Developing Ideas Using Personal & Large Screen Displays

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ABSTRACT

Our goal is to develop a collaborative system that enables multiple users to share and develop information in the best possible manner. We produced BrainStorm, a system that facilitates the development of projects by letting users develop ideas. It consists of a large screen display running a server and clients working as notification systems, allowing users to post ideas and receive updates using the client. When considering the problems that face our design, we realized that the client notification system could be designed in several different ways—we describe three prototypes that we created to understand the various options that exist. Our testing evaluated these three interfaces by using two different heuristic guidelines and a questionnaire. We demonstrated a usability comparison of three unique interfaces to show how notification methods directly affect the user. The effect of each interface feature indicates how a reengineered interface must be designed. BrainStorm combines characteristics of face-to-face communities, by using the large screen display, and also asynchronous distributed communities, by using the client notification systems.

Categories and Subject Descriptors

H.5.3 [**Information Interfaces and Presentation**]: Group and Organization Interfaces–*Collaborative computing, Computer-supported collaborative work, Evaluation/methodology.*

General Terms

Human Factors, Measurement, Design

Keywords

Groupware, notification systems, large screen info exhibit

1. INTRODUCTION

The need for sharing information among people always exists. Throughout time, there have been many developments that aim to facilitate this need; especially ones that have been designed for distributed communities. Many of these developments allow users to share a variety of information. Such systems are referred to as collaborative systems. They allow multiple users to use the same system to interact with one another. Our goal is to develop a collaborative system that enables users to share and develop information in the best possible manner.

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1.1 Collaborative Systems

Computer Supported Collaborative Work (CSCW) is an area of research that tries to understand the social dynamics of people working together in groups. Researchers try to find the characteristics of working in a collaborative environment so that better designs for groupware can be developed. Groupware is the technology used to enable groups of people to work together using computers.

The most primitive, but yet prevailing collaborative system is the listserv. Listservs are designed to allow an administrator to create a mailing list of users in order to precipitate discussion outside of the classroom or work setting. The system allows users to send e-mails to a specified address that, in turn, automatically forwards the e-mail to everyone subscribing to the listserv. Such a system allows for discussion and communication outside a physical setting. Groups of people working on a common or shared goal can exchange information pertaining to that goal. Listservs can easily accommodate an extremely large group of collaborators.

There are many disadvantages, however, in employing a listserv on a collaborated goal. The listserv has no form of house keeping. It will continually bombard an inbox with messages; some having a subject while others may not. It is often hard to understand which messages are new and which are comments to previous messages. The listserv is often a chaotic environment and many users tend to shy away from using it, and in turn, lessen communication among users.

Another type of collaborative system is Co-Web. Co-Web is simply a web page that allows users, with proper access, to edit the web page without any prior knowledge of HTML. A user can visit the page and read postings that other users have placed on the page. They can then place their thoughts anywhere on the page they desire. This system is an improvement over the listserv because it provides a less chaotic environment. Users can perform their own housekeeping. It is up to the user to place their thoughts and opinions where they please. This is an improvement, but has some very serious flaws. A system that allows users to have total control is a dangerous one and could possibly be an administrator's nightmare. This system would allow users to turn a peaceful, relevant, and easily understandable environment into a chaotic one. Co-Web also does not have any way of notifying its users of changes to the system.

Finally, Saul Greenberg's Notification Collage (NC) allows users to share notes, as well as pictures and video. The NC's goal is to promote general awareness for users. While the system has its advantages, one of the concerns of the users was the value of information [1]. The awareness provided contains a large amount of information that is not needed by the user.

1.2 Social Dynamics

When many people use a system there are many social issues that arise. To understand the problem, let us discuss the social dynamics of a face-to-face community and an asynchronous distributed community.

