

# Using Public Displays to Create Conversation Opportunities

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## ABSTRACT

Display and sensor technologies have advanced to the point where it is now possible to create large, interactive displays in public places. Several initiatives are exploring how such displays can be used in the *foreground* to support *highly focused* collaborative activities. We are exploring how an interactive display (or wall) can be used in the *background* to enrich *casual* interactions of the people nearby, by sensing the presence of those people, looking up profile information about them, and displaying selected information as they are gathered next to the display. Two applications / installations of such displays are described in this paper: GROUPCAST and the INTERACTIVE WALL MAP.

## Keywords

Situated computing, ubiquitous computing, CSCW, human-computer interaction, public displays, social issues.

## INTRODUCTION

We often hear predictions of a technology-rich future in which our environments will be filled with artifacts that can sense and respond to us in new ways – a world filled with cameras, microphones, visual displays and audio speakers, to name but a few. Although such a world may seem threatening or menacing in some depictions, it may be possible that such developments will lead to more accommodating environments, encouraging more frequent and beneficial interactions among the inhabitants of such spaces.

A physical space that can sense people in the vicinity, and has knowledge of their interests, can use this information to create new informal interaction opportunities for these people. For example, a shared public display in a workplace, combined with a tracking system, can display information of mutual interest to the people passing by the display. People may choose to take advantage of this information to initiate a conversation with someone about whom they may know very little, leading to an increased sense of community in the workplace.

Two examples of conversation-inspiring public displays are presented below. The first, GROUPCAST, is an application that runs on a large display in a casual group setting, such as a break area, where the content is selected based on the combined profiles of the group assembled (or walking by) the display at any given time. The second, an Interactive Wall Map, consists of six flat-panel touch-screen monitors embedded in a large wall map of the world that can display content relating to people nearby and geographic regions throughout the world.

## GROUPCAST

GROUPCAST explores what kinds of content would create opportunities for informal interactions in open areas in the workplace. By using our ArialView awareness system – a network of infrared badges and sensors throughout the workplace – we know who is near a large, shared display, and can use information about those people to display content that may provide opportunities for those people to start a conversation.



Figure 1: GROUPCAST in context of use.

For example, Joe and Teresa do not know each other very well; however, the “Wine of the Day” web site pops up as

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<sup>†</sup> Much of the research on the projects described in this paper was conducted while the author was affiliated with Accenture Technology Labs; more information can be found at [www.accenture.com/techlabs/mccarthy](http://www.accenture.com/techlabs/mccarthy).

they both pass by a large, shared display (Figure 1), leading to a spontaneous and serendipitous discussion about the merits of old-vine zinfandels. After the discussion, they both go away, knowing a little more about each other, and are more likely to have conversations in the future.

One of the stumbling blocks we encountered in the initial design of GROUPCAST was how to acquire content that would be of mutual interest – indeed, content acquisition is one of the most difficult problems to address when dealing with responsive public displays. We considered using a large web-based form describing items of content that people could rate with respect to their interest levels. When people passed each other in front of the GROUPCAST display, content in the intersection of their interests would be displayed.

However, we soon discovered we had conflicting goals: having a profile representation that would be broad enough to include content of potential interest to a large number of people, and yet still be small enough so that we could reasonably expect people to specify that content, e.g., by filling out a form. By the time we had amassed enough potential content in our profile form, we were fairly confident that no one (besides those working on the project) would take the time to fill it out.

Our solution was to take advantage of another application (and display setting): UNICAST, a peripheral display in an individual's office that can display a wide range of interesting—but not extremely urgent or important—content that a person may not actively seek out on his or her primary computer workstation, e.g., events of interest, artwork, cartoons, and a range of X-of-the-day web sites whose content changes daily (see McCarthy, *et al.*, [2001]). By using UNICAST, rather than using the intersection of known interests of both (or all) people near the display, we could just display content that one of the people had already specified in his or her UNICAST profile. Although that content might not match the profile of the other people, it is still of interest to at least one person passing by, and may still generate the desired conversation between the passersby. Using the UNICAST profile, we can rely on people's own self-interest in customizing content that they will see regularly (in their office), rather than struggling with the somewhat less rewarding task of specifying content that only is available when they are in a public area.

