

Using Large Public Interactive Displays for Collaboration

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Abstract. Large displays have several natural affordances that should make it simple to support collaborative work. They are large enough to hold multiple work areas, they are easy to see and can be manipulated directly via touch. The BlueBoard is a large plasma display with touch sensing and a badge reader to identify individuals using the board. The onboard software acts as a thin client giving access to each participant's web-based content (e.g., home pages, project pages). The client also has a set of tools and mechanisms that support rapid exchange of content between those present. The overall design of the BlueBoard is one that is easily learnable (under 5 minutes), very simple to use, and permits novel uses for collaboration. Our initial field study revealed a number of social issues about the use of a large display surface, yet indicates that a shared public display space truly has distinct properties that lend themselves to sharing content. Extreme learnability & overall simplicity of design makes BlueBoard a tool for collaboration that supports intermittent, but effective use for side-by-side collaboration between colleagues.

1 Introduction

Large displays are rapidly growing more affordable and offer new opportunities for ubiquitous placement in work environments. [1,3,6,7,8,9,10, 12] A recent trip through the Frankfurt, Germany airport showed more than 100 large displays scattered throughout the concourses as information displays: other air terminals show similar numbers of deployed large displays.

While kiosks have been popular items as information displays for some time, they have often suffered from an inability to act as general purpose access devices. Generally speaking, kiosks are placed in a space to sell a product or to push a particular set of information.

But when a kiosk has a personal authentication devices (e.g., biometric device or badge readers), and is placed on a high-speed network, the nature of the device changes in a fundamental way. No longer is it just a dispenser of canned information, but the kiosk with an integrated personal identification device becomes a new thing – a Large Information Scale Appliance (LISA).

Such devices placed into a work setting become a distinctly new kind of thing. LISAs are shared, communal information appliances that operate under a substantially different set of assumptions than the kinds of information tools normally used by individuals.

Working practices are especially subject to social effects when the devices are large and communal. In our initial tests, we have found a number of somewhat unanticipated interactions between the device as a thing to use, and the device as a place.

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2 BlueBoard, an example LISA

The BlueBoard is a LISA device based on a large 1.3 meter plasma display (XGA) with a resistive touch screen (from SMART Technologies [8]) and a badge reader for personal identification (an HID brand RFID reader connected to the serial port [5]), with a laptop PC secured in a lockbox bolted to the rear of the display, running the BlueBoard thin client software.

In ordinary use, the BlueBoard is intended for both very fast personal use (walk up, check your calendar, walk away – all within 5 seconds), and for small group collaborative use (a small number of people stand around the BlueBoard to sketch ideas, pull up information from their personal space, compare notes, share content, create something new).

In our design, a BlueBoard has no keyboard or mouse. While this seems restrictive, our goal is not to have BlueBoards become just another personal computer – it is consciously designed to support lightweight, fast encounters and simple spontaneous collaborative meetings. We do not believe that providing full keyboard capability (and corresponding security control problems) works to the BlueBoard's advantage.

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Fig. 1. The BlueBoard is a Large Scale Information Appliance offering fast access to personal information with tools for collaboration and small groups of people working side-by-side. The display has a touch screen overlay and a badge reader on the right corner for person identification. Network access is assumed.

In the BlueBoard, the badge's unique identifier is sent to a Badge Server database that authenticates the user, handing back a URL to that person's personal content.

The act of swiping your badge by the reader brings up a representation of the badge owner in a column on the right hand side of the large display (see Figure 2). A "personal icon," or *p-con*, is created on the BlueBoard display off on the side in the tools area. Note that a person's "home page" is not immediately displayed, but becomes available only by explicitly touching one's p-con.



Fig. 2. A typical BlueBoard personal display. This kind of content is set up by each user as their "home content." Content displayed on the BlueBoard can be shared with another person by dragging the content (window, image, URL) to their p-con. Here, Rich is showing his home page calendar to Daniel and Alison.

Clearly, such content needs to be created by the user. It's important to note that the BlueBoard system is not yet-another attempt to solve the web-site authoring prob-

lem, but rather simply presents information that is created elsewhere, linking high-value information to web content.

We are currently working towards a simplified BlueBoard content authoring tool, one that provides very simple templates to link personal content to the BlueBoard server. While not intended to be used at the BlueBoard, simple content creation is part of the entire BlueBoard use cycle. (The discussion of such a content creation tool is beyond the scope of this paper.)

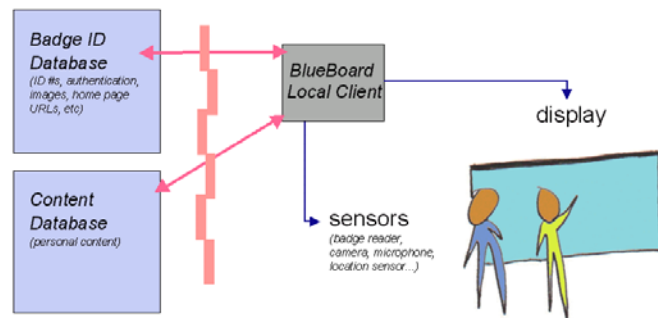


Fig. 3. A BlueBoard links backend content (on a webservice) with presentation on the large plasma display with touchscreen and badge reader. The badge ID is sent off for authentication, returning either an “unknown user” error, or an authenticated set of URLs in the Content Database. The effect is that a user “logs in” by simply swiping their badge at the display, getting rapid access to their content.

Appliance Design for Personal vs. Communal Uses

There’s an inherent design tension in LISAs: they are good for group work with peers standing shoulder-to-shoulder, working together. But they are also very handy for rapid personal, one-person information access. Unlike other information appliances, a LISA must support both single users and multiple users. It needs to work for a single person walking up to the BlueBoard to check their calendar, and it needs to work for small groups of people working together. Consequently, there are two very different sets of overall goals: design the LISA for individual information access, and design the LISA for multiple people using the display at the same time.