In general, groupware fails for the following three reasons:

1. The disparity between those who do work and those who get the benefit [2].
2. The threat to existing power structures.
3. The lack of a critical mass of users

Asynchronous distributed communities are groups of people that interact from different places at different times. In systems of this nature, it is hard to tell who does the most work. There may be people who post information that is good and others who may take that information and use it as their own. Some social loafers [3], ones who don't work as hard, cause others in their group to work harder to compensate for the work not done. Because users do not see each other, they may not feel that they are obligated to contribute to the system. In this case, people who do not work as much can get away with it and benefit from others using the system.

2. BRAINSTORM

We designed Brainstorm as a collaborative system that hopes to better the positive aspects of previous collaborative system, while at the same time eliminating the previous systems' flaws. The system notifies users of progress made on projects they may be working on. Users can post information regarding their projects for others to see. A large screen display is used so that users that are in a meeting may view the information posted. Clients away from the large screen display may use the client-side notification systems to keep track of information at the large screen display. With these affordances in mind, the goals of Brainstorm are the following:

1. Ensure that the value of data is maintained for the user by letting the user choose what data he/she wants to see.
2. Notify the users when other users post new data.
3. Facilitate the development of ideas as users interact with shared data by providing an environment in which users can generate ideas.
4. Encourage users to meet regularly by using a large screen display.

In this system, posted artifacts come in two forms: ideas and comments. An idea is usually information that is in the form of regular text. A comment is a note that is a reply to an idea.

BrainStorm has a client-server model, which enables all the users to share their information. The administrator running the server will have all privileges. He or she will be able to manage projects and postings on the server. While posting and deleting ideas are also allowed, he or she will be able to post, but not delete comments. The system performs its own housekeeping when ideas and comments are posted. It gathers the necessary information about a posting, and then places it on the display in a relevant fashion. A user, on the other hand, will only have the ability to post ideas and comments onto projects they subscribe to. The users will have a client that will be updated whenever new posting arrive and the user will be notified about the new postings.

2.1 Design Advantages

The design of BrainStorm improves upon previous collaborative systems in several ways. As mentioned earlier, a listserv can be useful, but it creates a chaotic environment. This type of a system does not provide an opportunity to develop a single idea because of its lack of organization. Even if users use filters, filters cannot distinguish between multiple topics of discussions within a listserv. BrainStorm limits the type of posts one should make. By making users only post ideas or comments, it allows users to make progress. BrainStorm is designed to have the same functionality as a listserv as far as the user and the administrator is concerned. Since the system performs the placement of messages on the system, the environment is a pleasant one where the user can follow along with the discussion in an orderly, chronological, and easily viewable manner.

The number of people using a single listserv can be great. It is likely that with a larger group, subscribers may not personally know the other subscribers. This situation may not allow everyone to work together effectively and can cause some people to make posts that others may not find appropriate. It may also be hard to determine who is actually controlling a listserv. Because the groups using BrainStorm will be smaller and from the same general area, it is highly likely that most of the people will know each other. Therefore, the users using the system will know what an acceptable post is. In an academic or corporate setting, BrainStorm users will know who the head is, letting the users know who is in control, limiting moderation needs.

The process of brainstorming will work better when users are posting ideas as clients [3]. This eliminates factors that can block someone from telling others what they think. There is less interference between group members. During meetings a proposed idea may be quickly forgotten. Posted ideas will remain for everyone to see and act as a record.

Co-Web gives complete control to the user. As previously mentioned, this can be a dangerous action with severe consequences. BrainStorm affords self-contained control of the system. It is a stand-alone system that allows users to perform only specified actions. The administrator, however, can adjust the system as they see fit.

The Notification Collage is found to contain a lot of information that is not needed by the user. BrainStorm increases the value of the information by decreasing irrelevant information provided to the user. Our system is designed to relay only information that is essential to the user.

Finally, the way in which these other collaborative systems notify their users of changes to the system needed to be improved upon. The listserv requires its users to constantly check their inbox. Co-Web and the Notification Collage provide no form of notification for its users. BrainStorm solves this problem by creating specific notification systems that serve the system's needs.

2.2 Justification

BrainStorm is a groupware system that lets a community work as both an asynchronous distributed community and a face-to-face community. When users are alone and interact through the system, they work as a distributed community. Meetings in front of the large screen display establish a face-to-face community. By combining these two types of interactions together, groupware issues in social dynamics are adjusted and corrected.

