Aware Community Portals:
Shared Information Appliances for Transitional Spaces

Nitin Sawhney, Sean Wheeler and Chris Schmandt
Speech Interface Group
MIT Media Lab
20 Ames St., Cambridge, MA
{nitin, swheeler, geek}@media.mit.edu

Abstract

People wish to maintain a level of awareness of timely information, including presence of others in the workplace and other social settings. We believe this provides better exchange, coordination and contact within a community, especially as people work in asynchronous times and distributed locations. The challenge is to develop lightweight techniques for awareness, interaction and communication using 'shared information appliances'. In this paper, we describe the design of an exploratory responsive display projected within a shared workspace at the MIT Media Lab. The system uses visual sensing to provide relevant information and constructs traces of people's activity over time. Such 'aware portals' may be deployed in casual workplace domains, distributed workgroups, and everyday public spaces.

Keywords: groupware, perceptual interfaces, awareness, situated interaction, responsive media.

Situated Interaction in Transitional Spaces

To understand the role of shared community appliances and interaction in a public context, we pose a number of questions that may suggest different design approaches. Such issues are encountered in everyday community appliances which purposely draw attention in public spaces, such as information kiosks in train stations, or an electronic whiteboard in a meeting room. These appliances tend to be situated in the heart of an area, surrounded by peripheral and transitional spaces, which are typically highly frequented but under-utilized. We are interested in exploring means for enabling brief encounters with contextually relevant information in such transitional spaces, as a means for enhanced awareness within a community.

Why is information about context necessary within a community? One view is that information permits co-ordination and negotiation between community members, clarifying and democratizing their decisions. Another view is that it provides assurances about the social order and one's role in the community. It allows one to stay *in the loop*. Hence transparent public access to situationally relevant information about the community is a desirable goal. The Portholes project [Dourish92] provided distributed awareness via periodic images of others, helping maintain a sense of community. Piazza [Issacs96] supported spontaneous encounters based on shared tasks. We believe shared information in a community space may trigger richer interactions.

Whose needs in the community should the system address? A community is held together partially by spatial proximity, established social orders, and a set shared interests and goals. The question of who belongs in a community could be broadly defined to include its current physical inhabitants, as well as on-line individuals and visitors who may engage in it briefly. Hence shared displays must allow others a level of access, while preserving community standards for privacy and anonymity if desired.

When should a system in transitional space draw attention to itself? An information system that provides continuous alerts or requires active user engagement is distracting. Designing graceful shared systems that coexist with the environment, requires a means to detect when an appropriate interruption is meaningful, based on the context of its participants [Sawhney99].

How does interface and modality affect transitional use of space? Many systems tend to utilize high-bandwidth interaction or modalities in a manner that asserts their presence in the environment. We take the converse view that a system, which inhibits the original use of its environment, may have undesirable effects. Hence the presence of the system itself may draw undue attention or distract from the primary social activity of the environment. Lightweight interaction and ambient modalities allow greater cohesion with the environment. Use of human intuitions about social distance [Goffman63], as well as our kinesthetic senses, is underutilized in current systems. We propose using movement, proximity and glancing as a *transitional interface.*

Figure 1: The Garden workspace with projected display in the hallway

Aware Community Portals: Design Exploration

Social Setting: The Garden Workspace

The MIT Media Lab consists of both shared offices and open spaces for workgroups. The lab thrives on the interaction among and between such groups to maintain an active research and fluid social environment. However as the lab grows (physically expanding to several facilities) and people work at asynchronous times, it becomes difficult to maintain awareness and social contact with other researchers. We chose to utilize a workspace and 'social collective', called the 'Garden' as the primary environment for our exploratory project. The Garden hallway, which is frequented by many people throughout the day, faces the entire space and is visible by most people working there (see figure 1). The hallway like a street corner has a high incidence of chance meetings and spontaneous discussions [Whyte88]. This provides a good opportunity to utilize this transitional area within the Garden workspace for responsive display of situated information and awareness patterns, in trying to support long-term social interaction. Our current prototype deployed here explores these themes and serves as platform for design experiments. The system consists of a projected video display driven by a graphics-rendering engine on an Alpha workstation, live information provided by servers, and active sensing from a networked camera in the hallway.

