Computer facilitation of communication within professional communities

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This report is based on several projects at the University of Michigan. The software used is CONFER, a computer-augmented conferencing program. Access is provided nationally through TELENET data services. The paper describes hardware and software for information systems at the University of Michigan, the development of CONFER, and a rationale for computer-aided communication within professional communities. Six applications of this particular software and system are summarized: national committees, regional planning groups, on-campus working groups, and user consulting services. One innovative application (support of an international congress held recently in Ann Arbor) is described in detail. Computer-based communications were used for sending messages, adjusting schedules, planning additional sessions and trips, and developing written material through computer-mediated caucuses on specific topics. Contributions of computing to professional communications are summarized, with particular attention given to projected impact on teaching and research in universities.

This report draws on experience with a collection of projects exploring innovative use of computer-aided communications within various scientific communities. The software used in most cases is CONFER, a computer-augmented conferencing program developed by Robert Parnes at the University of Michigan. The application is offered on the Michigan Terminal System (MTS) through the MERIT Computer Network in the State of Michigan, and through TELENET data services nationally.

The first section of this report provides some context for the development of the computing application: hardware and software for information systems at the University of Michigan, development of CONFER, and rationale for computer-aided communication within professional communities.

The second section summarizes six of many applications of this software and system (CONFER on MTS). The description and interpretations are based on experiences with national committees, regional planning groups, on-campus working groups, and user consulting services.

The third section provides a detailed description of one application in support of an international congress held recently in Ann Arbor. Computer-based communications were used for messages, schedule adjustments, planning additional sessions and trips, and developing written material (for the published report of the congress) through computer-mediated caucuses considering specific topics and concerns.

Contributions of computing to professional communications are summarized in the last section. Particular

attention is given to projected impact on teaching and research in universities. The bibliography provides pointers to additional information as well as references in support of points mentioned in the text.

We hope this report conveys our enthusiasm for computer-aided communications in college teaching and learning activities. Indeed, we intended to provide an expanded view of computer-based conferencing as a tool for scholarly work (Engelbart, Watson, & Norton, Note 1), as well as a medium for telegram-like communication (Turoff, 1973; Vallee et al., 1975). We have tried to include samples of use, but annotations cannot be written that adequately convey the interactive nature of the computer use.

CONTEXT FOR DEVELOPMENT WORK

Hardware for Information Systems at the University of Michigan

Computing hardware at the University of Michigan includes two major facilities. The academic timesharing system is based on an Amdahl 470V/6 operating under the Michigan Terminal System (MTS). Administrative computing is handled with an IBM 370/158 operated separately. Many of the schools and departments at the University maintain their own computing facilities. The Physics Department uses a PDP-10 for data analysis and special student projects. The School of Dentistry provides instructional timesharing with a Prime 400, including graphics as well as text-oriented tutorials and testing. The School of Natural Resources operates simulations of resource management, environmental planning, and the like with an IBM 1150. The Department of Psychology operates a PDP-8 (LINC 8) for on-line experimentation and student instruction. This list includes only a few of the departmental facilities;

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furthermore, the hundreds of machines dedicated to individual courses, laboratories, and projects are difficult to count (Zinn, Note 2).

The number of individuals who maintain their own computing facilities is increasing rapidly. Interest in computing as a hobby results in many more computer user terminals being available to faculty and students. Some are built from kits for less than \$300; some are purchased fully constructed and tested for about \$400. The local community is served by two computer stores, providing computers, terminals, and peripherals "off the shelf."

Software Used for Information Systems at the University of Michigan

The most popular language for programming information systems at the University of Michigan continues to be FORTRAN. Some parts of information system applications are programmed in the assembler language. Other languages include PL/1, SNOBOL, and PL/360.

AUTONOTE is a personal information system developed by Walter Reitman and others (1969) at the University of Michigan for research on scholarly and creative work. It continues to be used by some faculty members to maintain personal files of abstracts, references, and notes. It has been extended by Sabin Head at the Institute for the Study of Mental Retardation and Related Disability to serve a small community of users sharing a common data base.

MICRO was developed especially for numeric data bases. One special strength is in rapid retrieval according to complex categories and descriptors.

TAXIR finds considerable use on campus for handling taxonomic data files. It serves well the needs of groups of users processing hierarchical data structures.

BIRS was used for a time to handle a variety of information processing needs, including bibliographic storage and retrieval, data organization, and statistical analysis. It was designed at Michigan State University by John Vinsonhaler expressly to be transportable, and was implemented through the MERIT Computer Network as a demonstration facility.

SPIRES was imported from Stanford University for a variety of information handling needs. It serves bibliographic needs particularly well, and has been used to match faculty interest profiles with research opportunities.

CONFER was developed locally for computer-aided communication. It is more conversational than any of the other systems, and more directly accessible by persons not previously experienced with computers.

The systems used in the experiments reported here are CONFER, TAXIR, and SPIRES; CONFER was by far the most often used.