BrainStorm is used among people who are in the same general area. These people will get together often to have meetings as a face-to-face community. There will be a certain degree of social pressure and a clear power structure. BrainStorm allows these characteristics to be passed on to the distributed community interactions. Because face-to-face interaction will be common, the asynchronous distributed interaction becomes more like the face-to-face meetings. Members of the community will know that if any of them try to avoid work while they are alone, they will face the consequences when they actually meet with the others. Casual physical interactions throughout the day will force users to maintain their work habits while they interact as a distributed group. Thus, the meetings initiated by members or by the large screen display actually control the social dynamics of a distributed community.

As mentioned before, the logic behind BrainStorm is similar to that of newsgroups and listservs. An idea in BrainStorm is comparable to e-mail. E-mail happens to be one of the success stories in the area of CSCW. People tend to share the benefits and burdens of using e-mail equally [2]. For this reason, BrainStorm has a good chance of distributing the benefits and burdens to all group members.

The large screen display also develops the critical mass of users that is needed for BrainStorm. If a few members start using the system and constantly refer to the information on the large screen display during meetings, more users will become inclined to using the system.

3. INTERFACE DESIGN

The visual aspects of a display impact the users in numerous ways. In many cases, the interface is what makes or breaks a piece of software. Our current goal in this stage of research is to develop the interface that will work the best. At this point, there are two possible ways of displaying the information on the large screen display and three different client notification systems running on personal displays. The first large screen display mentioned, provides an overview of system activity while the second concentrates on posted information. The three notification systems are designed as active, passive, and intermediate. The active forces users to react to notifications made. The passive interface provides limited information. The intermediate interface provides more information, but limited notification. Testing will determine which visualization will be appropriate for the users.

3.1 Large Screen Display

As mentioned previously, the large screen displays are used to display posts in a common area. The first choice (Figure 1) of large screen displays interfaces acts on the concept of Post-it notes. The display has a menu bar that contains three buttons: one to post a new idea posting, one to post a comment on an idea, and finally an exit button.

Figure 1. Post-It Note Large Screen Display

When a user creates a new idea posting, the posting is designated its own row. The date it was posted, the name of the user who posted it, the subject of the posting, and a system generated idea number are put on a frame that resembles a post-it note and subsequently, placed to the far left of its designated row. The idea postings are ordered in chronological order, where the most recent is at the bottom and the oldest is at the top.

The color of the idea posting is yellow. This Post-it note must then be clicked in order to read the posting a user has written. Other users' comments are posted to the right of the idea in chronological order. The comment furthest to the right would be the most recent. Comment Post-it notes are given a light purple color in order to distinguish them from the idea at a glance. These postings also have the date it was posted, the name of the user who posted it, the subject of the posting, a system generated comment number, as well as the idea number it refers to. This large screen display design allows users to view the entire system without being overwhelmed and without confusion. It gives an overview of the activities of the users using the system.

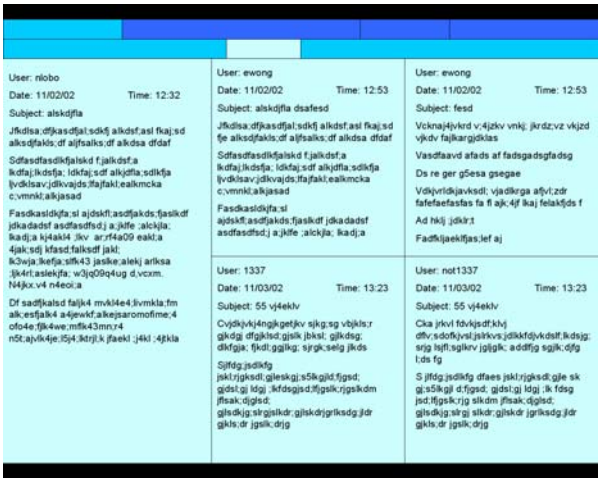

Figure 2. Large Screen Display with navigation system using bars

A second large screen display interface (Figure 2) has also been developed as an alternative. While the first large screen display focused on giving an overview of the ideas and comments, this second display aims to increase a user's understanding of the information.

