

The Plasma Poster Network: Posting Multimedia Content in Public Places

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Abstract: Much effort has been expended in creating online meeting spaces and information resources to foster social networks, create synergies between collocated and remote colleagues, and enhance social capital within organizations. Following the observation that physical corkboards serve an important community building and maintenance function, in this paper we describe a network of large screen, digital, interactive, bulletin boards, the Plasma Posters. The Plasma Posters bridge the gap between online, asynchronous, community-based, content sharing using personal devices, and sharing of content in physical spaces using public displays. We describe our design motivation, a fieldwork study of online and offline information sharing practices, and an internal deployment of Plasma Posters.

Keywords: Community; conversation; social network; social capital; digital bulletin board; field study; evaluation

1 Introduction

In recent years much effort has gone into the creation of online resources and locales for finding others with the same interests, engaging in conversations and exchanging information (Churchill and Bly, 1999; Girgensohn and Lee, 2002; Preece, 2000). Within organizations, such resources often take the form of project and personal Web pages that document organizational roles and personal interests, aiding expertise location, and providing potential for expansion of social networks (Bly et al., 1998).

Of course, people meet and share content 'offline', as well as 'online'. People are often locally mobile, moving around the physical workplace (Bellotti and Bly, 1996). Serendipitous face-to-face encounters while locally mobile create opportunities for making new contacts and for reinforcing existing ones. They facilitate coordination, cooperation and collaboration (Whittaker et al, 1994). In this way, such encounters contribute to the "stock of active connections" that are the "social capital" of organizations (Cohen and Prusak, 2001).

To address the gap between online and offline encounters and content sharing, we are designing community-oriented, digital information networks

and public display technologies. Our initial investigations within this design space have taken place within our own organization in the form of the Plasma Poster Network. The public face of the Plasma Poster Network is a number of large-screen, interactive, bulletin boards, designed to encourage casual, unplanned, social interactions. Underlying the Plasma Poster Network is a general information storage, distribution and publishing infrastructure.

In this paper, we describe the design, development and deployment of the Plasma Poster Network. We report fieldwork regarding online and offline communication and information sharing practices, detail the design of the interfaces and the underlying infrastructure, and report data from ongoing qualitative and quantitative evaluations of its use.

In evaluating the Plasma Poster Network we pose the following questions: Is there any value in offering public bulletin boards for digital content? Will people publish items to share with others in physical spaces? Will people read digital content in public spaces? Does content in the physical environment cue conversations, offline or online, between colleagues? Will content projected into the local physical environment be seen as a valuable addition to existing environmental and desktop

methods of content sharing (e.g. corkboards, email and Web pages)?

2.2 Informal information sharing in an organization

In order to better understand the potential for digital community bulletin boards as a mechanism for content sharing within our organization, we first carried out an informal study of existing content sharing practices.

FX Palo Alto Laboratory (FXPAL), a subsidiary of Fuji Xerox, Japan, is a software research company based in California. There are 34 full-time employees resident at FXPAL, comprising 25 full-time researchers drawn from diverse disciplines (e.g. computer science, psychology, engineering, linguistics), 6 administrative staff and 3 technical support staff. In addition, there are 14 contractors/consultants, and during summer months, student interns are also present.

For our study, we mapped the physical space of our lab using floor layout charts, observed/photographed activities in public areas and charted 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. 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. The following methods are routinely used to share information:

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, and to 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. People err on the side of caution; as one person phrased it, they didn't want to "fill other people's email boxes up with things that may be of peripheral interest to them".

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 intentional, directed information

access. Serendipitous noticing of content seldom happens in this context.

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 the same projects.

Chats in the hallways are a means of sharing 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).

Given our interest in content sharing in public spaces, we spent some time asking people about the use of *corkboards and paper postings* in the physical environment and observing people's practices. Although many people advertise personal interests by posting informal, often humorous content to their office doors, postings on public corkboards in public spaces are less frequent (Figure 1).



Figure 1: Cork boards and doors are sometimes used to post content that may be of interest to others

There are 7 corkboards in the building; observations revealed only 3 are posted to and read regularly. 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. Interview data revealed that boards where content changed frequently were deemed to be more interesting and eye-catching. Posted content was considered a reflection of the "identity" and "milieu" of the lab.

