VII.E. Computerized Conferencing in an Educational System: A Short-Range Scenario

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The NUCLEUS-Annual Report for 1983

As most of you know, it was ten years ago (in 1973) that we formally began the NUCLEUS at Northwestern University, with somewhat limited goals and even more limited funding. We are happy to report that as remote computer uses have spread, the project has become an integral part of life at Northwestern, serving as a medium for many types of learning and communication. Let us turn back to the 1973 statement of purpose for NUCLEUS:

> The Northwestern University Computer-based Learning and Educational Utility System (NUCLEUS) will be designed to introduce educators and students to the computer as a tool common to all of their specialties.
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> We deal first and foremost with the computer as a medium for presentation of new information, and second, as a utility to help with ancillary educational tasks and research.
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> Computer-based learning will be explored and expanded by the NUCLEUS. It uses the computer as a "nucleus" around which educators from all specialties can gather. The teaching-computer can be used for Drill & Practice, tutorials, testing, information storage and retrieval, games, interactive conferencing or data analysis, but its most effective uses are in the classroom itself. NUCLEUS will explore new modes of dealing with educational computer technology and new interactive modes for educational computers.
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> The educational utility is patterned after the concept of the computer utility; it is a set of computer programs, running on a "publicly" available computer, designed to augment the computer-based learning system; these programs are available interactively to all members of the University community. The utility includes programs of use to teachers in all disciplines, as opposed to data-analysis programs for specific research projects.
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> NUCLEUS will attempt to be large enough to encompass hundreds of programs and lessons, yet simple enough to be used within five minutes by a new student. Foremost, it will attempt to bring together specialists from many disciplines by providing a common communication link among them.

This current (1983) report focuses specifically on one portion of the NUCLEUS-the ORACLE. ORACLE was our first attempt at using the computer as the "common communication link" among specialists. Originally written as a computerized conferencing program, the ORACLE is now in everyday use for many other purposes, particularly those involving hybrids of computer conferencing and on-line Delphi conferencing. We will report on the evolution of ORACLE at Northwestern from 1973 to 1983, including some comments on successes and failures. Since ORACLE is now taken for granted by so many

of us, it is hoped that our appraisal here can serve as a catalyst for discovering new ways to use the system more effectively.

Before describing the latest ORACLE, we should comment on the present physical state of the computer facility at Northwestern. Since 1973 the growth of "remote" computing activity has been extreme. In 1972 there were perhaps two dozen computers scattered across the Evanston and Chicago campuses of the university: primarily small minicomputers used to monitor data-gathering experiments, but including a large-scale CDC 6400 computer (called a "Super Computer" by its manufacturer at that time because of its speed and size). In 1983, however, computing power has been drastically centralized into two computer utility installations:

(1) There is a large central computer used for research, which is wired via cable to experiments taking place across the campus. In its spare time it processes "batch" computing jobs equivalent to ten times the 1973 load. It has connections to the campuses of several smaller colleges on the north shore of Lake Michigan, and to a junior college.

(2) There is a computer-based learning system, developed largely from ideas tested in the 1970s, when the University of Illinois' PLATO IV project was controlling about 2500 student data-terminals across the state. The computer-based learning system is the home of ORACLE.

The centralization of computing power in two computers was the result of the economically depressed period of the late 1960s and early 1970s, when it was found that human support requirements for a utility were far less than those of a dozen scattered computers.

In early 1976 there was a drive to locate inexpensive data terminals for our system. The PLATO IV plasma-display had brought the price down under $2,000 per device, but this was still beyond the means of many educational institutions. However, with the advent of cheaper television-technology, the administration made the decision to install terminals (at a cost of $600 each) in dormitory areas (one terminal per twenty-five students), department offices (one per three faculty members), in personal offices of administrators (one per office), board-of-trustees members (at their own expense), in study carrels in the library, and in the student union study areas. Most of the terminals were bought by the university, but some were provided through outside funding or private purchase and were often connected to time-sharing systems across the country. Some of the trustees who have installed terminals at their personal expense in their business offices use them to perform commerical computational tasks by connecting to commercial time-sharing. Increased use of computers in primary and secondary schools has helped to alleviate the uncomfortableness felt by many students and faculty members in the 1970s-our faculty is almost considering a proposal to require some computer experience of entering freshmen.