Development of CONFER at the University of Michigan

CONFER was constructed in March 1975 for experiments with computer-based conferencing on the

University of Michigan computer system (MTS). The two motivating forces were research on University governance, for example, a need for computer assistance with communication among members of a committee and with their constituents, and research on information systems in teaching and learning, for example, a need for more effective communication, organization, and reporting of information in seminars, student projects, and curriculum planning (Zinn, Parnes, & Hench, 1976).

CONFER was programmed in FORTRAN by Robert Parnes, and draws heavily on the systems subroutines of MTS in a way which greatly reduces the cost and raises the reliability of operation. CONFER is available to users whenever MTS is available (from about 8:00 a.m. until 4:00 a.m. EST); it can be accessed through the MERIT Computer Network in Michigan and TELENET nationally. No charge is made for the software and computing costs average \$3/user h. Access from outside Ann Arbor via the Network adds about \$2 in communication charges; access from outside Michigan via TELENET adds \$3.50.

The CONFER approach to computer conferencing emphasizes procedures for restructuring information as well as for obtaining answers to questions. The conventions for organizing and retrieving information in shared or individual ways take a few hours to learn, but the resulting conference activity is likely to include complex lines of discussion with many branches that are immediately accessible to inexperienced participants. And knowledgeable users are able to assemble interpretive reports with alternate versions of difficult sections, affording more thorough review of different perspectives.

Rationale for Computer Conferencing Within Professional Communities

We proposed that computer-based communications would extend the benefits of a face-to-face conference in quite interesting and useful ways. This section describes our hypotheses for a specific experiment on support of communication at a professional meeting.

Potential contributions of computer-aided communication to activities and substance of the Second International Congress on Technology Assessment (ISTA) were explored with specific software and procedures. These included: collecting substantive information in parallel with technical sessions (to supplement and extend written papers), posting notices for special interest groups, arranging site visits in the vicinity of the site of the meeting, scheduling additional informal discussions and special activities, annotating supplementary information, for example, directory of work in progress, obtaining reactions of attendees to the Congress, and demonstrating the computer as a tool in the profession (technology assessment, in this case). We observed some significant communication activity in computer-aided conferences in all of the categories listed above. Some instances are given in a later section.

However, analysis of data could not be completed in time for this publication.

Intended outcomes of computer use (in association with the Congress) that might be supported by data are listed as seven hypotheses:

(1) Computer-based conferencing is easily used by a significant proportion (40%) of attendees during an international meeting. Special attention should be given to making the introduction an easy one, providing teleconferencing aides on the site as well as a convenient pocket guide. Many attendees will be too busy to try, and few will be definitely opposed to such use of technology.

(2) Costs are small compared to those associated with travel and time of participants. Analysis of travel costs vs computer and communication costs is easy, and has been done many times. We need to determine values that some attendees and nonattendees associate with time required to attend a professional meeting and the benefits of the limited personal contact achieved through computer communications, without personally being in attendance.

(3) Participants and expert observers report benefits, but these are difficult to pin down, especially in complex situations observed for only a short time. We are dependent on reports of participants supplemented by opinions of experts in computer-based conferencing.

(4) Participants report increased interest in potential contributions of computer-aided communications to professional meetings and to the practice of their profession (technology assessment, in this case). Confirmation of this assertion is sufficient justification for the experiment. The sponsor is interested in bringing positive instances of telecommunications technology to the attention of this and other professional groups.

(5) Some fraction of attendees (19%) will continue computer-based conferencing on Congress topics afterward. During the Congress all participants were invited to continue for about 6 weeks from other locations. The incentives include obtaining additional information, contributing to the report of the Congress, and learning more about computer-aided conferencing.

(6) Reports of the Congress show benefit in substance. The Congress will have no published proceedings. Instead a report will be prepared which interprets the current directions of the field. Some of the material for this report may be taken from the computer communications during and following the Congress.

(7) Congress staff reports advantages of computer assistance. Computer-based communications became a tool of staff for the Congress in the weeks preceding. Some services were offered to attendees that would not have been tried otherwise; some tasks probably were handled more effectively and efficiently than without computer assistance. Primary data on staff activities are difficult to interpret; support for this hypothesis needs to be found in reports of staff (es-

pecially those not already committed to use of CONFER).

Initial analysis of computer and registration records shows that Hypotheses 1, 4, and 5 are confirmed. About 40% of those registered used CONFER directly at least once. At least 15% used CONFER one or more times a day. Continuation after the Congress appears to include at least 10%. We did not expect all 15 conferences to be active. One of them, the caucus on technology assessment in the area of automobiles, had no items entered. All other caucuses had at least 10 items and eight participants. Some had over 100 new items of information entered by 15 or more participants.

Interpretation of the other hypotheses will be based on telephone interviews with a sample of participants in the Congress. Stratification will assure representative comment from off-site users, program committee members, student aides, nonusers, and users at various levels. Some of the comments will be best interpreted knowing the context. Even in this exploratory research, some group differences may show important considerations in redesign of the software and procedures for application of computer-aided conferencing in professional meetings.