Four perceived problems with corkboards were expressed. These can be characterized as problems deriving from the persistence and/or ephemerality of posted content, problems of impoverished social context for the posted content, and problems with moving content from physical (easy to share locally) to digital form (easy to manipulate and share

remotely). Thus, people complained about (1) the presence of out-of-date materials – it is sometimes hard to tell what was still relevant; (2) interesting content may be noticed, but sometimes “disappears” before people have had the chance to return and read it fully; (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). Finally, we asked people if they ever discovered unexpected overlap of interests with colleagues through physical postings. Several people reported this to be the case. Unsurprisingly, postings on office doors were reported frequently as leading to such conversations; here, the physical location of the posting leads to easy identification of *who* to follow-up with and *where* to find them.

From these observations we determined communication and content sharing with colleagues is seen as valuable within our organization, and that such sharing occurs both online via computer networks and offline via postings in the physical environment. Whilst online sharing is strongly preferred, this tends to be predominantly between members of established project and social groups. Few people send content of general interest to lab-wide distribution lists, as email is perceived to be a potential intrusion into people’s personal (private) digital space, and therefore socially risky. Intranet Web pages are not browsed. People’s interest is piqued by others’ postings in the physical environment. Events, such as presentations and visitors, and items posted on corkboards occasionally spark conversations, and people said they were sometimes pleasantly surprised to discover mutual interests with other colleagues when such conversations took place.

We concluded that digital community bulletin boards could potentially offer members of the lab the opportunity to share items of interest in a visible way without risking of annoying people due to email overload. The following more specific requirements were generated:

- Place digital community bulletin boards in high traffic areas and in spaces where people are waiting or “idling”
- Allow community postings to be distributed and displayed in a low effort way (i.e. build on existing content sharing practices)
- Create attractive, inviting interfaces where content changes regularly
- Associate content clearly with people who have authored/sent that content

- Provide overviews of content by date and author
- Provide a means whereby postings of interest can be easily printed or forwarded to others or to oneself digitally
- Provide a community repository or memory of postings that may be browsed after public showing of the content has expired
- Support easy administration and garbage collection of posted content, both for system developers, and for community members

2 The Plasma Poster Network

Plasma Posters are plasma displays with interactive overlays that enable direct touch interaction. 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 (Figure 2). This has proven to be a major initial attractor for passers-by. Underlying the Plasma Posters is the Plasma Poster Network, a content storage and distribution infrastructure that posts content to all registered Plasma Posters. Although our primary use of the Plasma Posters has been to publish content in different locations within our lab (see Figure 2), the underlying infrastructure supports content sharing between remote locations, and two have been deployed in sister labs in Japan. However, in this paper, we focus on our local deployment.



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

2.1 Interfaces and Interaction

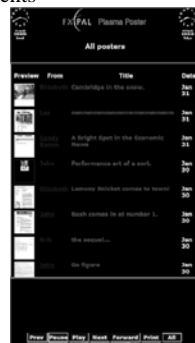
Content that is displayed on the Plasma Posters is of two types: content posted by individuals, and content that is automatically sampled from our intranet (e.g. announcing new technical reports, calendars of meetings). In the former case, authenticated community members can post items (text, URLs, images) to the Plasma Posters via email or a Web page. 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 on the right is a posted URL with information from the Japan Times. 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 3: The "PosterShow" Interface with content and comments

Figure 4: Content overview by person, by posting date and by content help readers at the Plasma Posters browse posted content.



Interactive, multi-media content presented in (relatively) public spaces assumes a very different model of *reader engagement* than content delivered to a personal computer screen or content presented on physical posting boards. Therefore we have focused on designing for four forms of engagement with content:

- *peripheral noticing*. Content is visually appealing, and dynamic. Postings are cycled through automatically one at a time and displayed for 60 seconds. All are augmented with contact information of the person who posted the content, the date/time of posting, and any audio or text commentary.
- *active reading*. 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. Live Web links can be followed.

- *navigating and browsing*. Buttons are available for manually moving *forward* and *backward* through items in the database. Browsing and navigating all items in the current list of postings is possible using with the *content maps* and *overviews* (Figure 4).
- *messaging*. Items can be *forwarded* to others who may be interested. The author can also be *emailed* with comments¹.

2.2 Implementation

The Plasma Poster Network is a client-server system (Figure 5) that has been designed for the collection, management, and publishing of community content. Server components provide an infrastructure for sharing. Client components provide a variety of content displays and interaction mechanisms.

