Defining Ambience: Public Ambient Displays for Promoting Community Awareness

William R. Hazlewood, Kevin Makice, Kay Connelly
Indiana University School of Informatics
901 E. 10th St., Bloomington, IN, 47408-3912, USA
{whazlewo, kmakice, connelly}@indiana.edu

ABSTRACT
In this paper we describe work being conducting to better understand the design of *ambient information*. We define our own take on ambient information, and discuss a developing framework intended to help designers think about how to provide this level of interaction within their own designs. Finally we describe how we have been exploring these concepts in one of our own designs, which incorporates a public ambient display to promote community awareness and participation.

Author Keywords
Ambient Information System, Framework, Public Ambient Display

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
As many may know, the concepts behind ambient information have their genesis in Mark Weiser's "Designing Calm Technology." In this paper Weiser describes the first documented example of a public information display designed to be visually pleasing, while at the same time providing information that is non-distracting and easily ignored when other issues require attention. Weiser described these properties as part of a possible set of technologies that could make better use of the periphery of our perception of the world [8]. Since Weiser's initial work, a small number of researchers have experimented with the idea of ambient information, but with the growth of large-scale ubiquitous computing research, there is a renewed interest in embedding information calmly into the surrounding environment. However, despite growing interests, we still have little research regarding the best ways to design technologies that facilitate this sort of interaction. It is not clear how we should operationalize the concept of *ambiance*, or how ambiance plays a role within different contexts (e.g. public vs. private spaces, or, large vs. small spaces). In order to study the use and effectiveness of ambient information, we have decided to develop our own definition, and focus on a specific context, in this case, public ambient displays for building community.

-

RELATED WORK
Since Weiser's introduction to the concept of ambient information, several researchers have experimented with ways of supplying information at this subtle level of perception. One of the first explorations was at the MIT Media Lab with the ambientROOM [2]. By saturating an office cubicle with several different forms of ambient information, the researchers gave us a glimpse into what an environment with this sort of information might look like. In the area of singular public displays, [1] created a display that could output information by controlling the way bubbles moved through a wall of water. This gave us an impression of how aesthetics could be incorporated into the design to allow it to blend smoothly into the surrounding environment, and also how seemingly non data related artifacts could be used to present data. The Ambient Agoras group provided a more developed version of an ambient public display in [4]. This display consisted of a large wall with embedded LEDS that could be mapped to things such as the progress of a team, or the status of a project.

While these examples have been a strong inspiration to other researchers doing work with ambient information, they have yet to provide any solid frameworks or design principles to help inform other designers. We are hoping to contribute to this domain by providing a framework that describes the roles that different interaction attributes play in increasing a design's ability to facilitate interaction at an ambient level.

DESIGNING AMBIENT INFORMATION
Many of the difficulties encountered when discussing designs that can facilitate ambient interaction are due to the ambiguity of ambience as a concept. For example, consider one of the devices that purports to be an ambient device, such as the Nabaztag [5]. Many of the features offered by the "Ambient Bunny" involve alerting the owner to various pieces of information, usually by playing a sound or displaying a pattern of lights. There is a kind of inconsistency in a device that is supposed to exist in our periphery, but at the same time acts to alert us to specific events. Through our discussions, we have come to the conclusion that most ambient appliances suffer from this same inconsistency.

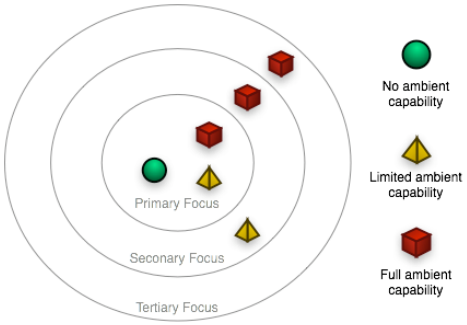

Figure 1: Artifacts can facilitate different levels of ambient interaction, allowing them to exist in different realms of attention

We have developed our own point of view that considering any artifact as being exclusively ambient or non-ambient is an inherently flawed proposition since the observer's primary focus of attention is never truly fixed. Instead, we are examining the ability of a design to facilitate ambient interaction as a property that may be expressed either highly or minimally. Designs can facilitate ambient interaction at varying levels depending on their relationship with the perceiver and the surrounding environment.