Eventually, we'd like to investigate other ways of using the profiles, such as using an intersection of the profiles (returning to the original design) or the set difference between profiles (since that would ensure novelty on at least one person's part). We also look forward to investigating the contrast, if any, between what kind of content people want to see in their individual workspaces (UNICAST) and what they want to see (and share) in a public area (GROUPCAST); one of the shortcomings of our

initial design was insufficient sensitivity to the issue of privacy.

### INTERACTIVE WALL MAP

Maps often act as *attractors*: people naturally gravitate toward maps, especially when they are mounted on walls, and even moreso when they are large<sup>1</sup>. Map viewers often exchange stories about their experiences in different locations depicted on such maps, e.g., “I once lived here...”, “Here is where I was born...”, “We'll be going here on vacation...”, “I spent a year working on a project here...”, “The year before, the conference was held here...”, and so on. In many cases, these stories have associated content in the electronic realm, such as digital images, project descriptions or conference home pages, but this content is typically not accessible in the context of the interaction in front of the map.



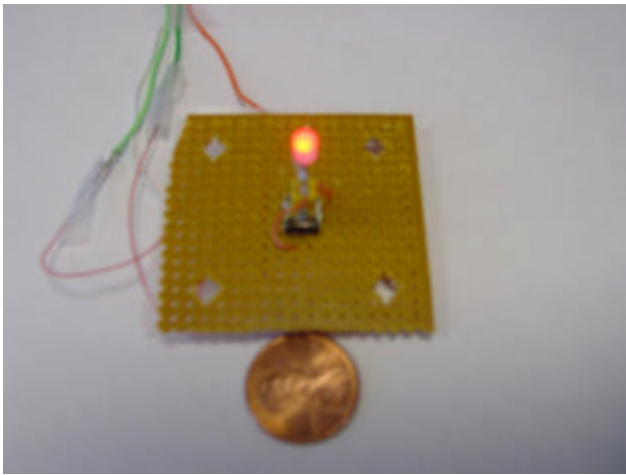
**Figure 2: Interactive Wall Map.**

We have created an Interactive Wall Map consisting of a set of six flat-panel touch-screen monitors and a collection of 24 LED-topped button switches embedded in a large (13' x 8', or 396 cm x 264 cm) wall map of the world (see Figure 2). The six monitors are paired up in three vertically partitioned geographical regions: the Americas; Europe, Middle East and Africa; and Asia / Pacific. The LED buttons (see Figure 3) are inserted into the map in the locations of some of the cities on the map that are of potential interest. An LED at the top of a button has three states:

- *off*: for power / LED conservation
- *green*: this location has some electronic content associated with it (not being displayed)
- *red*: content currently being displayed on a monitor is associated with this location]

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<sup>1</sup> The maps, that is.



**Figure 3: LED button switch.**

Although the main intended mode of interaction is for the map to respond in a background or peripheral way to the presence of people in its proximity, we have combined the LEDs with small button switches so that people can also use the map for foreground interactions by pressing the LED buttons in order to bring up specific content. This adds both input and output capabilities to the surface of the map in an unobtrusive way (at the expense of limiting the regions of the surface that have interactive capabilities to those spots where an LED button has been installed). Figure 4 shows a closeup view of a region of the map into which an LED button has been inserted.

The ButtonServer is a special-purpose application built to monitor and control the LED-topped button switches. The server maintains a SQL table to represent the state of the switches, with fields representing an identifier, a location, button status and a pointer to data associated with that location.



**Figure 4: LED button for Manila (red).**

The UNICAST profile framework is used to index content geographically that can be shown in one or more browsers running on the map's monitors. The initial version has a single profile that contains all geographically indexed content, such as digital images, weather reports, local headlines and regional stock quotes. The UNICAST control process continuously polls the table maintained by the ButtonServer; when it detects a 1 value in a button status field, it looks for content for that location, displays it on the monitor, and sets the corresponding button status field to 2. Thus, the table always represents the state of the LED buttons on the map.

