

# What's Happening?: Promoting Community Awareness through Opportunistic, Peripheral Interfaces

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## ABSTRACT

Maintaining an awareness of information about one's own community and its members is viewed as being important, but is becoming more challenging today as people are overwhelmed by so many different forms of information. We have developed the "What's Happening" suite of tools to help convey relevant and interesting community information to people in a manner that is minimally distracting and disruptive, with little or no user set-up and interaction. The tools are more lightweight than e-mail and Usenet news, and opportunistic in providing information to people when they are not deeply focused on some other task. This paper describes these tools and the techniques that they use, as well as our observations of their utility and impact.

## Keywords

Community awareness, opportunistic interfaces, peripheral interfaces, informal communication, CSCW, multimedia

## 1. INTRODUCTION

Community awareness often refers to the degree that people generally know about each other, about social norms and people's different roles within the community, and about issues that affect the community. Maintaining awareness of the on-going changes in the environment and the attributes of people, in-between interpersonal interactions, helps build and sustain social networks, facilitates the collaboration in creative work [10], and contributes to the missing link for achieving the state of "readiness" [26] for such collaborations [3]. When members know a community well, orient toward each other and the group as a whole, and feel a strong sense of attachment to the group, a sense of community is achieved [30].

In a large or geographically separated organization, however, social as well as professional interactions are relatively more difficult than in smaller, colocated communities, and therefore are likely to be less frequent and less effective. In addition, although a growing amount of information about individual communities is becoming available in electronic forms that enable faster access, it is becoming more difficult to notice and process such information due to our inherent attention limits [31] and the overwhelmingly large amount

of related and unrelated information that is available to us [21].

The College of Computing at Georgia Tech is an academic research organization consisting of several hundred faculty, staff, and graduate students in different areas of computing. Due to space limitations, this community grew out of its original home building (HB) to occupy two satellite buildings, SB1 and SB2.

Although SB1 is only a short walk away from HB and SB2 a short drive away, this geographic separation seemed to contribute to several problems. For example, people in the community felt an emerging sense of distance and unfamiliarity, and they worried about the reduced chances for casual interpersonal interactions. In addition, community members wanted better visibility of other people's achievements, better involvement in community events, and better resource sharing. Many people expressed a desire for ways to foster a sense of responsibility among community members and improve the sense of community, even though a certain amount of separation was inevitable given the amount of growth that had occurred.

One might speculate that technology could help improve community awareness in such situations. In particular, a large body of research in Computer Supported Cooperative Work (CSCW) has been focusing on supporting distinct awareness that directly relates to collaborative tasks. These systems often shorten the perceived distances between team members by providing virtual presences of people, enable team members to contribute to targeted products across time boundaries, and offer fine-grained control of collaborative activities [12]. However, these technologies tend to be most effective in organized teams with common goals, where people are already familiar with each other. They often demand a substantial amount of attention from the user and participation often requires the user to spend a considerable amount of effort. Since community awareness is usually only loosely related (or unrelated) to any specific collaborative tasks and the benefits are rarely immediate, using these technologies to maintain awareness at the community level becomes distracting, sometimes even overwhelming.

Unlike solution-seeking groupware systems, as the CSCW systems mentioned above are often referred to, opportunistic interfaces aim to create lightweight and unobtrusive *opportunities* for information discovery and exchange. They present information in a timely manner without distracting the user's attention away from the tasks at hand. The user can make sense and make use of the information with a minimal amount of effort when such chances arise.

In this article, we introduce "What's Happening" (WH for short), a set of two systems designed to help promote awareness of information and activities in a local community. Most importantly, the tools seek to do this in an unobtrusive, peripheral manner. The first tool is the WH Communication-Bar, a small corner-of-the-display interface that deliberately cycles through local community and general interest information blurbs that it has gathered. The second tool is the WH Screen-Saver that presents collages of images taken from web pages on the local web servers.

In the next section, we first discuss related research, then we introduce the WH systems, providing design objectives, design evolution, system functionality, and implementation overviews. Finally, we summarize by describing observations of the systems' use.

## 2. RELATED WORK

A number of systems have influenced the design of our awareness applications. Buddy lists such as ICQ [16] and Lotus Sametime [20] are small applications that show simple online status of remote users through changing font styles or indicators. ActiveBuddy is a collection of software agents acting as intelligent "buddies" that automatically answer instant messages and provide requested information [2]. Buddy list usage, however, tends to be limited to existing relationships rather than support exploring information about the unfamiliar parts of the community. Furthermore, interruptions caused by instant messages can hinder the user's overall productivity [6].

