

Chapter 10

THE PLASMA POSTER NETWORK

Social Hypermedia on Public Display

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Abstract: The sharing of digital materials within online communities has increased significantly in recent years. Our work focuses on promoting community information sharing in public spaces using large screen, interactive, digital poster boards called the Plasma Posters. In this chapter we first describe our fieldwork-led, iterative design process, and elaborate a number of design guidelines that resulted. Following this, the design and development of the Plasma Posters themselves and the underlying network infrastructure is discussed. Finally, we present results from qualitative and quantitative evaluations over the course of a ten-month deployment of three Plasma Posters within our own organization, a software research community made up of technologists and designers. We conclude with observations regarding ergonomic, social and other factors that were raised during the design and deployment and offer reflections on factors in the success of this deployment.

Key words: community information sharing, interactive public displays, social networking, collaborative browsing

1. INTRODUCTION

Developments in networking and display technologies have resulted in the placement of many large-screen, digital displays in public places for advertising and information distribution. Recent examples include AdSpace Network's CoolSign, which "utilizes multimedia displays to offer advertisers a vehicle with the impact of print, the pull of television, and the immediacy of the web" and the London-based Progress Bar public display onto which

patrons can post images snapped with camera phones via the Meshbox wi-fi and Bluetooth access point¹.

Within the workplace, large screen, public displays are being used as memory aids (e.g. Fass et al., 2002), and to offer awareness of colleagues' activities within small working groups (e.g. Greenberg and Rounding, 2001). Pushing further into the domain of focused, collaborative work a number of public displays also capitalize on touch-screen interaction capabilities allowing collocated collaborators to manipulate digital content (Guimbretiere et al., 2001; Klemmer et al, 2001; Pederson et al, 1993; Russell et al, 2002; Streitz et al., 1999).

In this paper we describe our work on the design and deployment of the Plasma Poster Network, digital bulletin boards that display community-generated interactive, multi-media content as a mechanism for low-effort, collaborative browsing and informal networking. This work sits within the same design space as work by Snowdon and Grasso on the 'Community Wall' (CWall; Snowdon and Grasso, 2001; see chapter 11) and work by Houde et al on the Newslens community display (Houde et al, 1998).

These research efforts aim to situate displays in public places as a means of promoting information sharing, encouraging social participation and strengthening weak social ties (see Wellman, 1999; Wellman and Giulia, 1999 on the computer mediated communication and the creation and maintenance of social ties), and thus promote cross-fertilization of ideas and interests across groups. These goals are in keeping with those of many online community technologies (Schuler, 1996; Virnoche and Marx, 1997). However, while online community spaces do not assume physical proximity, but rather assume focused, solitary readers who are connected only in the "virtual" space (Calhoun, 1998), the XRCE's CWall, Apple's Newslens display and our Plasma Posters are inspired by the use of physical poster boards in social spaces (see Figure 1), and are designed for people who, at least on occasion, occupy or move through the same geographical location. Our aim is to blur the notional "boundary" between content sharing in the virtual and physical domains, by encouraging offline, face-to-face interactions around content that is generated online.



Figure 10-1: Community poster boards: in the laundrette; on the street; in the workplace

In the next sections, we present results from our fieldwork on the use of informal poster boards within several different communities, and within our own organization. Following this, we describe the design of the Plasma Poster Network and its deployment in our building. We conclude with reflections on some of the socio-technical challenges in the design and deployment of community bulletin boards, and some comments about the potential for distributing community content in public places.

2. INFORMATION SHARING WITH PUBLIC DISPLAYS AND ENVIRONMENTAL ANNOTATIONS

Street gang graffiti (see Castleman, 1982; Phillips, 1999) and billboard advertising are instances of textual and graphical annotation of the physical environment. They play a strong role in asserting the identity of a place, and more specifically reflecting the habitation of that place. Similarly, posted paper fliers are a form of asynchronous communication that utilise the physical environment as their canvas or stage. They take advantage of the movement of people through social spaces, and are thus part of “the interplay of human activity with the physical place” (Jacobs, 1999, page 6). Such poster boards are part of the fabric but not the infrastructure of a space; in Brand’s terms poster boards are part of the malleable “space plan”, with the posted fliers part of the “stuff” that “twitches around daily to monthly” (Brand, 1994, p13). However, while there has been much written about

billboard advertising (and the design of the physical environment to encourage interaction, social engagement and community identification (e.g. *streets*: Jacobs, 1961; Jacobs, 1999; Whyte, 1971; *public spaces, bus stands, waiting rooms, interior gathering places*: Alexander *et al.*, 1977; *work places*: Albrecht and Broikos, 2000), there has been little written about the placement and use of community poster boards within these social spaces, or on the effect of such community poster boards in promoting social ties and encouraging community identification². Therefore, our design process began with consideration of information sharing within communities, and in particular the use of physical poster boards in such communication practices. Observations from two field studies are presented below.

Our first study was intended to elaborate a design space for the design of digital poster boards, based on consideration of the placement and use of physical, poster boards in public settings. For the purposes of this study we defined “public” to be on a continuum from “unrestricted” (e.g. streets) to “restricted” (e.g. small group, closed workplaces). The second study focused on our own workplace, the site of our first technology deployment. Observations from this study were aimed at generating specific design instances as appropriate for our use community, but also to establish whether there was a ‘natural’ role for public poster boards as a content sharing technology within our lab; that is, if there was a potentially good “match” between the technology and communication styles within our lab (Bly and Churchill, 1999; see also Harper and Carter (1994) for an instance of a bad “match” between a social milieu and technology features).

2.1 Study 1: Community bulletin boards in public spaces

We investigated the use of poster boards in unrestricted, “open”, public spaces (e.g. cafes, sports clubs and streets) in three local areas (Palo Alto, and two districts of San Francisco), and interviewed six local community members about their use of and views regarding public poster boards. In addition, we observed the use of public poster boards within three workplaces as instances of the content sharing in public places in more restricted settings (a research center, a technology sales office and a technology start-up). Our observations focused on: (1) location and access; (2) content analysis of posted material; (3) useage; and (4) people’s perceptions of poster boards.

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Observations: Poster boards are located in waiting areas (waiting rooms, stations, bus stops), where people are relaxing (cafes) and in community spaces where people go to seek community information (local and neighbourhood libraries, community centres).

