Meeting through your computer

Information exchange and engineering decision-making are made easy through computer-assisted conferencing

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Telecommunications

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As you read this article, 15 scientists from the U.S. Geological Survey (USGS) and three Energy Research and Development Administration (ERDA) National Laboratories are meeting to discuss modeling the impact on several western states of strip and underground mining, new power plants, and other schemes for energy extraction. At another meeting, several administrators from USGS offices in Menlo Park, Calif., and Reston, Va., are evaluating a contract proposal. At a third meeting, econometricians and other specialists are exploring the problems associated with the various approaches to modeling the U.S. economy.

What makes these conferences worthy of mention is that they have been underway for several months now and nobody has had to rush for airplanes or otherwise interrupt a busy workday to attend. Although the participants are hundreds or thousands of miles apart, they have been able to remain comfortably in their offices and converse with their colleagues—when they find it convenient to do so—via computer terminals and digital communication networks.

These meetings are among the first tests of "computerized conferencing," a new telecommunications technology that may eventually become as omnipresent and influential as the telephone in offices, laboratories, and homes. It can bring about significant changes in the way engineers and other professionals work with one another, for computerized conferencing may be one of the most effective tools yet devised for coordinating the efforts of individuals in an engineering project, as well as for the management of the project.

A system for computerized conferencing (or computer-mediated teleconferencing, as it is sometimes called) has three basic elements: the computer, the access terminals, and a digital network such as those operated by Telenet, Inc., and TYMSHARE, Inc. A user types a

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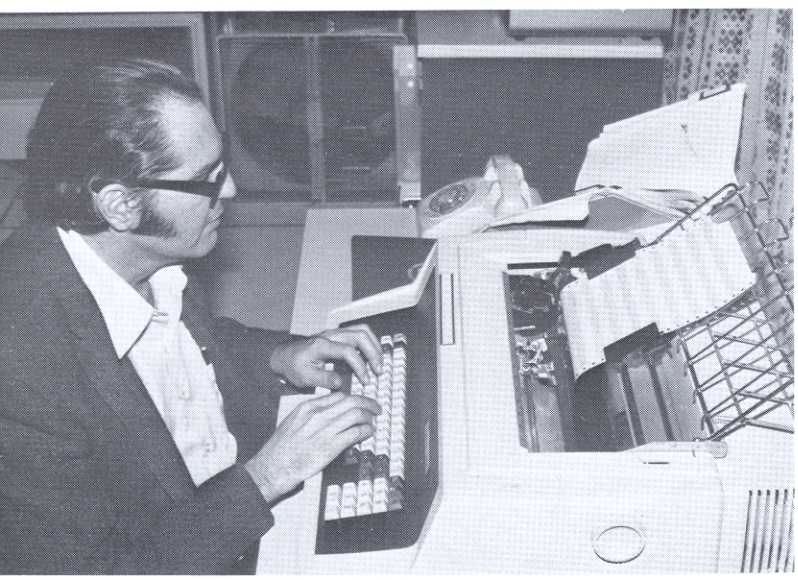
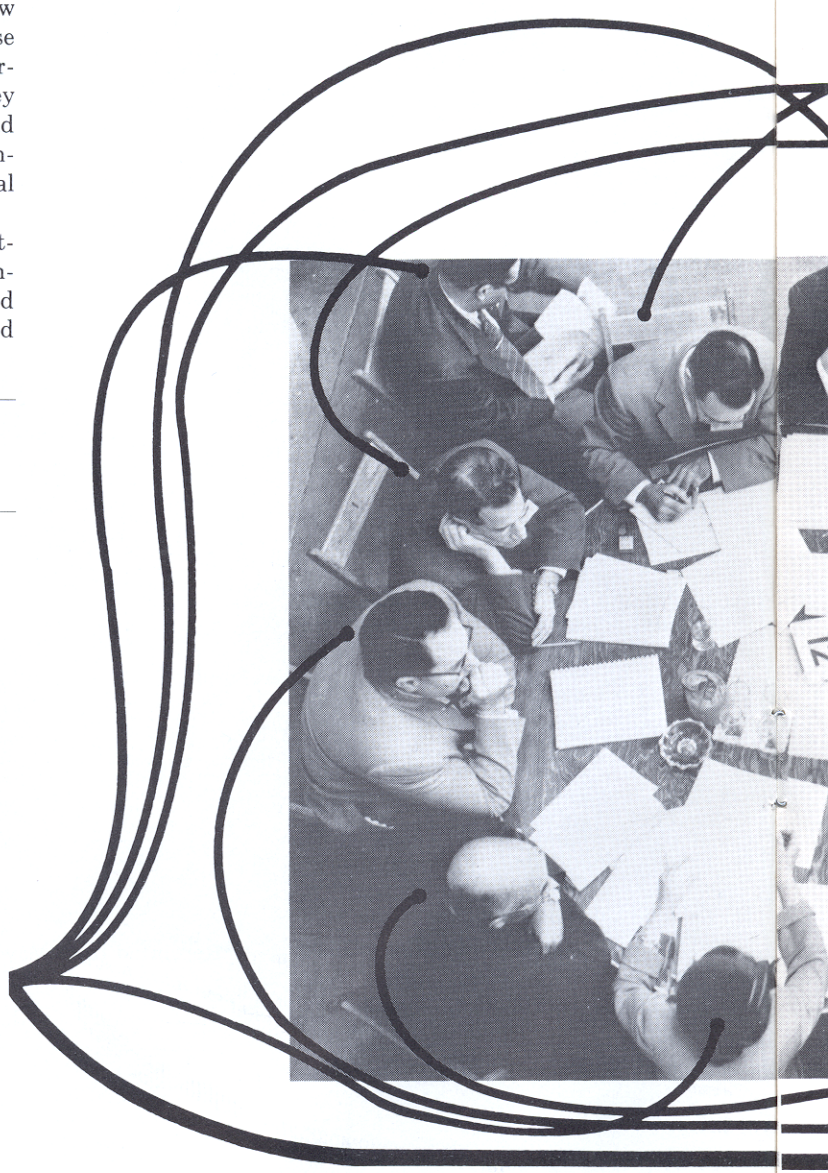




