# MessyDesk and MessyBoard: Two Designs Inspired By the Goal of Improving Human Memory

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#### **ABSTRACT**

MessyDesk is a replacement desktop that invites free-form decoration. MessyBoard is a large, projected, shared bulletin board that is decorated collaboratively by a small group of users.

We built these programs with the goal of helping people remember more of the content that they access through a computer. Our approach is to embed content within distinct contexts. For instance, a computer with multiple projection screens could surround the user with panoramic vistas that correspond to projects that the user is working on. Since few people are willing to create their own context, we created MessyDesk and MessyBoard in order to entice people to decorate.

Though we have not yet evaluated the impact of either program on users' memories, we have observed people using these programs over a several week period. From anecdotal evidence, we believe that MessyDesk may be a good tool for decoration and information management. MessyBoard became popular when we projected the board on the wall in our lab. We have seen that different research groups use it differently. One group uses it mostly for jokes and games, and another group uses it for long design discussions. It is good for scheduling, and supports factual as well as emotional communication among group members.

## Keywords

Ambient displays, computer-supported cooperative work, decoration, Info Cockpit, instant messaging, memory

#### INTRODUCTION

MessyDesk is a replacement desktop for Windows that allows free-form decoration. MessyBoard is a large, projected, shared 2D bulletin board that allows users to share pictures and text over the internet. Both programs make it easy for the user to decorate: users can simply drag and drop or cut and paste content from any Windows application.

Our initial goal with these programs was to enhance human memory for the content that people care about. We want

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Figure 1: A computer capable of providing context

people to remember more about e-mail that they read, documents that they author, and any other content that is presented to them by a computer. This work is not meant to help computer users remember details about how to use applications, such as where to find options in nested menus.

We have observed that human memory for information depends on the context in which that information is presented and the context in which a person tries to remember it. For example, imagine that you had a conversation in a scenic wilderness park a week ago and you want to try to remember that conversation today. Psychology studies have shown that you may have a better chance of recalling the conversation if you go back to the park and experience the same sights, sounds, and smells that were present at the time of the conversation [18, 22].

Current computers do not provide this kind of context, but we imagined a computer that could, like that shown in figure 1. A wide screen could show a panoramic image while stereo speakers deliver ambient sounds to make the user feel like he is in different environments when working on different projects. Multiple monitors could display information in different physical locations around the user's body so that the location becomes a memory cue.

Improving human memory using context requires that we understand what kind of context is best. After reviewing some of the relevant psychology literature, we decided on three design criteria: 1) Contexts must be distinct, 2) The context should be meaningfully related to the content that the user wants to remember and 3) The user should put some effort into creating the context.

We configured a machine like that in figure 1 and decided that we should try using context ourselves. However, making the system create and display appropriate context with little or no user input is potentially a difficult problem, and we suspect that a context that is generated automatically will have less of an effect on memory than a context that the user creates. We quickly found that most people, even the researchers involved in this project, are not willing to spend time finding or creating an appropriate context when there is other work to be done.

Our approach to this problem is to entice the users into creating their own contexts by giving them a more immediate incentive. Users can create a context by using MessyDesk to manage information or to personalize their computers with notes and pictures. Users can create a context by using MessyBoard to share pictures and notes with others.

So far, we have not attempted to measure the impact of MessyDesk and MessyBoard on users' memories. However, researchers at Carnegie Mellon University, the University of Virginia, and a private consultant in Boston have used both of these programs for several weeks. We have spoken with the users informally in meetings and one-on-one to find out how people are using them, what the biggest problems are, and what features they want.

We have observed that MessyDesk is most useful on a multimonitor workstation. Two of the early adopters were artists who used MessyDesk primarily for decoration. One user wanted to use MessyDesk to manage information, but she could not due to interface glitches and un-implemented features. These problems have since been fixed.