Content analysis of local community poster boards and interviews with local residents indicated that they provide an important communication function within communities, providing a means for people to seek and advertise viewpoints (e.g. support ecological initiatives), activities (e.g. join our band), events (e.g. come to the local Arts and Wine Fair) and services (e.g. babysitter wanted, carpool partners sought). Community members felt these boards provided an important function in demonstrating the vitality of their neighbourhoods. Loosely speaking, the boards provide a sense of the community “personality”, reflecting the preferred activities and the needs of the local inhabitants; poster boards in the Mission District of San Francisco advertised dance and cooking classes, English lessons and political meetings, while nearby Noe Valley poster boards sought and advertised babysitters, hiking partners, lost pets and yoga classes.

A major dimension on which boards varied could be characterized mapped well to online electronic bulletin board systems: from *formal and moderated* (items can only be posted by asking a “gatekeeper’s” permission; someone regularly “garbage collects”; items tend to be in prescribed formats) at one end of the scale, to *reviewed and informally monitored* (checked over regularly; sometimes cleared by various people), to *open* (anyone can post anything, in any format, anytime; old posters seldom cleared off). Posted items in the latter two cases tended to demonstrate by far the greatest variety. However, posting genres were visible: ‘accommodation wanted’ ads tended to be on small cards; announcements for events tended to be larger and on colored paper; items for sale were often accompanied by tear-off tags with phone numbers and email addresses; lost pet fliers were usually accompanied by a photograph.

Informal poster boards within three local organizations (two research laboratories and one technology start-up) varied in much the same way, lying between moderated and open. Content was less varied, and tended to be related to competitors’ activities, conferences, upcoming events, and recent news articles. Surprisingly, even in small organizations, people seldom had any idea of who had posted informal content. Within organizations, people were less uniformly enthusiastic about the presence of poster boards than the “external” community members we interviewed.

2.2 Study 2: Information sharing within FXPAL

FX Palo Alto Laboratory (FXPAL) is a software research company based in California, and is a subsidiary of Fuji Xerox, Japan. At the time of our study, 34 full-time employees worked at FXPAL. Of these, 25 were full-time researchers drawn from diverse disciplines (e.g. computer science, psychology, engineering, linguistics), 6 were administrative staff and 3 were technical support staff. In addition to the full time staff, there were 14 contractors/consultants currently working on projects, in full and part-time capacities. Student interns and visiting scientists are present during Summer months. Researchers tend to work in separate project groups; currently there are 7 such groups with little overlap in membership. The lab is located on the first floor of a two-storey building. All full time researchers have their own offices; contractors/consultants have offices or individual booths and interns have either booths or deskpace within a large, shared room.

Our study was in three parts. First, we mapped the lab space using floor layout charts, and observed/photographed activities in public areas and people's movement through the building. Following this we engaged 17 people in a photograph and text diary study with subsequent interviews about their online and offline information sharing practices within the organization, and about the presence and use of community bulletin boards within their home communities. Photographs and fliers people brought to the interview session were used as props to drive interview questions. We interviewed 2 administrative staff, 2 summer interns, 2 contractors/consultants, 3 support staff and 8 researchers. Interviews were semi-structured and lasted between 30 and 90 minutes.

Observations: In accord with other studies, our observations confirmed that people are not always at their desks, but are often locally mobile, moving physically around the building (Bellotti and Bly, 1996), and engaging in "water cooler", informal conversations (Whittaker et al, 1994).

Given our interest in content sharing in public spaces, we analyzed the use of *corkboards and paper postings*. There are 7 corkboards in the building; most are in corridors, one is located in the kitchen area and another in the mailroom area. As with the external community boards, each poster board has a different "personality"; one is dedicated to the display of items that are legally required to be on view (located in the mailroom), one is dedicated to newspaper clippings of interest (e.g. from the Nikkei Weekly), one is dedicated to conference and journal announcements, and the others are more informal, displaying jokes, ticket reductions for local events, and lunch menus.

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Observations indicated that people's interest is piqued by others' postings in the physical environment. Most of our interviewees thought they were a valuable resource and that the environment would be "sterile" without them. Boards that changed frequently were deemed to be most interesting and eye-catching, and that posted content was considered to reflect the "identity" and "milieu" of the lab. Events, such as presentations and visitors, and items posted on corkboards occasionally spark *in situ* conversations. People said they were sometimes pleasantly surprised to discover mutual interests with other colleagues when such conversations took place. The most read corkboards were those in areas where people were waiting or engaged in low concentration tasks such as waiting for printouts or coffee to brew, although hallway corkboards were also glanced at and sometimes referred to as people moved about the building. The 3 that are posted to and read most frequently are the conference announcement board, the newspaper clipping board and the kitchen-based, informal board. Four perceived problems with corkboards were expressed: (1) the presence of out-of-date materials – it is sometimes hard to tell what was still relevant; (2) interesting content sometimes "disappears" before it has been read; (3) it is hard to tell who posted material, so follow-up conversations are difficult to initiate; and (4) information on corkboards is not easy to copy and/or easily access digitally for later follow-up (e.g. URLs). This comment clearly reflected the fact that most information sharing occurs via computer. Therefore, to provide context for the use of poster boards as an information sharing resource we also interviewed people about other methods for information sharing.

As suspected, online sharing is common and, being seen as low overhead, given most people are working at their computers most of the time ("it doesn't take much effort to forward a link"). However, such online sharing tends to occur between members of *established* project and social groups. Little social mingling occurs through electronic media, and few opportunities arise for serendipitously discovering shared interests. *Email* is by far the most frequently used means of communication, although some people complained about email overload (cf. Whittaker and Sidner, 1996). Email is used for coordination, to share formal and informal information (e.g. jokes), send announcements, and share ideas and interests. Most emails are sent to small sub-groups and targeted individuals. When interviewees were asked about sending company-wide emails on things that may be of general interest, a reticence was apparent. Email is perceived to be socially risky and a potential intrusion into people's personal digital space, so people err on the side of caution. As one person phrased it, "I don't want to fill other people's email boxes up with things that may be of peripheral interest to them. People get irritated". *Intranet web pages* are used for general

administrative purposes and within projects for recording activities and research results. People seldom browse the intranet to learn about projects and colleagues' interests (one new person to the organization reported doing so). Use of the intranet tends to be for directed information access. *Presentations, seminars and reading groups* are used to share ideas about research areas and research results. On occasion, supporting materials are disseminated. Presentations tend to be company-wide, while participants in seminars and reading groups tend to be members of established teams. *Chats* in the hallways are a means of hearing about formal and informal information. These take place where people are waiting (e.g. the kitchen area, by printers), passing time (e.g. by the magazine racks) or doing low concentration tasks in public areas (e.g. photocopying, checking mailboxes) (Whittaker et al., 1994).

