Support for group work

Through networked computers and groupware, people can work together via their machines

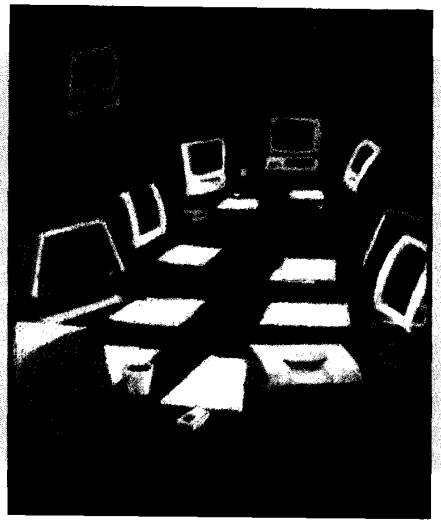

Image Bank

Saul Greenberg and Mark Roseman

Wander through almost any work place – – an office, a factory, a school – – and observe what people are doing. You will immediately notice that most people spend a good deal of their time interacting with others. They are gathered in face to face meetings, on the telephone, reading and answering correspondence, collaborating on a document, coordinating their schedules and negotiating commitments, chatting together over coffee, jointly operating machinery and so on.

Given that people work together, it is surprising how little the computer has been used to support group work. Most people (including software designers and researchers) view the computer as a tool to help in solo tasks. Programming environments, word processors, spread sheets, idea outliners, drawing tools (to name a few popular applications) are all built to support only personal work. Even the scientific field of human-computer interaction has, until recently, emphasized research studying a single user interacting with a computer.

In the mid-eighties, technology became cheap enough for many companies to supply their employees with interconnected computers. This platform has made group work through technology realistic. It has also helped motivate researchers and developers to focus on groupware and computer supported cooperative work.

Defining terms

Groupware is software that supports and augments group work. It is a technically oriented label meant to differentiate "group oriented" products, explicitly designed to assist groups of people working together, from "single user" products that help people pursue only their isolated tasks. The more familiar groupware examples include electronic mail, bulletin boards, and asynchronous conferencing. Newer examples include group schedulers, group decision support systems, collaborative writing tools, screen-sharing software, computer equivalents to whiteboards, video and workstation conferencing and so on.

In contrast, computer-supported cooperative work (CSCW) is the scientific discipline that motivates and validates groupware design. In other words, it is the study and theory of how people work together, and how computers and related technologies affect group behavior. What makes CSCW exciting is its multidisciplinary nature. This umbrella discipline covers a variety of specialties: computer science, electrical engineering, cognitive science, psychology, sociology, anthropology, ethnography and management information systems.

Researchers from each field contribute a different perspective and methodology for acquiring knowledge of groups, for suggesting how the group's work could be supported, and for building the technical platforms required. Researchers in CSCW must not only know about their own particular specialties, but must be conversant in how the other disciplines can contribute and interact with their own.

Some groupware applications

Electronic mail (email) is the success story of groupware. Its big advantage over surface mail is its speed, with turnaround times of seconds or minutes over even international distances. Thus, email is closer to message exchange than to physical mail, and often augments the roles conventionally assumed by interoffice memos, post-it notes, and even telephone calls. Email is especially good at getting around time wasting "telephone tag" that haunts people trying to get in touch by telephone. But email offers more than speed.

Bored with plain text? With multimedia mail, your note can include typeset documents, graphics, animations, voice and video clips, and even a program that will automatically run when the reader activates the message. Annoyed at junk mail? Intelligent filters can scan your incoming messages and prioritize mail, throw out junk mail, and move your messages into an appropriate location (such as an "urgent" folder).

Does your mail follow a structured communication exchange? Semiformal mail enforces a protocol, where message sequences are structured to fit the task on hand. For example, promises made to you through an email exchange will be listed on your screen as outstanding commitments.