We found that MessyBoard became popular once we started projecting it on the wall in our lab. We observed that different research teams use MessyBoard differently, and that their activity reflects the work that they do together. MessyBoard is good for scheduling meetings. MessyBoard supports "conversations", though users sometimes have trouble figuring out who said what and the exchange might seem less polite than a face-to-face conversation. Users played simple games on MessyBoard, and this generated excitement and caused people to pay more attention. We also found that inside jokes on MessyBoard can alienate users who don't understand the references.

#### **CONTEXTUAL RESEARCH AND LITERATURE REVIEW**

We have surveyed two bodies of literature. The first deals with the kinds of work that people do and how they organize their desks and offices to support their activities. We refer to this as the "messy office" literature. The second consists of psychology experiments testing the effects of context on memory. We refer to this as the "context-dependent memory" literature. Both of these have helped us to better understand the kinds of people we are trying to help and the ways in which we can help them.

#### Messy Office Literature

Reading the messy office literature first helped us to characterize the kind of people we are trying to assist. We decided

that the kinds of memory aids we were envisioning would be most useful to knowledge workers, as defined by Kidd [10]: "... the defining characteristic of knowledge workers is that they are themselves changed by the information they process." In other words, knowledge workers are paid to build an understanding of new information and inform others in their organization.

We tried to find out how knowledge workers organize their desks and offices, with the hope of finding ways to make computers more useful to them. Several researchers have noted a difference between filers, who file their documents in an organized way, and pilers, who leave documents in loosely organized piles around the office [10,12,14,25]. There is a general consensus that knowledge workers tend to be pilers, and that piling offers some benefits over a rigid filing system. Knowledge workers use piles to deal with incoming information when they cannot immediately classify it or determine its value. Piles of papers strewn about the office can also serve as important contextual cues to help a knowledge worker determine what they were doing the previous day or before an interruption [10]. Others are quick to point out that the piling strategy can become overwhelmed by too many documents [12]. We have come to the conclusion that piling, while not scalable to huge amounts of information, is an important strategy for knowledge workers at least in the short term. Computers do not currently allow for this kind of free-form organization, but perhaps they should. HCI researchers have attempted this in the past with some success [15,20,21].

#### Context-dependent Memory Literature

Since we first began looking at human memory, we have surveyed the literature, spoken to some of the leading psychologists in the field, and have drawn on our own intuition and experiences with memory. After searching for information from these three sources and attempting to reconcile it all over several months, we decided that context effects are in fact reliable and we came up with three design criteria for creating artificial contexts that will be effective memory aids:

- The context should be distinct
- 2. The context should be meaningfully related to what the user is doing
- 3. The user should put effort into creating the context

There is a great deal of literature on the effects of context on memory. Smith and Vela have conducted a meta-analysis of several experiments and found that environmental context effects on memory are in fact reliable and they can sometimes be large [22]. (A prototypical example of an environmental context experiment is to have subjects learn a list of words in a room and then have some of them recall the words in the same room and some of them recall the words in a different room. Under the right conditions, the subjects in the same-room condition will remember more.) Gordon and Asch et al. have both shown that distinct locations on a screen or board can serve as a context and improve memory for a list of nonsense syllables [2,7]. Murnane et al. have

reviewed several context experiments and conducted some original experiments in order to understand how different kinds of context are likely to affect memory [18].

Common sense and the psychology literature both tell us that in order for a context to be a useful memory aid, it must be distinct. For instance, going back to a restaurant where you had one conversation may help you remember that conversation, but it helps less if you have had many conversations there and you want to remember a particular one. Moscovitch and Craik have shown that when subjects use cues to recall a target item from memory, it is best to have a single cue for each target item rather than re-using each cue for several targets [17]. Dallett and Wilcox have shown that learning different material in two different contexts confers a memory advantage over learning all of the material in the same context [6].

Our intuition tells us that a context will be a better memory aid if the user puts some effort into creating it. For instance, if we surround users with panoramic photos as context, making users browse through a database and select a photo themselves makes it a better memory aid than if the computer chooses it automatically. Unfortunately, we have not found any literature that deals directly with effort and environmental contexts like rooms or outdoor settings. However, several studies have shown that memory cues are more effective if subjects generate them than if they are provided by an experimenter [3,16].