Content Filtering and Shared Display

A content transcoding server (written in Perl) monitors news sources of interest to the community. *Slashdot.com*, a popular technology web-log, was chosen as an experimental news source, as many people in the Garden workspace visit the site frequently. New articles at the site are parsed and relevant information is extracted from nodes in the parse tree. The system uses this information to create a graphic rendering for each news story, optimized for the low resolution and other display constraints of the projection system (see figure 2). The portal display engine, written in ISIS [Agamanolis97] (a programming environment for responsive media), renders graphics and text as a video projection, and manages live information queued from servers. The projection periodically shows information such as clock-time, hourly cartoon-strips, and live data (news and weather) from the transcoding server. The system is being extended to incorporate the Garden mailing list and allow people to directly post timely messages to the portal.

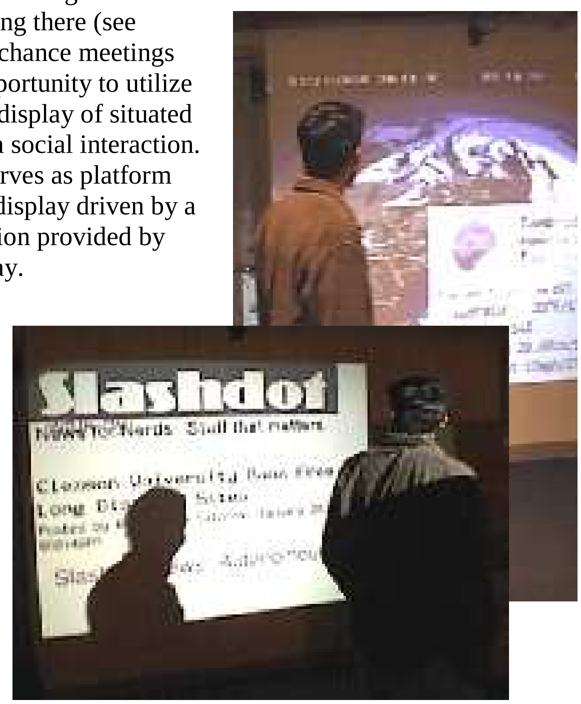

Figure 2: Transitional Interaction - a weather map triggered by the user walking by vs. a news article shown when the user lingers to browse. Notice a potential design element: shadows of prior viewers, cast on the article could be used to gauge community interest in current stories.

Proximity and Glancing as an Interface

To maintain a casual and natural interaction, user intent is inferred as they approach the projected display. A phased approach first displays an 'information glance' when new information arrives. When a person is seen *walking-by* the space, a sequence of recent articles are shown cycling through. If the person stops to *glance* at the display, a preview of the current story (news headlines or weather map) is shown for a short duration. If the person then continues to glance, the system assumes she wishes to *browse* the article in more detail, hence a sequence of related information is shown (see figure 2). After a person leaves, the display gradually fades away. The timing and duration of *information glances* and previews have to be carefully devised and synchronized with movement to provide fluid presentation and interaction without being overtly distracting or prolonging beyond a user's interest. A networked video camera mounted on top of the portal provides live video via a server to different processes that analyze the video. A video window on the top-right corner of the display shows the view seen by the camera both as a means of providing interaction feedback and assuring people of the purpose of the camera. Movement is detected via image differencing and thresholding techniques in ISIS. A face-detection system [Rowley98] monitors whether a person is looking at the display and triggers a close-up of the current article. A bounding box on the person's face indicates the system is tracking their face for a glancing action (figure 4).

Figure 4: Detecting a person glancing at an article and stepping closer to see more. By gazing at the camera for a longer duration, a person allows the system to capture his face.

Temporal Awareness Patterns

The portal is designed to allow people to maintain persistence of usage over time and provides a form of awareness of the presence of others during the day. One mechanism is to capture people's faces as they browse articles they are interested in. While glancing at an article if people choose to look directly at the camera (to indicate their interest), a bounding-box on the person's face grows gradually (see figure 4) allowing an opportunity to step back if they don't want their face captured. Once captured their face is shown on a timeline in the left corner associated with the article seen (see figure 5). This provides both an awareness of others who have browsed the article (and been around in that physical space recently) as well as a sense of the general popularity of certain articles.

Figure 5: A timeline of faces shown on a portion of the large display indicates people's interests in certain articles and also provides an implicit sense of awareness of whose around during the day.

In addition, an activity timeline at the bottom of the portal display (see figure 6) shows an on-going pattern of usage as people walk by and use the portal. Movement in the hallway (correlated with general activity in the workspace) is shown as small traces (squares) on the timeline. Faces captured while people browse articles are also shown (as reduced thumbnails) on the activity timeline. This provides a general sense of activity in the space and who's been around throughout the day. It is important to note that the system currently does not recognize the person whose image is captured (maintaining their anonymity to the system), however in the future such recognition may enable personalization of news content or tracking of user's interests (if desired).