In terms of interaction, a person's field of perception may be broken down into three realms of attention: primary, secondary, and tertiary (Fig. 1), and different designs can facilitate interaction differently within these realms. For example, the word processor being used to write this text is designed such that it exists exclusively in the *primary* realm of attention while in use—it has no real ambient capability. By comparison, the instant messenger application, which is also active, has a limited ambient capability and facilitates interactions in *secondary* realm of attention. As the instant messenger application sits on the edge of the screen one can subtly perceive the animations caused by people logging in and out. From the symbols and ornamentation associated with the screen names, one can gain a low-level understanding of the status of all the contacts. These cues can be perceived indirectly, and one does not have to break attention from the primary focus of the word processor to access the low resolution bits of information. The *tertiary* realm of activity occurs away from the screen. There are people walking the halls, doors opening and closing, vehicle traffic outside, the smell of coffee, cold air from the vent, and the sunlight shining brightly through the window. Each of these sensations provide small bits of information about the overall environment. This input may be insignificant in isolation, but when aggregated it can add context to other seemingly unrelated information. Our position is that the goal of ambient information research is to better understand both the secondary and tertiary realms of attention so that we may make better use of them in our designs.

As discussed above, thinking of a design as existing exclusively in one of these realms of attention can lead to much ambiguity over the concept of ambience. It is more accurate to think of the *level of ambientness* as a technology's ability to shift forwards and backwards between these different realms of attention. Some implementations may have features that enhance or reduce this ability. From the previous example, the word processor may have *no ambient capability*, while the instant messenger application has a *limited ambient capability*. The instant messenger can be used directly in the primary realm of attention, but as discussed above, it can also shift into the secondary realm and still provide some level of information. Beyond this, it is not clear that the instant messenger, as it is currently designed, could occupy the tertiary realm, so we would not say that it has *full ambient capability*.

Developing a Framework

Since the features which enhance a design's ability to facilitate ambient interaction are not well understood, our goal is to develop a set of individual design attributes that combine together to enhance or weaken the design's ability to facilitate interaction in the secondary or tertiary realms of attention. The list could include attributes such as: *speed*, *type of motion*, *type of sound*, *level of detail*, *size*, *scope of information*, *relevance, glanceability*, and the *orientation to the perceiver*. As a platform to explore these attributes, we are investigating the design of a public ambient display meant to promote community awareness. It is our hope that by exploring the relationships between the different attributes described above, we will better understand how they fit within our framework.

CONTEXT: DESIGNING FOR COMMUNITY AWARENESS

Educators are constantly challenged to create an environment suitable for learning. This involves more than providing spaces in which to conduct classes and the technology to facilitate communication. We humans learn best when stress is minimized, and that happens when we are connected to those around us. Fostering community awareness is one way to pave the way for stronger student connections.

In the context of campus life, community awareness begins with dissemination of information—to be aware, one must be informed. This takes place in the form of email lists, web portals and printed fliers posted on bulletin boards. Pushing that information into a community space, however, is not tantamount to community members receiving and accepting it. Not everyone is always aware of the broadcast, and some may consider the way in which the information is presented as intrusive.

For the information to be processed as intended, a person must first be positioned to receive it. For example, to benefit from an email alert she would need to be a subscriber and have the message survive her spam filter. The information must also be personally relevant and received at the moment she is ready for it. If the subject line isn't an appealing description of the content, or if the recipient is rushing out the door to a meeting, the email message may never be read. From the sender's perspective,

the communication was successful. The receiver, however, may not even know it was attempted. Ambient interaction allows the receiver to dictate their relationship to the message, producing a greater potential effect from the communication and perhaps a stronger motivation to engage the community.

Twitter as an ambient platform

Microblogging, the term given to short status messages reporting on the details of one's life, arrived on the scene as a major communication channel in March 2007 when Twitter became the hit of the South-by-Southwest Conference in Austin, Texas. The young company set up large screens to display content provided by conference attendees, who signed up for the service in droves. Since then, several other microblogging services have tried to catch that same lighting in a bottle. Jaiku, recently acquired by Google, and Pownce are considered the biggest rivals of Twitter, but other entries into the new domain include Tumblr, MySay, Hictu, MoodMill, Frazr, IRateMyDay, Emotionr, Wamadu, Zannel, Soup, and PlaceShout. What separates Twitter from the crowd is a combination of timing, transparency and simplicity.

