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The Coming Role of Computer Conferencing

There is frequent discussion about the transformation of the "postindustrial" society into a "communication-information" society. Already more than half the work force is involved in some type of communication-information function. The personal computer is one to which an individual has private access (Fig. 1). This could be a minicomputer or microcomputer capable of isolated operation or a terminal linked to a host computer on a time-shared basis. Personal computers and their changing roles are increasingly written about in the popular press as well as in technical journals (5,8).

With near immediate access to a variety of data bases and literature resources, the knowledge base available to an individual armed with a small computer is becoming enormous. Individual information users may be located nearly anywhere, may communicate among themselves without the need for formal organizational structure, and are not limited to specific working hours. Personal computers are also being used increasingly in specific research activities and administrative processing, with more and more professionals becoming familiar with the equipment. The way we work within our professions will be changed by these events in ways difficult to fully comprehend at this time (5,7).

Electronic conferencing offers a new approach to problem solving and general management. While the term "electronic conferencing" includes the familiar telephone, it primarily addresses video or computer-based information exchanges. With the cost of computers and associated storage and transmission devices dropping dramatically, increased use is being made of computer conferencing for both technical and nontechnical communication to reduce the number of required face-to-face meetings. In addition, computer conferencing can greatly assist premeeting planning and postmeeting follow-up, as well as offer some options not found in other forms of communication. This is
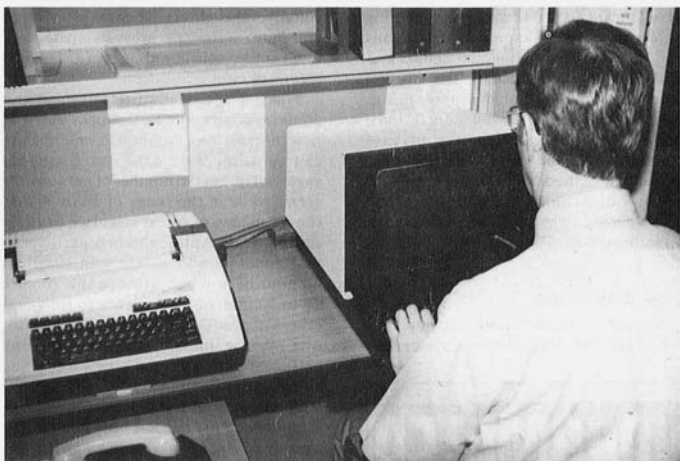

Fig. 1. Personal computers are capable of isolated operation or can be linked to a host computer on a time-shared basis.

occurring at a time when attendance at professional society and group seminars or meetings is declining because of dramatic increases in transportation and lodging costs.

Many problems facing society and the professions require knowledge of existing information, rapid discussion among diverse groups, and anticipation of potential alternatives. While computer conferencing is not a panacea, in many cases it does offer increased information at reduced cost over current techniques of communication.

Special Advantages

Complex problem resolution frequently requires the involvement of several professions or disciplines and may entail regional diversity as well as diverse experience among team members. In this regard, computer conferencing is somewhat like the "invisible college," where existing organizational and geographic constraints are reduced or eliminated. Computer conferencing eliminates some of the group interactive problems faced by members of technical committees. For example, less assertive members may not state their viewpoints during committee discussion or ranking individuals may be perceived as being more authoritative than other members. Computer conferencing reduces the inequality of members and allows relatively equal access by all participants, thus allowing a greater chance for free expression. There is also an opportunity to bring forth realistic risk situations without fear of reprisal; if such fear is a concern, a member can enter a conference comment anonymously. In addition, provisions can be made for a "rumor mill" or an anonymous suggestion box, and committee or team management may be democratic (if desired) by allowing members greater expression of their views and greater involvement in committee administration.

Because human communication by computer does not allow the traditional "body language" feedback, new feedback techniques and personalized processes soon develop among users. This form of "computer body language" can include spelling (that was soooo great), exclamations (ugh!), and personal

greetings or salutations. These factors—along with the speed of entry, transmission, and retrieval, the written transcript of all correspondence, the capability of using the system at times of personal choosing and without interruption by others, and the opportunity to look over materials before having to respond—make computer conferencing an attractive means of technical communication.