Irwin [24], the Awareness Monitor [4], and Sideshow [5] aggregate dynamic information from multiple sources and use small graphical tags or views to signal the relevance, magnitude, or urgency of the changes. These tools still require notable screen real estate and demand a considerable amount of effort in order to specify what information is being monitored, decode what is presented, or find particular pieces of information in the display.

The once-popular PointCast and many other commercial "Internet Toolbars" show information in the edges or corners of computer desktops or in the screen-saver mode. We feel that the developers' profit-driven business needs are in conflict with the users' need of monitoring secondary information in the periphery of attention. The result is that these tools often use flashy animation to attract the users' attention away from their primary tasks. Furthermore, when co-existing with other applications on the user's desktop, these

systems (such as Tickertape [8]) often rely on continuously scrolling animation in order to fit long textual messages in one or two lines, also distracting the user.

Calm technologies explore interfaces that stay in the user's periphery of attention while still providing some value to the user and shift smoothly into the focus when necessary [32]. The water lamps and pinwheels [7] and ambient displays in ambientROOM [17] convey information in the background, using unobtrusive physical objects, reflections, and sound effects. Audio Aura provides auditory cues about tasks and colleagues while the user moves around in the physical work space [25]. These technologies do not distract users from other tasks or use valuable screen real estate. However, they typically provide low information bandwidth and require a certain amount of effort to decode and comprehend the information.

Systems such as the Apple On-line Newspaper [19], the Aware Community Portals [29], the UniCast/Out-Cast/GroupCast trio [23], and the Notification Collage [11] use personal peripheral displays as well as large public displays to bring on-line content into the physical space where people work or pass by. The information being displayed keeps inhabitants of the shared spaces updated on local community news and events, external news, and stories contributed by community members. It also gives people something to talk about when they are in the same place. These systems are best suited for organizations that have natural shared spaces and they often require more than a small amount of effort to participate or use.

Our web image collage service, described later, was inspired by the CollageMachine [18] and Mandala [14] which used collages to facilitate browsing large sets of images and corresponding web sites. Our image collage community screen-saver, compared to other image-based screen-savers, effortlessly and automatically presents dynamically changing information about our local community. Lastly, while we show web images in their original content to support quick comprehension, the Kandinsky System [9] uses artistic templates with stock images to produce aesthetically pleasing collages that may evoke some level of understanding of the suggested information.

## 3. THE "WHAT'S HAPPENING" TOOLS

Our primary goal in this project was to allow people to discover information about their community in a non-distracting, low effort manner. In particular, the following objectives drove our directions:

- Provide useful and interesting content. To jump-start participation and minimize user effort, the system should provide automatically generated informative content. The system also should support user-submitted content to allow more personalized direct input.
- Encourage open, cross-group communication. One can help expand people's social ties by fostering an open

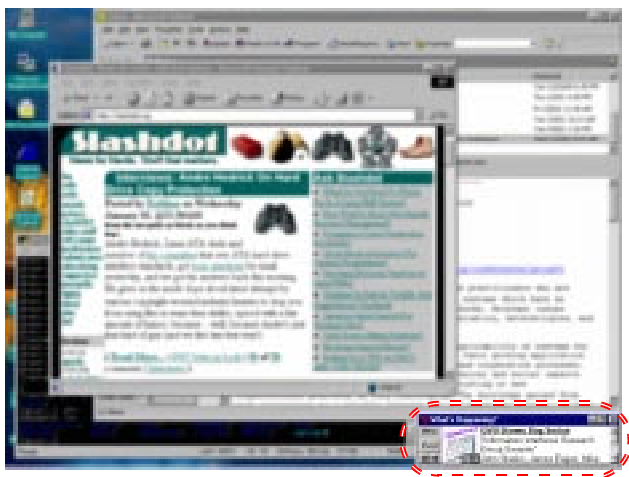
environment for cross-group communication [28]. In contrast, within-group communication may be better supported by more formal applications such as e-mail systems.

- Exhibit a simple and calm interface. Awareness tools need to stay in the user's periphery of attention when the person is not directly interacting with them. When the user is paying attention to the awareness application, the interface must be simple enough to allow the user to quickly finish what he or she want to do so the person can return to their primary tasks.

The "What's Happening" system consists of two main components, the WH Communication-Bar and the WH Screen-Saver. The Communication-Bar was designed to reside on a person's desktop and use little real estate. It deliberately cycles through pieces of community related or personally interesting information (an early version of the Communication-Bar was briefly described in [34]). The Screen-Saver shows graphics and text excerpts from pages on web sites in the community. Each of these components is described in more detail below.

