

Tele-Collaboration and Groupware

by Betty Collis and Elske Heeren

Telecommunications can be more than a series of E-mail messages. The technology already exists for simultaneous group problem solving in a virtual workplace that spans the globe.

The Tel-Ed Conference (Telecommunications and Education) will be held November 10-13, 1993 in Dallas and will bring together hundreds of educators from throughout the world, sharing their experiences and visions with respect to educational applications of telecommunications. The Co-Chairs of the Program Committee (Betty Collis and Lynne Schrum) had the exciting task of coordinating the selection process of papers and workshops for the Conference and then grouping papers that were selected into themes and clusters. We identified eight themes of particular interest to the Conference, in terms of representation among the proposals. These themes included topics such as teacher education, school and regional initiatives, and curriculum applications via the Internet.

Missing from the Proposals

One potential theme, however, failed to explicitly emerge from the proposals for the Conference and this omission surprised us. This under-represented theme is "Collaboration and Groupware." In distance education as well as in a number of other disciplines such as computer science, communication studies, and business and management, the development of strategies and software to help people work collaboratively while at a distance from one another is an area of excitement and much activity. Many insights and electronic tools are emerging that have direct application to the use of telecommunications by students and teachers. While many of the Tel-Ed proposals describe collaborative activities and give examples of how teachers or online service groups organized and supported such collaboration, few relate to how the technology of the software and online environments themselves can be organized so that collaboration is stimulated.

It is true that educators are not yet much aware of the considerable work going on in other disciplines around the concept of "CSCW" (computer-supported cooperative work) and the ways that software

can support online communication. However, considerable research and development in the CSCW community apparently makes little reference to what educators know about organizing cooperative work and learning activities. In this brief article we would like to reduce this information gap by giving an overview of what we call "telecollaboration support tools" and suggest how such tools in the form of two categories of groupware software can have exciting applications to telecommunications applications in education.

First, A Look at Collaboration

Every teacher knows about the importance of collaborative activities, not only among students but also among teachers involved in projects ranging from the organization of meetings to the development of curriculum and even the restructuring of local education. The first important insight about collaboration is that it is more than communication. The dictionary defines communication as "transmitting information" and the linguistic root of the word is to share. Collaboration builds upon these transmitting and sharing aspects, and adds something else: the process of shared creation and shared discovery. In addition to sharing experience, collaboration involves "the creation of shared experience" (Schrage, 1990, p. 25). In communication-oriented environments, people discuss ideas with one another, but often to some sort of purpose (i.e., to add to a shared data base, or a newsletter, or to learn more about each other's cultures or climates or schools). In collaboration, the process of "playing collectively with ideas and information" (Schrage, p. 31) is as important as the product that may result from such collaborative "playing."

But this does not mean that collaboration is not purposeful—it is, and particularly so in an educational context. Usually collaboration takes place in the context of problem solving, particularly problem solving that involves some aspects of creation and discovery. True

collaboration is not a routine process, involves a shared need or motivation, and requires the meaningful participation of all those involved. The complementary skills of the participants are melded so that what results from the process of shared creation is more than what any of the individuals working alone could do, and what results represents "social constructivist" activity.

Shared Spaces: The Concept Behind Groupware

A central idea in online collaboration is that participants need a shared space in which their collaborative activities take place. Within this shared space, shared documents are communally available, shared drawing surfaces could be available, and strategies for capturing the gestures and body language and other types of non-verbal human communication that inevitably accompany face-to-face collaborative activities could also be materialized. Groupware software in its various manifestations attempts to bring together these different aspects of the collaborative environment. "Groupware" is a generic term for many different sorts of electronic tools and types of software, for example, co-authoring tools, group decision-support systems, shared data bases, and "intelligent information-sharing systems" (see, for example, Greif, 1988; Grudin, 1990; and Malone, et al, 1987). And not only new functionalities are under investigation, but also new metaphors to help people as they work together electronically. New ideas are emerging with regard to the user interface through which persons interact with online shared spaces; so much so that the computer-based learning specialist John Seeley Brown has said that "the next breakthrough won't be in the individual interface but in the team interface" (Brown, 1986).