Computer conferencing has proved effective in developing agendas, preparing delphi-type questionnaires, voting, joint editing of specific sections or common areas of reports, responding to a series of rapidly occurring events in a timely manner, encouraging risk-taking in idea development and presentation, negotiating different views of complex definitions and processes, providing newsletters and bulletins, and conducting the normal meeting functions of brainstorming, decision making, drawing conclusions, and following up. Because private messages can be sent selectively to participants, there is an opportunity for private discussion as well as group conferencing, where all participants see all information.

The Limitations

No one communication system is best for all applications and no one system can efficiently serve even a specific application all the time. Thus, although computer conferencing could be used much more than it is, it should not be expected to provide all the answers. Primary limitations for individual use appear to be: 1) new interactive procedures have to be learned (eg, system commands and thinking at a keyboard); 2) new management procedures need to be developed for record keeping and filing; 3) a terminal has to be readily available; and 4) some ability to type is desirable. (Many of the concerns of nonusers about their ability to type and the need for learning new procedures are greatly reduced after they have been exposed to the value of computer conferencing.) Finally, the direct economic cost of computer terminals must compete with often hidden subsidized costs of alternative means of communication.

When the need is sufficiently great and conference size allows frequent entry of new information, computer conferencing can function well. Size and frequency vary widely, but the number of participants seems to be in the range of 10 to 30 and the frequency of use at least two or three times a week. Although a new participant may function adequately with less than an hour of practice, most people require 20 to 50 hours of experience to fully and efficiently use the relevant features. Thus, one of the initial hurdles is gaining sufficient experience on a new technique to recognize its full value.

A major limitation is availability of equipment and access to compatible systems. Because so many different systems are becoming available, compatibility is developing into a major issue. Even though most current systems will operate with any terminal, all participants of the conference must still subscribe to the services of the same host computer. Because no one system is "best" for all applications, it is unlikely that all desired participants in a conference would be in the same conferencing system. This can be partially addressed by a participant moving to a new system for the duration of a particular conference.

Examples of Diversity

While several conferencing systems are available, the Electronic Information Exchange System (EIES) developed at the New Jersey Institute of Technology with funding from the National Science Foundation is the most extensive in terms of participants and system options. (Specific information about the system can be obtained from the Computerized Conferencing and Communications Center, New Jersey Institute of Technology, 323 High Street, Newark, NJ 07102.) EIES was designed with strong consideration of technical application (there were about 120,000 hours of use at the end of 1980). Three case histories of information management are presented as examples of the diversity of such a system.

●For about 6 months before the White House Conference on Library and Information Services was convened in November 1979, planning and management were done largely with the EIES system (4). Twenty-nine members of the advisory committee and staff established 10 separate conferences so that specialized subject matter could be localized within a specific conference. Most users were not experienced with computers or with typing but typed material in themselves and generally found the system increased their communicating ability. Uses for EIES included: connecting various working groups to one another through electronic reports and messages; allowing both delegates and nondelegates to monitor the progress of all working groups; demonstrating a new technology for the sharing of communication and information; reporting the conference activities to EIES users and guests unable to be present; allowing interaction among the participants in three remote sites (Hawaii, Kansas City, and New Jersey); and providing communication between the delegates and the supporting groups in their states. This conference provides an example of a significant number of people able to learn a new technology sufficiently well in a relatively short time (a few weeks) to be useful to most of the participants. A detailed preconference and postconference questionnaire and evaluation are available (4).

● The Community News Exchange uses special programming developed by Peter and Trudy Johnson-Lenz and operates as a component of EIES (*personal communication*). The exchange consists of 55 people throughout the United States who are interested in community or neighborhood activities. They are able to raise brief questions as "mini-conferences," and others may respond without interfering with areas of other conferences. The questions or topics of interest to each member can be selected so responses are directed only to those who wish to receive them. In this way, a person can attend a number of "simultaneous" conferences and avoid those of limited interest. A topic designated "bulletin board" is a broad type in which everyone might be interested. The system also provides voting and management summaries of participants' various questions and responses and an overall summary of the topics raised and the number of responses entered. In the first 3 months of this exchange (through January 1981), 18 topics and 63 responses were entered on such subjects as the future of community information centers, examples of community self-help projects, data bases and resource tools, and rural community news.

