing beforehand.
WORKLOAD	++	
OICS	+	

It increases the need for strong and active leadership.

SYSTEM	RESPONSE	COMMENTS
DEVICES	0	Inconsistent evidence
WORKLOAD	++	
HEPATITIS	++	
CONFER	N.S.	Depends on the conference and group goals. It really goes both ways.
NLS	0	
OICS	+	

The emergence of a leader is different and less likely.

SYSTEM	RESPONSE	COMMENTS
DEVICES	-	
WORKLOAD	++	
HEPATITIS	--	
LEGITECH	+	Leaders became those who interacted most
WHCLIS	+	
CONFER	N.S.	It is "different" but not "less likely"
NLS	0	Since most NLS user groups are within geographical proximity, leadership is role defined, not emergent
OICS	-	Informal group leader(s) tend to develop

It promotes equality and flexibility of roles; roles such as moderator, groupware designer, and user consultant carry over to other social situations.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
WORKLOAD	-	
HEPATITIS	0	

It increases the potential for "electronic elites."

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
WORKLOAD	++	
HEPATITIS	+	
NLS	+	Particularly true for programmers. Observed
OICS	-	

The increased use of organizational consultants indicates more flexible structures.

SYSTEM	RESPONSE	COMMENTS
GST	+	
WHCLIS	+	

It increases the possible span of control.

SYSTEM	RESPONSE	COMMENTS
HEPATITIS	+	
NLS	++	Due to increased vertical communication
OICS	+	

It increases the density of social networks and increases connectedness among disparate members of a user community.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
DEVICES	+	
WORKLOAD	-	

HEPATITIS	+	
WHCLIS	+	See Appendix D, Q2A, Par. 10
CONFER	+	
COM	+	
NLS	+	Communication audit and usage statistics
OICS	+	

It increases opportunities for decentralized communication.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	+	
HEPATITIS	+	
WHCLIS	+	
NLS	+	
OICS	+	

The content threads of conversations increase.

SYSTEM	RESPONSE	COMMENTS
GST	+	
DEVICES	++	
WORKLOAD	+	
HEPATITIS	+	
OICS	0	

Rapid communication reduces lag time. Organizations (and people) learn more and more quickly of events of interest to them.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	0	Inconsistent evidence - can't make this a generalized statement - depends on too many other variables
WORKLOAD	++	
HEPATITIS	+	
JEDEC	+	pp. 64-65
WHCLIS	+	
CONFER	+	
COM	+	
NLS	+	Based more on later experiences with NLS (post study)
OICS	++	

It may increase informal communication.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	+	
WHCLIS	+	
CONFER	+	
COM	+	

NLS	++	Communication audit
USG-MSG	+	
OICS	+	

It changes who talks to whom.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	+	
WORKLOAD	-	
HEPATITIS	+	
CONFER	+	
COM	++	
NLS	++	Due mostly to exclusion of non-users
OICS	+	

Questions often go unanswered.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	++	
WORKLOAD	0	
HEPATITIS	+	
WHCLIS	+	
CONFER	-	True of any medium. But they often get answered as well. Depends on who is answering.
NLS	-	
OICS	-	

Groups take longer to reach agreement and consensus is less likely.

SYSTEM	RESPONSE	COMMENTS
FUTURES	-	
DEVICES	0	
WORKLOAD	++	
HEPATITIS	-	The key is compared to what? If comparing face-to-face, EIES probably takes longer. But if face-to-face is impractical, and you are faced with the alternatives like the U.S. mail, we made out better with EIES. No doubt.
OICS	+	

It is sometimes difficult to focus discussions.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
DEVICES	+	
WORKLOAD	++	
HEPATITIS	+	
WHCLIS	+	
CONFER	+	
NLS	+	
OICS	-	

Regularity of individual participation is sometimes difficult to enforce.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
GST	+	
DEVICES	++	
WORKLOAD	++	
HEPATITIS	+	
LEGITECH	+	Researchers were asked to participate at least twice a week. Majority did not do this, even after messaging and telephoning.
WHCLIS	++	See my "conference traffic" table and also Appendix D, Q3, Par. 2
CONFER	+	
NLS	+	
OICS	0	

There is a shift from hierarchical communication to fluid sets of teams.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
DEVICES	+	
WORKLOAD	+	
HEPATITIS	0	
NLS	+	Indicated
OICS	+	

There is greater equality of participation than in conventional media.

SYSTEM	RESPONSE	COMMENTS
FUTURES	+	
WORKLOAD	0	
HEPATITIS	-	
WHCLIS	+	See Appendix D, Q2A, Par 7
CONFER	-	The same kinds of inequalities seem to hold in practice though in theory this is very plausible
COM	++	
OICS	+	

Kinship ties resolidify to counter residential mobility.

SYSTEM	RESPONSE	COMMENTS

Additional Impacts

What other impacts of computer-based communication systems have we omitted? Please outline any important possible impacts you are aware of:

SYSTEM	RESPONSE	COMMENTS

Timeless. No problems getting rapid access to Hawaii or France.

FUTURES	+	

Unlike the phone, you can answer this when you feel like it.

FUTURES	+	

Users become more proficient in using more complex system features with increasing experience

LEGITECH	NS	

May increase ability to adapt to different mental models (used in designing different computer-based communication systems), not only within these systems but in other contexts.

WORKLOAD	--	

It increases amount of information available for decisions

JEDEC	+	pp.67-68

It improves continuity between meetings

JEDEC	++	pp.68-69

Intellectual effectiveness (the creation, organization, and exposition of ideas in written form) is enhanced. This is considered "communication with self," and takes all the forms of communication with others. It is caused primarily by the hypertext structure of the communications.

NLS	++	59% of respondents agree and strongly agree

Less risk that important factors are forgotten in decision-making

COM	+	

Easier to disseminate information to more people

COM	+	

Larger groups of people can influence decisions

COM	+	