APPLICATIONS OF INFORMATION SYSTEMS

Information systems have been used in a wide variety of applications at the University of Michigan. The area of most interest to the Center for Research on Learning and Teaching, the site of most of the work, is that of teaching and academic testing. CONFER has been used in a number of advanced seminars and shows promise in a wide variety of teaching situations (Zinn, Note 2). TAXIR and SPIRES have been used in support of test item files and on-line testing.

Proposal writing has been pursued through information systems, aiding in communication where the members of the group cannot otherwise get together for working sessions. Learning materials have been drafted in this mode, particularly where the substance involved computers directly, typically for models and simulation.

Administration of departmental and program affairs has been explored, particularly for those multidisciplinary programs for which faculty and students do not ordinarily come together as in traditional departments. Faculty and students plan curricula, converse about individual programs, and determine program policies.

A list of specific conferences is given in Table 1. Six of these are summarized in the following paragraphs.

Discussion Among Computer-Related Staff at CRLT

This conference has run continuously for over a year, having been restarted twice to clean out the data base. Staff members share information and opinions about ongoing work and keep in touch in spite of travel schedules, conflicting daily commitments, and other

Table 1
List of Conferences at the University

Anyone can join one of the public conferences by calling on it by name. The first half of the name usually identifies the sponsoring group.

CRLT:SIM—Karl Zinn, organizer

To share programs and ideas for computer-based simulation in college teaching, establishing a library of programs.

CRLT:MERRA—Karl Zinn, organizer

To explore trial uses of CONFER in the operations and project activities of the Michigan Energy Resource and Research Organization.

SFUD:PFASD—E. Daniel Ayres, organizer

To conduct discussions associated with a project on "procedures for the fair administration of school discipline."

SPSS:TALK—Tom Wilkinson, organizer

To provide consultation on and discussion of SPSS (statistical programs in the social sciences) package.

STAT:CON.CENSUS—Tom Wilkinson, organizer

To provide means for discussion of computer programs for statistics and their uses. To invite comment on the University Census of Statistical Programs.

CAP:SHARE—John Stuckey, organizer

To share information about programs and data bases, especially as used within the Computer Assistance Program of the Political Science Department.

CRLT:ORGANIZER—Robert Parnes, organizer

To share ideas about organization of conferences. To critique draft of an Organizers Guide for CONFER.

MNET:CAUCUS—Chris Wendt, organizer

To provide a forum for discussion of MERIT Network design and uses. To provide consultation to Network users.

CRLT:CBE (closed)—Karl Zinn, organizer

To explore potential computer-based education (CBE) systems for the University (and the state of Michigan).

CRLT:CREDITS—Karl Zinn, organizer

Project CREDITS staff meeting with participation from advisors (through MERIT Network), oversight committee members (distributed nationally), the project monitor at NSF, and other interested persons.

CRLT:ISTA (closed)—Karl Zinn, organizer

Planning committee for ISTA Congress held in Ann Arbor in October, 1976. Participants were from national and local planning committees. Replaced by ISTA:STAFF and others.

ISTA:XXXX—various organizers for 17 conferences

Operating conferences or caucuses during and following the ISTA Congress on 16 topics (plus a staff discussion) ranging from terminology to perspectives and from automobiles to education.

CRLT:CONDUIT (closed)—Karl Zinn, organizer

Discussion of computer program exchange in education via CONDUIT organization by members of national advisory committee.

The following conferences are not generally open to the public; therefore, only the second half of the conference name is given.

Table 1. Continued

DISS—Michael-David BenDor, organizer

To discuss plans for dissertation on information systems and community resource information services.

STAFF—Alfred Adler, organizer

To facilitate discussion among CRLT staff members working with computers, including project planning and review, reports and scheduling.

MHRI—Manfred Kochen, organizer

To explore issues concerning the Mental Health Research Institute at the University of Michigan.

TUTOR—Manfred Kochen, organizer

To encourage sharing of ideas among students and tutors in an experimental math course in the Residential College of the University of Michigan.

LAW814—Layman Allen, organizer

To support seminar on legislative writing in the Law School with discussion of purposes, projects, and outcomes.

TOPD—William E. Riddle, organizer

Staff discussion for research project on software reliability, involving graduate students as well as project staff.

OFFICE—Manfred Kochen, organizer

Discussion among office staff to plan for model building via computer-aided conferencing.

ASIS—Manfred Kochen, organizer

Discussion among some members of the executive committee of the American Society of Information Scientists, particularly regarding current business.

VALUES—Robin Crickman, organizer

To collect opinions about research on recombinant DNA as a part of a research study on values.

N631—Ruth Barnard, organizer

To facilitate discussion among students in a Nursing School class.

BIGTEN—Richard Bloomquist, organizer

To facilitate exchange of information among data system directors at Big Ten universities; a trial to explore computer-aided communications in collaborative work.

TASKFORCE—Harvey Day, organizer

To discuss the goals, progress, and outcomes of a task force on minority student issues at the School of Nursing.