What are some examples of these new functions and user interface ideas? Although there are many ways to discuss groupware, let us look via the perspective of people collaborating with each other all at the same time, but in different places ("synchronous" collaboration) or collaborating at different times as well as in different places ("asynchronous" collaboration). For each of these situations, we will describe a current groupware package.

Groupware for Synchronous Group Activities

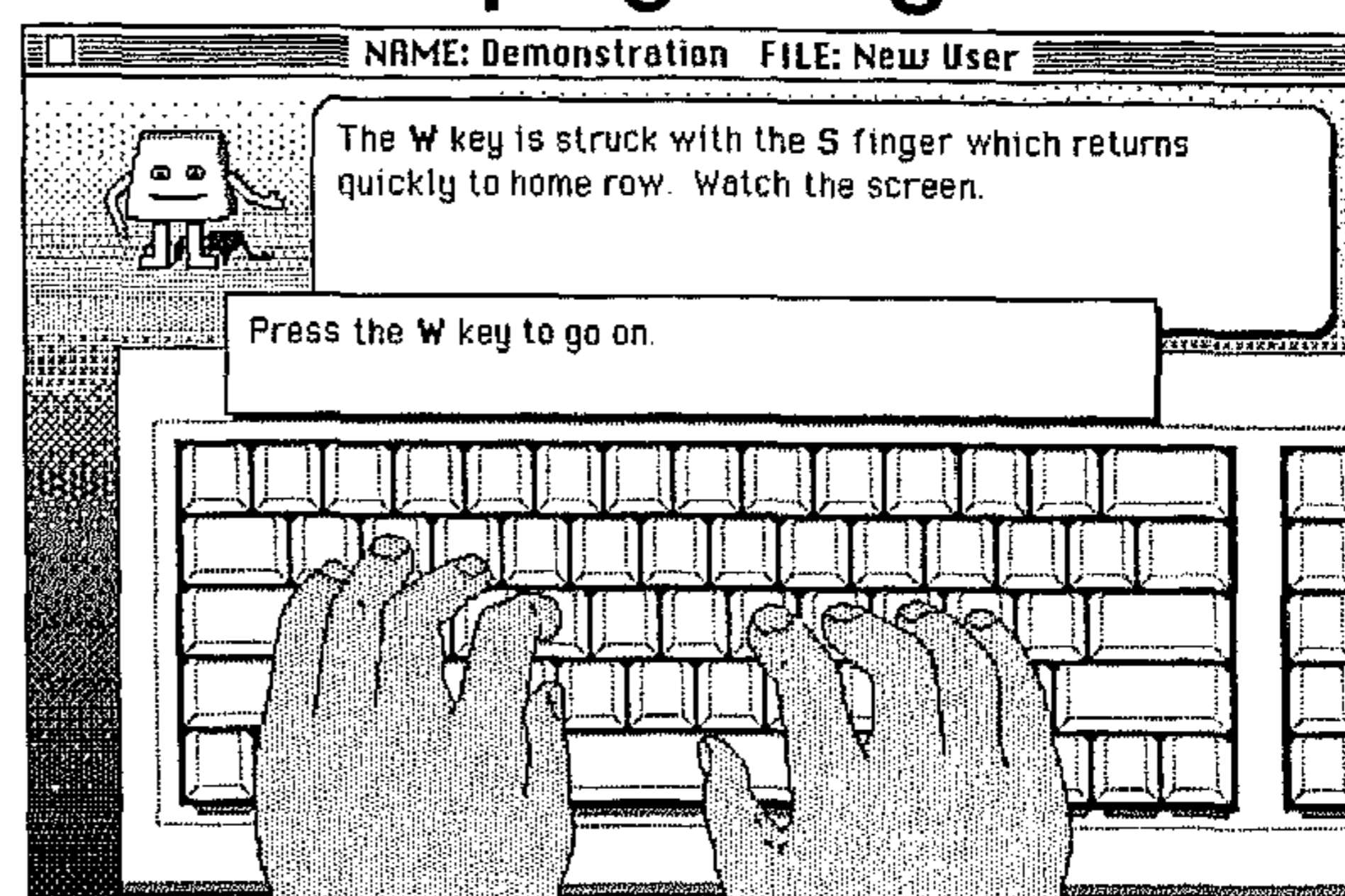
Aspects (Group Technologies, Arlington, VA) is a program for the Macintosh that lets all the members of a distributed group, sitting at their own networked computers, have the same file or files open and available for changes at the same time. These files can be text files as well as drawing files. Participants have their own cursors active, and these cursors can appear on the screens of the other participants, for example, to indicate a place for a change or addition to a shared drawing or sketch or document. Each participant can add to the shared drawings and documents, and what is added shows up simultaneously on the screens of the other participants. Thus all changes and creations are being made to the same shared document or documents.