message into the terminal and, when any necessary editing is completed, it is sent over the telephone to a host computer. There a number is assigned and the entry stored. The entry may be read at the recipient's terminal immediately, or days or weeks later—until it is purged from the computer's memory.

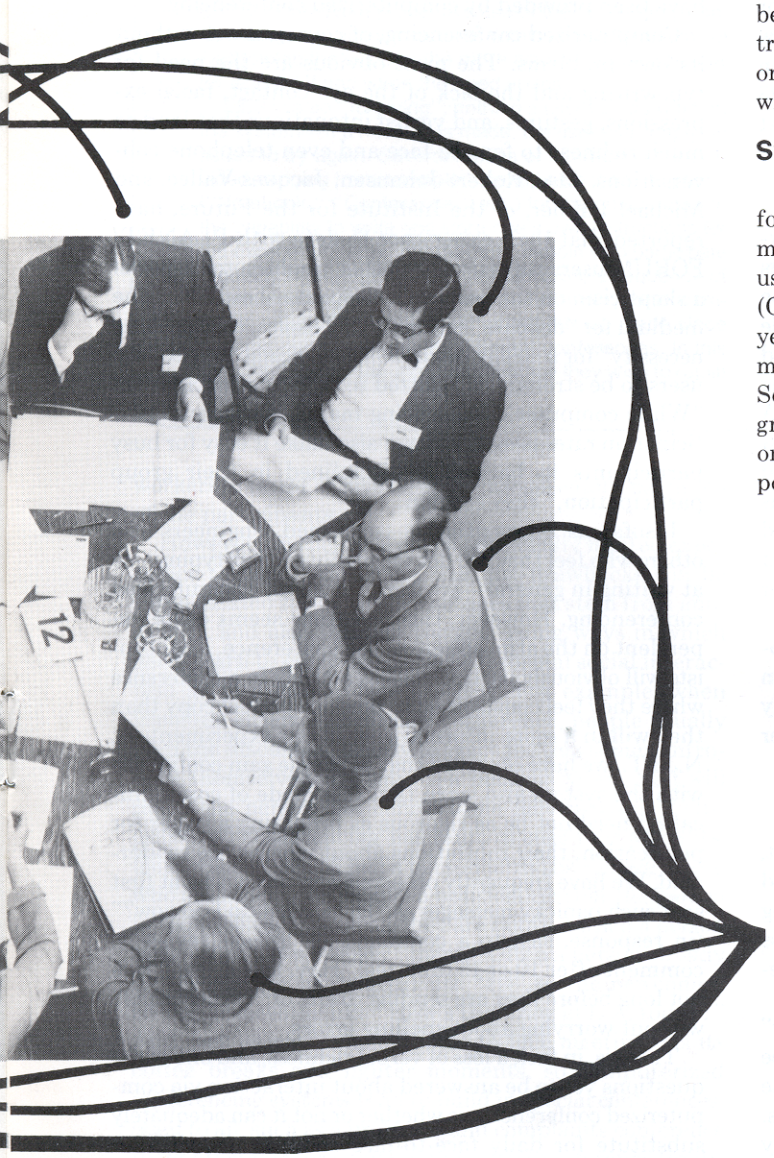
In a limited sense then, computerized conferencing can be viewed as a written version of the telephone conference call, except for the important advantage that each conferee can now select the time when he or she wishes to send or receive. For this reason, consider the metaphor of a giant blackboard that every participant can reach with a long piece of chalk—the chalk, of course, being the person's terminal and data link. The blackboard can be divided into "spaces," which participants use in the following ways:

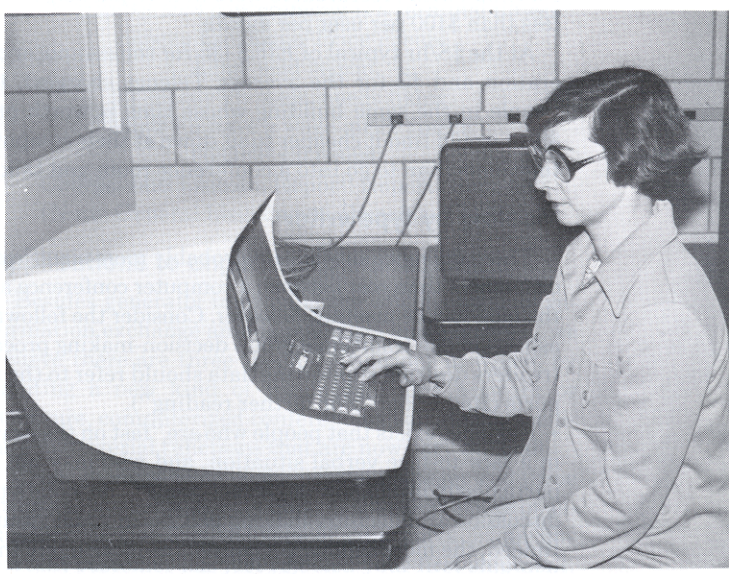
- *Messaging.* A *private* space where an individual may "whisper" to anyone else in the conference. Private messages can be delivered when the addressee signs on; the sender can receive confirmation of the time and date of delivery, and the message is immediately purged from the computer's memory.
- *Conferencing.* A *common* space where a group (usually between five and 50 people) can hold a common discussion on a topic and maintain a proceedings for later reference. Conferencing may be simultaneous, meaning that the persons engaging in the exchange are on the system at the same time, or delayed, meaning that they enter and retrieve materials at their own convenience. Conferences may stretch over weeks, or even months. Whenever people join an on-going conference, the simple act of "signing on" will bring them a complete transcript of the entries that have been made in their absence.
- *Notebooks.* A *personal* space for leisurely composing and revising material an individual might later wish to transfer to other parts of the system as entries. Pages of the notebook may be left open for others to read, or to write in as remote coauthors. Present systems permit storing thousands of typewritten lines in an individual's personal part of the computer memory.
- *Bulletins.* A *public* space for reports and newsletter-type items. Think of this as an on-line minijournal that enables the contents of a scientific paper or announcements of special events to be disseminated to interested members of the technical community without the delays associated with printed journals.

In addition, there can be a text-editing system that allows users to revise or rearrange material they either are preparing to enter or to have printed out. There also can be indexing, which allows entries to be searched and retrieved in a number of ways, including by topic, author, or date of entry, or as items that have been associated with an earlier item at the time of entry.

Systems in use

One of the earliest systems designed to perform these four functions—called EMISARI (Emergency Management Information System and Reference Index)—was used by the U.S. Office of Emergency Preparedness (OEP) starting in 1971. During the wage–price freeze that year, EMISARI monitored the data from some 40 terminals at OEP regional offices, the Internal Revenue Service, and the State and Treasury Departments. It greatly facilitated the gathering and analysis of statistics on complaints and inquiries, as well as the holding of policy meetings by anywhere from 30 to 100 people to





determine how the wage–price regulations should be applied in specific cases. Later, it was used by the Federal Preparedness Agency to monitor a voluntary petroleum-allocation program, the 1974 truckers' strike, a sudden shortage of chlorine that occurred for a few months in 1975, and similar situations. The total EMISARI package now known as RIMS (for Resource Interruption Monitoring Systems) still represents the most significant attempt to design a tailored human communications structure onto a computer system.

Among the other computerized conferencing systems in use today is the Institute for the Future system, called PLANET/FORUM. This is a relatively simple system, designed principally for conferencing and messaging. It uses a DEC PDP-10 computer and the TYMSHARE and Telenet networks. The thrust of the institute's work has been to evaluate computerized conferencing as a new medium, and to this end it has coordinated more than 50 such conferences, ranging from simple staff meetings to six-month discussions. Several hundred people—from the institute, various universities, and Government organizations such as USGS, the National Aeronautics and Space Administration (NASA), and ERDA—have already participated in these conferences.

PLANET/FORUM actually uses only a small part of a large time-shared computer system, but other computerized conferencing systems have been designed for use with smaller dedicated computers. Thus, the New Jersey Institute of Technology (N.J.I.T.) EIES system (see box on facing page) uses two INTERDATA 7/23 minicomputers. Access to EIES is provided via Telenet network ports.