Want to get in touch with people of similar interests? You can read and post information to the on-line community through an electronic bulletin board, or have heated discussions with smaller groups through asynchronous conferencing. Interested in building these

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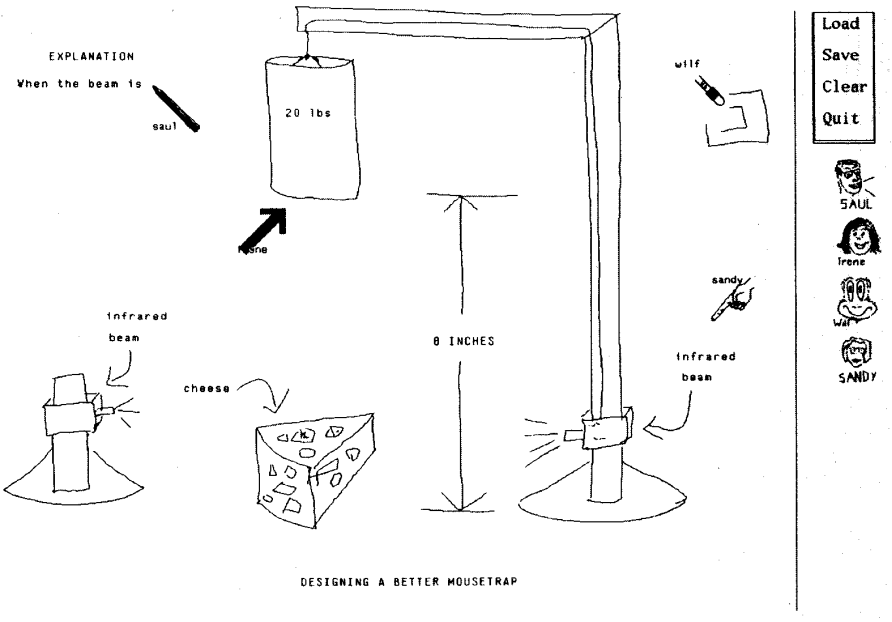
A group sketchpad for remote, real time conferencing



Successful groupware requires a sound combination of social study and technical innovation. As an example, we will progress through the design and implementation of a group sketchpad for real time, remote conferencing.

Many corporations with offices in different cities have tried to cut travel costs through video conferencing for meetings. These systems promote tele-presence, the feeling that participants are in the same room. Yet tele-presence is not enough, for real meetings are often centered around a shared workspace —a whiteboard, a large sheet of paper, an overhead projector — that participants use for presenting prepared material, working together on ideas, and recording group notes. But since a shared workspace is just a place to record information, all we need to do is fax the drawings and notes as the meeting progresses. Sound reasonable? It doesn't work.

Consider a study performed by researchers at Xerox PARC. They observed the use of whiteboards and large sheets of paper by teams meeting face to face. Analysis showed that only a quarter of all activities involved storing information. Team members used the workspace mostly to express ideas. The process of creating a drawing was meant to stimulate group reaction and involvement. Gesturing, often overlooked as a workspace activity, played a prominent role. Gestures were used to enact ideas, to signal turn-taking and to focus the attention of the group. There was also much simultaneous work. Now think about a fax machine. We cannot gesture through it; we cannot see the other person work on a drawing; we cannot work on it simultaneously. So much for our intuition!

Several tools have been designed to support how people really work over a shared workspace. GROUPSKETCH, a multi-user sketchpad running on networked Sun workstations, is one such system we have built (see above). Each participant can do freehand drawing and erasing any time he or she wishes, and all such actions are instantly visible on everyone else's screen. Also, each named cursor is displayed on all screens allowing gesturing and letting everyone know who is doing what. While simple in concept, usability studies show that people do, in fact, use GROUPSKETCH in much the same way they use traditional media.

Various enhancements have been carried out. Some systems fuse video signals together to provide the shared workspace. We've been working on an object-based system called GROUPDRAW that raises new questions about how multi-user objects should be manipulated. On the technical side, some of the work is now being generalized into a toolkit of groupware components (e.g. for handling network communications, for conference registration, for shared cursors, for generalizing the sketchpad capabilities). On the usability side, we are looking at the effect of this technology as the group size increases.

— S.G. & M.R.

advanced email systems? You will find yourself dabbling in data communications, multimedia databases, email protocol standards, interface design and even sociology.