### 3.1 The WH Communication-Bar

The Communication-Bar's user interface has a small footprint on a person's computer display, and is often suitably placed in the corner (see Figure 1). It is designed to remain visible and not be obscured by other windows. The system shows short "blurbs" of automatically collected local content such as official announcements and community events, as well as external ones such as news reports and weather forecasts (see Figure 2 for several examples). Each blurb typically remains active for a day or until it is removed from



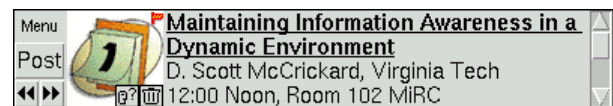
**Figure 1.** The Communication-Bar at the bottom right corner of the desktop. It does not use much screen real estate even on this 1024×768 display. In its default horizontal layout, the height of its main window is fixed at 66 pixels while the width is user-adjustable (340 pixels as shown here). The user can choose to lay out the interface vertically, in which case the height will become adjustable and the width will be fixed.

the corresponding data source. In addition, users can contribute content either by posting new stories or by "following up" on existing content in the built-in chat rooms. A user posting can last from an hour to a week. Chat Rooms, on the other hand, are automatically purged after being inactive for two hours.

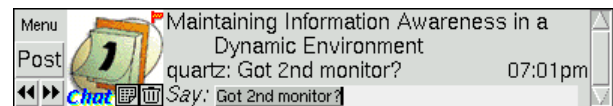
Blurbs are shown one at a time, in a cyclic manner. After displaying a blurb for a user-adjustable amount of time (default of one minute), and without any user input such as scrolling, the system automatically replaces the old blurb with a new one.

The Communication-Bar uses multiple levels of detail in the display of the blurbs. The most prominent visual feature is an image depicting the topic, source, or status of the current information, so that with a quick glance, a viewer can decide whether to pursue the information further or switch to other tasks (see Figure 3 for example blurb images). A red flag at the top right corner of the image signals that the blurb is being shown for the first time. The title of the blurb and a short summary provide the user with progressively more detailed information. In addition, the title of a blurb signals the scope of the information: local content uses a bold font, external content uses the regular font. Finally, the user can invoke a web browser to see the original full-text article by simply clicking on the title.

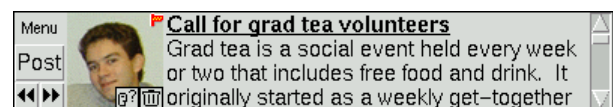
Small iconic buttons at the bottom right corner of the content image provide quick access to actions that can be performed on the current blurb. The trash can button removes the blurb so that the program will not automatically show it again in the future, even though the blurb is still stored in memory and can be accessed through a list of available blurbs. The head-and-question-mark button shows the activity level in the chat room for the displayed blurb: the bigger



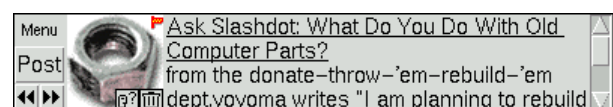
(a) An automatically collected seminar announcement.



(b) The chat room corresponding to the blurb in (a).



(c) A user-contributed blurb.

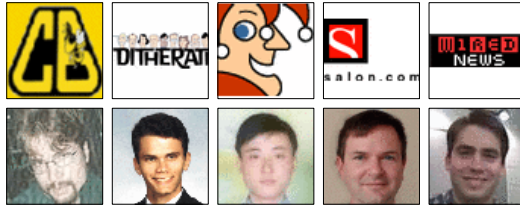


(d) External content: a Slashdot blurb in this case.

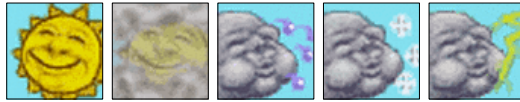
**Figure 2.** Example Communication-Bar blurbs.



(a) Images conveying the topic of the blurb.



(b) Images conveying the source of the information.



(c) Images conveying status such as the weather condition.

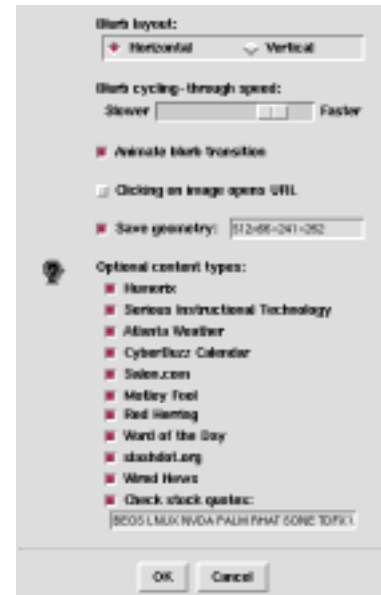
**Figure 3.** Example Communication-Bar blurb images.

and darker the head, the more recent that someone added to the chat room discussion. Clicking on the head-and-question button retrieves the corresponding chat room (as shown in Figure 2-b), which replaces the chat button with a document button that links the chat room with the web page for the original blurb.