Our final working hypothesis is that a context will be more effective as a memory aid if it is meaningfully related to the content that is to be remembered. For instance, Washington D.C. would be a better context than Pittsburgh for remembering the content of a conversation about U.S. politics. Again, we have not found any studies that directly support this claim for environmental context. However, Moscovitch and Craik have found that memory cues are more effective when the cue and target form "... a congruent, meaningful unit." [17] Murnane and Phelps argue that a context is more effective if it can easily be integrated with the content to create additional information in memory, which they refer to as an ensemble [18].

#### **BUILDING A COMPUTER WITH CONTEXT**

We configured a multi-monitor system with projected displays in order to make it capable of displaying the kind of artificial context we imagined. We built several variations over time and used them for preliminary studies and to do our own daily work.

We had intended to use the projectors to display context images, but we quickly discovered some problems. Programming the system to create or find appropriate context with no user input is potentially very difficult. Furthermore, we want the user to invest some effort in creating the context in order to make it a better memory aid. However, we found that none of us were willing to find or create our own contexts when there was other work to be done. Finding large high-resolution images on the web is time-consuming, modifying them with programs like Adobe PhotoShop is tedious,

and displaying them correctly as "wallpaper" on the windows desktop is very difficult with large images and multiple monitors.

# ENTICING THE USER TO CREATE CONTEXT FOR DECORATION: MESSYDESK

We decided that if we wanted users to create their own context, we should make it much easier and give them a more immediate incentive than a long-term memory benefit. We envisioned a different kind of windows desktop that could easily be decorated using text and pictures from other applications. With this program, users could decorate for fun or manage information by piling it in different places. We believed that the context they created would be distinct because it would change over time and it would be related to what the user is doing by virtue of the fact that the decorations would come from other programs that she is using.

We first tried using a commercial program called Talisman [13]. Talisman is intended for artistic expert users who want to customize the look and feel of the entire Windows interface. Talisman is more flexible than the Windows shell in that it allows multiple images and blocks of text to be placed on the desktop. However, Talisman does not make it easy to constantly add new decorations, move and resize existing items or edit text. Further, on a multiple-monitor system it only covers one display. DesktopX, a similar system, covers multiple monitors but has the same problems with object creation and editing [23].

TimeScape, a research prototype desktop environment, also allows the user to decorate the desktop with pictures and notes [20]. However, this work emphasizes the ability to browse through time, and it is not clear how easy it is to add notes and pictures to TimeScape, or whether it supports multiple monitors.

We ultimately decided that we needed to build a new desktop system that made it easy to add and rearrange pictures and notes, and we built a prototype called MessyDesk. With MessyDesk, a user can decorate by dragging an image or text from any Windows application onto the desktop, or by pasting from the clipboard. See figures 2a and 2b for a short description of how the user decorates using MessyDesk.

### **MessyDesk Observations**

We gave MessyDesk to researchers at Carnegie Mellon University (CMU) and the University of Virginia (UVa) in order to observe how they decorated their desktops. Initially, people stopped using it very quickly. This was partly due to the fact that MessyDesk created a new blank desktop and people lost access to all of their desktop icons, and partly because of various glitches: the desktop sometimes covered the taskbar, resize handles were sometimes hidden under notes or pictures, etc. Thus, we discovered that users rely on their desktops and they will not tolerate an application that interferes with this fundamental part of the user interface.

After fixing the worst glitches, we found that only people with multiple monitors used MessyDesk. When a user has only a single display, the desktop is almost always covered by an application and there is no point in decorating it. The



**Figure 2a:** Users can right-click the desktop and add new items from a menu



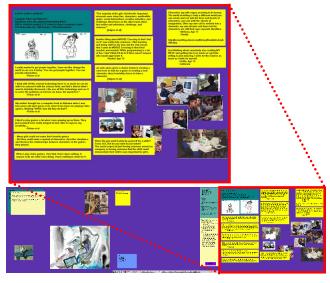
**Figure 3:** The artists in our group enjoy using MessyDesk for decoration. Each of the desktops spans two monitors

fact that MessyDesk is only useful on a multiple-monitor system does not concern us though, as we believe that multiple monitors will become more popular over time. Windows has included multiple-monitor support for a few years now, and other operating systems started supporting this option long ago. Extra video cards are cheap, and the cost of displays continues to drop. Furthermore, good displays do not become obsolete nearly as quickly as computers do, making them a worthwhile investment. Grudin's findings on multiple-monitor use support these arguments [9].