What computerized conferencing costs

Strictly from a cost standpoint, computerized conferencing has justified itself over both face-to-face meetings and telephone calls. Because conferees can read and type independently, at their own speed, a typical group is able to pass more material among themselves in a given period or, equivalently, to reduce the time spent communicating verbally. An Institute for the Future analysis of a NASA technology assessment conference held between August 1975 and March 1976 with PLANET/FORUM revealed that the cost per user hour was $26, of which $16.33 was the hourly charge for the network connection ($10) and computer usage. As the conference turned out, this meant some 35 NASA researchers were able to participate for less than $100 per user per month.

At the $8/hr typical of EIES ($5 for the computer operation and $3 for the average Telenet charges), ten people in the same building whose time is worth only $9/hr would find it cheaper to sit down at their computer terminals than to go into a conference room and talk.

Meeting by typewriter

There are more subtle, and probably more significant, differences than cost between a computer conference and the face-to-face meeting, however. Consider the following aspects of the traditional group decision-making process (readers desiring supporting data should refer to the reports cited under "For further reading").

- Evidence exists that people who are "fast on the draw" in a face-to-face verbal situation, and who may not be particularly intelligent or correct, tend to dominate the discussion and decision-making process in small groups. Indeed, the more talking people do, the more likely they are to be perceived as leaders.
- Leaders are sometimes inhibited in bringing up risky options for fear of losing face if rejected. Similarly, young or low-ranking members of a group are often unwilling to oppose the leader in a face-to-face discussion.
- Groups tend to get "hung up" on a topic, going over the same ideas rather than turning to new approaches. Often considerable time is lost at the beginning of a meeting in simply finding out what the issues are and "where everybody is at."
- When the hour gets late and people are tired or eager to leave, important decisions can get railroaded through without receiving the attention they deserve.

By permitting anonymity and leisurely reflection, computerized conferencing does not suffer from these drawbacks. Thus, we believe—and experiments are underway to demonstrate this—that computerized conferencing will provide a better means of considering complex technical issues, of ensuring that all the relevant facts and problems are brought out in the open, and so on. When one reviews the literature of unsuccessful engineering projects such as the Mohole drilling venture, or some of the projects described in the special "What went wrong?" issue of *Spectrum* (Oct. 1976), it is hard to escape the conclusion that an effective channel for group problem-solving was often lacking, one that might well have been provided by computerized conferencing.

Computerized conferencing, of course, is not without its own problems. The most obvious are the need for typewriting and the lack of the eye contact, facial expressions, gestures, and verbal intonations that lend so much richness to face-to-face and even telephone conversations. Also, Robert Johansen, Jacques Vallee, and Michael Palmer, of the Institute for the Future, have reported that their experience to date with PLANET/FORUM users suggests a few other troublesome aspects: a skepticism on the part of participants about using the medium for "delicate" interpersonal topics, the "striking necessity" for a strong discussion leader, and the need for users to be strongly committed to regular participation. "While computer conferencing makes more equal participation rates possible, it can also make it easy for busy participants to become undisciplined in their group participation," they caution.

Insofar as typewriting is concerned, engineers and others who feel they are not especially good at typing—or at writing in general—are hesitant about computerized conferencing. However, this hesitancy seems quite dependent on the atmosphere of the conference. Poor typists will obviously participate less actively in a conference where they feel constrained to produce perfect copy than they will in a more informal one. In our experiments at N.J.I.T., we have observed that as people gain confidence with the system and learn that this mode of communication need not be as rigorous as preparing a paper for publication, their inhibitions about writing are moderated. We have frequently observed new users, who at first sent such panicky messages as "Help, what do I do now?" (in response, say, to a command to "please review"), comment after 10 or 15 minutes, "Hey, this is fun." It is not long before they are sending drafts of "manuscripts" without worrying about spelling errors.

There is, in fact, a loss of verbal richness, and one of the questions yet to be answered about interaction via computerized conferencing is whether or not it can adequately substitute for daily face-to-face conferences with co-

Inside EIES

The EIES (Electronic Information Exchange System), developed at the New Jersey Institute of Technology with support by the National Science Foundation Division of Science Information Services, permits geographically dispersed groups of scientists and engineers to exchange information rapidly on research advances and problems of mutual interest. Currently, the system serves 200 people via 16 Telenet and eight local Newark ports.

Since becoming operational on an experimental basis in October 1976, EIES has been used for some 45 conferences with an average effective size of about 14 people. As of March 1, 1977, 3300 messages were being sent per month, with each message averaging a little over 200 words and going to between two and three people. At this stage, we have already observed a considerable amount of crosstalk as individuals joining for one purpose find other activities of interest. This normally occurs through use of the on-line directory or third-party introductions.