The “Menu” button to the left of the interface displays menu items to pause or resume automatic cycling, list available blurbs, and show the preferences dialog.

The preferences dialog allows the user to customize the application to fit his or her needs (see Figure 4). A user can choose either horizontal or vertical layout, adjust how long the program pauses when displaying individual blurbs, select whether the transition from one blurb to the next should be animated or not, and specify whether clicking on the content image should directly bring up the web page. In addition, users can save the geometry of the application, thus enabling the main interface to appear at a fixed location on the desktop every time the program starts. Finally, the user can select the external information sources to monitor through the interface. Since community related blurbs should have higher priority than those from external sources, local content will always be automatically cycled.

The “Post” button on the main interface displays the post-a-blurb dialog that lets the user submit a new blurb by specifying a title, a brief summary, an expiration time, and an optional web address for any details (see Figure 5). Since the precise moment that a blurb expires in WH is usually not a critical matter, the Communication-Bar presents a few choices of expiration time instead of requiring the user to type in a time, hence reducing the effort involved in posting a blurb. The image shown to the left of the dialog will be displayed along with the submission. It can provide a space for self-expression in similar ways that the “zsigs” in Zephyr do for its users [1].



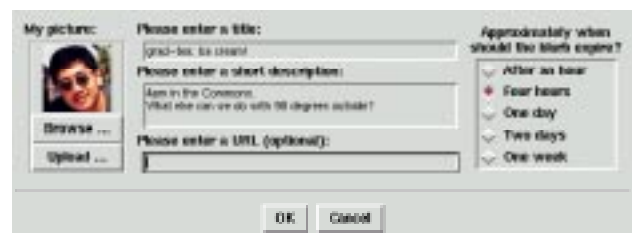
**Figure 4.** The preferences dialog.

Lastly, the two arrow buttons on the main window allow jumping to the previous or the next blurb in the cycle.

Even though there are many controls in the application, only a few of these, the most frequently used ones, are located on the main interface, thereby simplifying the appearance of the application. Furthermore, the primary method of use is to leave the interface in a corner of the display and let it quietly run. A new blurb replaces an old one in a smooth wiping animation that will be discussed further in the next section. The deliberate cycling of blurbs is meant to provide users with the opportunity of viewing an item when the person has a free moment or is in-between tasks.

### 3.1.1. Implementation and Evolution

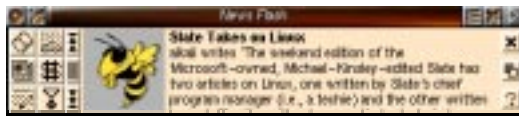
The Communication-Bar is primarily implemented in the cross-platform scripting language Tcl and its associated user interface toolkit Tk [27]. The awareness system consists of a server program running on a dedicated Unix machine and client programs running on users’ computers. The server handles collecting data and extracting content from local and external sources, broadcasting information to clients, relaying chat messages among the Communication-Bars, and cleaning up old content. The client program is responsible for receiving content from the server, filtering the blurbs according to user preferences, and presenting



**Figure 5.** Dialog for posting a new blurb.

them in an order that interleaves instances from different sources. The client also submits new blurbs and chat messages entered by the user to the server.

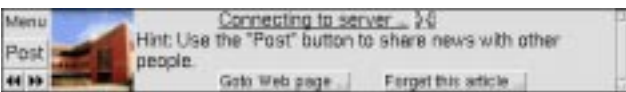
The development of the Communication-Bar was an iterative process [33]. Based on feedback from colleagues and users, we continuously reduced the number and complexity of interactive components on the main interface. For example, one of the early prototypes had a number of buttons for selecting from several categories of content to show. Another prototype used a tree-browser as the main display area for “expanding” or “collapsing” multiple blurbs. To reduce clutter and support quick, peripheral access, these features were later removed or simplified. See Figure 6 for a more detailed account of the interface design evolution.