We have come to recognize that several design points need to be satisfied to balance these competing design goals. These basic design issues are: (1) representing a person who’s participating in a session at the BlueBoard, (2) providing adequate tools for use at the board (e.g., a whiteboard function, a map of the area, etc.) and (3) keeping personal information private while making location-based information available.

Representing a person: P-cons for access & sharing

When more than one person is using the device, the device needs to know whose content is being viewed. There also needs to be a way to easily share content among the users who are all using the board at the same time.

The *p-con* is just an image of the person representing that person's content. When a badge is swiped, a person's p-con appears in the p-con dock on the right side of the display (see Figure 2). When more than one person is at the board, all of their p-cons show up on the display (currently up to six).

The p-con becomes the rapid access point for personal content. A user sets up their content ahead of time, linking items such as calendars, presentations, continually updated information (stock quotes, project status, etc.) to the home page. Then, once badged-in to the BlueBoard, a finger touch on the p-con brings up the first page of their content.

The p-con is also the way to share information between simultaneous users. If one user is showing a slide from their content or an especially interesting web page, a drag-and-drop movement from the page to a p-con will deposit a copy of that content in the p-con. When the p-con's person badges out (leaves the BlueBoard session), the contents of the p-con is e-mailed to them. In this way, sharing information is extremely simple – when you see something you like, just drag it to the p-con and the content is shared.

Since all content shown on the BlueBoard is some variant of a web page, dragging an individual item (e.g., a block of text or a picture) just copies that item into the person's temporary p-con buffer. To make a copy of the entire page, the user will drag from a "whole page" handle (the title bar) to the p-con.

In essence, the p-con stores content until the user badges out. At badge out time, the contents of the p-con buffer are packed up into an email message and sent off to the p-con owner's email space.

We have consciously avoided overly complex mechanisms such as group management or automatically trying to move the p-con buffer contents into their personal content web. An important goal is that the BlueBoard be usable with a tiny amount of training. Currently, to simplify things, only people present can share content, and sharing is done by logically moving shared material into their email. In a similar vein, we've attempted complex window management schemes for doing split screens, but have not yet been able to devise a way that allows the split screen to be simple to explain and use. It's too easy to become confused between foreground and background. Since an overriding goal is simplicity, we continually return to those roots in making design choices.

Tools for Rapid Use in Place

Public, shared, communal devices all need to be extremely simple to use and must be intrinsically useful even without special registration. We want people to be able to simply walk up to a BlueBoard and do useful work.

To date we have built a simple toolbar that allows a passerby to gain immediate access to several functions: a whiteboard sketching tool, a calendar that shows the current day / week / month, and a local map (showing the location of the BlueBoard in the local building).

These functions continue to be accessible after badging in as well. As with all other content shown on the BlueBoard, this content can be dragged to a p-con for sharing via an email connection.

Transient Information Must Be Truly Transient

When a user badges in to the BlueBoard, their content flows to that location. When they badge out, the content stored in the p-con buffer (if any) is emailed to the email address of their choice (pre-specified at BlueBoard user registration time). But equally importantly, any content that was pulled to the BlueBoard from the remote content server must be purged from the local system to avoid the possibility of compromise by later walk-up users.

To make this assurance, the BlueBoard tracks each content item as it comes into the system, tagging it with its owner's p-con ID. At badge-out time, all such content is explicitly removed (including items in the history list and any cookies that might have been created in the process).

FUTURE

We have been working closely with the MERBoard group at NASA Ames Research Center in Mountain View, California. [13] In that effort, we are working with that team to understand the collaboration issues that arise when MERBoards (a NASA variation on BlueBoards) are used in a constant-use, highly collaborative environment. In their environment, teams of scientists work together to plan future actions during a space mission, which requires pulling together and creating a variety of materials in a short amount of time. Their environment is highly collaborative, very secure, and continually in use.

By contrast, the working environment at IBM is much more one of infrequent use, and (as we have discovered!) more oriented towards linking remote teams working in synchrony, often involving live video conferencing tools. In this work we are moving towards a tight coupling of video environments with more traditional shared-space kinds of work. Our hope is to understand the best practices that evolve from this new kind of collaboration that joins groups in different time zones in a mix of video, live meeting and data exchange.

SUMMARY

Large displays, kiosks, and information appliances are all common. Yet few have tried to be all three at once. The trend towards increasing use of large displays in public spaces creates the opportunity for a new kind of ubiquitous / pervasive device: the large information scale appliance; a device that delivers personal information to authenticated, identified users in a kiosk environment.

Designing large information appliances requires balancing the need to work across a wide variety of user populations, work for a number of simultaneous users, while operating in a variety of locations and uses.

The social effects of a communal working space are subtle and varied: people have distinct styles when working in public, yet the value of a shared work surface seems unquestionable.

Our goal in the BlueBoard project has been to provide very rapid access to personal content while providing the easy-to-use functions of an information appliance supporting both communal and personal use. The important difference between BlueBoard and other kiosk systems is the design of the use experience for a kiosk that knows who is using it while supporting fast access and simple sharing of content.

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Biographies

Daniel M. Russell, Ph.D., is the senior manager of the User Sciences & Experience Research lab at IBM's Almaden Research Center at the southern end of Silicon Valley. Dan has worked in human computer interaction design for 20 years, with stints at Apple Computer and the Xerox PARC labs.

Alison Sue has worked in the IBM Almaden research lab for many years, bringing to the USER lab a wealth of experience in engineering. Currently, she has been working full-time on the BlueBoard project, making all the of the components play together well, as well as supporting an international array of BlueBoard systems.