Two of the people who like MessyDesk the most are artists. Their desktops are shown in figure 3. They use MessyDesk



**Figure 2b:** Users can drag and drop or cut and paste text or images from any Windows application onto their desktop to create notes or pictures. Image files can also be dragged in directly from folders.



**Figure 4:** A graduate student uses MessyDesk for information management. The blow-up region shows one of three monitors.

mostly for decoration. One artist has covered the desktop with cartoons, and the other has made a collage with pictures of Björk. We can also see some photographs of thermometers on the desktop. At the time this snapshot was taken, the artist was creating a 3D model of a thermometer and using these pictures as a reference.

Figure 4 shows a snapshot of a graduate student's desktop. It is partly covered with decorations, but one monitor is decorated with pictures and quotes related to the student's current research topic. When we spoke with her about her use of MessyBoard, she wasn't quite sure how useful this was. Though it may have been nice to have the information avail-

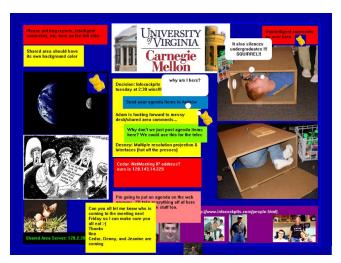


Figure 5a: The Info Cockpits MessyBoard



Figure 5b: The Alice MessyBoard

able at a glance, she was frustrated by the fact that she could not take the pictures from the desktop and use them in other applications, and by the fact that the interaction for moving and resizing notes was tedious. (Both of these problems have since been fixed.)

# ENTICING THE USER TO CREATE CONTEXT FOR COMMUNICATION: MESSYBOARD

After our experiences with MessyDesk, we weren't sure if decoration alone would be a strong enough incentive for people to create the kind of context that we had in mind. We decided that communication would be an even greater incentive: people would create a context in order to share pictures and text with others. We further hypothesized that a shared context would be even more effective as a memory aid, since people would pay more attention to it and one person could refer to it in order to cue another person's memory.

We imagined a shared projected bulletin board that anyone could decorate using the Internet. We already had some experience with video conferencing programs like NetMeeting, but we knew that we needed a more asynchronous medium that allowed many people to participate and share things over a long period of time.

A program called Notification Collage (NC) [8] had many of the features that we wanted. NC allows users to share notes and pictures and broadcast video. However, the user interface is very awkward so it was difficult to get people to keep using it. NC also places pictures and notes randomly and allows each user to move items to a different location. Thus, the layout of one person's view may differ from another person's view. We wanted a shared context that would look the same to everyone.

We revised the MessyDesk application to build a shared bulletin board called MessyBoard. MessyBoard runs in a window on each user's computer, and it is just as easy to decorate and rearrange as MessyDesk. We currently run two MessyBoard servers: one for the Info Cockpits project [24] (the work described here is part of this project), and one for the Alice project [5] (a drag-and-drop programming environment for creating interactive 3D worlds). We project the contents of both boards on different walls in our lab at CMU, and the researchers at UVa project the Info Cockpits board in their lab. Snapshots of both boards are shown in figures 5a and 5b.

#### **MessyBoard Observations**

To observe the system in use, we have been recording snapshot data whenever a change is made. We observed the projection screens to see what people were doing, checked the snapshots when we missed something, and made notes. We met once with the users of each server to review the history and discuss how they were using it and how we could make it better. The following bulleted list is a brief summary of our observations, and each is discussed in depth below.

