

UniCast, OutCast & GroupCast: An Exploration of New Interaction Paradigms for Ubiquitous, Peripheral Displays

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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 is possible that such developments will lead to more accommodating environments that encourage more frequent and beneficial interactions and a greater sense of awareness 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.

A physical space can also be used to convey information about people to others, thereby fostering greater awareness of each other's activities. For example, information targeted by users for shared use, such as the public portions of their calendar application, can be displayed on one's private display. A person viewing their display can learn that someone else in their group may be attending an upcoming conference or will be on vacation. Although it is possible for people to act on this information (asking their colleague about the conference), its primary purpose is to convey information that is often not shared in today's dynamic workplaces.

We have built three applications to explore the use and effects of peripheral displays in three different workplace contexts: UniCast, a personal display within an individual's office; OutCast, a personal yet shared display on the outside of an individual's office; and GroupCast, a shared display in a public area of an office building, preferably a lounge or discussion area. These will each be described briefly below, along with some of the user interface issues that have arisen in the design and implementation of these displays that are intended primarily for background (as opposed to foreground) interaction.

UniCast

UniCast is an application that allows users to specify content they would like to see on a peripheral display located within their primary workspace. In some respects, UniCast is an extension of PointCast™, which allows people to specify news topics and stock symbols about which they would like to stay informed while their desktop computer is in screensaver mode. UniCast is different in several key aspects: it runs all the time on a dedicated, peripheral display; it allows for a broader selection of content; it reacts to the location

of its “owner” via an active badge system; and it is tied into and makes use of content belonging to other UniCast and OutCast users. UniCast was designed to explore what kinds of content people would be interested in seeing on a peripheral display and investigate the ways in which people would interact with such displays.

Our model of interaction is primarily that of an ambient display [1] rather than the primary workstation display used for supporting a user’s primary work tasks. The hypothesis is that UniCast content would be interesting, but not terribly important or urgent, since important or urgent information is (or could be) sought out directly on the primary workstation. For example, the first author uses UniCast to cycle through his favorite on-line comics which help to brighten his day, but are rather peripheral to his work, and which he therefore rarely seeks out on his primary workstation.

The content for UniCast includes headlines and stock information as well as many other types of content. The current implementation includes user-configurable modules for each of the following types of content:

Web pages	Headlines	Stocks	Factoids
Weather	Horoscope	Flashcards	Announcements
Reminders	Artwork	Pictures	Webcams
Traffic	ActiveMap ¹	InfoShare ²	OutCast

Users first select a module to install and then add personalized preferences to the module. For example: for the web page module, any number of URLs can be specified; for headlines, there is a form with checkboxes for a listing news categories; and for weather, the user enters one or more U.S. zip codes. Each user’s modules and preferences are stored in their UniCast profile. UniCast randomly cycles through modules in the profile, generating content that is delivered to the user’s UniCast display for a fixed period of time (default is 15 seconds) before moving on to the next module.

UniCast content is viewed on a series of flat-panel displays we have installed in individual offices throughout our workplace. Each UniCast display is connected to the local network and includes a touchscreen. The touchscreen provides the user with minimal control of the display using a set of finger-sized VCR button controls. The user can pause the display, step back through recently displayed content, or resume operation. An additional control that allows a user to “beam” content on the display to their primary workstation for further exploration is under development.

Adding modules and editing module preferences in the UniCast Profile is done on the user’s primary workstation using a web browser. As the profile is modified, changes are instantly reflected in the content being delivered to the user’s UniCast display. This enables UniCast content to be displayed all the time on a device other than the user’s primary workstation. In addition to increasing UniCast’s usage and utility (initial UniCast observations indicate that usage and utility was greatly diminished when it was used on a primary workstation), it also provides the ability to maintain the simplicity of the device (eliminate a keyboard and mouse) while providing users with rich environment when detailed customization is desired. We hope to do a more formal study of people’s experiences with the system after a longer period of use.

The behavior of UniCast is tied into the infrared badge infrastructure in our office environment (see McCarthy & Meidel, 1999, or McCarthy & Anagnost, 2000, for more information). By sensing the owner’s location, the UniCast display toggles between two modes: home and away. When the user is in his or her office (*home* mode), UniCast displays content as described above. When the user leaves his or her office, the UniCast display switches to an *away* mode that either displays the user’s current location in the office (using the infrared badge system) or a message predetermined by the user.

¹ Active Map is an application that displays the location of people in an office environment based on information supplied by a network of infrared sensors and badges (see McCarthy & Meidel, 1999).

² InfoShare is a browser plug-in that allows users to send web content to not only people, but also a set of topics or projects to which people can subscribe. Unlike email, InfoShare enables people to subscribe to content areas (projects or topics) to which content can be directed without the need for the sender to know your interests. InfoShare content can be viewed at the subscriber’s leisure or through a variety of display mechanisms such as UniCast.