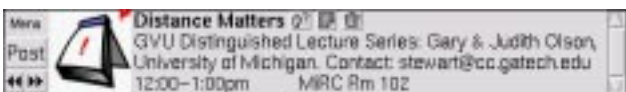
(a) The first design. The title bar showed the initial name of the application. The small iconic buttons on the left allowed the user quickly select the types of information that they might be interested in. The buttons on the far right allowed the user to quickly hide the application window or bring it to the front of the display. The text would automatically scroll up when the mouse pointer entered the application window. This interface was considered rather “busy”.



(b) The “What’s Happening” name was adopted in the second design and the number of content categories was reduced to two. The minus button collapsed the current article to show a list of all available articles. This design was still viewed as unnecessarily complex.



(c) Customizing the application, an infrequent activity, was supported through menu items and a preference dialog in the third design. The jump-back and -forward buttons were made horizontal to mimic those on home audio devices. Hint messages displayed at application start up replaced help documents. One drawback of this design is that the “go to web page” and “forget this article” buttons at the end of each blurb caused excessive scrolling.



(d) Text buttons were replaced by iconic ones in the fourth design and moved to the blurb title line. Since they still caused unnecessary scrolling, some of them were moved to the blurb image area in the current design.

**Figure 6.** Interface design evolution of the Communication-Bar.

How the application transitions from displaying one blurb to the next can affect the level of distraction incurred by the user. We suspected that directly replacing the current display with the new one or using the popular “tickering” animation as seen on TV programming would be distracting and therefore inappropriate. Since empirical studies of animations in awareness applications did not exist in the literature at that time, we prototyped several transition animations and presented them to trial users. We found that a wiping animation, which gave the illusion of the old blurb being “wiped” away to reveal the new one underneath, to be the least distracting and thus implemented wiping in the application.

Two separate research projects confirmed our hypotheses on the use of transition animation [22, 24]. They found that directly replacing old text with new is intrusive. Instead, using animation can help the application to stay in the periphery with minimal distraction. The studies also found that moving text is more difficult to read and more distracting than static text, which helped to explain why the ticker animation was considered obtrusive. Finally, discrete animation, which stops the motion for a moment when the information is in the view and resumes the motion at a later time, is less distracting than continuous motion. This supports our decision to pause between blurb transitions.

At the beginning of the development process, the Communication-Bar had a small set of automatically generated content items including the community calendar of events, local weather forecasts, and Slashdot news. Based on user feedback during initial deployment, we gradually added more information sources to the application, such as Salon.com news and user-customizable stock quotes from Yahoo!. The content server uses a common XML parser to periodically import content from web sites that have XML backends. For those without XML, we developed *ad hoc* algorithms to extract necessary information from the web pages.

To avoid community-related information being overwhelmed by more general information, it became increasingly important to add local content. However, some types of local information were relatively easy to collect automatically while other types were not. For example, a group of graduate students used a special mailing list to announce “happy hours”, a weekly off-campus social event. We set up an e-mail filtering rule to automatically forward the messages to the WH system.

Conversely, although community-related messages often appear in e-mail and newsgroup messages, developing a program to automatically extract the required information from an arbitrary text and decide its appropriateness for showing in WH is exceptionally challenging (essentially a natural language understanding problem). We use the notion of a content editor. This is a person who chooses and forwards messages such as community related news, events, and discussions not generally available through other com-



One accompanying objective of the WH Communication-Bar was to support the exchange of information not unlike e-mail or newsgroups, but to be more “lightweight” in doing so. For instance, the Communication-Bar is ideal for posting a message such as “My daughter is selling cookies to raise funds for school. Anyone interested?” Such a message might be viewed as “spam” in e-mail or news, but it is appropriate for WH where the information importance and required user access actions are both less than they would be with the other tools.

The Communication-Bar provides one form of local information such as announcements and discussions, but there also are other sources of information about a community and its members. One in particular is the set of local web pages about people's research interests, hobbies, travels, family, etc. With the proliferation of personal web pages though, it has become increasingly unlikely that people will browse the home pages of other community members. Thus, showing some of the information opportunistically without requiring much effort from the user may provide more chances for people to learn about each other.

One fundamental problem, however, is that images generally do not fit easily in a small space such as that provided by the Communication-Bar. As an alternative, we decided to utilize a screen-saver as a community awareness tool. First, we designed a server program to generate image collages. Each collage is a large JPEG image composed from smaller images that the server has collected from local web pages (see Figure 7 for examples). The program repeatedly creates different collages and copies each one to a fixed location on the network. Then, we developed a screen-saver client to periodically retrieve those collages from the network and display them on a screen.