EIES was designed for maximum flexibility and ease of use, rather than for the utmost "efficiency" in terms of computer time. For instance, EIES has the complete messaging, conferencing, notebook, and bulletin features, as well as a directory of participants and groups of participants, a powerful text-editing system, and a voting system by which, besides casting a simple "yes–no" vote, a participant can indicate desirability, feasibility, or probability. The system is segmented so that a user need learn only those features he or she wishes to use at the time. Thus, the user can make productive use of the messaging, conferencing, and bulletin features within about 30 minutes of first joining the system; the more advanced features may be learned if and when the need arises.

EIES is also "forgiving"; nothing a user can do will hurt the system—if a mistake is made, the user will simply be asked to try again. Several modes of interaction are provided, ranging from a simple "menu" selection of options ("Notebook," "Conference," etc.) for the novice user to the capability to write and store one's own instructions for the experienced user. For example, people who participate regularly in several conferences can store a sequence of operations that will allow them—with only one command—to receive transcripts of the entries made since they last participated in the different conferences. In this way, they can decide which conference they wish to rejoin without having actually to log in and out of each one.

Two INTERDATA 7/32 minicomputers, each connected via a separate disk controller to a DIVA DD/32 dual-disk system with more than 200 million bytes capacity, are the main hardware components. Only one of the minicomputers is used to operate EIES. The other minicomputer is for research and computer science education, but it can take over operation of EIES if a problem develops with the other processor.

Minicomputers were chosen for EIES because they:

- Provide computer-communication services at a third or less of the estimated cost of current commercial time-shared systems.
- Allow a predictable response rate for the user at the terminal by having everyone use the same software package. (Depending on the complexity of the task being performed, the computer may take between 1 and 15 seconds to respond to an input.)
- Provide the reliability and security that individuals need and expect from a communication service.

The software is based upon round-robin service doctrine, where service is given up by a user whenever an I/O (input/output operation) is executed. The "intelligent" I/O routine passes control to a scheduler, which chooses the next user in turn who is not waiting for an I/O service operation to be completed. At certain places in the program, virtual I/Os are used to ensure that no unfair allocation of service can occur. The result is a multiuser system regulated by events rather than time slicing, an arrangement that appears to be efficient for a system that is communications rather than computationally oriented.

One interesting special feature is the incorporation of Hal Zilog, a microprocessor that can respond to messages from other conferees with a host of special analysis and display graphics routines. Hal also operates his own dialer and can phone other computers to obtain information to send back from data bases or models located anywhere else. This allows the conference system to become a focal point for a group utilizing a variety of computer systems for some common objective.

The EIES system represents approximately $200 000 worth of computer hardware and at that price range could be considered by many medium-to-large organizations as a vehicle for setting up their own dedicated systems.

workers in terms of satisfying the social–emotional needs of the participants.

However, on the basis of the admittedly limited experience to date, we suspect that the drawbacks will be compensated for by the advantages that stem from anonymity and also through the intriguing ways in which users learn to carry on the same informal social interaction as in a face-to-face meeting. For example, when someone enters an ordinary conference, people usually stop the discussion briefly to greet the newcomer, introduce themselves, and say a few pleasant words that will make the person feel comfortable participating. Computerized conferencing has built-in cues to replace the usual visual cues. When a person joins the system, those who are already on receive a notification that the person is "now joining"; likewise, they are notified when a person signs off and is no longer "there." Often a person already on the system sends a private "Hi" to the newcomer, adding something like "How's the smog in L.A. today?" And, just as any extended face-to face meeting has its coffee breaks and lighter moments, so computerized conferencing systems tend to build in special conferences, open to all, such as a problems and complaints conference to let off steam, or a jokes and graffiti conference for diversion. Two current entries on EIES and a poem from EMISARI, written during the wage–price freeze, will convey the flavor of these moments:

"On a clear disk, you can seek forever."

"Computerized conferencing is a terminal illness."

Ode to the Wage–Price Freeze

Egad! said Nixon,
Economy's a mess, needs fixing.
I think I'll have a wage–price freeze.
To OEP I'll resort.
Charge! said Lincoln, Report! Report! Report!
(Note: General Lincoln was Director of OEP.)

Applications to engineering management

Besides generally improving the effectiveness of information exchange among scientists and engineers, we believe there are three specific situations in which, by creating a new kind of communications network or structure, computerized conferencing will greatly facilitate managerial functions that are now very difficult.

Crisis management. Your general manager and three other executives suddenly quit . . . a wildcat strike of assemblers jeopardizes delivery of vital parts . . . an important customer has just rejected your first shipment.

Such major and unexpected events in the routine of an organization are crises. Robert Kupperman, Richard Wilcox, and Harvey Smith, who encouraged the development of EMISARI for dealing with crises at OEP, have emphasized that such crises are distinguished by extreme unpredictability with respect to the amount and importance of readily available information. Consequently, most conventional information systems are inadequate for the task.