OutCast

OutCast is a variation on the UniCast theme. Whereas UniCast is directed toward a user within his or her own office space, OutCast is directed toward co-workers near the user's office. Rather than display information that is only of interest to the owner, OutCast displays information about the owner that is intended for others to view. In many ways, OutCast reflects a behavior that is pervasive throughout the office environment – the posting of articles, cartoons, photographs, and other paraphernalia on office doors. OutCast picks up on this behavior and moves it into the electronic realm, enhancing it where possible. The goal of OutCast is to foster a greater sense of awareness within a dynamic office environment where opportunities for socialization are infrequent or unsupported due to the tasks being performed.

The content for OutCast includes the following types of content:

Calendar (items marked public)	Project info & status
Pictures/cartoons	Personal biography
Message Box	Quotations/articles
Demonstrations of recent projects	

OutCast content is added and edited in the same manner as UniCast content – using a web browser on their primary workstation. One capability that OutCast has over UniCast is the ability to tie into existing enterprise applications and database resources. For example, calendar information is pulled from the centralized calendaring system for the office, and project and biography information is pulled from their corresponding databases.

OutCast content is viewed on a flat-panel display with a touch screen and network. The display is embedded in the outer walls of the user's office. Despite the similarity to UniCast, OutCast employs a distinctly different interaction paradigm. Whereas UniCast is largely passive, offering minimal interaction, OutCast has the ability to toggle between a passive mode, where content randomly cycles much as UniCast content does, and an active mode, where a user can interact with the display to navigate through and explore each module's content or leave a text message for the OutCast display owner. We are exploring ways add a video capture capability to the displays which would enable video messages to be left, and to adapt the displayed content to different visitors or classes of visitors, where visitors are identified via their infrared badges.

OutCast content is also available to UniCast users. Within UniCast, users can select which people they are interested in and what percentage of OutCast information they want to receive. For example, a UniCast user can specify that they want 80% UniCast content and 20% OutCast content. OutCast content will then be randomly pulled from the OutCast users they select. This enables OutCast content to be used in additional contexts.

GroupCast

The goal of GroupCast is to explore how various types of content can create opportunities for informal interactions in open areas in the workplace. By using our infrared badge system, we know who is near a large, shared display and can use information about those people or their ongoing conversation to display content that might provide opportunities for those people to start or enhance their conversation.

For example, Joe and Teresa do not know each other very well; however, the "Wine of the Day" web site pops up as they both pass by a GroupCast display, 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 to people. We first considered a large profile containing content that people could rate with respect to their interest level. 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 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.

After we launched UniCast, we had an insight: instead of using the intersection of known interests of both (or all) people near the display, just display content that one of the people had already specified in their 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 private workspace and what they want to see (and share) in a public area.

A planned extension to GroupCast involves the use of speech recognition software to contribute to and/or enhance ongoing, spontaneous conversations. By eavesdropping on conversations and spotting keywords, content related to the conversation can be identified and pulled from a variety of web sites. For example, a conversation about a political race might trigger GroupCast to display the latest tracking poll or political news headlines.

We are also interested in using speaker identification and/or emotion detection technology to allow users to "pick up" content from GroupCast displays by speaking to it. For example, when a user sees something of interest, they can say "Save this for me" and the content is automatically added to the GroupCast module in their UniCast profile or emailed to them.

Background and Motivation

Most environments are *passive* – deaf, dumb and blind, unaware of their inhabitants and unable to assist or engage them in a meaningful way. However, with the advent of ubiquitous computing – ever smaller, cheaper and faster computational devices embedded in a growing variety of "smart" objects (beyond desktop computers) – it is becoming increasingly possible to create *active* environments: physical spaces that can sense and respond appropriately to the people and activities taking place within them. Most of the early UbiComp applications focus on how *individuals* interact with their environments as they work on *foreground* tasks. In contrast, we are interested on how *groups* of people, as well as individuals, affect and are affected by *background* aspects of their environments.

The Active Environments research group at Accenture's Center for Strategic Technology Research (CSTaR) has developed a number of applications that create examples of active environments. Our first application, MusicFX [2,3], is an example of an active environment that senses who is present in a fitness center, knows the musical preferences of all its members, and chooses music that is best suited to the current set of inhabitants. We have subsequently explored new techniques for group preference arbitration [4] and other potential environmental contexts for adaptive music, such as retail stores and restaurants.

We are also developing new applications that focus on the workplace (rather than the workout place). One such application, ActiveMap [5], is a visualization tool that enables people to gain greater awareness of the location and activities of coworkers, creating opportunities for seeking out colleagues for informal, face-to-face interactions. Another application, EventManager [6], is an asynchronous awareness tool, enabling people to specify events of interest involving people and locations (e.g., “Tell me when Ted returns to his office”), so that users can find opportunities to find (ambush?) people with whom they would like to initiate face-to-face conversations.

Technology can have an isolating effect on people, as people spend more time with electronic gadgets and less time with other people. Our larger goal is to explore how technology can create, enhance and take advantage of group activities and relationships in the real world. We would welcome an opportunity to meet with other members of the CHI community to discuss any/all of these issues at the workshop.

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