RP—Robert Parnes, organizer

To conduct the work of the dissertation committee of Robert Parnes, reviewing plans, approving work in progress, and conducting oral defense of dissertation.

obstructions to coordination of work. The computer medium provides reliable communications on matters often requiring prompt and careful handling. Since much of the work of these individuals is conducted using the computer anyway, carrying on the additional discussions through the computer is quite natural.

CONDUIT Education Advisory Committee

Four members of the CONDUIT National Advisory Committee on Education carried on discussions for

about 3 weeks, primarily through computer-based communications. The goal was to draft a report and bibliography for CONDUIT. The computer role was quite suitable in that all of the participants were simultaneously reviewing computer applications in teacher education. The activity was restricted because of lack of funds for long-distance calls. Only one person in the group fell within the local calling area of a TELENET node.

A Continuing Seminar on Computer-Based Educational Systems

A seminar of students, staff, and faculty was conducted through computer communications for about 4 months. Individuals were able to join those parts of the discussion that were of interest and ignore others. Late comers could catch up on what had been happening. Resource persons responded to questions without exposing themselves to large time commitments.

Discussion of Design and Use of the MERIT Computer Network

Staff and users of the MERIT Computer Network have for some months carried on discussion and consultation using computer-aided communications. The activity has not been continuous, with some long periods of only private message communication. Potentially, staff would save travel time and costs and accomplish more writing. However, the use of this medium has not become a common work style for more than a few.

Discussion of Statistical Programs on the University Computer

In four different conferences, users of statistical programs have carried on discussion and consultation. The most general conferences were the least successful. Many more items are entered in more specific caucuses, for example, those concerned with SPSS and those discussing resources of the political science and/or sociology departments.

Impact of Technology on Educational Systems

Discussion of the impacts of technology on educational systems has been conducted in a small conference that grew out of the technology assessment Congress activity. This conference has replaced the seminar on computer-based education systems and presently draws more attention than the earlier one.

CONFER AT THE ISTA CONGRESS

Computing and telecommunications were used during the Second International Congress of the International Society for Technology Assessment (ISTA) to facilitate the discussion and contribute to the Congress report. In particular, the telecommunications activity was designed to enhance interaction on substantive issues and convergence on conclusions and interpretations.

Only incidentally were we conducting an experiment or trial (with support from NSF) for a community of potential users of computer-aided conferencing.

Therefore, the computer terminals and related staff were there to help participants gain more at this Congress, and also share more, perhaps leaving a more useful written record. But computing resources for modeling were also to be explored and tested. In any case, the computing activity was subordinate to Congress discussions and products useful in the field of technology assessment (TA).

Supplement to the Congress Program

A supplemental document provided information about computer-aided communications being offered in connection with this Congress. We set up resources and procedures in such a way that this document was unnecessary. However, those who wanted to obtain some overview, gain specific guidance, or just explore for curiosity's sake could find additional and helpful information in this guide. Those who wanted to use the facilities could go directly to a user terminal and rely on student aides to explain and assist.

This document, provided as a supplement to the Congress program, was organized in three sections: resources, services, and evaluation. An individual could go directly to the services section for information about specific techniques. Evaluation procedures were summarized for those who wished to help in assessing the impact of this communications medium on the Congress.

Drafts of the resource materials being developed through computer conferencing were provided in subsequent sections of the program supplement, for example, a glossary, list of current projects, and key writings in technology assessment.

Resources for Telecommunications at the Congress Site

The primary telecommunications resource provided at this Congress was a computer-aided communications system. A grant request by the University of Michigan to the National Science Foundation was funded for experimentation on the contribution of computer-based communications to a professional conference. The primary computer system was the Michigan Terminal System (MTS) with CONFER software. An alternate system, the PLANET computer-based conferencing system available through the TYMNET and TELENET data networks, was offered for more economical telephone communication from remote sites, but direct communication with on-site conferencing was selected by all off-site participants.

Audio and video resources were available as well. Some tapes were recorded in the weeks preceding the Congress and some were borrowed from existing libraries. Additional tapes were recorded during the Congress, not only from sessions but at interviews specifically scheduled for the purpose. These were available on the site for review by participants at any

time. In particular, "recap" sessions were scheduled in the evenings.

The computer was also used to demonstrate tools of technology assessment, for example, models and analytic procedures on the University of Michigan computer and elsewhere. These tools were then discussed in the computer-aided conferences.

Services Offered Via Computer Communication

Exchange of messages with other participants. All of those registered for the conference were included in a general communication medium called `ISTA:SCHEDULE`. A list of participants' names was included at each user terminal on the Congress site. It also could be obtained at any remote site by listing `ISTA:PARTICIPANTS`. Messages sent to any of these people were received in their "message files" immediately. How soon they were viewed by the recipient depended on his or her frequency of use of the computer system. A sample of sending and replying to a message is included in Figure 1.

Planning supplementary meetings and visits. An individual could scan the `ISTA:SCHEDULE` conference for notes and notices about additional sessions or special-interest meetings and possible visits to projects or offices nearby. The person could enter a suggestion for such a meeting or visit, or enter a specific request for travel. To check for replies, one would join the conference at a later time and request a display of responses to the item. Prime references attached to the item indicated which other participants had responded in detail; the "votes/feelings" were expressed in some brief notes; notes also identified others who were interested. A sample of this use appears in Figure 2.