Twitter is a thriving community of both members and developers. The company engineered several ways to post and receive *tweets*, the short 140-character messages members publish into the information stream. Text can be published through the Twitter web site, an instant messaging client, or by texting from a cell phone. According to TwitDir (http://www.twitdir.com), Twitter boasted 510,550 public accounts as of October 13, 2007, about one year after the community officially launched.

A University of Maryland study published in 2007 captured 1,348,543 tweets from 76,177 members over a two-month period between April and May [3]. The researchers analyzed both content and network structure of their sample, concluding that there are four common user intentions for members on Twitter:

- Daily Chatter: talk about daily routines and activities.
- Conversations: use of the @ to specifically reference another member
- Sharing Information: inclusion of a pointer referenced in the tweet
- Reporting News: manual and automated reporting of new information, typically through mash-ups with RSS feeds

Twitter maintains a simple, open API. By emphasizing code transparency, the company has inspired widespread development of third-party applications. These unofficial tools cross platforms, integrate with other Web 2.0 systems, and contribute new innovations for how members can interact with the system. A fan wiki (http://twitter.pbwiki.com) currently lists 176 applications available for use with Twitter, including platform-specific support for Windows, Macintosh, and Linux. There are also tools specifically built for Second Life and for the iPhone. Applications range from visualizations of the public tweet stream to integrations serving specific communities, such as diabetics posting sugar intake to SugarStats.

One of the most promising interfaces to arise out of the open API is Twitterrific by Icon Factory. This desktop application works only on a Macintosh and accounts for about 9 percent of all tweets, according to the Twitter Facts blog [6]. While that is far behind the Twitter web interface (60.77%), Twitterrific is the leading third-party application despite its platform constraints. Arguably the most appealing feature is an ambient one, *glanceability*: Tweets pop up from the desktop application and remain for only a few seconds before disappearing. The level of interruption is minimal and requires no additional action to return to the previous state.

The nature of Twitter's personal information streams also expresses an ambient property. Taken individually, a person's microblog content comprises a longitudinal diary but contains information that is already known before it is posted. The relevance is high, but the information entropy is low. By comparison, the public stream containing all member tweets is noisy and without context. The entropy is now high, but the relevance is low. The sweet spot in between is the personal information stream, comprised only of a member's own tweets and those of the people she chooses to follow. Particularly when the in-degree (followers) and out-degree (following) are comparable, the tweets in the personal information stream are highly relevant with high information entropy. In other words, any investment in time to acknowledge new information will be seen as worthwhile.

EXAMINING PROTOTYPES

Our motivation for studying this sort of community awareness is to develop prototypes that embody aspects of our framework's attributes so that we can observe how subtle changes may make an implementation more or less capable of facilitating ambient interaction. Our method of exploration involves an iterative design of a Twitter visualization as described above.

Prototype 1: Simple Screen-Saver

For our first exploration into this prototype, we developed a simple screen-saver using Quartz Composer. The prototype worked by reading the most recent 15 entries from the twitter channel every few minuets, and cycling through the messages while they were in the queue. Some small aesthetic components were added to make the display less bland. For example, the background color would cycle through several gradients, and some text effects were applied to the messages as they appeared (Fig 2).

While the display was active, we found it was tempting to pay close attention to the content since it was never clear when a message would be repeated, if at all. The casual observer would not know that these messages were cycling through a queue every few minutes, nor were there cues to indicate the message's place in the queue. We derived that

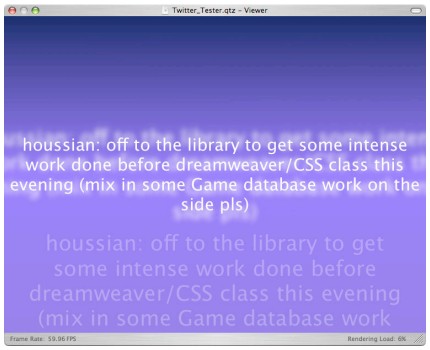

Figure 2: Simple Screen-saver

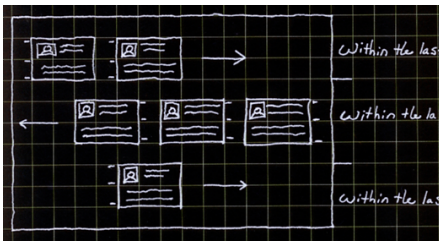

Figure 3: Scrolling Marquee (Low Resolution)

