Collaborative Environments Supported By Large Screen Displays

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ABSTRACT
This project investigates the use of large screen displays to encourage communication and collaboration between members of a group in a shared area. A system implemented by the authors finds and displays information of common interest to a collection of people by using a sophisticated and extensible information collection framework in conjunction with classic information visualization techniques.

Keywords
notification systems, peripheral displays, groupware, large screen displays

INTRODUCTION
Various software tools have been developed to facilitate interaction and address issues surrounding computer supported collaborative work (CSCW); many examples of groupware support these issues by allowing direct interaction and communication between members of a group. The authors are interested in investigating the role large screen displays as secondary interfaces can play in promoting interaction and collaboration for two reasons: First, casual interaction and collaboration between people in some environments is virtually absent, due to various complex social forces and other factors. Second, large screen displays are often idle unless being actively used. We want to put these displays to use.

To this end, the authors have developed a synchronous face-to-face CSCW notification system. Given sets of user interests, the system analyzes these interests and collects pertinent information that highlights areas where users' interests intersect. The display then reflects this information, which could be common project information, local news, and/or other information of interest, and notifies the users in the display's presence. The expectation is that the display will encourage collaboration, foster community, and increase awareness by highlighting shared interests, both professional and personal, among people in common physical places.

This sort of approach has been taken before; two good examples being the Notification Collage [1] and the Awareness Module [2]. Both of these systems enable users to post content to a shared space. Our system diverges from this model by collecting information automatically; the only cues the system needs are users' pre-defined interests and which users are currently in the presence of the display. A second difference is that our system displays multiple items of information simultaneously, and applies information visualization techniques to effectively convey relationships between the users and the information being presented. This differs from [1], which displays items in an unsorted way and allows a user to actively position items, and [2], which displays a single item at a time.

CSCW'02, November 16–20, 2002, New Orleans, Louisiana, USA.

INTEREST RESOLUTION
Before information pertaining to user interests can be gathered, the system needs to decide for which user interests it should collect information. User interests map from topics of interest (strings) to integers between -3 and 3. A value of -3 indicates that the user has a strong dislike for a particular topic, and a 3 indicates a strong preference. Each user defines such a map, and this information combined with which users are in the presence of the display (or "logged in") is used to determine which interests are shared between the present users. Then if required, the appropriate information gatherers ("collectors") are launched and information for those interests is gathered.

This approach is similar to the approach taken by the MUSICFX [3] system, however our implementation is slightly more generalized due to the fact that we collect and display more than one type of information at a time. Due to the similarity between the two implementations and the success of MUSICFX [3], it is expected that our implementation will cater reasonably well to the preferences of the users in the room at any given time.

Once collectors are launched, they scour various data sources (including the Internet) for information, and then create "items of interest" (IOIs) that contain the information collected.

In general, the quantity of information available is inversely proportional to personal relevance. Filtering the collected information by compiled group preferences reduces the amount of irrelevant information being displayed.

INFORMATION VISUALIZATION

The overarching objective for notification systems is to maximize comprehension while minimizing negative interruption. Towards this goal, some information visualization heuristics are used to display information to the user(s) of a peripheral display. First, information should not visually obstruct other information. This differs from the Notification Collage [1] scheme but is important because these displays are secondary and shared. Individual users for the most part should not directly manipulate the display, and for that reason they should not have to move information in order to view it. Peripheral notification systems should make it clear as to which information is new, position related IOIs close to each other, and display more important (or newer) IOIs larger and closer to the center of the display. In order to minimize distraction, animation should be avoided whenever possible; fading IOIs is a more effective alternative.

These guidelines are incorporated into our most detailed implementation by arranging collected IOIs into a grid centered on the large screen display. This grid is divided into three concentric layers. IOIs displayed in a given layer are twice as large as IOIs displayed in the next layer farther away from the center of the screen, thus approximating a hyperbolic layout of rectangular IOIs (See Figure 1).

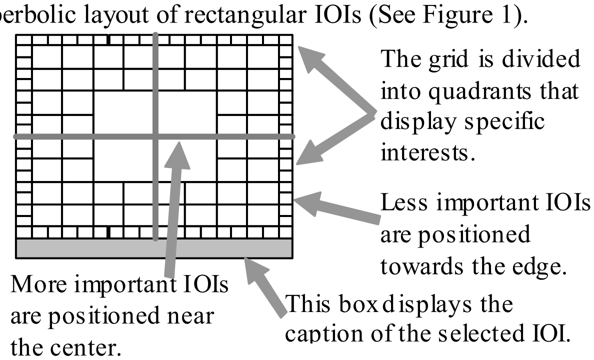

Figure 1. Information Visualization Grid implementation.

As new IOIs are created, old IOIs are pushed towards the edge of the display in order to make room. This allows the newer IOIs to display themselves in the larger center grid cells and the older IOIs to be gradually phased out. The grid is also divided into four equally sized quadrants where each quadrant displays information for a specific interest, thus allowing related IOIs to be displayed closely to one another. All of the IOIs on the display are faded except for one, which is said to be selected and its associated text is displayed at the bottom of the screen. The display highlights interests of the group by more frequently selecting IOIs that best represent the users present as determined by their compiled user preferences.

ARCHITECTURE

Due to both the computational nature of collecting and structuring information from a variety of sources and the physical separation of several networked large screen displays, the architecture for the system is designed using a client/server paradigm. The role of the server in this paradigm is to collect and process information while the role of the client is to request and display that information to users. Therefore, the computationally intensive task of collecting and processing data is done on a separate computer from the one displaying the information. This architecture also allows multiple large screen displays to share one data-collecting server as well as facilitating client-to-client interaction between several collaborating groups simultaneously using the system.

The system is extensible in that various components can be added or removed with little effort. For example, another implementation of the information visualization or interest resolving algorithm can be implemented and dropped in. Other information collectors and displayable IOIs can also be added to the system with virtually no effort. This allows further experimentation with alternative algorithms and heuristics, additional displayable content and collectors, as well as potential end-user customizability.

CONCLUSIONS

The system demonstrates how large screen displays could be effectively used to highlight common interests of people in a shared location. The filtering of collected information in this way increases personal relevance by decreasing irrelevant information. In our ongoing work, we consider whether these displays are destined to be used only for casual use for broad topics, or whether there a place for them in classrooms, offices, and meeting rooms with more focused interests. There seems to be a quantity-relevance tradeoff whereby the quantity of information available is inversely proportional to personal relevance. While there is a constant stream of new information available on world news, sports, and entertainment, there is generally less on information sources related to work, hobbies, and other activities shared with friends and colleagues.

Another important consideration is identifying ways to determine the effectiveness of these types of displays. Most evaluations to date have relied only on anecdotal reports. We plan to explore more systematic methods for examining the effectiveness of these types of systems in supporting useful interactions. In determining utility, any immediate and long-term benefits must be balanced against negative distractions resulting from the presence of the displays.

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