2.3 Summary and Design Requirements

Communication and content sharing with colleagues outside project and social groups is seen as valuable within our organization, but does not occur as frequently as is desired. We posited that digital poster boards could represent a new genre of informal, "lightweight" communication medium within FXPAL, leveraging the existing bias for electronic communications but providing a less intrusive method (not direct to others' InBoxes) for sharing content. The following more specific requirements were generated:

- Place digital community bulletin boards in high traffic areas and in spaces where people are waiting, "idling" or passing by.
- Consider ease of (physical) access to boards for reading (make sure people can reach interactive content)
- Design for low effort sociability; allow community members easy access to poster boards (make posting low effort by using tools for content sharing that are already familiar, such as email and the Web, see also comments by Houde et al., 1998)
- Create attractive, inviting interfaces where content changes regularly
- Associate content clearly with people who have authored/sent that content
- Provide an easy way to get overviews of what has been posted
- Allow duration of posting to be manually specified if desired
- Provide a means whereby postings of interest can be easily printed or forwarded (to others or to oneself)

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- Provide a community repository or memory of postings that may be browsed after public showing of the content has expired
- Design appropriate content moderation policies
- Support easy administration and garbage collection of posted content, both for system developers, and for community members

3. THE PLASMA POSTER NETWORK

Plasma Posters are plasma displays with interactive overlays that enable direct touch interaction. We placed three Plasma Posters in our lab, one in the kitchen area, one in a foyer and one in a hallway (see Figure 2). Inspired by the aspect ratio and layout of paper posters (Timmers, 1998), Plasma Posters are oriented in portrait format, distinguishing them from other plasma displays. Underlying the Plasma Posters is the Plasma Poster Network, a content storage and distribution infrastructure that posts content to all registered Plasma Posters. We first describe the interfaces that have been iteratively designed over the last year to suit the needs of our local community members, then offer a brief overview of the underlying infrastructure.

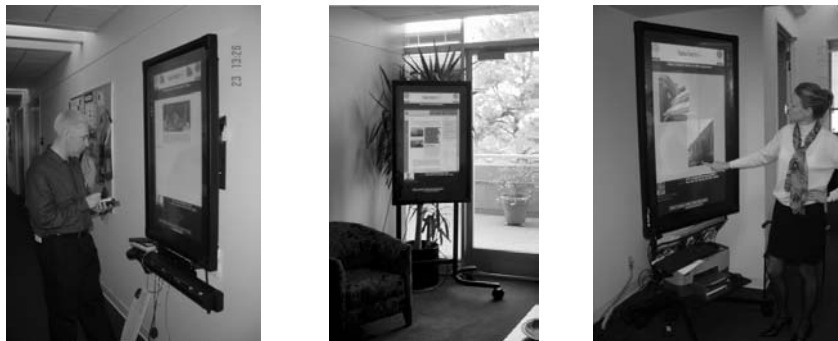


Figure 10-2: Plasma Posters are located in a corridor (left), a foyer (middle) and the kitchen (right)

3.1 Content, Interfaces and Reading Practices

Posting Content: The Plasma Poster Network stands in contrast to the deployment of advertising bulletin boards and digital poster boards, where non-interactive content is centrally authored and/or moderated, broadcast

and displayed for an audience of consumers in public spaces. Rather, content that is displayed on the Plasma Posters is generated from two sources: content that is explicitly posted by individuals, and content that is automatically retrieved from selected intranet Web pages (e.g. announcements of new technical reports, announcements of upcoming meetings). To support the former case, we have implemented applications that allow authenticated community members to email items as attachments (text, URLs, images, digital movie clips) or post items from a Web. In designing applications that leverage existing information sharing tools and practices, our intention has been to minimize effort and expertise requirements on the part of our community members; the requirement of such effort would, we believe, prove a barrier to use.

Displaying Content: Figure 3 shows the current “PosterShow” interface. The image on the left is a posting from a traveling colleague who has emailed images and some accompanying text as commentary. Any number of images can be posted; once displayed they can be zoomed, reduced and dragged. The image in the middle is posted text that has been formatted by the author. The image on the right is of a URL. Content can be scrolled and all links are live. Postings are by default removed after 2 weeks, but posting duration can be manually set. All postings and relevant meta-data (e.g. date of posting, duration posted and comments) are kept in the user’s personal profile, accessible from a Web page, so old postings can be reviewed and reposted.