- Different research teams use MessyBoard differently, and their usage reflects both the nature of the projects and the nature of their collaboration.
- Projecting the contents of the board on the wall affects the way people use it.
- People want to use the board to know who else is available, but they quickly learn to ignore this information if it is unreliable.
- A shared bulletin board is better than e-mail for scheduling meetings.
- Users sometimes have trouble figuring out who said what.
- Conversations on MessyBoard sometimes seem less polite than face-to-face conversations.
- A simple game or contest gets people more excited about MessyBoard and causes them to pay more attention.
- Users sometimes feel alienated when the board contains references that they don't understand.



**Figure 6:** A panoramic photo of part of our lab at CMU with the Alice MessyBoard (left side) and Info Cockpits MessyBoard (right side) projected on the walls

#### Differences between research groups

We set up the Info Cockpits server first and encouraged researchers at CMU and UVa to use it. It immediately became a forum for discussing bugs in and suggested features for MessyBoard. People also used it to share humorous pictures and comments and play simple games. MessyBoard was not used very much for research collaboration. We suspect that MessyBoard was used this way because the users know each other well and they fequently contact each other by phone and e-mail, but nobody at CMU was collaborating with anyone at UVa on a specific project with concrete short-term goals.

We later set up the Alice server, which was used quite differently. The Alice team is mostly made up of researchers at CMU, with one member working remotely from Boston. The content of the Alice MessyBoard consists almost entirely of design discussions with snippets of code and snapshots of the interface, with an occasional inside joke or discussion of an unrelated topic. We believe that the Alice team uses MessyBoard this way because it is so well suited to the their project: they need to collaborate with a remote member and they have long discussions about their interface design that span several meetings. MessyBoard is good for displaying a small piece of a visual interface and allowing many people to comment on it.

#### Projection

We observed that projecting the shared context in the lab makes a huge difference. Everyone looks at it as they walk by, and everyone in the lab can see that others are paying attention to it. This prompts people to participate in decorating and sharing pictures and text, since they know that others will notice it. In one instance we observed members of the Alice team gathered around the projection of the Alice MessyBoard discussing the snapshots of the interface that they had posted. Greenberg and Rounding observed similar behavior when they ran Notification Collage on a large public display [8]. Figure 6 shows a panoramic photo of part of our lab at CMU with two MessyBoards projected on the walls.



**Figure 7:** Users on the Info Cockpits board put up pictures of themselves to let others know they are available

#### Awareness: Who's Around

One of the first things we did on the Info Cockpits board was to put pictures of ourselves in the bottom right corner to indicate who was in the lab, as shown in figure 7. This information is potentially very useful since the Info Cockpits team is spread over two universities. However, the information is unreliable because people often forget to remove their pictures when they go home, so users have learned to ignore it. We plan to add a mechanism that automatically detects who is available, similar to the system used by AOL's Instant Messenger [1].

#### MessyBoard is Good for Scheduling a Meeting

One of the best uses for MessyBoard is scheduling a meeting. E-mail is very annoying for this purpose: each user ends up with a pile of responses in their inbox and it is difficult to figure out when everyone is available. With MessyBoard, each person can put their availability into a single shared note so anyone can immediately see when people are available, as shown in figure 8.

#### Authorship and Politeness

A technical discussion on sound measurement started when a researcher at UVa replied to an initial posting by a researcher at CMU. The discussion continued over several hours as shown in figure 9. Though it was encouraging to see this kind of interaction, it revealed two shortcomings in MessyBoard. First, the authors had to explicitly write their names or manually choose a specific color for their notes so others could tell who had said what. Second, some users thought that the conversation became slightly rude. This was later confirmed at a face-to-face meeting with all of those involved, and it is known that electronic "conversa-

```
Rescheduling next week's teleconference (Tuesday, 16 October)
When are you available?
         <12
                   1:30-3:30
Andrew
         no
                   ok
         ok all day
cedar
.19
Denny
                   ok
Adam
         nk
                   nk
Phantom no
                   >2
                   mavbe....well, ok
tom
         no
Randy
randy has a class 1:30-3:30, and 3 people can't come in the morning,
how about someone make an executedision about who needs to be there?
We vote tuesday at 2:30 (cedar & J9), since that seems to be the maximal
participation (if everyone is counted equally, that is)
l (Adam) agree.
```

Figure 8: MessyBoard is good for scheduling meetings

tions" often seem less polite than real-life conversations [4,11].