Since the images embedded in or directly referred from a single web page are more likely to be related, a collage based on these images is more likely to form a consistent message, allowing a casual viewer to get a rough understanding of what the collage is about with a short glance.

collage server then creates a list of unique web pages that have been modified in the previous 18 months, arranges the list in a random order, and processes each page sequentially. For each web page, the collage server randomly selects items from the set of images associated with that page, ignoring decorative elements such as thin separators and small buttons to reduce clutter, and adds the selected images to a blank canvas to form a collage. If the web page has less than five images, the collage server inserts the first several lines of text on that page into the background of the collage to help convey the topic of the page quickly. If the canvas appears to be full, i.e., the sum of the areas of all the images added to the canvas exceeds a threshold, or if the total processing time for this collage exceeds its corresponding threshold, the server will stop adding images to the current collage. Lastly, the server draws the title of the page at the top of the collage and draws the location of the page at the bottom. It uses a shadow style to draw the annotations so that they are recognizable on both dark and light backgrounds.

[illegible]

**Figure 7.** Example local web image collages.

### 3.2.2. Image Layout

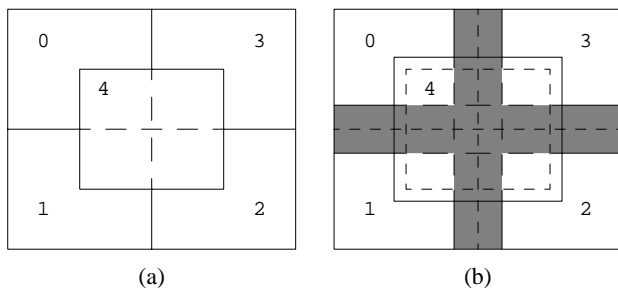
The initial collage server simply used the system built-in random number generator to calculate where to put an image into the collage canvas. Since the system random number generator only outputs deterministic pseudo-random numbers, the images tended to overlap and cluster on the collages. The resulting collages did not utilize available space efficiently and often were not aesthetically pleasing.

A second revision of the collage server used a simple layout algorithm to further spread out the images on the collages. The algorithm divided the collage canvas into four quadrants and added a fifth region of the same size to the center of the canvas. The regions were labeled from 0 to 4 as shown in Figure 8-a.

The collage server then added images to the five regions 0, 1, 2, 3, and 4 sequentially, iterating back to 0 after region 4. For each image to be added, the collage server scaled the image down to no more than 90% of the size of the region, if necessary, and placed the image at a random location within the selected region.

This division method reduced the amount of overlapping and the images in the generated collages appeared more spread out. Trial users, however, commented that collages including four or five large images were not visually pleasing. This occurred because the gaps between the images tended to become similar in size when laying out large images with similar aspect ratios. While the images were not laid out exactly symmetrical, viewers felt that the resulting collage suggested symmetry. Therefore, they concluded that the collage layout was poor. Other users commented that they did not like those collages because of their monotonous appearance.

The current collage server implements a modification to the spreading algorithm that expanded each of the five regions by 10% to allow a small amount of overlap across regions (see Figure 8-b). Reaction to this collage layout technique has been favorable, and people have noted that the new algorithm produces more attractive collages.



**Figure 8.** Dividing the collage canvas into five regions. Region 4 is drawn as if it is a semi-transparent sheet. The original regions are shown in (a). The expanded regions are shown in (b) where the dotted lines denote the original region boundaries and the shaded area represents overlapping among regions 0, 1, 2, and 3. Region 4 always overlaps with the other regions.

### 3.2.3. Value-added Collages

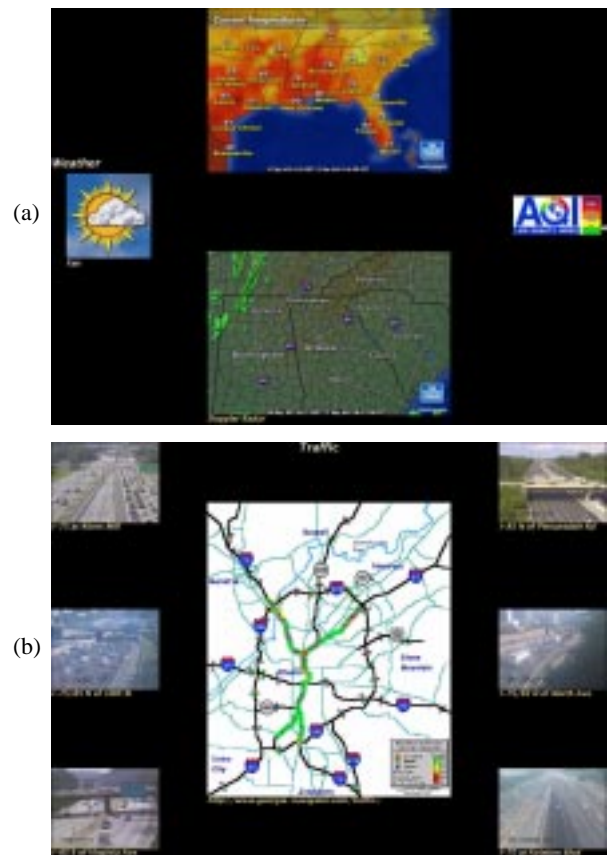
In addition to showing image collages that help people discover parts of the local community web space, the screen-saver gave us a chance to provide value-added services that may opportunistically help viewers in certain aspects of their daily lives. For example, every 40 minutes or so, the collage server generates a weather collage. This collage contains images from The Weather Channel that depict current weather conditions and temperatures, weather radar scans, as well as the current air quality index (Figure 9-a).