However, different sorts of group-process control are also possible, such as different varieties of the idea that everyone is able to alter the shared documents at the same time. For example, a "chairman" can be appointed who determines whose cursor is "active" at a given moment.

If communication is desired during this synchronous document-creation and -adaptation process, a telephone connection must be used, but other types of groupware and internetworking are gradually allowing multimedia signal passing, so that computer data and audio signals can be simultaneously transmitted.

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As an example of this kind of groupware in an educational setting, consider the following: A group of teachers, living in different locations in a state but working together on a curriculum-material development project, agree to come online together at a certain time for a distributed "brainstorming" session. They use their shared drawing surface to enter various key terms and ideas, and link the ideas, in different clusters, to each other with lines and arrows and other sorts of sketching activities. Once a grouping of topics is agreed upon, indications can be typed in on the screen to show who will have the responsibility for what further tasks and in what order. If useful diagrams are available in the shared library of the environment, these graphics can be called up and made available within the on-line shared space, to be further annotated and manipulated.

Thus what is being supported is like a shared blackboard from a traditional idea-exchange session but with extra benefits not available after a face-to-face blackboard-supported brainstorming session. What are these extra advantages? For one, what is communally derived can then be electronically saved and reproduced and available on disk for each person's further work. Secondly, the ability to call up resources from an on-line library can be especially useful in turning ideas into learning materials. At the University of Twente, a major research project is underway with respect to such "real-time" shared spaces for collaborative learning (Heeren, Collis, & Gervedink Nijhuis, 1993) and how and when to support them further with audio conferencing.

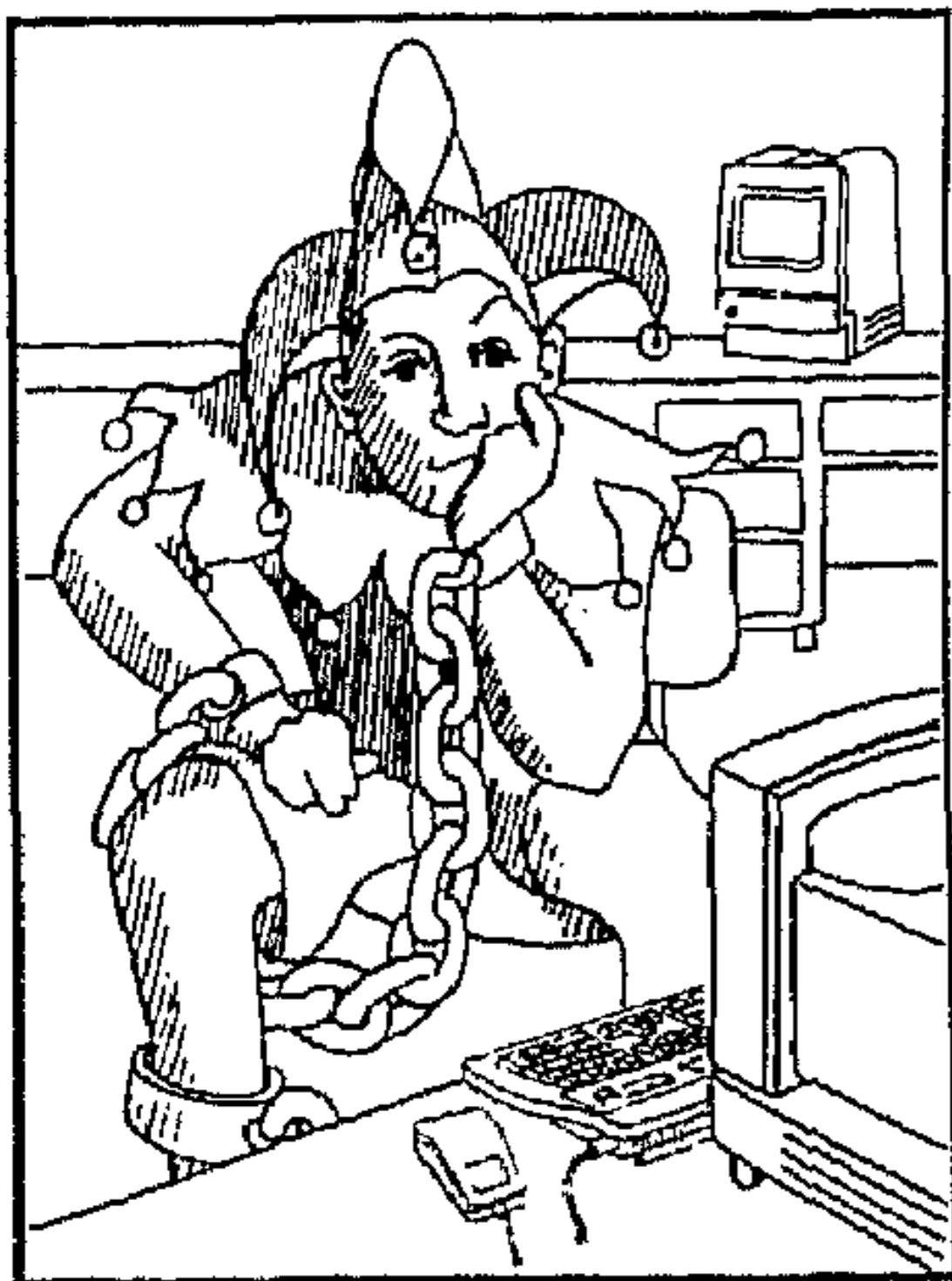
Groupware for Asynchronous Group Activities