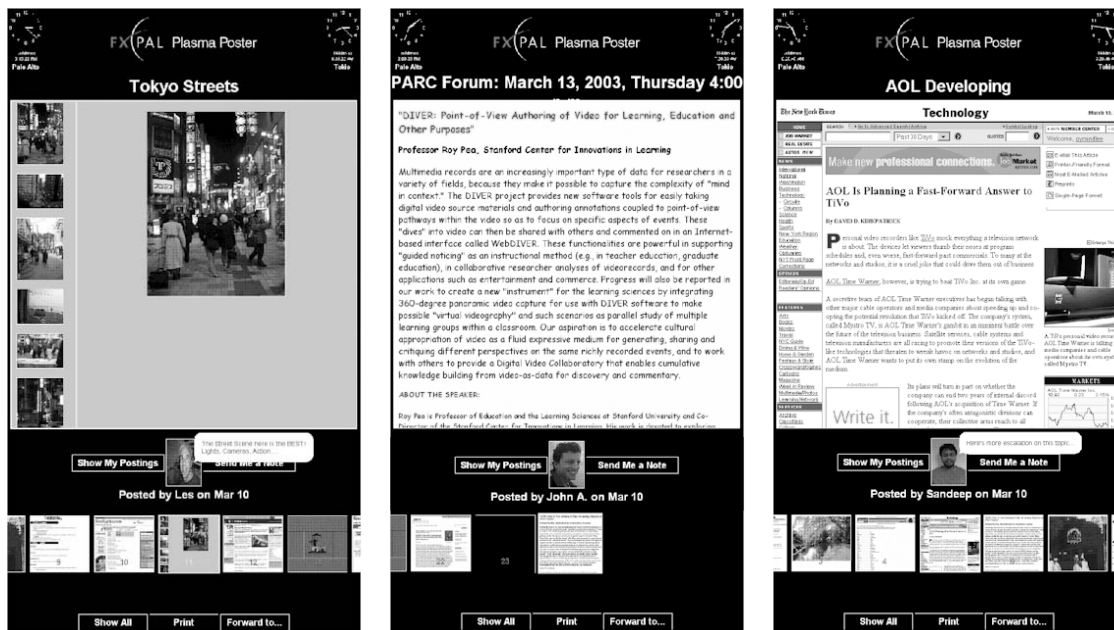


Figure 10-3: Examples from the “PosterShow” Interface showing posted images, text and a URL. Author comments appear in the speech bubbles by their photographs. Upcoming and recently shown content appears as thumbnails below the currently displayed ‘main’ posting. Buttons along the bottom bring up the overview of all content, print current content and support the forwarding to others of the currently displayed main content.

Reading content: Interactive, multi-media content on large displays in (relatively) public spaces is a different form of *reader engagement with text* than reading personal content from paper (O’Hara, 1996; Adler et al, 1998) or from a personal computer screen (Schilit et al, 1998). However, analytic categories discussed in these contexts map fairly well to interaction with content on physical public poster boards (e.g. goal or task driven: skimming and active reading; undirected: browsing).

Therefore, we have designed for the following forms of engagement with content:

peripheral noticing. Public displays are a form of peripheral technology – *until something catches one’s eye* when attention becomes focused and cognitive engagement with the text ensues. In the design of the Plasma Posters, effort has been expended in designing content to be visually attractive and to invite observation and interaction. To achieve this we have designed to display colors that stand out in the local lighting conditions,

designed animation and movement in the interface, and used fonts that are large enough to give some gist of the content from a distance. Rather than recreating the clutter of many physical bulletin boards, we have taken advantage of the dynamic properties of a digital posting board, and postings are cycled through automatically one at a time and displayed for 60 seconds. Given our focus on the social aspects of information sharing and our belief that an initial attractor for information is *who* posted it, all postings are augmented with contact information of the person who posted the content, the date/time of posting, and any additional audio or text commentary.

(inter)active reading. People manipulate posted pages on physical poster boards to be able to read content (lifting, moving aside). On the Plasma Posters, content that is displayed can be *paused*, *scrolled* and *printed*. Touching the display (e.g. when scrolling) or selecting the pause button reinitiates the 60 second timer. Given digital content is hypertextual, we support the following of live Web links. In physically embodied contexts, people remove postings; digital content on the Plasma Posters can be printed.

browsing and searching. People remove physical postings to see what lies beneath. When they have noticed something previously, they sometimes come back to explicitly look for it. On the Plasma Posters, buttons are available for manually moving *forward* and *backward* through upcoming and previously displayed content. Browsing and navigating all items in the current list of postings is possible using with the *overviews* (Figure 4).

messaging. People tear off tags and note down phone numbers, URLs and email addresses from physical postings for later follow-up. Items displayed on the Plasma Posters can be *forwarded* to others who may be interested. The author can also be emailed with comments.



Figure 10-4: Scrollable content overviews by person, by posting date and by content help readers at the Plasma Posters browse posted content

3.2 Implementation: Parsing, Storing and Distributing Content

The Plasma Poster Network is a client-server system (Figure 5) designed for the collection, management, and publishing of community content. Server components provide an infrastructure for sharing multimedia content within a user community. Client components provide a variety of reading and writing interfaces for displaying and interacting with content, as described above.

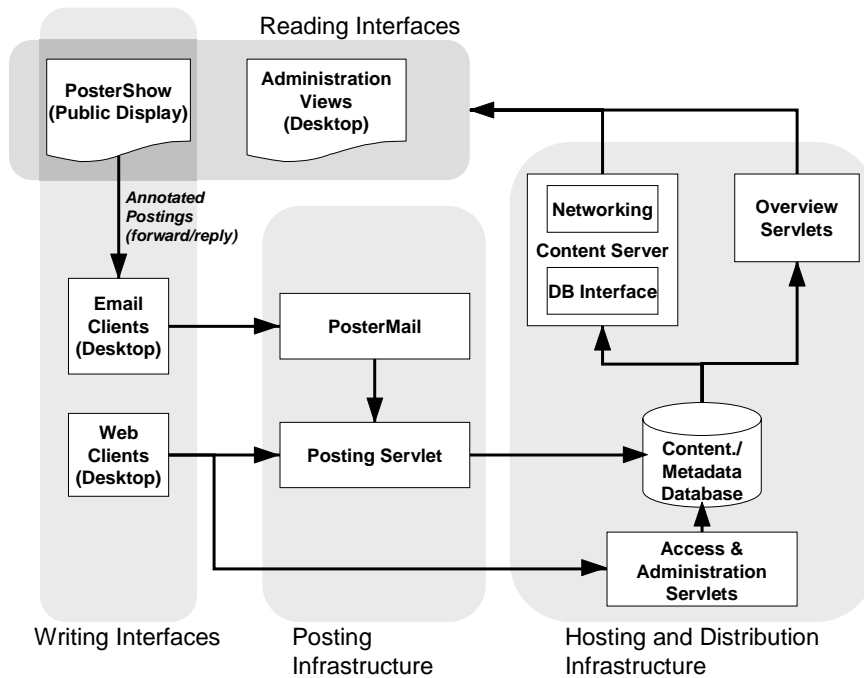


Figure 10-5: The Plasma Poster is a client-server system that supports community knowledge sharing

The Plasma Poster Network infrastructure consists of the following server components: a number of Java servlets that run in a standard Web server (e.g., Tomcat from the Apache Software Foundation) that manage the flow of posted content and user data into the system; a relational database for content and user data and metadata (e.g., MySQL from MySQL AB); a Content Server Java application program that controls access to the database using standard interfaces (JDBC from Sun Microsystems) and provides a remote Networking interface (implemented as a Java object and includes monitor and callbacks for pushing information updates to clients); and a number of parameterized Java servlets that extract content and metadata based on the needs of different client types (e.g., overview suitable for public displays such as interactive plasma display).

