Evaluation of a continuing computer conference on simulation

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A 20-day computer conference was held in preparation for a face-to-face meeting to produce a computer simulation. The conferencing resulted in the generation of seven different models and was excellent preparation for the subsequent meeting. Computer conferencing appears to hold great value for faculty development in a period of reduced faculty mobility.

Sedelow (1976) has pointed out that a computer network has a multitude of elements, and a thorough description and evaluation of the entire person-machine system requires attention to all elements. Vallee, Johansen, and Spangler (1975) suggest that computer conferencing represents a new and altered form of communication, one in which the users are required to develop new kinds of communicating behavior. If one can conceive of a continuum of interpersonal communication that extends from direct (face-to-face) communication to communication by letter, then it would seem that two major underlying components are the forms of information conveyed and the speed of feedback. With direct communication, the usual verbal content is augmented by voice inflection, facial expression, and gestures, and the process is facilitated by direct feedback. Written communication, on the other hand, lacks all the accouterments of face-to-face communication, tends to be much more formal, and feedback is very slow, influenced by the vagaries of the mail system and the desire of the correspondents not to delay the process. Various media range somewhere in between, including the telephone conference call, two-way interactive television, and computer conferencing.

Computer conferencing is a process in which conferees obtain telephone access to a central, often quite remote, computer and communicate with each other by entering messages to an executive program, which then distributes the messages to the appropriate recipients. Requirements are an acoustically coupled terminal, minimal typing ability, and access to a computer-telephone network. The conference discussed in this paper was conducted on the TELENET system using a DEC-10 computer at Bolt, Beranek and Newman in Boston, Massachusetts. The executive program, PLANET-2, is the latest version of the program FORUM, by the staff at the Institute for the Future in Menlo Park, California.

Because PLANET-2 keeps track of the messages that each participant has and has not seen, there is no requirement that the conferencing take place in real time. A user can log onto the system, be brought up to date by reading messages he has not yet seen, and can

continue participating by entering whatever messages he wishes, regardless of which conferees, if any, are present. Messages can be public (for all participants to see) or private (sent specifically to a particular member of the group only). Thus, with computer conferencing, the normal constraints of time and space are largely eliminated, and participants are free to join and leave the discussion as their schedules permit. This freedom poses some problems for ongoing activity, because unless a participant chooses to activate his terminal and join the conference, there is no way for other conferees to reach him except by some other medium. This problem, which has appeared in previous conferences (Vallee, Johansen, Lupinski, Spangler, & Wilson, 1975), was also apparent in our conference.

Vallee and his associates (Vallee et al., 1975a; Johansen, Vallee, & Palmer, Note 1) have identified five styles of conferencing. The *Notepad* style was the earliest type used, being basically a noninteractive process for pursuing common areas of interest. This type is often an adjunct to other modes of communication. The *Seminar* focuses on a specific topic for a defined period of time, including both synchronous and asynchronous communication. This is the style of the conference being reported here. The *Assembly* is complex, covering a variety of topics with differing patterns of participation. The *Encounter* is a predominantly synchronous conference, conducted at an intense level and for a relatively short period of time (hours). Finally, the *Questionnaire* is a highly structured conference involving computer-controlled voting on a series of questions. Because of the concentration in this conference on computer modeling over a relatively restricted period (24 days between the start of the conference and the beginning of the face-to-face meeting), it clearly fits in the category of the *Seminar*.

GOALS OF THE CONFERENCING GROUP

The primary goal of the group was to produce a functional computer simulation of a task that has received attention in the recent psychological literature—developmental transitivity. The plan was to mail copies of

relevant articles (by Trabasso and his colleagues) to the participants prior to the start of the conferencing activity. These articles were to be read prior to the start of the computer conference. It was hoped that the participants would enter the initial 24-day computer conference with a good understanding of this literature. The goals of the computer conference were to sharpen individual understanding of the transitivity data and to begin generating one or more models which could be finalized, integrated, and programmed during the 2-day face-to-face meeting at Denison University.

THE INITIAL COMPUTER CONFERENCE

The first phase of the computer conferencing ran from September 13 through October 7, 1976, for a period of 24 days. The face-to-face meeting took place at Denison University from the evening of October 7 through the evening of October 9. During the time of the conferencing 315 public messages (those seen by all participants) were sent. However, the last five messages, sent during the final 4 days, pertained to details of traveling to Ohio for the meeting, and will not be dealt with here. Thus, the primary conferencing activity involved 310 public messages sent over a 20-day period. At present, the computerized data on private messages are unavailable, and since any participant can know about only the private messages he or she received and sent, there is no way to analyze the private message aspects of the conference at this time. Fourteen people were initially listed as participants. Three of these were from either Lilly Endowment, Inc., or the Institute for the Future and served primarily as facilitators and observers. The remaining 11 participants, all psychologists (later expanded to 12 individuals), constitute the conferencing group whose activities will be reported here.