The ORACLE is a part of the computer-based learning utility. It is a computer program which connects students' data terminals to each other through the computer. This can be done in two ways: (1) students using the computer at the same time may be directly connected so that what one student types appears on the data terminals of the other students to whom he is connected, or (2) the ORACLE can set up ORACLE-groups in which "items" for consideration of the group are recorded in the computer (in the form of text) and are *later* typed for other students to see. The second is the more common of the two means of interacting.

Because of the multiplicity of interconnections, established by the computer's users themselves, ORACLE is extremely flexible. It treats messages from participants (e.g., new items to be entered for the consideration of other group members) as data to be stored for later examination. Comments entered by participants in a group are appended to the new items themselves. The ORACLE then presents a "menu" of items from a conference, and the participant asks it to retrieve the appropriate data. Thus ORACLE does not commit itself to certain topics in advance; students and faculty decide the topics, enter the items or events, and the ORACLE performs the data-handling function. Some of the areas of university life where ORACLE is now in common usage are as follows: (1) citizen sampling on current events and long-range alternative futures; (2) course and curricular evaluation; (3) committee work and long-range university planning; (4) conflict management and diagnosis; and (5) , interface with computer-based learning. Each of these general areas will now be discussed in some detail.

1. Citizen Sampling on Current Events and Futures

In recent years there has been an increasing use of future-studies techniques in the operation of the university, much as systems analysis came into its own in the 1960s. Actually, the ORACLE itself offers various modifications of the Delphi technique for sampling and sharing opinions. These include options for exploring the *desirability* and *probability* of proposed events, as well as a *voting* (yes/no) option. When used in the citizen-sampling mode, ORACLE presents items to the participants, solicits judgements on desirability, probability and/or a vote (depending on the preference of the conference initiator or person who entered the new item), and then proceeds to the next item. Some of the citizen-samplings which have proven most popular in the past few years are:

"Alternative futures for the family"
"The university over the next fifty years"
"Possibilities for space travel and colonization"
"Conference on world simulation systems"
"World federations in the future"
"Expanding the ORACLE"
"Improving computer operations in the university"
"Social possibilities for the computer"

These ongoing samplings have been designed by a broad cross section of persons, many of whom have no programming experience. They are known as *public conferences* and are available to anyone who is interacting with the computer at any time. Though more long-range in focus, these conferences have prompted some fascinating dialogues which might not have otherwise occurred.

On a more immediate level, ORACLE is used by experimenters as a kind of automated suggestion box to test feelings about various ideas and current issues. This usage has proven especially helpful with regard to controversial issues where a quick (but broad) sampling of community opinion can add greatly to the potential for reaching creative solutions to pressing problems. The *Daily Northwestern* (our student newspaper) uses these immediate feedback methods to gather student opinion; often the editors will open a new public ORACLE group in the afternoon, and check the results the next