• Conference C-795 on Energy and Environment is an example of a single conference on EIES (R. L. Caldwell, *unpublished*). This was operated from June 1980 to June 1981 and involved an average of 25 members from 15 states and countries representing 21 disciplines. The conference included joint document preparation, discussion on general and specific issues, group-selected topics, current literature summaries, monthly progress reports, and voting. In the 9 months of conference activity, there were 350 comments averaging 300 words each, or about 39 comments a month. Activity included initial brainstorming (6 months), detailed discussion of two selected topics for 1 month each (2 months), a critique (1 month), and a time when material could be retrieved but no new items entered (3 months). All comments are entered chronologically with this format, so several related topics often are under discussion at one time, with the comments interspersed. Since in addition to key words each comment may have a reference number tying it to an earlier comment, there is generally no confusion among users.

These three examples all have provisions for retrieving specific comments and for searching by key words, authors, or related comments. The systems also allow receipt of all comments developed since the last entering of the conference, so a member can pick up waiting items and not be burdened with material already received.

EIES Procedures

EIES allows: 1) private messages (with confirmation of receipt) between individuals or groups; 2) conferences in which the membership entry is controlled by a moderator; 3) notebooks in which an individual or a group can keep private information, give others permission to use portions, and allow joint report writing and editing by those given permission; and 4) voting and transfer of information from one place to another (1). In addition, previously entered material can be modified and earlier receivers notified of the modification, abstracts can be submitted and full papers specifically requested by interested individuals, and searches can be made on titles, key words, authors, or associated messages or comments. Tables (but not graphs) can be easily prepared and corrections, additions, or deletions made to the text during or after entry. The EIES system operates on a minicomputer at the New Jersey Institute of Technology and can be connected by telephone to any computer terminal or to a word processing unit with communications option.

All commands for operating the system can be listed on one page of paper, and the most commonly used commands are easily learned. There is also an extensive on-line set of explanations. Special new commands may be defined by individual users by adding a string of more specific commands. For example, MAIL could be defined as getting all waiting messages, going to selected conferences and retrieving any waiting items, and signing off the system. Thus, one simple command can be entered and the system will run itself while the user is involved in other activities. For example, in 8 minutes I picked up several private messages to me, received confirmation of the receipt of messages I previously sent to others, received waiting comments from two different conferences, and

Table 1. Example of the comment format addressing the question of typing ability and conference use

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C1000 CC302 ROGER L. CALDWELL (UNIV-AZ,795) 2/1/81 10:10 PM L:4
KEYS:/PROFESSIONALS/COMPUTER CONFERENCING/TYPING ABILITY/

I have heard from several nonusers of computer conferencing that a major drawback for professionals to use it is the lack of typing ability. Do you find this to be a particular problem?

C1000 CC304 ELAINE KERR (ELAINE,114) 2/1/81 10:34 PM L:15
KEYS:/TYPING ABILITY/A:302

Roger, my own research and experiences suggest that typing ability is a complex issue, but not nearly as much of a hindrance as observers (rather than participants) of the medium often guess it to be. It can be a negative factor, but only to the degree that it affects motivation to sign on and participate. And motivation is a much stronger determinant of the use and acceptance of the medium than is typing ability.

First of all, the asynchronous nature of the medium means that people participate at their own convenience and pace, so that slow typists have an annoyance rather than a real disability. Secondly, the norms on most of these systems and for most of the groups that use them are that typos are acceptable as long as the meaning is clear.

Using the keyboard or delegating the input to someone else is a separate issue, and there is some evidence that it can under certain conditions inhibit feelings of trust in a group.

C1000 CC305 PETER & TRUDY JOHNSON-LENZ (P+T,118) 2/2/81 L:8
KEYS:/TYPING SKILLS/EIES USE/DATA FROM JEDEC PROJECT/A:304

Elaine has given a good and comprehensive summary of what is known about the relationship between typing ability and use of the medium.

The only "hard" information we can add is from the evaluation we did of the JEDEC project. JEDEC is the Joint Electron Device Engineering Council. JEDEC members used EIES for trying to set standards for electronic components over a period of 22 months. One of our evaluation hypotheses was that EIES use is related to typing speed, but that hypothesis was not supported by the data.