Reading and writing client interfaces have been incorporated into the system as standalone Visual Basic applications, Web-based programs

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implemented as Java applets, and dynamic Web pages using Javascript. These access community content through the server resource described above.

This standards-based, client-server implementation is used to provide the scalability and flexibility required for a heterogeneous information distribution system that has been developed while being deployed. Stress testing the system with 400 consecutive postings/deletions has been successfully made. Examples of the system flexibility include the 'hot-swapping' of different prototype interface clients while the system is in operation, and the ability to switch database and servlet software by changing configuration files. This has proven particularly important in supporting rapid prototyping and evaluation cycles with our user community.

The system facilitates the flow of information across the diverse sets of hardware and software upon which users conduct their online activities (i.e., linking email, Web interfaces, Web-based services, our own infrastructure services, and public and private device content representation services). The need to work within the user's preferred working environments has lead us adapt the behaviors of these other resources. Two examples in particular highlight this approach for *repurposing*. The PosterMail servlet parses incoming email messages that users spend minimal time formatting (e.g., drag, drop, send). Different content types (e.g., texts, movies, URLs, and collections of photographs) are detected and the content is appropriately arranged for presentation on the Plasma Posters (e.g., single frame, linked frames, or collages of content, with titles and commentary attached). Another repurposing is found in our PosterShow application that displays posted content on large screen, interactive, publicly situated displays. Posted content is rendered by a Web browser, but for public display we do not want the display to behave interactively in the same manner as a desktop browser. For example, many people post specific Web pages for further discussion; however, these Web pages may in turn be navigated, thereby leading to some confusion about what content is posted and what subsequently browsed. Our solution is to re-host the browser (in this case Internet Explorer) inside another application (our own Visual Basic program) and to trap and reprocess all user input events. In this way we can represent posted and browsed pages as distinguishable kinds of reading (e.g., showing all browsed pages in a separate overlaid frame).

We are currently using our infrastructure to develop and evaluate a larger range of reading and writing interfaces, including awareness and overview representations suitable for display on PDAs and other personal and desktop devices.

3.3 Use and Impact of the Plasma Posters

Data from 10 months' use of the Plasma Poster Network were collected (see Churchill et al 2003 for evaluations after 6 months' usage). In addition, qualitative evaluations have been carried out to document people's experiences, responses, and reasons for posting/non-posting; these were three interview-based evaluations (with 7, 10 and 8 interviewees respectively) and an email survey (with 23 respondents of which 13 had never or only once posted content to the Plasma Poster Network). Another interview-based evaluation is currently being planned. These evaluations have provided us with ongoing user feedback regarding interface design and system features. In addition, the evaluation data are pertinent to our broader research questions regarding the potential in fostering social interactions for large screen, digital, community bulletin boards. For the purposes of the data analysis, we posed the following sets of questions:

1. **Technology use:** posting and interaction with content: Will people *post items* to share with others in physical spaces? Will people *read digital content* in public spaces? Do people *engage with content* on the Plasma Posters, and if so, are there *patterns of interaction by location and time*? What are *patterns of posting*?
2. **Technology reception and impact:** Are the Plasma Posters perceived by members of the community (posters and non-posters) to be a valuable addition to existing methods of content sharing? That is, is content projected into the local physical environment seen as a *valuable addition* to existing environmental and desktop methods of content sharing (for example corkboards, email and Web pages)? What are the most *popular forms of content*? What are *reasons for posting and non-posting*? Does content in the physical environment *cue conversations* between colleagues?

3.3.1 Posting content

Eight hundred and fifty-nine postings have been sent to the Plasma Poster Network, with an average of 85.9 posted per month (sd = 28.7; min = 45.0; max = 137.0; median = 91.5)¹. Figure 6 shows the mean postings by month, and clearly indicates an upward trend for posting.

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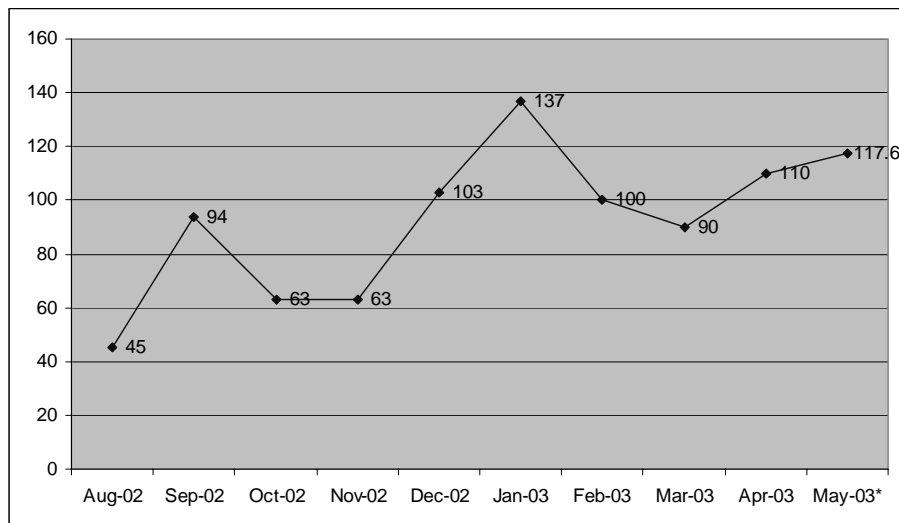


Figure 10-6: Number of postings by month over 10 month deployment period

Most postings are during the working week (Monday-Friday; mean = 167.8; sd = 18.2), rather than the weekend (mean = 10; sd = 3.0). There are no significant differences between the days of the working week in terms of number of postings. Content has been emailed to the Plasma Poster Network from traveling colleagues; interview comments suggest these postings are very popular; authors and viewers feel a presence within the community is maintained by these postings.