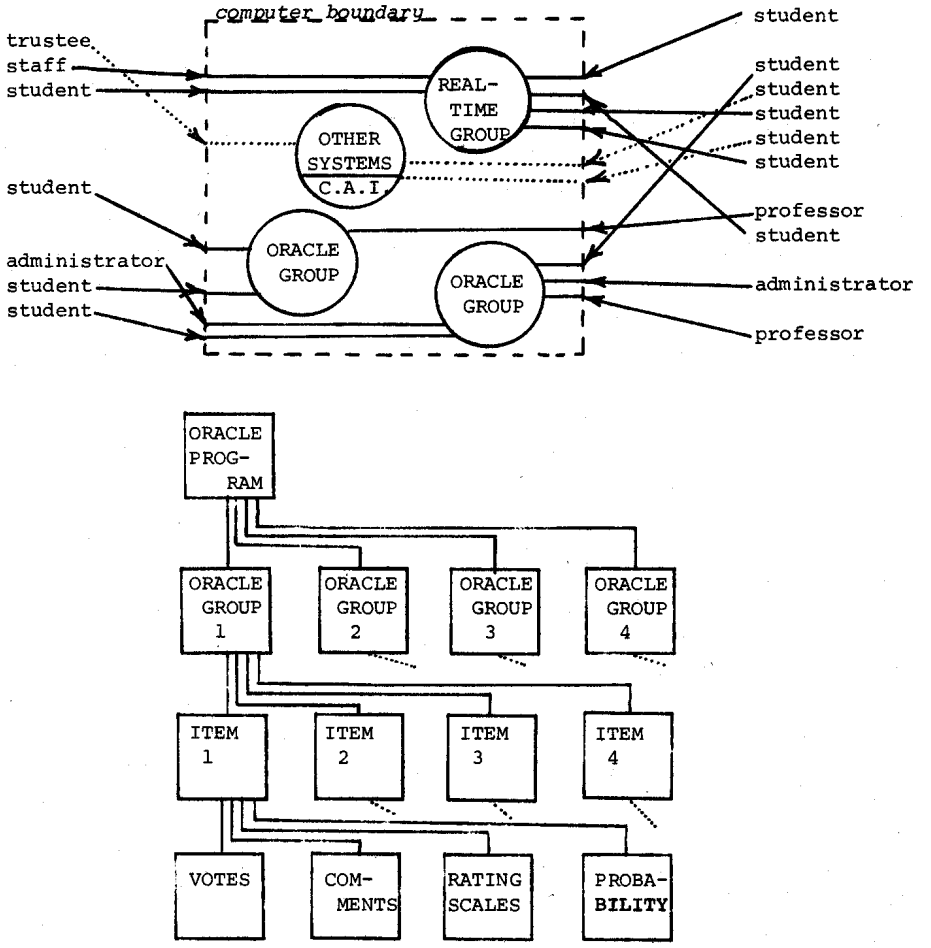

Fig. 1. ORACLE structure.

morning. This is feasible because many students spend their evenings studying in the library or the student union, and will often take a study break by going to one of the data terminals and trying the latest ORACLE groups. For those who don't study, terminals are also available in the dormitories.

2. Course and Curricular Evaluation

Use of ORACLE in curricular evaluation was actually begun at the Garrett Theological Seminary (located on the Northwestern campus) at about the time the NUCLEUS began in 1973. Experimentation in curricular evaluation and feedback was done more easily at Garrett, since there were only a few hundred students involved, rather than the six thousand at Northwestern. The original motivation for the program centered around the

construction of a computerized questionnaire which could give participants immediate feedback on their responses, rather than waiting months for data analysis and then getting only collective responses. Though this method raised immediate problems of reliability (especially when compared with paper-and-pencil methods), the program was eventually refined as an alternative questionnaire which students "took" from dormitory or apartment data terminals.

Another facet of this Garrett curriculum project involved a modification of the Delphi technique in which students were given a list of alternative futures for the school and asked to assess probability, desirability, and estimate of average *faculty* desirability ratings for each of the events. When these rating categories were then compared, participants were able to get some idea of how they perceived themselves in relation to the faculty - at least in regard to the cross section of futures under consideration. (For instance, an *index of perceived alienation from faculty* was computed by taking the student's own desirability ratings and comparing them with the ratings he thought the faculty would give - the difference would tell us how much he thought the faculty differed from his own desires.) Using the conferencing system, this feedback was both immediate and personal. Collective-data analysis was also performed to assess the differences between faculty and student views (the faculty also participated in the experiment). The *perceived* differences and accuracy of estimates from each group were also included. The result was an exploration of intragroup perception and stereotyped images, as well as a citizen-sampling of various alternative futures.

Emerging from these early efforts at curricular evaluation was the need for *more specific feedback* from students with regard to specific courses of study. Faculty evaluation such as this has, of course, now become generally accepted. But at that time (1972-73) such things as unlimited faculty tenure were commonly accepted traditions. Thus some caution was necessary in order to avoid approaches which might have proven overly threatening. This was partially alleviated by providing professors with the student feedback early in the course and only making the *final* data generally available. Thus professors got feedback early enough in a course to be able to revise their strategies if necessary.