Crisis management requires:

- Factual information from many sources.
- Value judgments from key individuals.
- Discussion on proposed alternatives and the ramifications of the suggested alternatives.
- Anonymity in voting or discussing such issues so that middle managers do not feel inhibited in criticizing the ideas of their superiors.
- A way of determining the general consensus within a short period of time when a decision must be reached.

EMISARI has demonstrated that computerized conferencing, with its ability to structure and categorize the information flow quickly, can clearly fill these needs. Richard Wilcox, who used a descendent of EMISARI when he had to report twice daily to the White House during the 1974 truckers' strike, points out that the typical MIS is highly structured and designed essentially for one-way communication from the field to headquarters. In a crisis, the advantage of computerized conferencing is its flexibility, he says. "Headquarters can communicate quickly back to the field, saying, for instance, 'The guidelines have changed, forget the Table 3 we asked you for yesterday, today we need the following information instead.' This request can, in turn, be questioned and perhaps modified through rapid communication with many people simultaneously."

Delphi conferencing for planning and forecasting. The Delphi method involves a structured series of questionnaires about probable future developments and possible plans for dealing with them that are administered to a group of "experts," usually from outside as well as inside the organization. Possible developments are rated according to their probability and desirability, and the answers, comments, and options generated by the participants are fed back anonymously after each round. The results are then used to generate another set of issues and projections, or are used as the basis for further discussion or voting, until a consensus or stability of position is reached. Automating the whole procedure by means of a computerized conference obviously can speed the process greatly. It can also facilitate the participation of many people from all parts of the organization without the expense of bringing them to the same location in order to avoid dragging the rounds out over several months.

Managing dispersed task groups. In an article entitled "Beyond bureaucracy," the noted management authority Warren Bennis predicted that in the future organizations will be based upon "adaptive, problem-solving, temporary systems of diverse specialists, linked together by coordinating and task evaluating specialists in an organic flux." How can this be reconciled with the increasing resistance of executives and their families to endless transfers from one location to another? We believe that one of the most profound impacts of computerized conferencing will lie in its capability to allow geographically dispersed people to work together as if they were in the same office.

Engineering management by computerized conferencing: a scenario

It is 7:30 a.m., and the smell of the bacon frying in the kitchen finally entices Joe out of bed. He is going to work in his study at home today, using his computerized conferencing system, so there is no need to get up at 6:30, grab a quick cup of coffee, and get out on the thruway.

"Good morning, Dad," says daughter Jill, popping her head in the bedroom door. "Can I see what's on the terminal, please, please?" Jill is ten and frequently vies with 12-year-old Jeff for the privilege of signing in the conference system and retrieving entries for Dad.

"Sure, Jill. Please take delivery of all messages, and also get me a copy of the Bulletin for today." The Bulletin is a daily on-line paper distributed to all middle- and top-management personnel in the company.

After Jill enters her father's user code, she receives the following inquiry from the computer:

Welcome to EIES 10/26/76 7:37 a.m.
Last active: 10/25/76 10:32 p.m.
Waiting:
2 private messages
1 group message
4 confirmations
Accept private messages (Y/N/#)? Jill types Y.
M37 John Hill 10/25/76 11:32 p.m.
Joe, don't forget that I will be in Chicago tomorrow. I am taking my terminal but probably will not sign in until the late evening.
CC: Smith, Jones
M43 Esther Smith 10/26/76 6:47 a.m.
Will arrive at 9:30 Friday in Newark for the Marketing Modeling Meeting. Will plan to take a taxi and should be there by ten. With all of the things we've worked out already on the conference, I assume that the meeting will be over by two and I can tell my family that I'll be back in Washingto for dinner. What's your estimate?
Accept group messages? (Y/N/#)? Y
M68 John Hill
To: R&D Management Group
If you really want to beef up the new coating project, you're going to have to drain off about $20 000 from other items. That's the best I can do on the current budget. The figures have to be finalized Friday because it goes in the computer and then it's in concrete short of a presidential directive.
M70 Abe Carter
To: R&D Management Group
Surely we can squeeze $10 000 of what John wants out of Joe's projects. I don't see the need for some of the increases he has requested.
(How's that for ruining Joe's breakfast?)

Just how crucial this can be is evident from several studies that reveal that even within an organization the frequency of technical discussion tends to decrease exponentially with distance. Arthur Gerstenfeld has written: "We find that the telephone is seldom used for technical discussions, and colleagues on other floors might as well be in other states." (In a study of the causes of failure in R&D projects, Mr. Gerstenfeld cited "the lack of meaningful interaction between the marketing and R&D groups" as the most prevalent explanation for the high percentage of nontechnical failures.)

Computerized project management conferences would provide a written record of all specifications, changes, clarifications, and suggestions that took place, in addition to providing complete accountability, if ever needed.