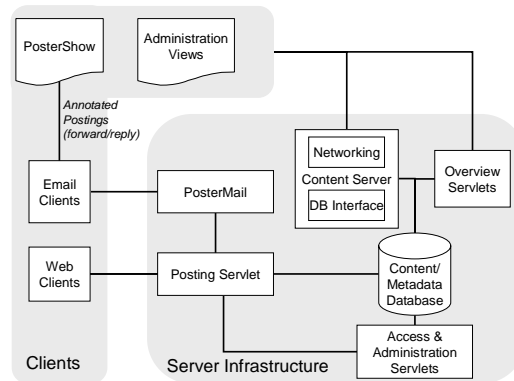


Figure 5: The Plasma Poster is a client-server system that supports community knowledge sharing

The Plasma Poster server consists of the following components: a number of Java servlets that run in a standard Web server (e.g., Tomcat from the Apache Software Foundation); a relational database (e.g., MySQL from MySQL AB); a *ContentServer* Java application program controls access to the database using the Java standard interfaces (JDBC from Sun Microsystems). Servlets provide access to the Plasma Poster capabilities. *Overview* servlets provide representations of posted information organized for easy location and browsing of

¹ 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.

community content. Plasma Poster Web pages format the overview information into a variety of representations, including a tabular list, and tiled or overlapping image maps. *PosterMail* and *Posting* servlets allow posting of information to the Plasma Poster Network through email and through Web interfaces.

A set of client components have been incorporated into the system, including: standalone applications; Web-based programs implemented as Java applets, and dynamic Web pages. The *PosterShow* Visual Basic application provides a cyclic view of posted content suitable for display and navigation on a Plasma Poster client platform (e.g., large plasma display or personal computer). *Annotation and mailer* clients allow free form responses made at a client platform to be distributed back into the user community (e.g., as a reply to the posting user or forwarding to others). Finally, Administration and Access Control Web pages allow us to easily maintain the content and metadata required by the system.

A standards-based, client-server implementation gives us the scalability and flexibility needed for a heterogeneous information distribution system that has been developed while being deployed. We have tested the system with 400 consecutive postings/deletions. Examples of system flexibility include 'hot-swapping' of different prototype interface clients while the system is in operation, and switching database software by changing configuration files.

2.3 Usage of the Plasma Posters

The Plasma Poster Network has been fully functional and stable for 6 months. During the past 6 months, user community activities have been logged, and evaluations carried out to evaluate people's experiences with the Plasma Posters, and reasons for posting/non-posting. 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) were carried out. For the purposes of the data analysis, we posed the following questions: 1. Do people post content to the Plasma Poster Network? What are patterns of posting and reasons for non-posting? 2. Do people engage with content on the Plasma Posters, and if so, are there patterns of interaction by location and time, and what reading practices can be observed? What are the most popular forms of content? 3. Does content in the physical environment cue conversations between colleagues? 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?

2.3.1 Posting content

Since the deployment of the current system 28 weeks ago, 501 postings have been sent to the Plasma Poster Network, with an average of 17.9 posted per week (range 1-43; sd 8.72; median 16; mode 14). This posting activity was generated by 28 people, again with an average of 17.9 postings per person (range 1-155; sd 32.74; median 4; mode 2). Nine people are responsible for the bulk of the posted materials (88.6%). All postings have occurred through email; nothing has been posted from the Web interface.

During the first week of this deployment 14 items were posted. The greatest number of postings in a week was 10 weeks after deployment (43; mid October), and the fewest 2 weeks after deployment (1; mid August). Most postings are during the working week (Monday-Friday; mean=98, sd=21.01), rather than the weekend (mean=5.5; sd=3.5). There are no significant differences between the days of the working week. Three people have posted content when traveling (3 short reports, 4 conference announcements and 6 sets of photographs). Interview comments suggest these are popular; authors and viewers feel a social presence within the community is maintained by these postings.

Content varies 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; 74% of the postings have been text or URLs, 25% 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), news items (unsurprisingly especially concerned with technology innovations), jokes and political commentary, interactive surveys (these are mostly comical, e.g. "Which Simpson are you?"; "How hot am I?"), book reviews and poetry. 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.

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”).

2.3.2 Interaction and reading practices

We logged 22239 user interaction events from the three Plasma Posters over 149 consecutive days (including weekends)². Using the analytic categories outlined above, *active reading* accounts for 62.4% of all activity (scrolling content and following links; pausing content and printing); *navigation and browsing* for 36.3% (show all postings; resuming content cycling by pressing “Play”; show previous posting; show next posting) and *messaging* for only 1.3% of activity (replying to content authors; forwarding content to others). Finally, 0.9% of activity was people looking for more information about content authors/posters.

Location makes a big difference to interaction. 67.9% of all activity occurred at the kitchen Plasma Poster, 19.8% at the hallway poster and 12.3% 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. We are currently analyzing our interaction data by content type to establish whether different forms of content and different locations systematically invite particular forms of interaction.