The course evaluations have proven especially helpful in large section courses (more than thirty students). Feedback in such large groups had always been a problem and the availability of an immediate and constant feedback mechanism has promoted information exchange which was never before possible. It also provides (through directly recorded student comments) more open-ended *conversation*, rather than only the coded responses of a standardized testing instrument.

Now that so much of learning has moved out of the classroom (owing to television circuits, action research, independent study, etc.), this kind of feedback has become doubly important. The Chicago "TV College," run by one of the educational television stations, regularly uses the ORACLE for feedback through several remote centers, established in Chicago and suburbs. Students take the TV College courses in their homes, but report to the remote centers for testing and feedback. Up to 1975 this testing always took place by pencil and paper, at predetermined times and places; now it takes place whenever a student has finished a course, or even earlier if he desires, since the computer selects test questions at random from a rather large data base of questions presented by the teacher. Two students seldom get the same test. At each remote center there are several data terminals, connected

to the computer via telephone lines. The student who finishes a test satisfactorily is often prompted to enter one of the ORACLE course-evaluation groups for the course in which he was just tested. Thus the professor gets constant feedback from his students which he could not get otherwise. Because Northwestern has adopted the computer utility standpoint, it also processes curricular feedback (at cost) for a growing number of local colleges and universities.

3. Committee Work and Long-Range Planning

Before data terminals reached their current low prices, it was uncommon to find ORACLE used for Conferencing, because few participants would take the time to go to the library where the terminals were located. Those few users who owned their own terminals used ORACLE, but infrequently since there just weren't enough users to make a good ORACLE group. Now, with terminals in most offices, ORACLE is used extensively in planning the university's committee work. The University Computer Committee was the first to experiment in this direction; in 1973 they began prescreening their discussion subjects through ORACLE groups. A committee member first adds a suggested item to the ORACLE group anonymously. Later he may gather the comments made by other group members and decide to submit them with the item as an agendum. At this point the item is "voted" on by committee members (still through ORACLE). If it receives a substantial number of "yes" votes, it is placed on the agenda

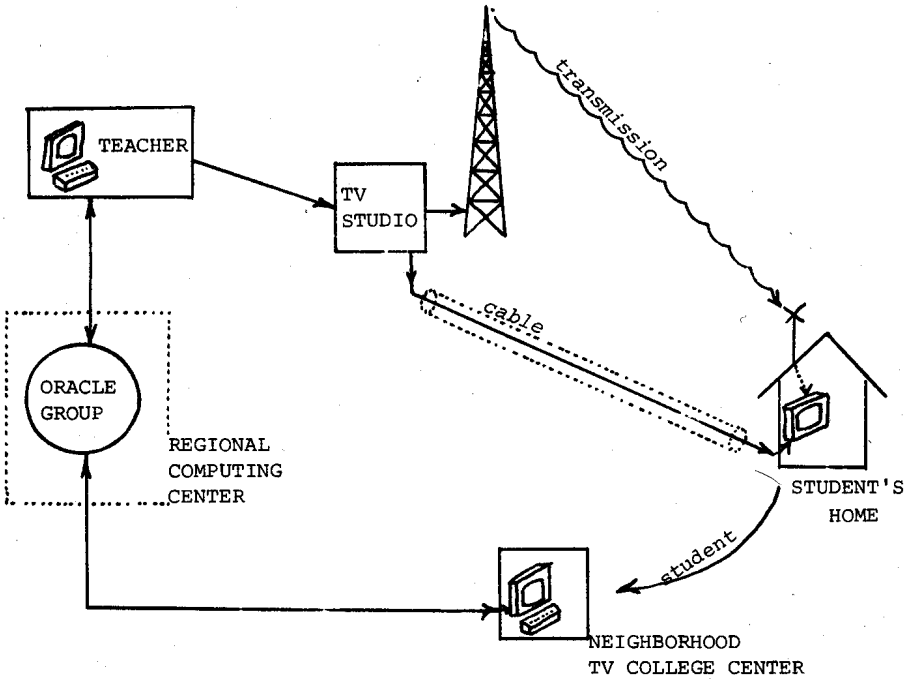

Fig. 2. A "feedback" TV College.

for the next committee meeting. Note that ORACLE does not take the place of face-to-face confrontations; it is primarily a prescreening device from which members may obtain soundings on the relative merits of various proposals before bringing them up for discussion.