Between 4:30pm and 7:00pm on workdays, the collage server builds a traffic collage every 3 minutes (Figure 9-b). The higher frequency provides users increased possibility to observe traffic conditions, which is a more vital task during that time period. The traffic collage contains a traffic map highlighted by average highway speeds. It also includes images from highway cameras so that a viewer can assess traffic conditions visually.

Finally, the collage server is also a client of the WH content server. Thus, it generates a news collage based on a Communication-Bar blurb every ten minutes.

## 4. STATUS AND EVALUATION

The WH Communication-Bar and Screen-Saver have been in use for more than two years. Below we discuss lessons we have learned from the tools. Our reflections come from



**Figure 9.** The (a) weather and (b) traffic collages.

observations of actual system use in the community as well as an in-depth survey of 14 WH users and 55 non-users. As one component of the survey, we asked each person to rate their familiarity with different community activities. The results are shown in Table 1. Note that it is inappropriate to attest too much significance to a comparison of the ratings due to intervening factors, other potential reasons of causality, and the self-selection of WH users.

**Table 1:** Comparing answers to familiarity and sense of community questions. Ratings were given on a 7-point scale, where a rating of 1 represented “very unfamiliar” or “very bad”, and a rating of 7 represented “very familiar” or “very good”. The neutral rating was 4. The top number in each table cell represents the average rating, while the bottom number represents the standard deviation. The arrows highlight pairs of results that are statistically significantly different ( $p < 0.05$ , two-tailed Student’s  $t$ -test). Note that this survey included people in all three buildings and the responses were consistent across different buildings.

Question	Users	Non-Users
Familiarity with research events	5.6 $\sigma=1.45$	4.4 $\sigma=1.59$
Familiarity with social events	4.7 $\sigma=1.54$	3.7 $\sigma=1.60$
Familiarity with research in other groups	2.4 $\sigma=1.09$	3.4 $\sigma=1.57$
Sense of community in the local organization	4.1 $\sigma=1.41$	4.1 $\sigma=1.12$

Nonetheless, it is good to see that overall ratings and trends do seem to support some value in the WH tools. One exception is the lower rated familiarity with research of other groups. A possible explanation for this is that WH provides enough information to make users aware of the broad research initiatives of other groups in the community, but not enough to gain “familiarity” with the research.

We feel that more useful evaluation data came from open-ended feedback on the surveys and observations of actual system use. These findings are discussed below.

#### 4.1 Communication-Bar Observations

We estimate that approximately 60 people tried the application in the first several weeks that followed the initial deployment, with about 25 becoming regular users who kept the application running on their desktops at all times. These users largely felt that the system was valuable, but we were disappointed that even more people did not become regular users.

People used the multiple levels of detail in the tool to gauge what was shown and used the web link feature to seek related information when they were interested. Some users even shrunk the application window to only display the blurb image and the first few words of the title.

We observed that there were different styles of interacting with the Communication-Bar. Most people used the tool in a passive manner: they looked at the information display when they were waiting for a lengthy computing task to finish, when they wanted to take a break, or when they were generally not very busy and their eyes came across an interesting blurb by chance. None of the users with whom we have interacted permanently disabled the automatic cycling of the blurbs. As people became accustomed to the application, they also became less inclined to remove and hide unwanted blurbs in the presentation cycle.

A few people treated the WH Communication-Bar in a way similar to the morning newspaper: at the beginning of the day, they would click the forward button to go through all available blurbs and check if there was anything interesting to them. After reading the “newspaper”, their usage pattern usually became more passive, similar to other users’ patterns.