The display can be described in two parts: the information and the navigation system. This interface concentrates on giving users more information. The reason the display increases a user's understanding of the information is because of the fact that the contents of all ideas and comments are displayed without any need for user interaction. When we look at the display, we see that the space is divided into two sections. On the left, the idea remains static as up to four of its comments ticker by on the right side. This tickering is done with minimal interruption. As the comment tickers by, a quick association can be made with its idea since it remains viewable. The navigation bars can also traverse through the information.

There are two bars at the top of the display that allow users to understand what information they are looking at. The first bar represents the idea and the second represents the comments. The highlighted parts of the two bars are references to the current information being displayed. As the ideas and comments ticker by, the highlighted areas in the bars move from left to right. This change effectively makes these bars act like scrollbars. Users may click on any part of these bars to quickly retrieve a certain idea or comment. The top bar is also divided into sections with each section representing one idea. The number of comments posted for that idea determines the size of these sections. By adding this extra value into the navigation system, a user may have a general understanding about posting activity just by looking at the bars.

3.2 Client Personal Display

Our current work concentrates on the development of the client notification systems more than the large screen displays. The problem is that one does not know what the perfect notification system should be like.

Notification systems are designed to inform users when certain events occur. The design of a notification system depends on the information it must keep track of and the manner used to alert a user. The challenge in this field of research is to determine what notification method is appropriate for any given situation. It is difficult to determine what type of notification system the user will prefer. For this reason, three separate interfaces are used for development and testing to determine the favorable design. These interfaces are designed to be active, passive, and intermediate interfaces in terms of their interruption, reaction, and comprehension. The interruption caused by a notification system is the reallocation of attention from a primary task to a notification. The reaction is the immediate response resulting from stimuli. Comprehension is a measure of the overall sense of information a user has over an extended period of time. These three interfaces are designed in a simple manner in order to compare claims during evaluations.

The passive interface (Figure 3) design is designed with the idea of a dashboard in mind. It allows the user to, at a glance, receive a general overview of what is happening within the system. The interface has one frame with the idea postings listed in chronological order. Directly under that the number of comments posted to each idea is listed. Below this are a 'See Postings' label and an icon that brings up the large screen display interface. When a new posting is entered into the system, a pop-down frame appears and tickers a message informing the user of the new posting. This pop-down window has an OK button below it, which must be clicked in order to close the ticker. While the client runs, either a new idea number is created or the number of comments for an idea is incremented. This new incremented number changes colors from black to red and stays red until the user see the posted information on one of the large screen display interfaces.

Figure 3. The passive client with the popup

This interface is designed to have a low interruption due to its inactivity. The system creates no movements unless a change to the system is made. In which case, only a small ticker appears. The interface is designed to have low reaction because the only reaction by the user is to remove the ticker if he or she desires, or to go to the large screen display interface if he or she desires. There could be no reaction to the system if the user chooses not to close the ticker and continue with their primary task. Finally, the interface hopes to afford low comprehension. No information, other than the number of postings made, is given. There is no description of who posted it or what the posting is about.

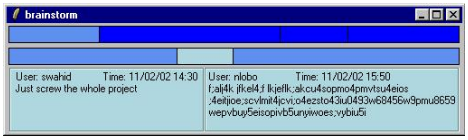

Figure 4. The intermediate client

The intermediate interface (Figure 4) increases the level of interruption and comprehension. The design is similar to the second large screen display. The top of the notification system sports the two navigation bars used in the second large screen display. Under the bars, the left and right text boxes contain the first few lines of the current idea and comment respectively.