The primary areas of expertise included physiological, experimental, learning and motivation, cognitive, memory, perception and developmental, thus representing a broad range of knowledge. Since only two participants had prior exposure to the research on developmental transitivity to be modeled, one of the initial goals of the computer conference was to bring all participants to a working level of understanding of the experimental task, the data, and various theories. The activity carried little social pressure to participate and was an addition to the regular duties of the participants. As a result, the degree of participation by the members ranged from very little to a lot. Due to this and to the fact that not all were able to attend the meeting at Denison, the evaluation survey¹ was sent to only eight participants. Much of the data to be presented below comes from this survey and from an analysis of the public messages themselves.

Seven of the eight individuals surveyed indicated that they had considerable experience using packaged com-

Table 1
Tabulation of Answers to Questions from Group Survey Dealing With How Participants Felt About Computer Conferencing

Question	Always		Never			Mean
	5	4	3	2	1	
1. Distraction by system/terminal			2	3	3	1.88
2. Types of contributions constrained			3	2	3	2.0
3. Overloaded by information		2	3	2	1	2.75
4. Able to express views	5	1	2			4.38
5. Feeling of personal contact	2	5	1			4.13

puter programs, four had used computers for on-line research, and five had programmed. (The same pattern would apply to those members who were not surveyed.) Since group members had considerable experience with computers, it is not surprising to find that all conferees did their own typing, the overall quality of which was rated just above adequate (3.3 on a 5-point scale from very poor to very good).

Table 1 presents the results of five questions dealing with the users' feelings about the conferencing process. Generally, the group did not feel very distracted or constrained by the computer system, and did feel able to present their views and gain a feeling of personal contact. The participants had met the previous summer so there was no need to make initial introductions through the computer. In general, the results of Questions 1, 2, 4, and 5 are more favorable than those from other conferences (see, e.g., Vallee et al., 1975b, Tables 11 and 12). The question on degree of information overload provided the greatest spread of responses, and tends to agree with the results of several previous conferences (Vallee et al., 1975a, Table 11). All but one member of the group felt overloaded by information at one time or another. Overloading is relatively easy to handle by simply logging off the system and studying the messages, a procedure that was used a number of times by a variety of the participants.

ANALYSIS OF PUBLIC MESSAGES

Of the 310 messages sent during the 20 days of primary conferencing activity, 3 had no entry, leaving a total of 307 messages sent. Of the 12 users listed as participating, 2 each sent about 30% of the messages, a 3rd sent 15%, 2 more sent about 6.5% each, and the remaining 7 participants sent about 13% among them. Thus, about 75% of the conferencing activity, as represented *only* by sheer number of messages sent, was carried on by three participants. However, significant contributions were made by several people who, for one reason or another, sent only a few messages. For example, one conferee, who sent only 6.5% of the total messages, contributed flow charts for two different models; another participant sent a total of only four messages but he also contributed a model. The disparities in participation are especially interesting in light of the

Table 2
Examples of Different Types of Messages

SOCIAL

[1] Thorson (ORG) 13-Sep-76 8:50 a.m.

Good morning, everyone. We are still missing a few participants, though I hope the whole group will be ready to go by this Friday. Nevertheless, why don't we at least try to get started?

PROCEDURE

[99] Spelt

I'm going to try to get a flow chart on the system FRO //O/R for you all, if this infernal machine doesn't kick me off before I'm done. The messages will be one geometric figure per message. First will be the form (square, diamond/DND, etc.). The chart goes inside the form. Then you can all draw your own flow chart. O.K.?

POSITION

[170] Johnson

Re 169 Yes, Esther. I think depending on how difficult the task is the subject would have differing load placed on immediate memory. (I mean a short-term memory.) The particular strategy used by the subject during testing could vary a lot as a function of task difficulty and, of course, this would make the problem of modeling transitivity very difficult. Trabasso's situation reflects only tasks within a narrow range of difficulty.

INTEGRATION

[131] Thorson (ORG) 22-Sep-76 7:28 a.m.

