Remote Presence in Intelligent Environments

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The Problem: As the use of intelligent environments expands, the ability for people to communicate with others in geographically distant environments is becoming more and more necessary. In order to create a rich collaborative experience, high-resolution video and audio should be broadcast among locations to allow others to see the people communicating from remote locations. Also, the state of the environment should be transmitted to all participants. This could allow for an increased quality of verbal communication using non-verbal clues, collaboration on documents, and synchronous display of media.

Motivation: As part of the Intelligent Room project at the MIT Artificial Intelligence Lab, the presence project will seek to bring multiple rooms into communication with each other. Most importantly, it will provide a means of interaction for people in geographically distant locations. This interaction will be more rich that standard video conferencing solutions because it will provide connections between aspects of the room's state. For example, users in each room could automatically view the same web page as another user, or hear certain speech generated by the room. This sharing of state will make collaboration across distance easier for all participants and will provide them with key data without needing to interrupt the flow of verbal and visual communication.

With collaboration tools in place, the Intelligent Room can move beyond an isolated point in space and will be able to connect people in interactive, collaborative meetings and discussions. As face-to-face meetings become less common and more people rely on technology for their communication needs, this type of collaboration tool will provide a virtual presence and increase the quality of remote collaboration.

Previous Work: There are currently many projects devoted to collaboration in media-rich environments. One of the most well-known is the Access Grid project which grew out of Argonne National Labs in Argonne, IL and now has 49 grid node sites throughout the country [4]. The 'Grid' provides a rich environment of shared video streams among many users of a high bandwidth network. It also currently supports a shared slide presentation utility to allow all users to view the current slide in a live presentation.

Some Grid sites are working to integrate computationally expensive information not available at remote locations by sharing video streams from advanced visualization systems. Projects like these expand the Grid to more than just a video link between two people and allow collaboration not possible before [3].

The Grid falls short of many people's expectations. One of its main criticisms is that it does not create a virtual shared space. When a participant turns his head to the left, for example, he may not be looking at the same thing that is to the observer's right. Another reason that the Grid does not create a true feeling of presence is that current uses of the Grid do not allow for detailed video focused on a single person. Therefore, it is impossible to see each participant's individual gestures and facial expressions [5].

Finally, the Grid is very difficult to use and does not easily blend with existing communication. The sharing of documents other than PowerPoint slides is not supported which makes collaboration difficult. For these reasons, the main use of the Grid has shifted towards distance learning and away from collaboration. Although collaborative events occur on the grid, they are often very one sided conversations that have a presentation style. Remote participants usually only contribute in the form of questions. To facilitate true collaboration, a different type of environment is needed.

Commercially available programs such as Microsoft's NetMeeting also provide collaboration tools. NetMeeting is becoming popular in industry as a way to eliminate face to face meetings. However, NetMeeting has its shortcomings. Among these is a limit of one receiving video stream per user. It is very difficult to create an illusion of presence with only one video stream. There are features of NetMeeting that should be included in the Intelligent

Room's collaboration tool. NetMeeting has a well-implemented shared white board feature as well as built in file transfer and text chat. Text chat can provide the opportunity for talking to other participants without making an audible comment.

Approach: A better collaboration system would provide close-up views of each participant as well as a means of shared locational perspective. It would also provide for sharing more than just PowerPoint presentations. Collaboration among Intelligent Rooms can take advantage of the Metaglue system [2] to share state information.

The sharing of information can be as simple as pushing web locations to participants, or can include detailed information about device usage. Sharing of high-level information can work across different hardware and preferences. Thus, a page viewed in IE on a Windows machine, could also be viewed in Netscape (if it was the default browser) on a participating Linux machine because only the URL was shared. Likewise, speech generated by the room can be vocalized in the style preferred by each participating space.

Also, participants should be able to edit and view documents jointly and use common writing space. A virtual white board that projects onto a physical wall or table could be created to share information among participants and create a heightened sense of presence, as if all participants were actually using the same physical white board.

Impact: Before intelligent spaces like the Room are truly accepted, they must become involved in everyday activities [1]. The goal of this research into collaboration is to break down barriers that exist when people are trying to collaborate from geographically distant locations. Just because people are separated physically, they should not have to lack information that those in another location have at their disposal. This can range from physical gestures and expressions, to web pages and documents being viewed at one side of a collaboration.

This collaboration system will help to make information sharing between locations flow with conversations and move conversations and idea sharing along without the need to request additional information or describe images or documents that would not otherwise be shared between the locations. A participant at a remote room should feel like he is involved in the events occurring at the other locations in order for collaboration to truly be effective.

Future Work: At this time, a preliminary video chat agent is being created that will allow one Intelligent Room to share video with another room. The design and implementation of this agent will be completed during the fall term of 2001. After this agent is created, a plan for designing the full collaboration environment will be completed. Before the end of the fall term of 2002, the completed collaboration tool will be demonstrated and documented.

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References:

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