Content has varied from work-related to hobbies, and from general interest to company specific, including announcements of product releases and upcoming events, visitors, lunch menus and images from company events; 79% of the postings have been text or URLs, 21% have been images and <1% have been short movie clips. URLs largely consist of announcements for local and external events (e.g. conferences, movies, plays, sports), news items (unsurprisingly especially concerned with technology innovations), unusual examples of technology related products or designs, political commentary, interactive surveys (these range from comical, e.g. “Which Simpson are you?”; Edward Gorey’s GashlyCrumb Tinies; to discussion documents, e.g., National Geographic’s “Why Does Geography Matter?”), items of cultural or personal significance to the posting community member (e.g., favorite Web cams, unusual language use or customs), book reviews, and poetry. Jokes and satirical commentary are also popular; sometimes items indirectly refer to ongoing work or related

work, and to previous conversations. Barsoux (1993) has noted the role of humor in organizations, stating humans use humor “to criticize without alienating, to defuse tension or anxiety, to introduce new ideas, to bond teams, ease relationships and elicit cooperation”. The Plasma Posters offer a non-intrusive, socially lightweight, informal way to tease others and to share funny and satirical items as a stimulus for and/or reaction to conversations.

As can be seen from the above list, posted content tends to be for low urgency information sharing, and few items that explicitly invite transactions or interactions are posted (e.g. items for sale, requests for carpools). Interview comments revealed that queries regarding specific projects are still are sent via email to targeted individuals. Content that is posted also tends to be ephemeral; although people can explicitly extend the length of time something is available on the posters by setting expiry dates and/or can repost items, almost all items posted are left with the default setting and expire after 2 weeks.

Interview and survey data revealed that content sent to the Plasma Posters would “probably not be emailed” to the lab-wide email alias, as people felt they wouldn’t want to “fill up others’ mailboxes” with things that may be of peripheral interest. These comments suggest to us the Plasma Posters do indeed provide a complementary mechanism for content sharing within our lab. InBox cluttering from bulk email has been a common complaint in the organization even with work specific (e.g., technology innovation) or company sanctioned (e.g., product and organizational information) contents. This is not a complaint with the Posters.

The most common reason for not posting was that people felt they didn’t think others would be interested in their content (“I’m not sure what to post, my sense of humor is pretty different”; “my topics would be too boring”). Some people expressed that they tended to share content with smaller groups; lab-wide visibility was not something they were comfortable with (“with most things I would want to share with only a select group”; “I haven’t come up with anything that would be of interest lab-wide yet”).

3.3.2 Interacting with Content

We have logged 58,878 user interaction events from the three Plasma Posters during the past months. The mean interaction events per month is 5887.8 (sd = 4191.4; min = 380; max = 15685; median = 5360.5). We evaluated activity by the analytic categories outlined above, (inter)active reading accounts for 73% of all activity (scrolling content and following

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links; pausing content and printing); *navigation and browsing* for 25% (show all postings; resuming content cycling by pressing “Play”; show previous posting; show next posting) and *messaging* for 2% of activity (replying to content authors; forwarding content to others).

3.3.3 Interacting with Content by Location and Time

Location makes a big difference to interaction. 75.4% of all activity occurred at the kitchen Plasma Poster, 17.0% at the hallway poster and 7.7% at the foyer poster. Table 1 shows the mean number of interactions per day broken down by the different Plasma Posters, and by reading, navigating and messaging activities. People interacted with content that was on display on the Plasma Posters, but did not forward content or reply to content authors, although in interview people were intrigued by the potential of these features.

Table 10-1: mean and percentage interactions per day by poster and reading activity

Category	Foyer (Clicks per day)		Hallway (Clicks per day)		Kitchen (Clicks per day)		Total (Clicks per day)	
	Mean	Percentage	Mean	Percentage	Mean	Percentage	Mean	Percentage
Active Reading	32.2	75.5%	122.0	79.4%	148.5	72.0%	201.3	73.5%
Messaging	0.7	1.7%	6.0	3.9%	3.3	1.6%	5.5	2.0%
Navigating	9.7	22.8%	25.7	16.7%	54.6	26.4%	67.1	24.5%
Total	42.6		153.7		206.3		273.9	

Figure 7 illustrates that interactions at all posters has increased over time, with the kitchen poster being the most used. Again, this was in accord with our interview and survey findings. Few people reported reading content on the foyer poster or the hallway Plasma Poster. When asked why not, people said the foyer poster was “out of the way”, and the hallway poster was “too close to people’s offices”, where “it feels odd to stand outside someone’s office door and read stuff”.

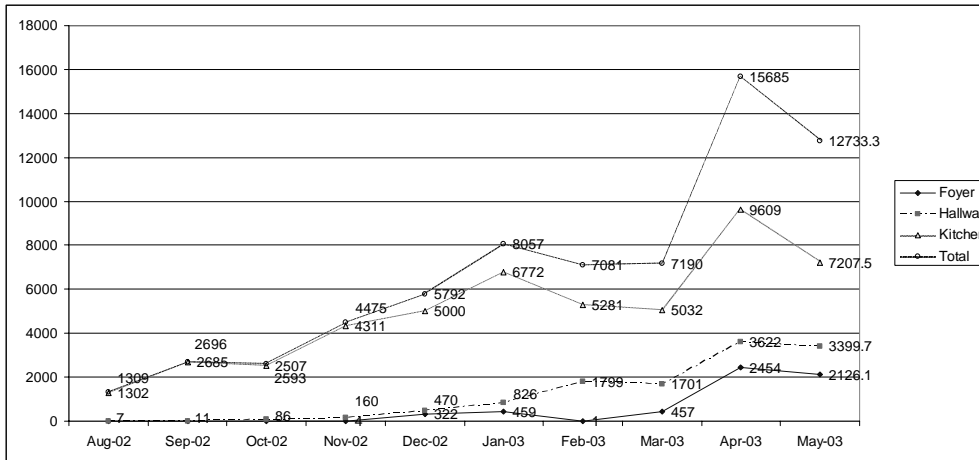


Figure 10-7: Total interaction events by Plasma Poster by month

Activity data reflect the working rhythms of the lab. Weekday interactions account for 99% of the data logged. Interview and survey data suggested people read content early in the morning and at coffee breaks, and this was reflected in our activity logs; activity peaks are at 10am, 3pm and 4pm, and activity tails off around 6pm (not surprisingly, as most people leave the building between 5pm and 6pm).