Real-time, face to face meetings are the cornerstone for people working together. It is vital for brainstorming, for rapid evolution of ideas and arguments, for making decisions, and for information exchange. Technology can support real-time meetings in several ways. Consider an electronic meeting room where people seated around a table can see a wallsize computer screen, and can access it by connecting their personal computers to the screen via a wireless network. Instead of a mere whiteboard, the group has at hand all the power of contemporary computer applications. With spreadsheets, the group can rework financial models on the fly and wrangle over the results. With a brainstorming tool, the group can generate and prioritize ideas. Even a simple word processor can be used as a public minutes tool, so the group can verify that key points have been marked down. Through an electronic facilitator, participants can vote anonymously, with results tabulated automatically. Ever been bored at a meeting? Perhaps you (and others) could enter your mood status to the machine, which would then display the average mood of the group to the speaker.

Remote, real-time conferencing brings people together at the same time, even when some or all are physically distributed over different locations. Video conferencing gives a sense of presence by allowing distributed participants of a meeting to see one another over a video and audio link. A shared work space permits participants to work together through a shared media (see box). Meeting schedulers assist in the daunting task of getting all the participants together at the same time.

Casual interaction, vital for initiating and coordinating collaboration, can be supported as well. For example, Xerox PARC's VIDEOWALL is a video link connecting two distant laboratories by their coffee rooms to encourage spontaneous "drop-in" interactions between remotely-located people.

BellCore's CRUISER system creates a virtual hallway where everyone has instant access to everyone else via a video link. A user can "video-peek" into someone's office to see who is there, wander the electronic hallway looking for several people, and accidentally bump into others. With shared electronic documents, you know who else is working on the document at the same time, and you can then hookup via an audio and video channel.

Shared cyberspace is the most innovative, unusual and futuristic approach to remote interaction. Cyberspace immerses a person's senses into a three-dimensional simulated virtual world. Seeing the world in a stereoscopic head-mounted display that contains a small computer screen for each eye, one moves through the space using head and body gestures. Motion sensors pick up and translate real movements to virtual ones, and the view is adjusted accordingly. Users interact with the simulated world through a data-glove or data-suit that allows them to grasp and manipulate the virtual objects they see. Sounds are synthesized by 3-D audio techniques. The effect, although still primitive, is to exist and interact within a virtual environment. What makes it interesting to CSCW researchers is that the environment can be inhabited by several people. Imagine a virtual conference room with attendees milling about holding public and private conversations, and viewing and manipulating some of the 3-D objects around them. Or perhaps the cyberspace simulates a planet. A whole class can fly over the planet's surface together and explore its features. Science fiction? Not quite, for shared cyberspace systems now exist in some research labs!

While many exciting ways have been tapped to support team work, groupware development is still in its infancy. It is an area for invention and innovation and for turning conventional ideas on their head. It is an area that will fundamentally change the way people work and play together.

Advice

Since CSCW is interdisciplinary, you will have to go outside your department to get all the background that's required. And do lots of extra reading (see "Read more about it"). While you do not have to be an expert in all fields, you must know enough about them to understand their literature and value.

First, you need a reasonable foundation in human sciences; basic courses in human factors, psychology and/or sociology will get you started. Second, you need to know how human sciences can be applied to groupware design and implementation. Here, a foundation in electrical engineering, computer science and a course in human-computer interaction is essential. Finally, your systems should be visually appealing to users and well packaged. Taking a course in graphical and industrial design has merit.

Read more about it

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About the authors

Saul Greenberg is an Assistant Professor of Computer Science at the University of Calgary in Calgary, Canada. He is the editor of the book, *Computer Supported Cooperative Work and Groupware* (Academic Press), and has published papers in this field. Dr. Greenberg and his graduate students are currently designing, implementing and investigating several groupware systems. When not working, he is an avid ski-mountaineer and climber.

Mark Roseman is a graduate student in computer science (also at the University of Calgary) specializing in CSCW. His research interests include computer-supported group drawing and groupware toolkits, as well as the architectural considerations of groupware conferencing systems. Some of his other interests include philosophy and creative writing. ■