Annotating and extending the resource lists. Three or four resource lists were assembled from a variety of sources. Each of these was intended to be helpful to participants in the Congress, particularly those who were not familiar with the terms, literature, or current activities in the field. Each of these is likely to become a part of the report of the Congress. Many participants helped by extending and adding to the lists, reviewing copies near each of the user terminals on site (or listing them from the computer), and entering "VOTES" or "ITEMS" which provided elaboration. An instance of commenting on an `ISTA:WRITINGS` entry is included in Figure 3.

Discussing issues related to TA methodology and perspectives. Some of the participants found it helpful to explore a variety of issues and ideas through a kind of computer-aided "caucus" in parallel with the sessions and discussions of the Congress. The convenience of getting information in and out of the computer made it possible for attendees to carry on this additional dimension without interfering with their usual approach to sessions and conversations. Furthermore, the issues, questions, and tentative conclusions emerging from these "conferences" were introduced into the work-

shops Wednesday and the final plenary discussion Thursday. Nine such topical "caucuses" were defined, one for each of the major themes of the Congress. Three more were set up for discussion of aspects, perspectives, and paradigms of technology assessment. An example of use of one of these is given in Figure 4.

Reacting to the substance and procedures of the Congress. The response forms for sessions and general procedures of the Congress were included on pages of the program. Additional copies were available near each session room entrance. Participants could write reactions (a question, suggestion, comment, or substantive contribution) and have them processed through the computer-aided conferences. If substantive, an item appeared in one of the topical sessions. If procedural, the suggestion was entered into the "SCHEDULE" conference or the staff conference. Those working on the telecommunications experiment invited any kind of input which might enrich the data on the experience.

When reviewing the substance or content of any conference with more than 20 entries, participants used the "agenda" categories or cross-references to organize and trace the discussion. Otherwise, a participant would get bogged down with irrelevant items. The multi-dimensional format of computer-based conferencing encourages participants to enter a great variety of material; some of the material is of no interest to many other participants. However, the computer facilitates multiple "conversations" and permits individuals to select items of interest.

One could browse within any conference using the cross-references introduced by various participants. Interesting activity in one conference was mentioned in some others; ordinarily some summary information appeared in `ISTA:SCHEDULE`. An individual could easily skip from one "conference" to another by using the JOIN command.

Many facilities were available to participants on-line that would not show up in a computer listing of all text. But those lacking experience with interactive computing could browse through the printed listings available near each user terminal and in the display areas.

Technical Assistance

Experience with CONFER was very favorable. Many people oriented themselves in 5 min to the sending and receiving of private messages as well as entering and retrieving public items. Because CONFER has many capabilities for searching, reorganizing, and developing information, the satisfactory demonstration of a real conference takes at least ½ h; interested participants were likely to spend an entire hour.

In order that the conferencing activity would not be a distraction, we arranged to have teleconferencing aides near all terminals on the site of the Congress at those times most likely for use by participants. These students had used CONFER before (although never all

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LAST ITEM IS ITEM 3
LAST YOU HAVE SEEN IS 1
LAST MESSAGE IS 4
DO NEXT? messages
  1__MESSAGE FROM: ZINN, KARL           12:08 10-23-76 SF HC:MF
  2__MESSAGE FROM:                     12:27 10-23-76 UMDM:MF
  3__MESSAGE FROM:                     12:34 10-23-76 UMDM:MF
  4__  REPLY FROM: LOLA GARLAND        17:42 10-23-76 UMAU:MF
WHICH MESSAGE? 2

2          LINES=2          19:20:31 10-23-76
MESSAGE FROM:                     12:27 10-23-76 UMDM:MF
DO YOU KNOW ABOUT INTENTS OF ROBERT RANDOLPH TO BE WITH US?
ENTER FORWARD, REPLY, DELETE, OR IGNORE: reply
ENTER YOUR MESSAGE. TERMINATE WITH $ENDFILE
>I do not see his name among the advanced registrations, but I will
>watch for his name to appear. You can also check at one of the computer
>terminal locations on Monday, looking either in the printed listing, or
>asking the computer to make a more current search. Karl Zinn
>\
TO EDIT COPY OF MESSAGE ENTER E:
OK? TO SEND TO                   : ok re Robert Randolph
MESSAGE SENT
ENTER RECIPIENT (OR PRESS RETURN):
ENTER FORWARD, REPLY, DELETE, OR IGNORE: delete out
DELETED