The more I looked at Phil's flow diagrams last night, the more excited I got, and I now think I understand so much better what all that Trabasso data is about. Phil has modeled that process hypothesized on page 146 of the Pick article. That was the one Trabasso opted for until the reaction times came in. Let me try an incomplete model of something I think will handle both the error data and the RTs. There's no "getting the stuff into memory" part of the model yet, and I hope Dave and Bill will work out some sophisticated system for doing that. In fact, I think we should try to take a look at some of the apparently relevant papers by Moyer and Landauer (page 148 of Pick), DeSota, London, and Handel, page 145, Huttenlocher, page 159, as well as whatever other we might derive some ideas from.

QUESTION

[8] Hayes 13-Sep-76 9:20 a.m.

Now, about transitivity. What is the difference between transitivity and seriation?

survey results which indicated that the group as a whole was highly motivated to participate (the group mean was 4.75 on a scale in which 5 indicated very strong motivation). The behavior of the participants at the face-to-face meeting indicated that they were able to participate "passively," that is, without sending messages.

The public messages that constitute the body of this conference can be categorized into five types.² *Social* messages are those of greeting or other social amenities that do not contribute directly to the conference topic (see Table 2, Message 1). *Procedure* messages deal with the mechanics of conducting the computer conference (Table 2, Message 99). *Position* (Table 2, Message 170) and *Integration* (Table 2, Message 131) messages deal directly with the substance of the conference, the former elaborating one or another position or fact

Figure 1. Cumulative frequency of various types of messages as a function of 4-day blocks. The number to the right of the slashes indicates the number of the last message sent in that block.

about transitivity and the latter dealing with some kind of synthesis of facts, data, and/or positions. The *Question* category (Table 2, Message 8) included questions pertaining to all other categories except social. Social questions were categorized with the Social messages.

Figure 1 presents the cumulative number of messages for each of the five categories as a function of 4-day blocks for the 20 days of the conference. The number of the last message sent in each 4-day block is indicated to the right of each slash. The second and fourth blocks (8/127 and 16/248) each include 2 weekend days, a fact that is reflected in lower slopes for the curves from Blocks 1 to 2 and Blocks 3 to 4 than for the other portions of the graph. Figure 1 shows that Social and Procedure messages accounted for the highest number of messages, Position and Integration an intermediate number, and Questions the fewest. The high number of Social messages probably reflects the fact that the group knew each other and were taking advantage of the available system to exchange pleasantries. The Procedure messages include those pertaining to the computer conference, the model(s) to be produced, and the two face-to-face meetings (the one at Denison and this Symposium). There is a greater correspondence between Position and Integration messages than has been presented previously (Vallee et al., 1975a, p. 79), a fact probably reflective of the task set for this group—to produce a model that integrates existing data and theory. The function for Integration messages in Figure 1 reflects an interesting aspect of this conference, especially in comparison to the other functions. The first Integration message sent was 65, at the end of the first 4-day block. The second block shows a sharp increase in Integration messages and relatively little increase in the other categories, a situation which is repeated in the fourth block (Days 13 through 16). Since these were the two blocks that contained 2 week-

Figure 2. Number of messages sent per hour as a function of time of day.

end days, it appears that participants were spending the weekend absorbing and integrating information, and returning after the weekend to enter a relatively larger proportion of Integration messages. This interpretation is supported by the fact that very few messages were sent during the weekend hours.

Figure 2 presents the number of messages sent per hour as a function of the local time of day. As suggested by Figure 2, no messages were sent between 3:00 and 7:00 a.m. Because so few weekend messages were sent, they were incorporated into the data presented in Figure 2. The most striking aspect of these data is the fact that 83% of the conferencing was done between the hours of 9:00 a.m. and 5:00 p.m., the normal business office hours, with over half the activity occurring during the afternoon, when the TELENET system received its heaviest use. This probably accounts for the frequent complaints that the system was slow and that there were problems staying connected to the TELENET system. The large number of messages sent between 3:00 and 6:00 p.m. is due to the fact that several participants fell into the practice of "meeting" via the conference at that time of day.

EVALUATION OF THE COMPUTER CONFERENCING

The primary objectives of the conferencing were successfully met. During the 20 days of activity prior to the Denison meeting, all participants significantly increased their understanding of the transitivity problem and the research findings of that area. Moreover, descriptions of flow charts for seven different models were submitted by various individuals and drawn by others around the network. There was some question, initially, about the ability to transmit flow-chart information by computer conferencing, but the group evolved a very efficient method for transmittance, consisting of the shape of the symbol, the verbal con-

Table 3
Examples of Flow Chart Messages

[192] Ruggiero 24-Sep-76 3:09 a.m.