#### Simple Games Attract Attention

One of the first uses of MessyBoard was for simple games. We played tic-tac-toe for a day or two with different people making moves every few hours. Someone then started a game of Pong, where CMU controlled one paddle, UVa controlled the other, and anyone could move the ball. This is shown in figure 10. These games used only existing elements: the tic-tac-toe board was made up of 9 small notes, the pong paddles were long thin notes, and the ball was a picture of a circle. These games had no hard and fast rules anyone could move any of the game elements, and there was a good deal of cheating. People enjoyed these activities anyway though, and they pay more attention and check the board more often when something like this is happening.

#### Inside Jokes Cause Alienation

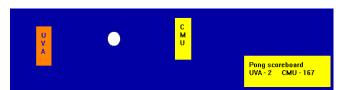
Researchers at UVa felt alienated when CMU researchers posted pictures relating to an inside joke that UVa did not understand. The incident began when the CMU group purchased a large quantity of gummy bears and someone put pictures of gummy bears on the Info Cockpits board, as shown in figure 11. The following posts show that researchers at UVa were upset, but everyone's sense of humor was still intact. We confirmed later at a face-to-face meeting that the objections from UVa were in fact sincere and they did feel alienated.

# UPCOMING FEATURES FOR MESSYDESK AND MESSYBOARD

One of the most common requests for MessyBoard was to have a complete log of the entire history of the board. Though we have snapshots of the entire history, these are only available to the authors on the server machine. Users wanted to scan through the history to see what they missed and they wanted a way to recover deleted items. We feel that a complete history would also be useful for MessyDesk, and being able to see the history of your desktop or a shared bulletin board is an important step toward our goal of improving human memory. Seeing a previous context could

Measured the effectiveness of the silent projector boxes this morning. The boxes reduced the volume of an Eiki by a factor of 32 (15dB), the Epson by a factor of 6.3 (8dB). Measured the effectiveness of the silent projector boxes this morning. The boxes reduced the loudness of an Eiki by a factor of 32 (15dB), the Epson by a factor of 6.3 (8dB). not i denny sez: happ is this taking into db = 20log10(P1/P0)here account the andrew sez: yup. exponential nature of dB = 10log10(11/10)not i the decibel scale? [both are right] heck yes... denny responds; it is not 10, because pressure is a 2-d energy tall across Measured the effectiveness of the silent projector VΑ boxes this morning. The boxes reduced the loudness of an Eiki by a factor of 32 (15dB), the Epson by a factor of 6.3 (8dB). denny sez:db = 20log10(P1/P0) andrew sez:dB = 10log10(11/10) [both are right] denny responds; denny sez: it is not 10, because pressure is a 2-d energy huh?!? what is andrew responds: intensity? I'm talking about intensity not pressure. (I = P^2) Intensity is a measure of energy per time per unit area. (Power is just energy per unit time; expressed in Watts). So Intensity is Watts/m^2. deciBels are defined as the log of the ratio of powers (or intensities). Pressure (aka displacement) is the square root of the intensity: Í = P^2. So a doubling of intensity is +3dB: 10 \* log ( 2/1 ) = 3.01 A doubling of pressure is +6db: 10 \* log ( (2/1)^2 ) = 2 \* 10 \* log ( 2 ) = 6.02

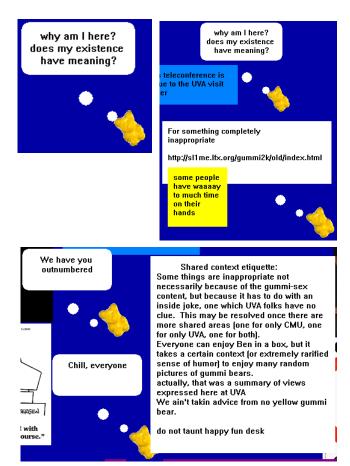
**Figure 9:** A technical discussion on sound measurement took place over several hours



**Figure 10:** Users play Pong on the Info Cockpits MessyBoard. There are no rules; anyone can move either paddle or the ball.

be a valuable memory aid to help the user remember what else he was doing at that time.