DO NEXT? transmit
ENTER YOUR MESSAGE. TERMINATE WITH $ENDFILE
>Kan Chen, the supplementary materials are done. I will now do some
>additional work on the other conferences (caucuses). Some of us will
>begin work at 9 am, others at noon. Everything should be ready by
>2 pm, the beginning of the roundtable sessions.
>Karl
>$endfile
TO EDIT COPY OF MESSAGE ENTER E:
ENTER RECIPIENT (OR PRESS RETURN): chen
OK? TO SEND TO CHEN, KAN : ok ready to go!
MESSAGE SENT

```

Figure 1. Receiving and sending messages.

on one site and during as short a time as 1 week) and all were interested in technology assessment. Although they had no special training in CONFER or experience in orienting new users, we were sure they could be helpful.

When participants approached a user terminal, it would likely be connected to the computer system. If not, they could ask one of the aides to do so. We encouraged participants to call upon a student as an intermediary with the computer. The student could interpret a participant's intentions to the computer and cover any difficulties that might arise due to an interruption in communications or the operating system.

The user on MTS is identified by the computer when "signing on" or "logging in." Because of the cost and delay caused by one user signing off and another signing on (and reloading the software), a facility for switching identity was introduced. The teleconferencing aides could easily participate as someone else, although special access codes were set up to restrict this feature to trained staff.

The computer was available from 8:00 a.m. until 4:00 a.m. Occasionally, unforeseen difficulties required

reloading of the operating system or shutting down the entire system for checks and repairs. When the machine was unavailable or the terminals were busy, participants could turn in response and message forms for later entry. Some used the forms to avoid typing material into the computer. Participants were encouraged to dictate or provide handwritten copy for entry of messages or items. For most efficient entry copy was routed to the most capable typist. To facilitate effective distribution of work, participants left forms in trays about the Congress site.

CONFER was not the place to convey detailed information. It did perform a number of functions: planning, scheduling, organizing, critiqueing, and seeking consensus. Full copies of materials that could be circulated on the site of the Congress were not entered into the computer. We did not intend to use the computer as a printing machine, listing separate copy for each individual.

COMPUTER CONTRIBUTIONS

Potential contributions of computing to communi-

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DO NEXT? enter
ENTER NUMBER OF ITEM THAT MOST INSPIRED THIS ITEM:
ENTER YOUR TEXT. TERMINATE WITH $ENDFILE
>Greg Edwards NSF in Washington, D.C., has some suggestions for
>establishing a network (perhaps via computer-aided conferencing)
>which will explore futures. Perhaps there are others with interest
>in discussing the goals and means for such an activity. If so, I
>will call him and enter more details. If you are interested,
>type your name (and any brief comment) on the "vote" line.
>\
TO EDIT TEXT OF ITEM ENTER E: e
:a 4 ;uc;cu;
: 4 in discussing the goals and means for such an activity. If so, I
:alter 5 ;more;his;
: 5 will 1 call him and enter his details. If you are interested,
:insert *1
?Of course, you can enter your ideas
                                alternate ideas in full on a new item.
?
:stop
ENTER THE HEADER FOR YOUR ITEM ON ONE LINE
suggestion for special interest group (and caucus?) on futures network
ENTER NUMBER OF ITEM YOU RECOMMEND BE READ NEXT:
TO ABORT ENTRY, PRESS <ATTN>. OTHERWISE. . .
ENTER LIST OF ITEM NUMBERS FOR REFERENCING

YOUR ENTRY IS NOW ITEM 4

LAST ITEM IS ITEM 4
LAST YOU HAVE SEEN IS 1
DO NEXT?

```

Figure 2. Scheduling additional discussion.

cations among professionals are many and varied. Some of those observed in our exploratory conferences are noted below.

Rapid Exchange and Revision of Information

Computer-based communication has served well in rapid distribution of information. Copy can be taken out at a remote site immediately after being entered. More important, corrections and elaborations of information (plans for a new curriculum, draft of a proposal, or text of a recommendation) are available to all users as soon as they have been entered. Commentary by the first readers is attached to the items of information so that later readers can benefit from it, much like marginal notes in a shared text. In general, materials receive wider review without distraction for those developing the information (proposal or plan) and with minimum effort on the part of the observers.

Convenient Organization and Reorganization of Information Stored

Documents in preparation are on public view, at least to the extent of access permitted through computer codes, and are extended and revised in a rather public way. Exchanges among a few individuals normally are private, but can easily be made "public" in order to share the ideas. Typically such openness leads to improved products and increased cooperation. Alternate versions of text and multiple dimensions of discussion

are not the problems they might be without convenient means to organize the information. Designated "organizers" group the items of information in categories summarized by a "public" agenda. Individuals make up their own categories for personal purposes. Those who contribute information provide cross-references which further link the elements of a data base (or proposal draft).

Communication Within a Core Working Group and With a Wider Audience

The computer as a medium can support a core working group and still open up access to a wider audience. Individuals in the central group are protected by whatever filtering they establish as individuals (checking within categories, "forgetting" or ignoring some items, attending primarily to items entered by others in the group). And yet their "conversations" through public items are open for any approved observers to review. Reactions from this larger audience can be very helpful.

Provisions for Elaboration of Information

Assembly of the text of a proposal or curriculum recommendation as a set of items in a data base makes possible convenient elaboration. Special terms are defined as a result of questions raised; additional background is provided in extra items. More important, underlying issues are explored with more care than is

DO NEXT? join ista:writings
 >You are leaving ISTA:SCHEDULE.