The board of trustees also uses ORACLE to sound out proposals before they are actually discussed. A spin-off of this involves a special trustees' conference which has been created (it is not a public conference). Trustees enter items to be placed before the board. This was formerly done by writing letters' or calling on the telephone but ORACLE has proven to be much faster and the trustee then knows that the proposal will be worded exactly as he intended.

Network conferences with other. universities around the country have also been implemented experimentally. One result of this usage has been to encourage administrators to move beyond a crisis-response orientation toward an examination of alternatives which might not have previously been part of the decision making process.

4. Conflict Management and Diagnosis

The first uses of ORACLE to help professors and administrators deal with conflict began in the early 1974 school year. In this dialectic inquiry mode, ORACLE is used as a kind of blackboard on which opposing sides in a disagreement can sketch their positions. Usually the participants are "coached" in advance by a Conflict Manager as to what kinds of supportive evidence should be entered along with the "items" used to express the two groups' positions. Participants in each group enter items and evidence, as two teams, with each group working out its difficulties before entering its items. When the two ORACLE groups have been created, the tables are turned and each member of Group A is required to enter the ORACLE group B. Comments are recorded, along with desirability, probability, and perhaps votes (as in other ORACLE group conferences). We have also found especially helpful the use of "user-created" scales, in which the group itself decides exactly what wording to use in a specific question which is then asked of the participants-responses are given on a numeric scale, or as comments. Participants in conflict groups then return to their own original groups to view the comments made by the opposing group. This trading of groups continues until the two slates of items have been hammered into relatively congruent positions, at which point the human Conflict Mediators take over and attempt to resolve any remaining difficulties. ORACLE most often serves as a prelude to negotiation. Its most important function has been as an aid to understanding opposing positions and surfacing actual differences. Thus conflict may still exist, but it is more likely to be real conflict than simple misunderstanding. We have found that another advantage of ORACLE in conflict mediation is that the computer is viewed as an impersonal medium and, because it cannot take sides, both groups are often willing to work with it where they might be quite suspicious of a human mediator.

Building upon this potential, the conferencing system has also been used as an aid for small group communications. Limited experiments have been attempted in "T-group"-style labs, but the most intensive applications have focused on communication within various family arrangements. They first began with couples, but have recently been broadened to include extended families and other intimate living groups. In situations such as these, com-

munication is both vital and elusive. ORACLE is used to encourage dialogue on future directions for the family, as well as to assess the accuracy of one's perception of other group members. For instance, one family member might be asked to register his opinion about particular alternatives being discussed and also to predict how each other family member will react to each idea. (These differences can then be analyzed statistically using an item-by-item index of dissimilarity, if this is desired.) Surprising misperceptions have often occurred which have served as a basis for reassessment of family relationships. Though an application such as this might have been perceived as dehumanizing in the 1970s, we have now come to see that human applications of technology can offer insights to even intimate relationships if care is taken continually to adapt the technology to human needs.

In summary, the great advantage of ORACLE in these conflict situations is that it provides an *open-ended* vehicle for expressing and examining the fundamental bases of some human relations.

5. Interface with Computer-Based Learning

The ORACLE is still a part of the NUCLEUS system, and therefore is embedded in a computer-based learning environment. The NUCLEUS is primarily used for giving students basic lessons and review work in connection with courses; there are nearly a thousand lessons (most from the early PLATO IV systems) available at any time of the day or night. Professors have now learned to coexist with computer-based learning; the best teachers rapidly shot into higher orbits, teaching their students more about the social implications of the technical subjects they were learning through the computerized lessons. Classrooms became hotbeds of discussion and criticism, and the more mundane technical problems were handled outside of class (e.g., students learned data analysis techniques for sociology from the computer, but they came to class to discuss interesting experiments). The poor teachers, who were out-of place in a classroom, moved into managerial and clerical positions in the computer-based networks, which are now employing more people than the educational systems of the late 1970s ever did.