In addition to the map, its embedded hardware and associated software, we also have an ArialView infrared badge system (see McCarthy & Meidel, [1999], for more information) in use, with badges that transmit identification signals every 2 seconds that are picked up by ceiling-mounted sensors in front of the map (and elsewhere throughout the lab). This enables the system to detect who is nearby and respond appropriately.

The next version will have different profiles for different people, so that when one or more people with such profiles are detected near the map, content can be selected from among these profiles, displayed on a nearby monitor, and the LED in the associated location(s) can be changed from green to red. The UNICAST framework will enable us to cycle through the geographically indexed content (conference web sites, digital images, calendar information) of all people near the map, or focus only on intersections, e.g., showing content on different monitors from profiles of multiple nearby people with the same geographical index. The buttons will also give us the capability to allow people to identify regions of interest, so that the displays embedded in the map can show content related to a particular place, rather than randomly selecting content from a broader region.

### RELATED WORK

A growing number of researchers are exploring the area of large public displays, and ways of interacting with them. However, most of them (e.g., Guimbretière, *et al.*, 2001; Russell & Gossweiler, 2001; Streitz, *et al.*, 1999) are intended to support focused collaborative activities in the foreground of the users' attention. Our emphasis has been on more casual usage, where the displays operate in the background or periphery of the users' attention

The Plasma Poster [Churchill & Nelson, ?] is intended to support more of this kind of background or peripheral information awareness among colleagues in a distributed workforce, but requires people to actively submit content. We have been exploring other ways to acquire content for public displays.

Our goal is to explore how content that is responsive to the people near these displays can spark conversations [cf.

O'Hara & Brown, 2001] and increase the sense of community among the passersby, who often share more in common than they realize.

## CONCLUSION

Our experiences with GroupCast and the Interactive Wall Map highlight issues that need to be addressed by any large, interactive (or reactive) public display.

### Identifying People or Objects Nearby

Public displays do not need to identify, nor respond to, people or objects in their vicinity, but knowing something about whom or what is nearby provides the potential to enrich the experience with such displays. We have had the luxury of an infrared badge system for the installations described here, but other technologies for identification would likely be needed for other, or more general, deployments. Examples may include mobile phones or radio frequency identification (RFID) tags. Note that identifying the objects people are wearing or carrying – such as fashionable shoes or a handbag – may provide as interesting an experience as identifying the people (“Ooh, there’s a pair of Hush Puppies and some Nike Air Jordans out there ... here’s some content that might spark conversation between their wearers...”).

### Acquiring Profiles

Identifying people or objects is the first step, but then we need to know something about them. For people, acquiring a profile is quite challenging, both because of *privacy concerns* (how much do you want to reveal about yourself on a public display?) and because of the *distribution of profile information* (can you point to any single source, or even a small number of sources, that provides a broad representation of your interests?).

### Acquiring and Maintaining Content

If something is known about the people and objects near a display, what kind of content can be found that may be of interest to those people (for the moment, we’ll ignore the issue of how to interest shoes and handbags)? If the public display is in a place that the same people regularly pass, updating that content so as not to bore the passersby becomes a challenge as well.

### Determining the Interaction

What kind of interaction – if any – should be supported by the display? There was no interaction supported by the original GROUPCAST, but as we added new “modules” of content, we found that people wanted to bring content home to their UniCast profiles (see Huang, *et al.* [2002]). The Interactive Wall Map has touch-sensitive surfaces: the flat-panel touch-screen monitors as well as the LED buttons

on the surface of the map. Technologies and techniques such as gesture recognition, eye gaze detection and speech recognition may expand the modes of interaction that can be supported by interactive public displays.

## ACKNOWLEDGMENTS

The author wishes to thank Theodore Anagnost, Chris Chung, Tony Costa, Elaine Huang, Eric Meidel and Joe Tullio for contributing to the various applications that are used in the current version of the Interactive Wall Map, and especially Xuehai Bian and Venkat Ramachandran who fabricated the LED button switches, inserted them into the wall map, and developed ButtonServer.

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