A MULTIMEDIA INTERFACE FOR KNOWLEDGE BUILDING AND COLLABORATIVE LEARNING

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ABSTRACT
We describe a multimedia tool developed for scaffolding constructive conversation and sharing information by means of a public kiosk. The Multimedia Forum Kiosk (MFK) provides an environment where users communicate asynchronously with video, audio, and text. Unlike unstructured media such as email, the interface provides multiple representations of the structure of the discourse which aid in understanding the previous discussion, eliciting and refining new ideas, and developing a sense of community with other users. The software has undergone evaluation, testing, and revision as a tool for an education research community. Preliminary results indicate that users learn the interface unproblematically without training, and that they successfully explore and contribute to the discussions. We introduce the MFK as a tool for collaborative discussion and learning, and discuss several potential uses for the tool, both pedagogical and utilitarian. A more formal testing plan to evaluate the software and interface design is underway.

KEYWORDS: communication, computer-supported cooperative work, discourse, education, multimedia.

INTRODUCTION

One of the greatest roles of the computer in society is to enhance communication. Many tools and interfaces have been developed specifically to support collaborative work, and collaborative learning. Technologies for collaboration have gained importance in education, both due to promising studies on group work and socio-cognitive theories of learning. These theories emphasize the importance of developing knowledge in a social context of a community.

Social theories of learning, beginning with those of Vygotsky, treat learning as a social phenomenon. Under this view, a person learns by first observing and listening to others. Then, with the help of others, the learner begins to internalize, use, and apply the knowledge where they could not do so unaided. Over time, the knowledge becomes fully internalized and the learner can function alone [1]. Recently, educational research has focused on the need for "communities of practice" for learning, or social groups where the knowledge and skills to be learned are used in day-to-day life. The values and practices of the community support the learning and knowledge-use of the individuals within that community. [1, 2]

Computer technology has much to contribute to inducing social learning. The Internet was originally built to link research communities nationwide. More recently, software for school collaborative learning such as CSILE [4] ICLN, and LDLN [3] have proven the effectiveness of computers in aiding learners to work together. We believe new interactive multimedia technologies that combine video, audio and images, can produce a better collaborative tool. Specifically, we hope to use multimedia to create an interface that encourages reflective discourse, engages users, and helps people build knowledge in social context.

DEVELOPMENT GOALS

Our goal was to design an interface to encourage learning through community discussion. This should occur through exploration and participation in an asynchronous electronic discussion. Users could take advantage of and internalize the stored community knowledge by reading comments of others, and they could integrate and apply knowledge by adding comments of their own. Multiple representations of the discussion would help the user to consider different perspectives and to organize knowledge. Moreover, the interface would represent individuals, not just opinions or remarks, which would allow users to develop a sense of community with other users. This ongoing construction of community perspective should allow individual users to learn about the topics they discuss and to gain experience in crystallizing and expressing their thoughts.

SOFTWARE DEVELOPMENT AND RESULTS

The Opinion Area

The MFK is composed of two main components: the Opinion Area, and the Argument Map. In the Opinion Area, each screen is a posting space where a single pre-defined topic and a collection of movies to illustrate the topic are posted. Comments are represented in the system by miniature pictures of their authors. The user can directly click on faces to see peoples' overall opinion, or click buttons to access help, watch movies or make comments. After exploration of what previous users have said, an author's audio note overview, and movie watching, users of the kiosk can make a comment to the given topic. Because the Opinion Area is designed for users to gain an overview of the community perspective (and due to limited screen space),

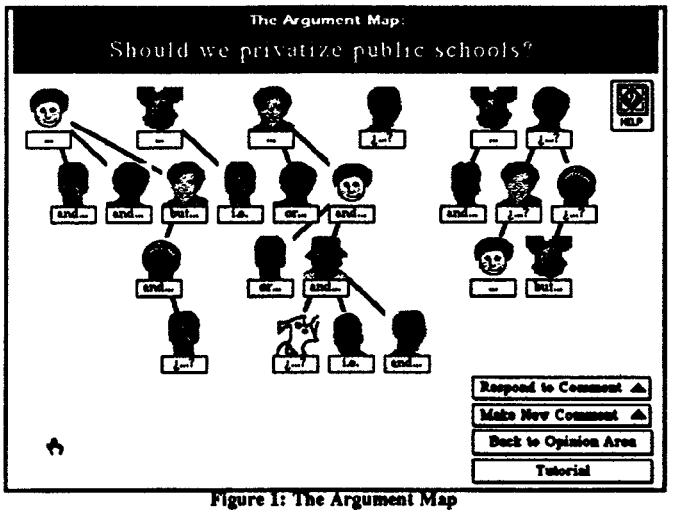

Figure 1: The Argument Map

the user is limited to one comment in this part of the kiosk. Having one opportunity to express their overall view forces users to be articulate.

The Argument Map

The Argument Map is a representation of the evolution of the conversation to illustrate the spatial and temporal paths of the discussion where users can trace an argument, line of reasoning or origin of a thought. Users can start new lines of thought or respond to an existing comment. The display clearly indicates the relationship between the response and the original comment. As the user writes each comment, he or she classifies it as an elaboration, critique, alternative, question, rephrasing, or new idea. The labels AND, BUT, OR, ?, I.E., and NEW appear below each comment as appropriate. The comments thus appear in trees, where each tree covers some topic and descendants of any node are responses to that comment. Users may make any number of comments but are forced to place each one within the tree structure. As conversation and argumentation structures are made explicit, we intend novice users to learn to recognize, categorize and organize their knowledge of the subject.

Implementation

We developed the MFK in Hypercard on the Apple Macintosh because of multimedia capabilities and rapid prototyping features . Movies were digitized using Apple's QuickTime video format.

Software Evaluation

During development, over 30 subjects have used the software. Subjects were graduate students or faculty in education, each having differing computer experience, ranging from complete novice to expert Macintosh users.

We studied four subjects in depth using videotape and protocol analyses. Subjects were asked to use the software without assistance and to think aloud. Detailed analysis of the videotapes broke subject activities into five categories: interface issues (including both time spent figuring out the interface and time waiting for the computer to respond), reading or rereading comments, making comments, thinking aloud about comments, and making strategic or metacognitive comments. The interface category was further examined for impasses, in which a subject demonstrated noncomprehension of the interface.

CONCLUSIONS

Based on the qualitative evaluation of data, we have satisfied the goal of producing an intuitive interactive software environment for knowledge building and collaborative work. Users found the environment to be intuitive, fun and motivating. The forced interactions required by the user in the Opinion Area and the Argument Map were useful in encouraging reflection and integration of viewpoints, whether or not they added comments of their own.

Graphs of activity categories demonstrated that subjects engaged in reflective thinking. No subject made a comment without reading and considering others. Each of the four subjects exhibited a pattern of reflective reading in which each period of reading a comment was followed by thinking aloud, or reflecting on the comment; sometimes reading and thinking also had metacognitive, strategic comments interspersed. This high level of participation leads us to believe subjects are engaged in the subject discussed and will, we hypothesize, learn more about it than someone who simply reads a text containing the same information as the comments.

Subjects successfully navigated in the interface. All four subjects read comments and interacted with both the Opinion Area and Argument Map; no subject entered an impasse that they did not resolve.

Future development efforts include addressing interface design issues concerning space usages for collapsible node architectures, as well as testing more subjects to evaluate the cognitive goals. Plans include introducing the MFK in science museums, public hallways and classrooms.

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