For further reading

Readers desiring more on potential applications to engineering management are referred to M. Turoff and J. Scher, "Computerized conferencing and its impact on engineering management" (presented at the October 1975 Annual Joint Engineering Management Conference, Washington, D.C.) and R. Kupperman, R. Wilcox, and H. Smith, "Crisis management: some opportunities" (*Science*, Feb. 7, 1975, p. 404). Arthur Gerstenfeld's research is reported in *Effective Management of Research and Development* (Reading, Mass.: Addison Wesley, 1970), and Warren Bennis's article "Beyond bureaucracy" appeared in *Trans-Action*, July/Aug. 1964.

Pertinent aspects of group problem-solving, including the perceived relationship between talking and leadership, are examined by S. R. Hiltz, in "Communications and Group Decision-Making: Experimental Evidence on the Impact of Computer Conferencing," (Report No. 2 of N.J.I.T. .omputerized Conferencing and Communications Center, 1975), and "A social scientist looks at computer conferencing" (*Proc. Int'l Computer Communications Conf.*, Toronto, Ont., Canada, Aug. 1976).

For more on the Institute for the Future's experience with PLANET/FORUM, see: R. Johansen, J. Vallee, and M. Palmer, "Computer conferencing: measurable effects on working patterns" (paper presented at the National Electronics Conference, Dallas, Tex., Nov. 29, 1976); J. Vallee and T. Wilson, "Computer-based communication in support of scientific and technical work" (final report to NASA, Mar. 1976); J. Vallee *et al.*, "Group communication through computers" (three vols., Oct. 1975).

A report on Bell-Northern's CMI experiment appeared in the company's journal *Telesis* (G. Millard and H. Williamson, "How people react to computer conferencing," Aug. 1976).

Cost is examined in detail in M. Turoff, "The cost and revenues of computerized conferencing" (presented at the 1976 ICCC meeting, Toronto).

An unpublished paper entitled "Computer-mediated communications and the disadvantaged," by S. R. Hiltz and M. Turoff, is available by writing to them at N.J.I.T. The Delphi method is covered in H. Linstone and M. Turoff, *The Delphi Method: Techniques and Applications* (Reading, Mass.: Addison Wesley, 1975).

There would also be a significant impact on the manager's ability to regulate his own time, and to be fully involved in more than one task force at once. With computerized conferencing, it is up to the user to choose when he or she wishes to review the new items and make contributions, rather than being a slave to the ringing telephone and the meeting scheduled at someone else's convenience.

Betsy Yount is a geologist with the U.S. Geological Survey who has been using PLANET/FORUM for nearly two years to confer with 20 other colleagues in a Congressionally mandated program to appraise the mineral potential of Alaska public lands. She says that with most of the Alaska branch geologists located at Menlo Park, and the USGS geochemists who do the analyses based in Denver, Colo., PLANET/FORUM has proved better than the telephone as a "bulletin board" for sending messages and keeping records. "It's very hard for us to get in touch with one another because people are in and out of their offices, and the time difference [one hour] makes it awkward. With PLANET/FORUM, you just enter the message once and can walk away assured it will get through; you don't have to keep calling back to get people in their offices."

Another USGS scientist, Gerald Askevold, may well prove the forerunner of an increasingly large number of professionals who, we anticipate, will be eager to work from their homes once computerized conferencing becomes routine. Mr. Askevold works half-time for the USGS Office of Resource Analysis from his home in Ketchum, Idaho, via PLANET/FORUM. From the terminal in his study, he currently: supervises staff members in Menlo Park who are creating an Alaskan mineral resource data base; confers on administrative problems with USGS personnel in Reston, Va.; prepares a paper with a coauthor from the Institute for the Future (in Menlo Park); and participates periodically with several other USGS staff members in a contract proposal evaluation conference that has been underway since September 1976. Gerald Askevold says he has found the day-by-day record of his activities that his computer transcript provides to be a much more effective reminder of his activities and responsibilities than if he had only the telephone and the mail to rely on. However, he also says there are times at the terminal when he experiences a tremendous energy drain. "It forces me to concentrate harder than I would normally," he says.

The functioning of interindustry, intercompany, and professional society working committees or special-interest groups could also be greatly enhanced with computerized conferencing. (The IEEE Standards Office is currently considering using computerized conferencing for collecting failure rate data on components used in nuclear plants.) Relying only on mails and telephone, it is virtually impossible for a geographically scattered group to reach conclusions, agree on wording, and publish a polished report, without the effort either being concentrated in one or two people who dominate the proceedings or having it default to the one with the most clerical support.

Sam Scheele, of Social Engineering Technology, is directing a research effort for the Office of Environmental Education that involves a project team of about 30 people spread across the U.S. He believes the ability to coordinate such an effort has been considerably improved by the team's current use of EIES. A similar example of project coordination is the use of EIES by members of the 1977 National Computer Conference Steering Committee.