Users expressed that the Communication-Bar was fairly unobtrusive. Once they became familiar with the tool, they tended to forget about its existence when they focused on other tasks. Its interface and modest, deliberate use of animation appeared to help assure minimal distraction. One user commented that it was “the first community support tool that I’ve seen that is unobtrusive enough for me to actually keep it on my screen”. Another said that it was “a less intrusive way to keep up with information than, say, e-mail”. However, one person commented that being curious about whether there was new information available in the application could be distracting at times.

In a few cases, the Communication-Bar even stimulated real-world interpersonal interactions. For example, people expressed birthday wishes when they bumped into a community member because they saw the corresponding information earlier in the Communication-Bar.

Although several people had posted blurbs or engaged in chat room discussions using the communication-bar at the beginning, participation declined to the level of about one user-generated posting per month, not counting blurbs forwarded by the editors. People felt reluctant to participate because of several reasons: they did not personally know the general audience and whether their posting would be interesting, they did not know what would be appropriate, and they thought other people might post the same information, thus making their own posting redundant. A few users also commented that they did not know whether their postings were read and did not get the feedback to encourage them to post other information.

#### 4.2 Screen-Saver Observations

It was impractical to track the exact number of Screen-Saver users, but observational evidence leads us to estimate that the WH Screen-Saver had a higher number of users than the Communication-Bar. Many individuals installed the Screen-



Saver on their personal systems. We also set up several Windows NT machines in different labs to use the WH Screen-Saver as the default logon screen-saver. The logon screen-saver is activated when the system is not in use by anybody, i.e., when no one is logged in on the console. In addition, the WH Screen-Saver is shown on a large hallway display in our home building (see Figure 10). This way, the screen-saver becomes a part of the physical environment, delivering information to whomever passes by.



**Figure 10.** People intrigued by the web image collage while passing by the hallway display.

The Screen-Saver users showed strong individual differences in evaluating the utility of the tool. Some users liked the way that the images were placed. Others sometimes found the collages displeasing due to the randomness of the layout algorithm. Some users were satisfied with the depth of information displayed. Others wanted a way within the Screen-Saver to directly load the web page from which the images were collected.

Although people were generally interested in collages of local web images, there was much variability in their interest levels on the specific types of collages. For example, some users liked to see other people's vacation pictures while one user wanted a way to filter out these images.

A few non-users dismissed the Screen-Saver because they were usually never around when the Screen-Saver was activated. On the other hand, people who used the Screen-Saver had a slightly different work style — they often stopped to read, think, or deal with other activities next to the computers, which gave the Screen-Saver more chances to activate, and consequently they saw the Screen-Saver display more often. In addition, users who had secondary monitors commented that putting the Screen-Saver on the secondary displays made the application more enjoyable (a practice that is becoming increasingly common [13]).

People sometimes received information that they initially did not know. For example, one user was not aware that a certain member in the community got married until he saw the wedding pictures on the Screen-Saver. People also commented that the Screen-Saver had a certain entertainment

value. Sometimes they talked with other people about what they saw on the Screen-Saver.

People did not, however, report that having the Screen-Saver activated was a distraction to conversations with others. A few people commented that the Screen-Saver gave them something to discuss. Even though it did not seem to directly help their tasks at hand, they might indirectly benefit from the interaction in the future.

## 5. CONCLUSION

The development of the “What’s Happening” tools demonstrates two example designs of community awareness applications, with an emphasis on providing useful and interesting content through simple and calm interfaces. The evolutions of these examples contrasted the implications of two design choices — a Communication-Bar that co-existed with other applications on the user’s computer desktop versus a Screen-Saver that had exclusive control of the entire display area. In order to avoid distracting the user from other tasks and give the user a rough estimate of the information in a short glance, the Communication-Bar utilized a small on-screen size, a few simple controls, a layout that supported information presentation in progressive details, and a smooth, gradual animation that minimized sudden changes in appearance when switching from one instance of information to the next. The Screen-Saver, on the other hand, traded the capabilities of customization and screen-sharing in exchange for the advantage of being able to show large images to convey information that was otherwise difficult to describe. It focused on creating visually pleasing image collages and mixing image presentations from different sources to let the viewer discover interesting aspects of the community.

Our observations of trial system use showed that opportunistic interfaces can convey information in the periphery and unobtrusively enrich one’s information space without requiring considerable user effort. In addition, we learned that the effectiveness of community awareness applications depend not only on lightweight interfaces, but also the information content communicated through these interfaces. To foster community awareness, designers should couple awareness technologies with practices in the community culture, such as contributing editors that help create interesting content, set examples for other users, and encourage participation.

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