Sometimes it is necessary that persons working collaboratively do so at different times. There are many varieties of groupware software that support this so-called "asynchronous" collaboration. One ex-

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collaborative learning. This is the underlying aspect of our research. We are finding that we must not only consider the different types of group-process support under investigation by the CSCW community but also need to bring in perspectives that relate to the unique aspects of problem-solving activities in a learning context. (We discuss this in more detail in Heeren & Collis, 1993.) We are testing our different design possibilities among groups of adult learners in our Faculty of Educational Science and Technology and also among adult learners in different training centers in The Netherlands. Our work is grounded in the concept of social constructivism—how technology can help distributed learners to conjointly develop a shared view of a problem space and a shared sense of meaning in the solution that they create for the problem.

We suspect that the technology can bring more to the collaborative situation than only compensation for learners “unfortunate” enough to not be able to work as a group, face-to-face. We think that the added value of the technology has the potential to enrich groupwork even among collaborating learners in the same location. The benefits of groupware packages such as *Instant Update* can be just as valuable to a group of students and teachers in the same class or building as they are to distributed collaborators. We look forward to continued cross-fertilization of ideas and insights from the educational community and the CSCW community so that design principles for educational groupware can further emerge. Hopefully, at future Telecommunications in Education conferences, design guidelines for educationally-oriented groupware will be a theme topic. 

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ample is *Instant Update* (On Technology, Boston, MA), also for the Macintosh. This package is a sort of group editor for text documents. The original document is prepared in advance with any of a range of familiar word processors, and then distributed to each of the participants in the collaborating group. Each can make further changes and additions to the core document, which can be similarly distributed through the “update” option. When the current version of the document is opened, a click of a menu allows any member of the group to see, through various graphic annotations, what has been changed on the document since the previous time it had been opened. For each section of the document, the original version can be compared to the altered version, and also information can be obtained as to who has done the various alterations. In a “document management window,” each participant can see the status of a document (as for example, when it has last been altered and who has read the document).

This package lacks the possibility of support for synchronous communication; for this, other technologies such as the *Aspects*-type groupware or the use of telephone conferencing must be called upon. However, for many collaborative activities in educational contexts, both for teachers and students, a brainstorming phase at the beginning of a collaborative task using graphically oriented online shared drawing spaces, combined with the further use of an asynchronous-type collaborative groupware environment for further development of shared writing and reporting can be a powerful combination.

Design Issues for Educational Groupware

Much is now being published with respect to design issues for groupware (see, for example, Chapter 11 of Schrage, 1990), but very little yet is specifically oriented toward the design of groupware for

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