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signed off the system; this process produced the equivalent of five double-spaced pages. An example of the comment format is shown in Table 1.

Pest Management Projects

Many projects dealing with pest management involve participants from different geographic areas and frequently from several disciplines. For example, task force reports of the type developed by the Council for Agricultural Science and Technology or the U.S. Department of Agriculture generally require a membership in the range of 10–20 members located throughout the United States and involve meetings lasting 1 or 2 days. This type of report draws on existing information, uses the collective wisdom of a group of professionals, and is quite amenable to computer conferencing. After initial brainstorming and development of a report outline, selected members could author specific parts of the report and the entire group could then review and make comments, followed by revisions by the original

authors. This would allow all members to have full access to their normal reference materials, to continue their other activities while serving on the task force, to reflect on the comments of others before responding, to see everything in writing, and to avoid short meetings with long-distance travel. The time frame for computerized conferencing could be considerably compressed over that for a face-to-face meeting or telephone conference; for example, arranging for everyone to be available at the same time and mailing draft reports would be unnecessary.

Another example relates to ongoing research management through such groups as the U.S. Department of Agriculture and state agricultural experiment station regional research projects. These activities typically involve 10–20 people within a selected geographic region of the United States. They usually meet annually, but some meet more often. This unique research arrangement provides that individual projects contributed from each state become a part of the whole project dealing with

regional concerns. Accordingly, the members must communicate so that the total project is more than just a sum of the individual pieces. With computerized conferencing, reports could be entered and discussions held throughout the year rather than at specialized times at infrequent intervals.

A third example could be the use of technical expertise in the political decision-making system, such as the Pesticide Impact Assessment Program (Rebuttable Presumption Against Registration). As the U.S. Environmental Protection Agency reviews technical data for registration determination on an existing pesticide, there is broad evaluation of existing data and discussion of data interpretation. Both before and after review by the agency and the U.S. Department of Agriculture, scientific committees and ad hoc task forces meet to review the material and offer technical comment. There are a considerable number of pesticide-related projects in universities, industry, government, and citizen groups throughout the United States. These technical sources could be linked by computer conferencing and their comments reviewed and judged in the political process within which a regulatory agency must operate. The speed at which some of the regulatory decisions have to be made at times precludes or discourages the collection of appropriate technical comments. Use of computerized conferencing could allow rapid communication with a previously determined number of participants and result in greater consideration of technical information in a short time frame. In addition, the variety of backgrounds of people on a conferencing system could serve as a minipublic review, where a diverse group of people make comments to the agency rapidly

Table 2. Specific cost comparisons for equivalent information exchange

Type	Number of participants[a]		
	5	10	25
Face-to-face meeting[b]			
Travel	$1,674	$3,348	$8,370
Per diem	480	960	2,400
Salary	1,080	2,160	5,400
Total	3,234	6,468	16,170
Cost/comment	25	50	124
Cost/person	647	647	647
Hours/person	8	8	8
Telephone conference[c]			
Telephone charges	$1,084	$2,168	$5,420
Salary	600	1,200	3,000
Total	1,684	3,368	8,420
Cost/comment	13	26	65
Cost/person	337	337	337
Hours/person	8	8	8
Computer conference[d]			
Compose item (equipment)	$108	$108	$108
Receive item (equipment)	54	108	270
Compose (salary)	325	325	325
Receive/read (salary)	163	326	815
Thinking time, 2 hr (salary)	150	300	750
25% of $75 monthly EIES cost	94	188	469
Total	894	1,355	2,737
Cost/comment	7	11	21
Cost/person	179	136	110
Hours/person	8.5	6.3	5.0

[a] Participants meet in Dallas, with one, two, or five from Dallas, Chicago, San Francisco, Tucson, and Washington, D.C. Round-trip air fare (as of 1 February 1981) to Dallas from the other cities is, respectively, $374, $494, $362, and $444.

[b] Per diem for participants traveling to Dallas is $60 for 2 days; salary for those traveling to and for those living in Dallas is $15/hr.

[c] Charges (taxes not included) for 8-hour conference call from Dallas to other four cities are according to rates in effect 1 February 1981; no provision is made for recording of transcript.