Good morning. This thing certainly is addicting. I'm going to try some flow charting. There are two parts to the model I'm describing. The first part handles the end anchored pair (1-6) and the end pairs. The second part is intended to take care of the remaining pairs. There are two different models suggested for the second part. One is characteristic of Trabasso (I think), and the other is inspired by Huttenlocher and an empirical study I conducted yesterday morning using three sleepy freshmen. Science plods along!

FORM#, SHAPE, DESCRIPTION, ARROW(S) DIRECTION.

[193] Ruggiero 24-Sep-76 3:14 a.m.

Part 1: End anchored pair and end pairs.

1,BOX,INPUT TEST PAIR.,→2.

2,DIAMOND,IS THIS THE END ANCHORED PAIR(1-6)?, YES→3,NO→4.

3,BOX,PRINT NAME OF ANCHOR WHICH MATCHES QUESTION.,→11.

4,DIAMOND,IS EITHER MEMBER AN END ANCHOR?, YES→5,NO→6***

5,BOX,PRINT NAME OF MEMBER THAT MATCHES QUESTION.,→11.

11,DIAMOND,ARE THERE ANY MORE TEST PAIRS?, YES→1,NO→12.

12,O/AL,QUIT.

***Either Model A or Model B can be fit in at the ***.

tent, and where the arrow(s) go(es) from that element (see Table 3 for an example). Of the seven models, one was an input, or initial training, model and the other six were of the testing phase, during which transitivity data are generated. One of the significant realizations that came out of the initial conferencing was that the simulation finally produced would have to integrate training and testing phases, whereas none of the models the group had reviewed had done this.

In addition, the preparation of the group for the face-to-face meeting was such that relatively few hours were required to bring all participants to the same relatively sophisticated level of understanding of transitivity phenomena. This preparation was done the first evening and the following morning, so that by lunch of the first full day the group was ready to begin making substantive decisions about the model to be developed. The final 1½ days were spent designing an integrated model, flow charting it, and programming. There was universal agreement that the accomplishments of the 2-day meeting would have been impossible without the preparation provided by the computer conferencing.

In response to an open-ended question on the survey dealing with ways in which the conference was successful, the participants indicated that it was very useful in the early layout of the problem and in shaping the group's thinking about the problem. Other benefits included an increased ability to think about problems in terms of flow charts, the thought-provoking nature of many messages, and relatively quick feedback compared to other written forms of communication. One

of the greatest benefits of computer conferencing derives from the fact that the machine is a perfect stenographer, permitting participants to review particular messages whenever they need to. This was especially useful for the messages which contained the flow charts and for those who used CRT rather than hard-copy terminals. Finally, a universally expressed benefit was the great motivation for small-college scholars to engage in the conferencing. Many of the participants expressed, in one way or another, the developmental benefits of being part of the group. In this period of reduced faculty mobility and the corresponding increased need to find other ways of communicating with scholars on remote campuses (Astin, Comstock, Epperson, Greeley, Katz, & Kauffman, Note 2), the computer conference appears to provide a new alternative.

Many of the unsuccessful aspects of the venture seem to stem from the way in which the group used the conference. Several members had considerable trouble maintaining connection with the computer over the TELENET system, and many found slow computer response time (as opposed to the time required to receive others' messages) to be frustrating. Both of these problems could have been reduced had conferencing taken place outside of the peak TELENET hours of use. Many of the group felt the schedule was too rushed to produce a really successful model between the time we started the venture and this conference (November 10, 1976). While the group felt that computer conferencing cannot replace face-to-face meetings, at least for the purposes for which this group was

convened, it was a definite beneficial supplement, and would be even more so with the opportunity to profit from the mistakes made in learning to use the medium.

REFERENCE NOTES

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2. Astin, A. W., Comstock, C., Epperson, D. C., Greeley, A. M., Katz, J., & Kauffman, J. *Faculty development in a time of retrenchment: A change*. Publication by the Group for Human Development in Higher Education, 1974.

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- VALLEE, J., JOHANSEN, R., & SPANGLER, K. The computer conference: An altered state of communication? *The Futurist*, June 1975, 116-121. (b)

NOTES

1. This is the standard questionnaire that the Institute for the Future has developed for evaluating computer conferences, very kindly provided by Robert Johansen.
2. These categories are based on those used by Vallee et al. (1975a, pp. 78-79).