CONFERENCE for ISTA:WRITINGS
 Please respect informal nature of some entries

ZINN, KARL

LAST ITEM IS ITEM 21
 LAST YOU HAVE SEEN IS 21
 LAST MESSAGE IS 5
 DO NEXT? agenda all

AGENDA CATEGORIES
 REPORTS OF TA'S OR ANALYSES OF TA'S
 11 14 18
 ARTICLES IN JOURNALS, MAGAZINES AND PROCEEDINGS (AND SOME BOOK CHAPTERS)
 3 5 6 7 8 10 12
 BOOKS AND CONFERENCE PROCEEDINGS
 2 4 9 13 15 16 17 19 20

...ITEMS NOT CATEGORIZED
 1 21

DO NEXT? item
 YOU ARE UP TO DATE

DO NEXT? item 21

ITEM=21 11:55:34 10-23-76 LINES= 2 PRIME=6 NEXT=
 CHEN, KAN
 DOBROV: WISSENSCHAFT

DOBROV (DOBROW), GENNADY M. "WISSENSCHAFT: IHRE ANALYSIS UND
 PROGNOSESIS" STUTTGART, 1975.
 REF TO ITEMS 6

VOTES/FEELINGS
 THIS IS A BOOK IN GERMAN WRITTEN BY A DISTINGUISHED SOVIET
 ACADEMICIAN.

GIVE YOUR FEELINGS AND/OR CURRENT VOTE ON ONE LINE
 Are there any plans for translation into English?

Figure 3. Extending a resource list.

typical in face-to-face meetings. New directions appear in parallel discussion without distracting from completion of the original development.

Scheduling of Meetings, Prompting of Input

The most convenient time and place for a meeting evolve from discussions about agenda and intended outcomes through the computer. At a given point in time, the schedules and preferences of all potential participants can be considered. Also, the work yet to be covered through the computer-aided conference and related activities can be scheduled.

Direct Access to Computer Aid

At the University of Michigan, the timesharing system used for conferencing is the same general-purpose facility used for data analysis, modeling, and other computing in support of scholarly activity. At least one conference has encouraged participants to go back

and forth between the textual discussion and checking out the results of models on the computer separately. An item in the conference may raise questions that are answered by a look at a model of the process, and the results of the simulation provide additional input to the textual discussion.

We will continue our exploration of computer assistance with technical communication in scientific communities. Additional opportunities for experiments present themselves each month as more individuals and organizations discover the advantages of computer-aided conferencing. We aid all we can, counseling caution in committing resources to new media for communications where group members may not be receptive to the technology or purposes may not be served within the constraints. We select for systematic data collection those groups and situations which appear to add additional dimensions to our understanding of this new resource for educational and scientific communication.

Figure 4. Discussing perspectives.

DO NEXT? join ista:perspectives
 >You are leaving ISTA:STAFF. Enter SIGNOFF to leave computer.

CONFERENCE for ISTA:PERSPECTIVES
 Please respect informal nature of some items.

(Usage statistics are being collected)
 ZINN, KARL
 YOUR CURRENT BRIEF NOTICE IS:
 I am particularly interested in academic perspective
 ENTER REPLACEMENT (OR PRESS RETURN)

LAST ITEM IS ITEM 27
 LAST YOU HAVE SEEN IS 27
 DO NEXT? agenda

AGENDA CATEGORIES
 INDUSTRIAL
 "SELLING" OF TA
 NULL ITEMS
 DEFINITION OF THIS CONFERENCE
 GOVERNMENT
 ACADEMIC
 INTERNATIONAL
 CONFLICT
 PUBLIC

WHICH CATEGORY? sell
 "SELLING" OF TA
 ITEMS IN THIS CATEGORY
 25 26
 CATEGORIZE WHICH ITEMS?
 * THESE ITEMS? yes
 THESE ARE NOW THE * ITEMS

DO NEXT? items *

ITEM= 25 12:18:02 10-28-76 LINES= 9 PRIME= NEXT=
 SIMMONDS, W
 How can we sell technology and TA better.

By always reporting the positive gains to society as well as those to
 the organization proposing a change, investments, etc.
 All legislation, all investment, all change creates benefits
 for some with some disbenefits for others. We should therefore
 emphasize the positive rewards to society of the right use of technology,
 coupled with warnings of the consequences if proper safeguards are not
 also installed.
 This gives a positive focus to the use and sale of both technology
 and TA.

REF TO ITEMS
 PRIME REF FOR ITEM 26 JARBOE, KENAN

VOTES/FEELINGS
 IF YOU GIVE ONLY THE POSITIVE SIDE TA BECOMES TECHNOLOGY
 JUSTIFICATION AND NOT A TRUE TOOL FOR POLICY MAKING. I COULD NOT
 DISAGREE WITH THIS ITEM MORE. TA IS NOT A SALES OR ADVERTISING TOOL
 FOR TECHNOLOGY!!!!!!!!!!!!!!