A common request from the users of the Info Cockpits board was for some form of automatic decoration and automatic clean up. MessyBoard activity occurs in quick flurries sepa-

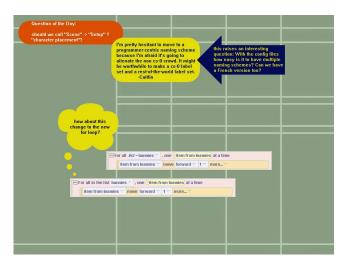


**Figure 11:** CMU researchers posted gummy bears as part of an inside joke, causing UVa researchers to feel alienated

rated by lulls where nobody posts anything. The computer could automatically find interesting items to post during a lull in the hope of getting people to post more items in response to it. This could work especially well if users do not know whether the computer or another user has posted the item. One way to do automatic clean-up is to make MessyBoard scroll slowly over time, so that old notes and pictures disappear off the edge of the screen and make room for new items. Another idea is to have a timer on each note, or make an item disappear after every user clicks it to confirm that he or she has seen it.

Both groups of users decided that each person should have a unique color for his or her notes. Most users want Messy-Board to allow them to choose a unique font as well, and they want it to remember their preferred font and color so they don't have to set it for every note. In addition, we've discussed the possibility of putting people's faces on the notes. We've noticed that having pictures on the board makes it seem more lively and interesting, so it would be nice to automatically have pictures even if people only post some text.

With both MessyDesk and MessyBoard, users have expressed a desire to copy content off of the bulletin board or desktop into other applications like PowerPoint or Word.



**Figure 12:** A concept sketch for a new MessyBoard with aesthetic elements and a non-intrusive background image

We'd like to add this feature soon, and we feel that it would make both programs more useful as information management tools. Users would be able to spread pictures and notes over multiple monitors, create loose piles and categories, and then use any of them as needed in documents or presentations without having to store them in the file system.

We've noticed that users tend to create loose collages in both MessyDesk and MessyBoard with very little organization or attention to aesthetics. Though they have not complained, we are concerned that these collages will blend together in the users' memory over time and cease to be an effective memory aid. We plan to experiment with the idea of an interchangeable "theme" or "skin", similar to the themes in Windows and the skins in Winamp [19] and other applications. A theme could consist of a limited set of colors and distinct shapes for notes along with a pleasing but non-intrusive background image, as shown in figure 12.

Finally, we've seen that simple games like Pong or tic-tactoe that are played asynchronously over hours or days are good for attracting attention and getting people excited about checking the board. We are thinking about including simple games or activities as part of MessyBoard.

## **SUMMARY AND CONCLUSIONS**

We began with the goal of improving human memory for information that a user views or works with on a computer. We hypothesized that we could do this by enticing the user to create a context for the information. To do so, we built two programs that support the creation of personalized context. MessyDesk makes use of the desktop for decoration and information management. MessyBoard encourages decoration through a shared projected space.

We collected feedback through informal observations and conversations with our users. We found that MessyDesk was well-liked by the artists in our group, who used it mostly for decoration. A graduate student attempted to use if for information management, but she was frustrated by the fact that

she could not get pictures out of MessyDesk into other applications. We conclude that MessyDesk may be useful for information management once this feature is added.

MessyBoard has been popular as a shared communication tool. One research group used it for project-related discussions. Our research group used it to discuss the program itself, to play games, and to share jokes. The different patterns of use reflect fundamental differences in the way the two groups collaborate and the nature of their work.

Though we began with the goal of improving memory, MessyDesk and MessyBoard have opened up new potential avenues of research. We may choose to study MessyBoard as a tool for information management and observe how it affects users' work habits over a long period of time. We could also study MessyBoard as a tool for awareness and communication for remote collaborators.

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