The category that is not reflected in our activity logs is *peripheral noticing*, as no touch interaction occurs when people are not (inter)actively reading, messaging or browsing. Observational studies are currently being carried out to measure the extent of peripheral noticing and distant reading (e.g., analyzing basic motion near a poster along with the interaction events), by content and poster location. Initial results show the kitchen area is the most traveled and populated of the three areas. It is also where people tend to “hang out”. While people glance at all the Plasma Posters, only glances at the kitchen Plasma Poster regularly lead to touch screen interactions.

Observations and logged data suggest that current affairs articles, technology news items, images and movies draw the most attention. Popularity of content is also driven in part by sender; content (especially images) posted by regular posters of “quirky content” and by absent colleagues is very popular. Not all content starts in digital format; several postings have been scans of paper materials.

3.3.4 Perceived impact

Surveys with follow-up interviews conducted when the Plasma Poster had been deployed for 6 months revealed a positive attitude towards the posters; preliminary results from more recent discussions suggest this is still the case. At 6 months, survey respondents said they had read items posted to the Plasma Poster, and 19 of the 23 said they had conversed with people about posted content. Many said conversations occurred when they were with others in front of the Plasma Posters, but 13 said they also conversed with others later about content they had seen on the displays. One respondent said “I often talk about stuff I see on the Plasma Posters, more usually with friends outside of work in fact”. Two people said they had posted content to the Plasma Poster Network as part of an ongoing discussion. Although we cannot measure whether the Plasma Posters have increased informal interactions in the lab, we took reportage of these “conversational threads” as support for our assertion that the Plasma Posters spark conversations.

People commented that they liked finding out about others’ interests. As one person phrased it, “I like seeing other people’s interests and foibles, plus there is often quite a lot of interesting and relevant information in there”. Another said, “I like coming across things I would not see otherwise”. People also liked getting postings from absent and remote colleagues (“it is nice to find out what they are thinking about or doing”; “it is great to see their face on the display”).

Survey respondents were asked to comment on whether they saw value in having the Plasma Posters and if they would miss them were they to be taken away. All but three of our 23 survey respondents saw value in having the Plasma Posters, and were in favor of retaining them. Comments included: “I would especially miss the pictures posted by people who are away and I like seeing pictures of things people have attended, like conferences”; “I would miss having topics to talk about when it goes quiet at lunchtimes”; “I would miss interacting with people on topics posted on the poster”; and finally, “I would miss tidbits and insights into people’s personalities and what interests them”. By contrast, one person (a non-poster) said they would not miss the Plasma Posters because they felt the posters actually *detracted* from spontaneous conversational topics arising over coffee breaks and lunch because conversational topics naturally drifted to what was being shown on the Plasma Posters.

The Plasma Posters were not valued equally. While 20 of our survey respondents stated they would miss the kitchen Plasma Poster, only 4 said they would miss the hallway Plasma Poster. Three people said they would miss the foyer Plasma Poster, and 3 others said they thought it is good for

visitors. It has taken time for the technology to be accepted, and for people to want to use it. One regular poster said although they had been unsure what to post at first, once they had started doing so “it was addictive”. Recent informal conversations suggest the interest in the Plasma Posters continues to grow.

More recent comments have been offered in preliminary conversations to another interview-based survey. Our users feel like the Plasma Poster is a “direct” community content sharing tool, and contrast this to technologies where content is only automatically selected from selected Web sites and content repositories. Our users appreciate the diversity of content that is displayed, and indicate that finding out about interesting *sources* of information is as useful as the specific content that is posted. Many postings contain games and artful demonstrations that feed into the already existing appetite for jokes, games and whimsical multimedia amongst company members. Finally people appreciate the display itself and the fact that it is large and not “owned” by any one group. This is in accord with Bellamy et al (1998), who state their display made sharing “... not feel like ‘work’” but feel “lightweight and fun”. Comments we received included “the posters are in open territory, it’s noone’s turf, so you don’t feel like you’re interrupting to share or talk about something.”

3.4 Summary

Observations have made it clear that the Plasma Posters have become an everyday part of life within FXPAL, and have increased social interaction between members of the lab.

Discovery of overlapping interests has been reported and posting ‘chains’ (posting in response to others’ postings) have been observed. Content that in the past has been sent to small friendship and project groups has been posted to the Plasma Posters. Of course, previously popular means of content sharing (i.e. email) continue to be used. However, interview data suggested that some content sent to the Plasma Posters may not have been posted at all, suggesting we have created a space and means for sharing *new* kinds of content between lab members. In this regard the Plasma Posters are a new communication genre within our lab (Yates and Orlikowski, 1992).

Members of our community are active readers, following links and scrolling through postings; at present forwarding content, printing, messaging and replying to content authors is rare, although people are positive about the potential for these features.

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Location is a big factor affecting the ways people interact with content on the boards. There are more consumers than producers of content within our organization; some people post regularly, while others have sent no postings despite liking the technology. This finding is in keeping with others' observations of online community participation (Nonnecke and Preece, 2003).

4. DISCUSSION

Before drawing general conclusions we would like to reflect on broader design issues that have arisen during the deployment of this public-space, community technology with regard to the *ergonomic factors* (physical, behavioral and cognitive ergonomic factors), *technical factors* (both the prototype requirements and the supporting technical infrastructure of the deployment location, i.e. are there power sockets available?), and *social factors* (knowledge, expertise, relationship dynamics, broader civic/organization context).

In terms of the ergonomic issues explored for the current deployment, we have made efforts to ensure the Plasma Posters are *effective* interactive, public displays. We have addressed issues of screen height, lighting and glare, font and button size, and color saturation on the display. Sensitivity to visual pollution has been essential; certain animations and dynamic screen changes have proven disturbing to some viewers. Sound pollution has also been addressed; initially all Plasma Posters had speakers, but these have been inactivated at the request of our users. Interface design has proceeded with consideration of how to effectively signal functionality and invite interaction, without implying features that are not supported. Given we have a highly technical community, it has been a challenge to restrict interaction to our design intent without incurring frustration; on occasions members of our user community have wanted to appropriate the plasma displays as collaborative, digital workspaces, or as large screen interfaces to personal computers. On the other hand, as is always the case in design, there are tradeoffs; just as these behaviors derive from their comfort with technologies, their expertise has also meant they are tolerant of prototype failures, vocal with feedback and helpful with debugging.