Computerized conferencing may also prove a much more effective means of getting people from different disciplines to "listen" to one another than the usual interdisciplinary symposium. This is one of the main reasons why the EIES system is being tried for a conference on national modeling now underway between Massachusetts Institute of Technology experts in the system dynamics approach and econometricians and others experienced in large-scale modeling. Dale Runge, assistant professor of management at the M.I.T. Sloan School and coordinator of the conference, explains that these are "distinctly different paradigms with very clear differences in the way they approach such basic questions as how one validates a model. With that sort of gap, the communications problems are awesome, and even when background papers are prepared in advance, people tend to talk past one another, with no real understanding of what's been said. In contrast, with computerized conferencing there is ample opportunity for people to read and reflect, and to question one another, without having to rely on memory or faulty hearing. There is a much better chance of understanding what the different sides

When satellite launch was delayed

A teleconferencing experiment between NASA Ames Research Center and the Institute for the Future, using PLANET-I, produced the following entries during the difficult period that followed successive postponements of the launching of the U.S./Canadian Communication Technology Satellite.

[96] Lumb 13-Nov-75 9:15 AM

Hunczak. To answer your questions of yesterday. For experiments 16, 17, and 18, the subcarrier frequencies we have hardware for in the analog FM TV mode are 5.14, 5.36, 5.79, and 6.2 MHz.

For experiment 16, 17, 18, the ARC transmit frequency is 14.2471666 GHz.

For experiment 4, the ARC transmit frequency is 14.0521666 GHz with a 25 MHz subcarrier service channel.

[97] Kaiser 14-Nov-75 9:00 AM

This one is for whoever from NASA is looking. I am working on the link budget calculations for the tech. managers meeting. I have some of it done; the rest will follow. Kim.

I see from the latest entries that people are watching this.

[333] Lew 12-Jan-76 2:47 PM

To all!

In view of the short turnaround between the time that the decision is made (anticipated at noon EST, January 13) and a launch as early as 1821 EST, January 16, it is suggested that all PLANET folk check into PLANET on an hourly basis on January 13, 1976, starting at about 1000 EST.

From J. Vallee and B. Gibbs, "Distributed management of scientific projects" (*Telecommunications Policy*, p. 75, Dec. 1976).

are saying." For these reasons, Prof. Runge is hopeful that when the conference ends (possibly a year or more from now) the participants will feel a sense of accomplishment almost impossible without EIES.

More generally, computerized conferencing can facilitate the overall decentralization of information exchange and decision-making. The home office, for instance, might become much more of a supplier of services to relatively autonomous units of the organization.

Bell-Northern Research found that in a recent conferencing system field trial with personnel from the Canadian Post Office, a private business firm, and Bell Canada, managers and their secretary/typists quickly picked up the ability to use the system for sending messages, and that they liked its friendliness and availability. (One of the first dedicated minicomputer systems, it asks the name, rather than account code, of a person signing on. The system, known as Computer Mediated Interaction, understands commands in either French or English, and also keeps track of what a participant in a number of simultaneous conferences has seen. When that person returns to any one conference, he or she will be advised "60 messages since you were on; do you want them all?") At the height of the three-month trial, some 80 people across Canada were using CMI. It reportedly worked well in dealing with a major interruption in mail service. People were able to quickly exchange ideas on what they thought had gone wrong and what they might do to correct it.

Research directions

The National Science Foundation (NSF) Division of Science Information Services is now inviting research groups in engineering and the natural and social sciences to submit proposals to demonstrate whether or not their use of EIES will improve their ability to exchange research information. Such groups will generally consist of ten to 50 people geographically dispersed throughout the U.S. and engaged in research in the same specialty area.

Among other assessment efforts, the Institute for the Future is midway into a two-year project to measure the effect of computerized conferencing on the working patterns of small, geographically dispersed groups doing energy research.

As a result of such assessment projects, within the next few years a fairly detailed picture should be available of the effects of computerized conferencing systems upon work patterns. While certain endeavors such as engineering project management seem well-suited to computerized conferencing, there are other areas—such as scientific productivity—where many years may be required to assess the impact.

Meanwhile, among the necessary advances in the technology of computerized conferencing, there is an obvious need for a "human communications language" that will enable a nonprogrammer to design and specify a communication structure for computerized conferencing in one to two weeks. Present systems represent many person-years of software development effort, which severely limits the introduction of such systems to large-scale and long-term projects. A major effort aimed at designing such a programming language is underway at N.J.I.T., with support from the National Science Foundation Division of Mathematical and Computer Sciences.

There is also a need to make graphics available to users of conference systems. At N.J.I.T. we are attempting to do this as part of a program sponsored by the HEW Office of Education to develop a computerized conferencing system for people involved in environmental education. The system would make such enormous graphics as network diagrams and relevance trees available on computer-output microfiche, and it would allow participants to send graphs, histograms, or outline drawings by simply typing in the necessary data. Obviously, this kind of capability would greatly increase the value of the system for engineering and scientific users. ◆

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