[d] Composing time includes 10 minutes at equipment costing $5/hr. Composing time does not change with increased number of participants because total number of comments entered is constant; receiving items at 1 minute each increases, however, because all participants receive all items. Salary time is estimated for 10 minutes per item for composing and for 1 minute per item for reading; additional 2 hours are allowed for "thinking about" comment content before composition. Terminal is assumed available at no additional cost, and all calling stations are assumed to have TELENET.

Fig. 2. A portable terminal can be used with a public phone.

and in a documented fashion. Or, the process could be used to negotiate agreement among diverse viewpoints represented by the members.

A fourth example is use of computer conferencing by a professional consultant to supply timely and documented advice. Consultants may travel frequently but still be in contact via a portable terminal that can be used in hotel rooms or with public phones (Fig. 2). They may join with other consultants to give a group opinion and they may be easier to contact in an emergency through computer messaging.

A final example of potential use is by a professional organization. Most organizational committees meet only annually and rely on limited use of mail between meetings. These committees vary widely in activities and may use considerable professional and secretarial time in carrying out their duties. With computer conferencing, the work load may be distributed more easily and the transcript may serve as background information to other committees. In addition, annual reports may be jointly written, or at least reviewed by broad membership, and may be formatted by the society so that all pieces flow to a final document. Provision could be made for an electronic journal, abstracts, or preliminary test results of pest control experiments.

Criteria for Success

Because of the general lack of familiarity of most professionals with computerized conferencing, it may be best to approach those projects with the greatest chance of success. Although the criteria for success vary according to the group and activity, several factors seem worth consideration: 1) the need for communication among participants is significant, 2) a management structure is agreed on and a team leader or moderator is designated, 3) the membership is sufficient for new material to be entered in a timely fashion, 4) training on equipment and procedure is provided, 5) a learning curve is recognized as necessary, and 6) computer conferencing is not used to the exclusion of other communications media.

Studies have been undertaken on the sociological aspects and privacy concerns of computer conferencing. In a number of cases, the early perceptions of nonusers about how the conferencing would work or how effective it would be were altered by using the technique (1,3,4). Experience is being gained on how various moderators operate their conferences, and a rapidly growing literature base provides examples of use as well as analytic evaluations of the process.

The inital step in computer conferencing is to evaluate which of the several systems currently available are most applicable. The systems vary in cost, capability, and
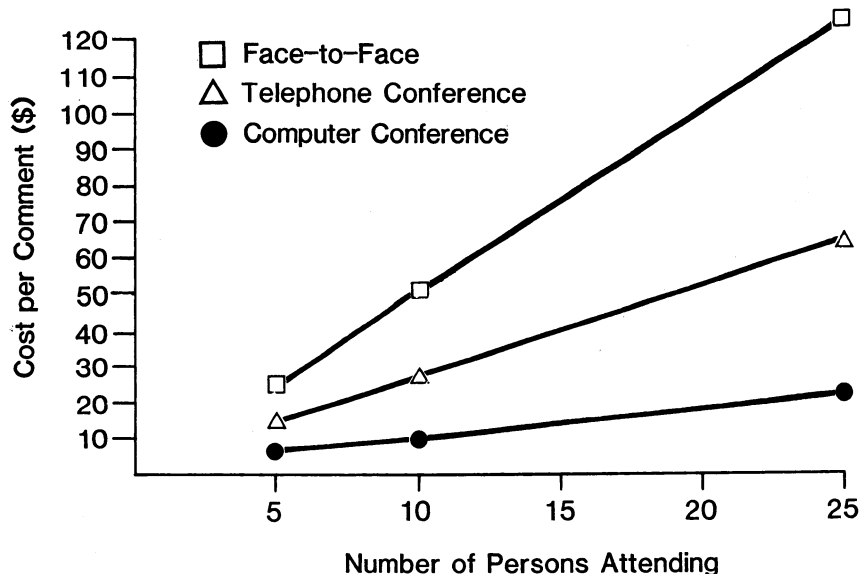

Fig. 3. Cost per comment of a face-to-face meeting, a telephone conference, and a computer conference compared on the basis of the equivalent information exchange method of Hiltz and Turoff (1).

reliability. Included are central computer systems where any terminal may be used for connection and individually oriented systems where each terminal must be selected for compatibility with other terminals on the system. A group with common interests and needs can be involved in designing the management and operating procedures for future activities. If the initiators begin small, allow for future expansion, and provide operations and management support when necessary, changes can be made along the way based on feedback from members and users of the results.