GIVE YOUR FEELINGS AND/OR CURRENT VOTE ON ONE LINE
 TA may be (mis)used by some for selling, but profession should try to remain neutral!

ITEM= 26 17:16:45 10-29-76 LINES= 10 PRIME=25 NEXT=
 JARBOE, KENAN
 REACTION TO ITEM 25

I AM IN TOTAL DISAGREEMENT WITH ITEM 25. I BELIEVE IT IS A GROSS DISTORTION
 OF THE GOALS AND AIMS OF TECHNOLOGY ASSESSMENT. TO EMPHASIZE
 THE POSITIVE REWARD TO SOCIETY OF AS THE AUTHOR OF ITEM 25 CALLS THE "RIGHT"
 USE OF TECHNOLOGY WITH WARNINGS OF CONSEQUENCES IS AN INTELLECTUAL COP-OUT.
 IT IS SAYS THAT ALL TECHNOLOGY IS GOOD IF IT IS ONLY USED "RIGHT". IT IS

A "LOGICAL" CONCLUSION OF A DYING PHILOSOPHY. YES ALL CHANGE CREATES BENEFITS FOR SOME AND DISBENEFITS FOR OTHERS BUT TO TAKE THE STAND TAKEN IN ITEM 25 ASSUMES THAT ALL WE CAN DO IS MINIMIZE THE DISBENEFITS OF A CHANGE THAT WILL HAPPEN ANYWAY AND THAT WE ARE UNABLE TO MANAGE CHANGE, USING THE TERM PRESERVING THE STATUS-QUO EXCEPT TO DULL ITS BITE A LITTLE.

REF TO ITEMS 25

TOO FEW VOTES ON THIS ITEM AS YET

GIVE YOUR FEELINGS AND/OR CURRENT VOTE ON ONE LINE

The proponents of technology Simmonds refers to in item 25 are justified only in an adversary sense, as marketers of technology. Professionals can take this approach (selecting out positive results!?!).

DO NEXT? transmit

ENTER YOUR MESSAGE. TERMINATE WITH \$ENDFILE

>Perhaps you would like to elaborate on item 25, clarifying the "we" and
>the nature of advocacy intended?

>\

TO EDIT COPY OF MESSAGE ENTER E:

ENTER RECIPIENT (OR PRESS RETURN): simm

OK? TO SEND TO SIMMONDS, W. C. : ok re advocacy of technology

MESSAGE SENT

ENTER RECIPIENT (OR PRESS RETURN): jar

OK? TO SEND TO JARBOE, KENAN : ok cc: jarboe re simmonds advocacy point!

MESSAGE SENT

ENTER RECIPIENT (OR PRESS RETURN):

DO NEXT? reminder

ENTER REMINDER NOTE. TERMINATE WITH \$ENDFILE

>check votes on items 25-26 in perspectives (advocacy)

>\

TO EDIT REMINDER ENTER E:

ENTER EFFECTIVE DATE FOR REMINDER (EG. 02-28-78): +1

REMINDER POSTED FOR 10/30/76

DO NEXT? agenda academic

ACADEMIC

ITEMS IN THIS CATEGORY

14 18 19 27

CATEGORIZE WHICH ITEMS?

* THESE ITEMS? yes

THESE ARE NOW THE * ITEMS

DO NEXT? descriptors *

ITEM= 14	11:45:09	10-26-76	LINES= 7	PRIME=	NEXT=
CHEN, KAN					
ENGINEERING CURRICULUM					
REF TO ITEMS					

ITEM= 18	01:20:03	10-27-76	LINES= 10	PRIME=	NEXT=
AYRES, ERLE DANIEL					
15.9 Educational Systems Assessment					
REF TO ITEMS 3					
PRIME REF FOR ITEM 19 AYRES, ERLE DANIEL					

ITEM= 19	01:29:55	10-27-76	LINES= 8	PRIME=18	NEXT=
AYRES, ERLE DANIEL					
15.9 The New Jersey Situation in Educational Systems Assessment.					
REF TO ITEMS 18					

[etc.]

REFERENCE NOTES

1. Englebart, D. C., Watson, R. W., & Norton, J. C. *The augmented knowledge workshop*. AFIPS Conference Proceedings. Montvale, N.J.: AFIPS Press, June 1973.

2. Zinn, K. L. *Educational computing at the University of Michigan: A survey of activities and resources*. Ann Arbor: MERIT Computer Network, 1976.

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REITMAN, W., ET AL. Autonote: A personal information

storage and retrieval system. *Proceedings: National Conference of the Association for Computing Machinery*. New York: Association for Computing Machinery, 1969.

TUOFF, M. Human communication via data networks. *Computer Decisions*, January 1973, 25-29.

VALLEE, J., ET AL. Group communication through computers. *Pragmatics and dynamics* (Vol. 3). Menlo Park, Calif: Institute for the Future, 1975.

ZINN, K. L., PARNES, R., & HENCH, H. Computer-based educational communications at the University of Michigan. *Proceedings: National Conference of the Association for Computing Machinery*. New York: Association for Computing Machinery, 1976.