This display only shows one comment for the current idea. The few lines of text displayed give the user an idea of what the idea or comment is about increasing the comprehension of the user. The changes in the interface do not support any type of smooth transitioning. This increases the interruption caused. On the other hand, this system falls short of alerting the user of any new posts. The only way the user would know of a new post is if they notice that the size of the sections in the ideas bar have changed. The bars in this client, however, do not afford clicking like the second large screen display. Although they still use the highlighted section to indicate the current information, it is primarily used as a link between the client and the large screen display. If this client were to be potentially used with the second large screen display, a user who knows the approximate location

of the two highlighted areas of the bars would easily be able to find the same information on the large screen display.

The interruption of this system is greater because there is constant change within the display. The highlighted section is constantly moving as the ideas and comments ticker by. The reaction to the system is intermediate because it forces a user to go to the large screen display at some point in time to see the full contents of an idea or comment. This system also provides a greater jump in comprehension because of the fact that it is showing the first few lines of the posts.

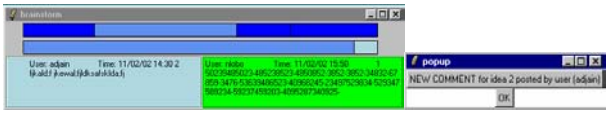

Figure 5. The active client with the popup

The active interface (Figure 5) takes all the features of the intermediate client and adds a few more. It keeps track of the number of ideas and comments that are posted. As the idea and comments scroll by, the number keeps changing to show what number idea and comment is displayed. If a new comment is posted, a popup window appears to alert the user of a new comment. The window shows which idea the comment was posted for the user that posted the comment. New ideas and comments are displayed using different colors and remain so until the user goes to the large screen display to read the information. This interface is designed to have a high interruption, reaction, and comprehension. The popup increases the interruption of this client since it would interrupt any primary task a user works on, forcing the user the click on it. The user's immediate reaction to the popup window increases the reaction of the system. The comprehension is high due to the amount of information shown in the display.

4. USING BRAINSTORM

At this point, it is predicted that BrainStorm will work well with groups of people ranging from six to twenty. One person from this group will act as the administrator of the system. This person will create a project for the work the group is working on. Once this is done, members of the group will subscribe to the project.

Members will subsequently start posting ideas for the project using the client. Every posting acts as a contribution to the project. Others may post comments on the ideas that are posted to improve the quality of ideas. This stage in the process resembles the process of brainstorming.

As updates are made, users are notified so that they may be able to follow the progress of the project throughout its lifecycle. When users talk to each other at their own computers, the notifications can lead to further interaction and project development among group members. When there are a significant amount of ideas posted, the group may come to the point where they need to talk about the information and make decisions. This is facilitated by the use of a large screen display, strategically located where the group can meet. During a meeting, the group members can use the display to look at all the information. Ideas and comments are evaluated and decisions are made.

The use of the large screen display greatly helps the quality of the discussion. The users can decide to meet and use the postings on the display as a topic of discussion. At the same time, the display itself may initiate a meeting with the help of casual interaction among users and act as an agenda for discussion during meetings.

5. EVALUATIONS

The testing performed concentrates on analyzing the three client-side interfaces in development. We aim to compare the clients to understand which specific claims of each display would constitute a final interface. These results constitute the basis of a reengineering plan.

5.1 Testing

The test results are based on two heuristic evaluations. The first are the guidelines developed by Nielsen for user interfaces [3]. The second evaluation consists of a set that was developed Brandon Berry, a researcher also in our department, to evaluate notification systems. A final questionnaire was given to the users to ask specific questions about the interfaces. Tests were conducted in a lab setting where users were able to view demonstrations of the interfaces. The evaluation sessions are composed of an introduction to the system, a demonstration of the two large screen displays, and demonstrations of each client interface. Users evaluate each client interface after each client demonstration. The order in which the client interfaces are demonstrated is switched for each session. A final questionnaire is used at the end of each session to gather data specific to the system.

5.2 Results

To process the results, we have given priority to the user comments regarding the three client-side notification systems. They enable us to detect fundamental problems regarding the systems and also allow us to create an agenda for reengineering. When we look at all the comments, we find that the systems in general are reliable and do not have any errors that may occur. Users do not have a problem with the reliability of the system. Most of the comments, however, concentrate on problems with the interface.