ORACLE has been used from the start as 'a feedback tool for NUCLEUS. As a student finishes a lesson, he is advised that an ORACLE group exists for that lesson and is shifted into ORACLE if he elects to perform an evaluation. The results of student feedback are presented to the teacher who wrote the lesson periodically (normally once a week, since a thousand students may take a lesson during that period). However, the volume of such evaluations has grown so that there is now the necessity to prescan some of the students' comments and lump them together before presenting them to the teacher; the development of sophisticated English-language-understanding, computer-based learning systems in 1978 has made this almost feasible.

This feedback to computer-based lesson-writers is doubly important now that the State University systems of New York, Illinois, and California are bargaining for exchange rights on PLATO programs developed at their respective sites. The possibility now exists for interconnection of their total of fourteen computerized learning systems. By *1985* lessons developed in New York may be transported to computers in southern California and it will be important to be able to route feedback information to the author directly. This is just one of the more important problems these systems have yet to solve.

6. The Computer Learns to Talk

One of the truly remarkable applications of technology in the *1970s* was the coupling of the computer with television. The early instructional uses of television were limited primarily to TV College (in the broadcast range) and to closed-circuit classrooms (in the closed-circuit range). Later instructional uses were developed as the cable-TV franchises began springing up around the country. Since every new home built after *1980* was required by law to have cable access as a utility, and since the signal carrying ability of cables could be divided up (or multiplexed) in several ways, it became possible to send different "programs" to each house in a city. The information-handling capabilities of the computer were harnessed to cable TV by assigning a device in each home a distinct *code number,* which was sent with the television picture for that home. Thus, the pictures were broadcast to all homes, but only the device with the proper code number would receive and activate the picture on its television screen. Ambitious experiments were undertaken to provide education in the home using computer-controlled cable TV. The computer would select the materials, generate display pictures, and send them to the appropriate homes. The students (both children and adults) would respond to the information displayed by calling the computer on their touch-tone telephone and using the numeric keys to communicate with the computer. Early systems of this sort used multiple-choice questions, or "menus" of possible responses identified by numbers. The trouble with these experiments was that they left the audio capabilities of the telephone/television communications link virtually unused.

We have recently begun experimenting with a "talking ORACLE" on a local computerized cable-TV system. Participants in the talking ORACLE see an item on the TV screen, generated by the computer, and sent to their home receiver. In some cases they may also request an oral reading of the item. They then press the "*" key on their touch-tone telephone to indicate that the computer may proceed. Our computer then plays recordings of questions, such as, "How desirable is this item by 1980? Please rate from -100 through + 100." The participant punches the proper keys on his telephone to indicate his response and the computer continues to the next question. When the time comes for comments by the participant, the computer chooses a previously unused track on its recording disk and saves the participant's comments in digital form. Because they are recorded by a sampling technique, these comments retain the intonation and tonal quality of the participant, and can be played back for other participants. The computer can measure their length and compress them if necessary. This heightens the illusion that individuals are actually conversing with each other via the computer-controlled system. The prognosis for this system in our future looks quite good.

7. Possible Misuses of ORACLE

Though this report has been basically favorable to the current uses of ORACLE, computerized conferencing of this sort also has potential uses which the authors of this report would regard as improper. In general, this judgment is grounded in the original purposes of ORACLE, which focused on its use as a catalyst for human communication. It

was never intended to be a replacement for human interaction, except in regard to the most mundane matters. Thus a primary goal is to facilitate communication, not replace it.

Still, ORACLE is only a framework for communication and can be developed in many different ways. Thus it is quite possible for it to be used as a *barrier* to separate persons from each other and encourage only automated interaction. For instance, computer conferencing could be used by decision making bodies to filter out dissenting opinions and discourage the consideration of controversial issues. By requiring a high number of approving votes in conference screening sessions, many of the issues could simply be kept off the agenda for actual meetings. The consensus-encouraging potential of computer conferencing is appealing, but not if this is a false consensus, forced by the form of the interaction.