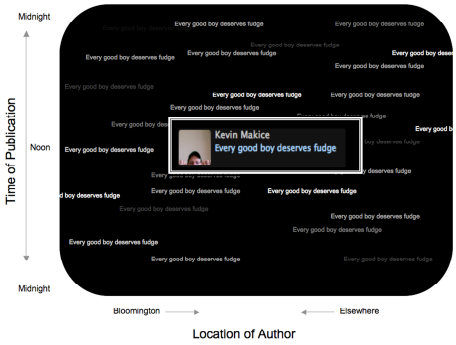

Figure 4: Scrolling Marquee (High Resolution)

one of the important features necessary for allowing ambient interaction is the ability to *ignore* information, and one can only ignore information if he or she feels comfortable that nothing of importance was missed.

Prototype 2: Scrolling Marquee Low Resolution

From our observations on the first prototype, we decided that data persistence was a necessary feature in facilitating ambient interaction, and should be added to our list of attributes. We mocked-up a a low resolution marquee where the information could slide smoothly and slowly across the screen, gradually moving from top to bottom based on the amount of time since the message had been created. We also added images of the message authors. From a distance, observers can quickly tell if the message was posted by someone of personal interest, or tell if a new member had joined the community. We think that this prototype will facilitate the ambient interaction better than the first, with the ability to better occupy the secondary realm of attention described above.

Prototype 3: Scrolling Marquee High Resolution

We began to wonder if we could encode more information into the design while still allowing it to facilitate somme level of ambient interaction. In a manner similar to [67], we want to differentiate the user experience in three zones depending on the distance of the observer from the display. In this prototype, up to 100 queued messages can be displayed concurrently. As content moves further back in the queue, the text begins to blend into the background, allowing recent posts to be most visible. Each message is also place on the screen vertically relative to the time of day it was posted and move horizontally based on the self-disclosed location of the author. When a new message arrive, the content shifts in both obvious and subtle ways. The new post is highlighted with additional information, such as the member photo and name, in a box to draw some attention. After several seconds, the box and meta information about the author fade until only the message remains, flowing with the rest of the stream. A new post also adjusts the array, which means a barely visible message is removed from the screen and all other text grows a little darker.

In this arrangement, the distance between the display and user afford different informational experiences. At the tertiary level (when the observer is at the opposite end of the room) a general shape and a pattern of horizontal movement is perceived. This may be sufficient to get a subtle sense of time and location of the community. At the secondary level (as the user moves within a few meters of the display) specific text becomes legible and key words or phrases may capture the observer's attention. At the primary level (the observer is in a position to interact directly with the display) a mouse, touch pad or touch-screen interface may be used to click on the display to see more information about the author and show connections to other posts in the queue.

DISCUSSION

It was clear from the first prototype that we had not considered the attribute of *persistence* in our framework. This leads us to believe that there are several other possible dimensions we may not have considered. The only way for us to explore the other possibilities is to continue refining Twitter visualization and note the effect each *tweak* has upon the design, and therefore the overall framework. We are hoping that this workshop will be a good forum to discuss our concept of ambience, and further explore the possible dimensions of our framework for ambient interaction.

REFERENCES

1. Heiner, Hudson, and Tanaka, “The information percolator: ambient information display in a decorative object,” 1999.
2. Ishii et al., “ambientROOM: integrating ambient media with architectural space,” CHI 98 conference summary on Human factors in computing systems, 1998.
3. Java, A., Finin, T., Song, X., and Tseng, B. (2007). Why we Twitter: Understanding microblogging usage and communities. Proceedings of the Joint 9th WEBKDD and 1st SNA-KDD Workshop 2007.
4. Prante et al., “Ambient agoras: InfoRiver, SIAM, Hello.Wall,” 2004.
5. Nabaztag, http://www.nabaztag.com
6. Twitter Facts, http://twitterfacts.blogspot.com
7. Vogel and Balakrishnan, “Interactive public ambient displays: transitioning from implicit to explicit, public to personal, interaction with multiple users,” 2004.
8. Weiser and Brown, “Designing Calm Technology,” PowerGrid Journal 1, no. 1 (1996): 75–85.