Economic Considerations

It is not easy to compare various communication processes on an economic basis because the benefits unique to each process cannot be specifically evaluated in dollar terms. For purposes of this discussion, the costs of a face-to-face meeting, a telephone conference call, and computer conferencing are compared on the basis of the "equivalent information exchange" method of Hiltz and Turoff (1). For this example, 5, 10, or 25 people meet in one city, with 4, 8, or 20 of them traveling from other cities.

In order to compare these three types of meetings, the equivalent speaking time for 8 hours constant technical speech is converted to the equivalent number of typical EIES conference comments. A speaking rate of one word per second (60 words per minute) for 8 hours results in 28,800 words. The typical EIES conference comment is 221 words, so this is the equivalent of 130 comments. A detailed comparison of the three types of communication is shown in Table 2, using travel costs, per diem ($60), and professional salaries ($15 per hour). All participants at face-to-face meetings or

telephone conferences have to be present and listening to only one person speaking at a time, so the costs are the same for the speakers and the listeners. In computer conferencing, receiving a comment takes much less time than composing one, so the cost differs for these two activities. Also, 2 hours of thinking time is added to the cost estimate to allow reflection on the issues before responding. In addition to the actual transmission costs, the economic analysis includes 25% of a monthly $75 EIES cost, which is not related to usage quantity. (EIES is at the low side of the cost range of computer conferencing systems, and other systems would require a different economic analysis.) The computer rate assumes an item takes 10 minutes to compose and 1 minute to receive, with a transmission cost of $.083 per minute.

Computer conferencing is considerably cheaper than a telephone conference, which is considerably cheaper than a face-to-face meeting (Fig. 3). In actual practice, the computer conference would cost less than stated because some members could compose off-line with word processor units or have the typing done by lower-salaried personnel, although materials preparation would still be required. Also, using EIES for additional purposes would reduce the portion of the monthly charge calculated for one conference. For practical purposes, a telephone conference call of 25 is high, and the assumption that speech would be continuous for 8 hours at the face-to-face meeting and during the telephone conference is unrealistic. Although the computer conference could complete the task in 1 day with full effort by the participants, it is more likely to occur over a period of about 2 weeks. This may be about the same time required for the face-to-face meeting when report

generation is considered, but it allows time for reflection and better response to issues raised during the discussion. In addition, fatigue or jet lag is not a problem with computer conferencing. Finally, computer conferencing provides a verbatim transcript, whereas both a telephone conference and a face-to-face meeting require recording, duplicating, and mailing a transcript.

An Efficient Competitor

Computer conferencing systems have been around approximately 8 years, but are still somewhat in the experimental stage and are not in widespread use. Computer conferencing, along with electronic mail, automated office procedures, and computer research applications, is rapidly prodding many professionals to become "computer literate." Early uses of electronic communication have tended to simply (and perhaps naively) "automate" the way we do things, eg, word processing, data base management, and literature citation retrievals. Now developing are methods for modifying the entire way we communicate based on what we need to do (as opposed to the way we currently do things). By focusing on easily apparent changes to make more efficient operation, we may inadvertently postpone more far-reaching and dramatic potential uses of electronic communication (6,7).

Because of the way most computer conferencing systems are designed, there is essentially no required knowledge of computer techniques for successful participation. While there are a number of unknowns about computer conferencing, there are also many unknowns about standard face-to-face meetings and how to run them efficiently (2). There are obvious resistance factors and needed incentives for any new procedure, and for computer conferencing to succeed, incentives must be provided.

While the lack of availability of computer terminals and specific member accounts is a great drawback for most uses of computer conferencing, simply knowing of its existence and utility will accelerate its use. Among those experienced in its use, this technique already efficiently competes for time and money with other types of communication. As more experience is gained in computer conferencing and as noncomputer professionals gain exposure, the personal computer may rapidly become a part of our everyday professional lives.

Acknowledgments

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