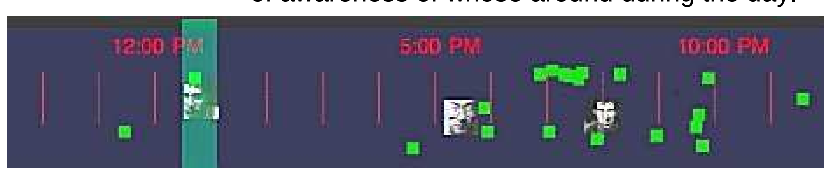

Figure 6: The activity timeline at the bottom of the portal display shows traces of activity near the hallway (squares) and the presence of people (faces) who browsed articles on the portal throughout the day. The highlighted area marks the current time.

Hence even with lightweight transitional interaction on the portal, a range of responsive behavior can be provided. Awareness cues can be implicitly captured and represented over time. Previously stored facial images were used in the Piazza system [Issacs96] to show other users browsing the same document on-line, whereas the portal provides awareness of people's interests and activities in a shared physical space over time. Informal usage of the portal shows that people are curious to use such a display in their workspace, however initially desire better cues (such as audio/visual or text-prompts) to enable them to understand the different modes of interaction. The glancing interface requires some familiarization and conscious interaction, hence should be improved. Users have a strong desire to post messages to the portal easily, in addition to the current web-based content. The awareness cues in the timeline engage people, however extensive observation over time is necessary to determine their impact on everyday communication and awareness in the workspace.

Conclusions

Publicly available information is predominantly accessed through private information appliances. For information of broad community interest, however, it may be more appropriate to integrate the information within the very spaces we occupy [Dourish97]. Such systems must have an unobtrusive means for sensing user intention and activity patterns while remaining sensitive to the privacy and cultural norms within a community. Our current prototype explores these issues within a workspace using transitional interaction techniques and a representation of awareness patterns based on visual activity. One can consider techniques for extracting high-level activities of people in workspaces from motion templates [Bobick97]. By providing more personal information to a shared portal, one may get more relevant information from the system and allow known others to get better awareness, however there is also a greater potential intrusion of ones privacy [Hudson96]. We need to consider negotiated protocols and interfaces that *perceive* and retain the level of privacy one demands in different situations.

A natural and useful extension of these 'aware-portals' is to provide awareness and communication between distributed workspaces. Audio/visual interaction protocols must be developed to enable spontaneous and situated communication opportunities between distributed portals. Providing shared community-postings and annotation on the portals may allow greater engagement with people in distributed locations. We believe a transitional place for shared information access and awareness within a workspace can be a valuable means to support coordination, negotiation and a sense of belonging.

References

[Agmanolis97] Agamanolis, S., Westner, A., and Bove, Jr. V. M. 1997. "Reflection of Presence: Toward More Natural and Responsive Telecollaboration," *Proc. SPIE Multimedia Networks, 3228A.*

[Bobick97] Bobick, A. 1997. "Movement, Activity and Action: The Role of Knowledge in the Perception of Motion." *Phil. Trans. R. Soc. Lond.* B (1997) 352, 1257-1265.

[Dourish92] Dourish, P., and Bly, S. 1992. "Portholes: Supporting Awareness in a Distributed Work Group." *Proceedings of CHI '92.*

[Dourish97] Dourish, Paul. 1997. "Extending Awareness Beyond Synchronous Collaboration." Position Paper for CHI '97 Workshop on Awareness in Collaborative Systems.

[Goffman63] Goffman, E. 1963. *Behavior in Public Places: Notes on the Social Organization of Gatherings.* The Free Press.

[Hudson96] Hudson, S. E. and Smith, I. 1996. "Techniques for Addressing Fundamental Privacy and Disruption: Tradeoffs in Awareness Support Systems." *Proceedings of CSCW '96.* pp. 238-247.

[Issacs96] Issacs, Ellen, Tang, J.C., Morris, T. 1996. "Piazza: A Desktop Environment Supporting Impromptu and Planned Interactions." *Proceedings of CSCW '96.* pp. 315-324.

[Rowley98] Rowley, H.A., Baluja, S., Kanade T. 1998. Neural Network-based Face Detection. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, Volume 20, Number 1, pp. 23-38.

[Sawhney99] Sawhney, N., and Schmandt, C. 1999. "Nomadic Radio: Scaleable and Contextual Notification for Wearable Audio Messaging." *Proceedings of CHI'99*, 96-103.

[Whyte98] Whyte, William H. 1988.City: Rediscovering the Center. New York: Doubleday.