It would also be possible for decision making bodies to use ORACLE as a voting device for issues which demanded more consideration than would be possible in a hundred years of ORACLE-ing. The system contains a voting mechanism, but this is intended only for preliminary sampling, not for actual decision making. It is also true that voting connotes majority rule and a number of decision making bodies do not function along majority-rule lines. We do not want to enforce majority rule on those who have other ways of deliberation. For these processes, ORACLE serves to introduce some of the issues and opposing views; it is not a substitute for dialogue.

Perhaps predictably, the increasing availability of data terminals at low cost has promoted both positive and negative applications of computer conferencing. Thus we find a growing need to examine continually the more subtle implications of using ORACLE in communications systems. These considerations must involve more than cost and productivity analysis. Potential users should be aware (to the degree to which this is possible) of the possible effects which computer conferencing could have on their particular groups. Such information can be available only if current users are able to pool their experiences in a form which enlightens the newcomer, without limiting his perspective on potentials. A continuous ORACLE group with this "introspective" purpose has been established and is available to all users. In this arena, both criticisms and possibilities are surfaced and discussed.

Written summaries of ideas raised in these conferences are now available in the form of a newsletter distributed monthly. This newsletter reaches many nonusers of the system, and a major function of the publication is to encourage new applications. It serves as a permanent forum for debate on uses and misuses of ORACLE. The newsletter complements the public conference (where most of the ideas are initially raised) and makes the dialogue more generally available. It is our feeling that the dialogue on the effects of computer conferencing may be just beginning, since it is only now that the system can be given adequate tests.

Getting Oriented in Space/Time

This scenario has been extrapolated from work already in progress at Northwestern University. It is a projection of very possible futures, perhaps even very probable futures. The time referent is short range-approximately ten years. But most of the uncertainties are social and political, rather than technological (the

computer-based learning systems LINGO and PLATO IV have already been developed, the NUCLEUS exists, the cable-TV system is being tested by MITRE corporation, and the ORACLE has been a reality for over two years).

The scenario revolves around a computerized conferencing system called ORACLE, which the authors built and operated during the 1971-72 period at Northwestern University. ORACLE operates on a Control Data 6400 computer and is written in the LINGO programming language, developed specifically for computer-based learning experiments. As a "utility" program, ORACLE serves many users at once, each in unique ways. Since it is not sensitive to the content of ORACLE groups, it provides a Delphi-conferencing framework on which experimenters may build questionnaires, citizen-sampling, feedback networks, and other types of conferences.

It is possible for persons with no programming experience to establish ORACLE groups (or conferences) on whatever subjects they may desire. ORACLE is centered around numerous "groups" of participants, each group considering a number of "items" (alternative futures). The items may change, and new items may be added by participants. The options available to initiators of ORACLE groups and to participants or "eavesdroppers" are outlined below:

Conference-related options (set by the initiator of the conference or the item):

??Anonymous conference (alternative is names recorded)
??Mandatory events for each participant to look at (How many?)
??Can new items be added by participants, or is the conference to remain as initiated?
??Additional items or event to be deleted by the initiator

Item-related options (set by the person who enters an item):

??Nonvoting items (comments only)
??Voting items
(a) comments recorded
(b) no comments
(c) secret ballot or names recorded
??Delphi items
(a) probability only (What scale?)
(b) desirability only (What scale?)
(c) both (What scales?)
(d) by what date will each item take place?
??Other
(a) design your own scales (for questionnaires, etc.)
(b) Likert-type scales (agree, neutral, disagree)

Feedback-related options:

??No feedback
??Feedback after each event is completed by a participant
??Feedback only after all events have been completed by participant
??Eavesdropper (feedback only, no participation)
(a) complete printout on high-speed printer of conference
(b) comments only since a certain date
(c) comments on a particular event only
(d) comments from a particular person only
(e) printout of data for an analysis program

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