- **Lack of customization** was the biggest problem among all three interfaces. The clients do not allow users to take control of the system so that it works better for them. In the case of the passive client, users wished they could be able to turn off the red numbers without going to the large screen display. The other two interfaces did not afford locking. Users cannot stop the systems from cycling through the posts if they wish to read one; they have to wait until the next time the same information appears. Apart from that, they cannot customize the speed at which the posts cycle through.

- **Feedback about priorities** was another important problem. If a user has the ability to tell the system which ideas or comments to alert them of, the system would not needlessly alert the user. A user may not even want to know about certain posts. By assigning priorities to ideas or comments, the user can make the system act specifically to their needs.

- **Feedback about system status** was also found to be lacking in all three clients—not telling the user if the system is down or

when the last update was done. Users may potentially be looking at the same information for a long period of time without getting any new information.

Looking at the individual systems, we discover that the passive system forces users to know what the ideas are about since the system only provides numbers. On the other hand, users find the number to be easy to understand. Users have no way of looking at individual ideas or comments and are forced to click on the button to see the large screen display. Users also do not have a way of telling which posts came first. They challenge the system by stating that it is not necessary to know how many posts there are and that just seeing the actual post itself would be better. The popup that appears below is also found to be undesirable since it does not provide any new information.

The two bars in the other two clients were found to be useful. They provided a good hierarchical view when trying to understand which idea a comment belongs to. Users also, however, think that the bars force a person to remember the location of the highlighted area in order to retrieve the same information at the second large screen display. Both these clients provide good information when it comes to the ideas and comments, but it forces the user to physically go to the large screen display. There is no way for the user to get more information on a idea or comment. The idea and comment box should also have a bigger difference between them in order to portray the difference between the contents. Both these clients are also very big and take a lot of space.

6. REENGINEERING

The results of the evaluations allow us to develop a modified interface reflecting the comments of the users. Our reengineering priorities are as follows:

- Future development of displays for clients must certainly be smaller in size. The small size will allow users to place it in the corner of their display without much distraction.

- Because of the smaller size, the numbers from the first passive client can be used to display data regarding the system. Users will be able to tell if new comments or ideas have been posted by glancing at red numbers.

- To solve the problem of not being able to see the specific data that was just posted, users will be able to click on the numbers to see the idea and comment just posted. Clicking of the numbers will provide a more intuitive interface. The information can be displayed in the manner used in the intermediate and active systems where the idea and comment were both displayed.

- The two bars can be incorporated into this part of the system. While a user reads the idea and comment, a static bar on top can show the highlighted areas to indicate where the same information can be found on the large screen display.

- A link to the actual large screen display will also be provided to allow the user to gain access to all the information that has been posted. This will greatly increase the comprehension of the system without using up too much screen space.

- Finally, customization will also allow users to determine which ideas they should be notified about. This will establish priorities among ideas and will allow the notification system to act according to the users' needs.

7. SUMMARY

The discussion has given an overview of the design of BrainStorm, the testing performed on users, and reengineering plans. BrainStorm is a system that uses a client notification system and a large screen display. Both these notification methods are tied together in order to promote the development of ideas that people work on. In no way is BrainStorm a system that generates ideas for the people, but instead an environment in which ideas can develop.

It is thought that BrainStorm should work effectively as a groupware system. Face-to-face interactions between members act as mechanisms that make distributed interactions similar. Asynchronous distributed involvement in the system starts to gain a sense of social pressure and a power structure. The critical mass of users can be established by using the large screen display to attract more users.

Testing has allowed users to evaluate three different notification systems. Users pointed out the lack of customization and priorities in the user interfaces. The results have determined a clear path for reengineering. New prototypes that may be developed will concentrate on solving the basic problems indicated by the users.

Overall, our method to finding a good notification system has been to develop separate notification systems that can be combined later. By narrowing our choices, one can eliminate design options earlier in the development stage. The current reengineering plan is our solution to our problem of developing a notification system for BrainStorm.

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