While these considerations pertain to the design of interfaces, or the "public face" or "skin" of the technology, it is also clear that the technical infrastructure of the lab has been crucial in the success of the technology. Without the ability to easily access power sockets, utilize existing mail servers, take benefit from our high-speed intranet, draw on the expertise of

our technical support team and so on, the integration with existing tools and practices far more difficult. The impact of this foundational infrastructure has already become apparent as we design for an upcoming external deployment.

Although deploying within our organizational setting has meant maintaining a sense of corporate professionalism that may not be so important in other settings, it is clear that the restricted physical setting and the relative informality of our workplace have been central to the success of the technology. We have a minimal content moderation policy, relying on social accountability to ensure appropriate content is posted. This works solely because of a shared sense of content appropriateness; in other situations this shared understanding may well not exist and stricter guidelines and posting policies would need to be enforced. Having said that, our workplace has permeable boundaries, and, on occasions (3), we have been asked to remove material to avoid possible offense to visitors, or because company sensitive material was alluded to in a posting. Interestingly, when problematic content was posted, it was seen by some of our users as a problem caused by the existence of the *technology itself* and not an issue to be raised with person who posted the content.

In considering the issue of appropriate content, as we move toward distribution of content to remote (and possibly culturally very different) locations, content moderation becomes more important. In our current deployment situation there is enormous overlap between online and offline community membership and all members are familiar with the social and physical locale. People's ability to envision the audience for their content when they are distant from the physical location of its appearance is limited. Thus, by making it easy to post without going to the physical space, we are also making it easy for people to be inadvertently (or intentionally) socially inappropriate.

Finally, we would like to speculate on reasons for the successful adoption of the Plasma Posters in our organization. There has been much work done to tease out factors that lead to successful adoption of information technologies, and groupware in particular, within organizations (e.g. Cockburn and Jones, 1995; Ehrlich, 1987; Grudin, 1988; Steves and Knutilla, 1999; Steves, 2001). Steves and Knutilla (1999) outline major factors to be (1) management backing; (2) grassroots champions who are also users; (3) conducive group dynamics; (4) corporate mentality that is conducive to cooperative or collaborative work; (5) non-threatening technology, especially in terms of job security; and (6) support for tasks and processes. Ehrlich (1987) also highlights the importance of ongoing

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attentiveness to user reactions and to system problems, suggesting teams should provide adequate “follow-through to encourage system use” and make sure they are “troubleshooting system problems quickly to avoid premature rejection”.

Although the Plasma Poster Network represents an *informal*, social technology that is not concerned with task accomplishment, unlike the foci of these acceptance and adoption studies, many of these factors have also been important in the success of our deployment. Steves and Knutilla’s sixth factor is therefore not as relevant for our deployment, although we would argue that information sharing is a fundamental process and of great value in our organization. We have identified the following individual, group and organizational levels as being important:

- Corresponding to Steves and Knutilla’s first and fifth factors, the Plasma Poster Network has organizational endorsement, including a relaxed attitudes to content that is not directly work-related or corporately vetted. Further the organization is supportive of collaborative and cooperative work, and sees social intercourse and cross-fertilization of ideas wrought by informal sharing to be of value.
- Corresponding to the third factor, there are conducive group dynamics for the presence of a lightweight social technology. In addition to the group dynamics, individuals also have skills that make them comfortable sharing digital media in this way, and have an appetite for information. Recent comments supplement those above: “people wanted to talk to each other already, and now the posters are there, the content breaks the ice” and “there is no stigma here associated with forwarding bad jokes as long as it doesn’t fill up mailboxes”.
- Corresponding to Ehrlich’s points and to Steves and Knutilla’s second factor, the physical presence of the design and development team creates a “buzz” and excitement around the technology that may not be present if we were remote. In some sense, the evident engagement and enthusiasm of the team provides an advertising function for the technology itself, even though intentional solicitation for participation is minimal. In addition, the physical presence of our team means bugs and problems can quickly be noted and rectified.
- In addition to the points above, the social and physical characteristics of the place in which our Plasma Posters are located are important, including the presence of open, shared spaces within a restricted-access building. This allows people to notice things while moving through the building or “hanging out” but also there is a sense of comfort when posting content, as people know who is likely to see what is posted. The

characteristics of the physical space is less clearly important when considering “invisible”, online groupware systems and applications. Finally, the capacity of the Plasma Posters to contribute directly to more subtle social aspects like trust, enjoyment and playfulness are central factors in the success of the technology.

5. CONCLUSIONS AND FUTURE WORK

In this chapter we have described the design and deployment of the Plasma Poster Network within our lab, focusing on the large screen, interactive displays that represent the public “face” of the network. Quantitative and qualitative data and informal observation testify to the success of this deployment.

While our current implementation is well received, we have plans for further development work that will allow us to explore more deeply people’s practices around content sharing with personal and/or public displays. Based on user feedback and further analysis of field data on the use of physical community poster boards, we are currently modifying our content distribution services, content management applications and content authoring tools. In particular, we are designing: a content distribution manager to allow users to direct content to specific Plasma Posters; applications for accessing community content from personal desktops and from mobile devices; and content authoring and presentation tools that allow people expressive freedom in creating the look and feel of their postings.

We are encouraged by our initial explorations within this area. As a new genre of community communication, technologies like the Plasma Poster Network move interactions with and over hypermedia content off personal technologies and into public arenas.

NOTES

1. Reported by the BBC, <http://news.bbc.co.uk/2/hi/technology/2861749.stm>
2. However, much has been said about the vital role of community print media in the form of local newspapers (that include classified ads, which in many instances are the print version of community bulletin board content) in this regard (e.g. Janowitz, 1952; Stamm and Fortini-Campbell, 1983; Tripp, 1994).

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3. At present, no authentication procedure is required at the board; members of the local community are trusted to identify themselves manually. However, implementing a badge-in mechanism or pin entry would be trivial.
4. Note that occasional host machine crashes meant that at times, not all of the three Plasma Posters were available.
5. Data for May are partial and have been extrapolated.

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