Activity data reflect the working rhythms of the lab. Although the data in Table 1 include weekends, weekday interactions account for 99% of the data logged (weekday interaction events per day mean=205.9;sd=169.7; weekend mean=10.8;sd=8.2). Interview and survey data suggested people read content early in the morning and at coffee breaks. 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). There is a trend

for increased activity as the week goes on, but there are no significant differences between days.

Kitchen		
Active Reading	95.9	61.2%
Navigating	58.9	37.5%
Messaging	2.0	1.3%
Totals	156.8	
Hallway		
Active Reading	34.3	75.1%
Navigating	10.7	23.5%
Messaging	0.6	1.4%
Totals	45.7	
Foyer		
Active Reading	18.7	66.0%
Navigating	9.1	31.9%
Messaging	0.6	2.1%
Totals	28.4	
All		
Active Reading	149.0	64.5%
Navigating	78.7	34.1%
Messaging	3.3	1.4%
Totals	230.9	

Table 1: Mean and percentage interactions per day by poster and reading activity

Most of the activity peaks were generated by interactions at the kitchen Plasma Poster. 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”.

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, 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. Images and movies appear to draw the most attention. Interviews and survey revealed the most popular content to be news items, jokes and images. Content (especially images) from traveling colleagues was also very popular.

2.3.3 Perceived impact

Reactions to the system reported in interviews and informal comments have been largely positive. All survey respondents said they had read items posted to the Plasma Poster. It is clear the Plasma Posters provide a novel mechanism for information sharing in our lab; one interview respondent stated “I

² Extraneous interruptions of system and network services meant that on occasion not all Plasma Posters were available.

like coming across things I would not see or hear about otherwise”.

Nineteen of 23 survey respondents said they had actively 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 to illustrate points made. Reported conversational topics include work-related topics (conferences, product releases), discussions about news items and discussion of photographs.

Although it is hard to measure whether the Plasma Posters have significantly increased informal interactions in the lab, we took reportage of “conversational threads” as support for our assertion that content on the Plasma Posters leads to social interactions. More generally, people commented frequently 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”. Being able to post content to the Plasma Posters via email, irrespective of physical location, was perceived to provide a valuable relationship maintenance function; people valued getting postings from absent and remote colleagues very highly (“it is nice to find out what they are thinking about or doing”; “it is great to see their face on the display”). These direct and indirect effects are undoubtedly important for the development and strengthening of social ties, and are in accord with Cohen and Prusak’s notions regarding the establishment of ‘social capital’ (Cohen and Prusak, 2001).

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.

3 Related Work

Technological advances and cost reductions have resulted in many large screen displays in public places for advertising, information sharing and collaborative task support. Most are minimally interactive, but a number of interactive applications have been designed within research labs. Examples include displays to support focused, task-centered work (e.g. Guimbretiere et al., 2001; Klemmer et al., 2001; Pederson et al., 1993; Russell et al., 2002; Streitz et al., 1999), to support memory of one’s activities (e.g. Fass et al., 2002) and to offer awareness of colleagues’ activities within small working groups (e.g. Greenberg and Rounding, 2001; Huang and Mynatt, 2003).

Within the same design space as the Plasma Posters, Houde et al’s (1998), community newsletter and Xerox’s CWall (Snowdon and Grasso, 2002) are designed for public information sharing within loosely knit groups and communities. The Plasma Poster Network builds on the example set by these community content-oriented technologies, facilitating the authoring, distribution and publication of *informal, interactive, multi-media* content across a *network* of digital bulletin boards in different locations.

4 Discussion and Summary

The Plasma Poster Network has become an everyday part of life within our lab, and informal reports suggest social encounters have increased as a result of their presence. People post, read and interact with content. People are active readers, but seldom message and reply to authors (although many were positive about this functionality). Location makes a difference to reading and interaction patterns. Most community members see the Plasma Posters as a valuable addition to existing content sharing methods, and an addition to the physical environment. As such, the Plasma Posters are a new,

complementary genre of communicative practice within our organization (Yates and Orlikowski, 1992).

Notably, it has taken time for the Plasma Posters to be accepted, and for people to actively post and interact with them. One regular poster said although they had been unsure about posting at first, once they had started doing so, "it was addictive". Even so, there are still more consumers than producers within our organization; participation in terms of posting is skewed with some people sending much content while others send none, even when they view the technology as interesting and valuable. This finding is in keeping with others' observations of community participation.

Future work will focus on improving our current internal deployment, and on designing for an external deployment. Specific activities include further design of personal and online community Web pages; offering provision for directed content posting to specific Plasma Posters; and collecting ratings and mining logged activity data for automatic reposting of popular content and as feedback for content authors. Our planned external deployment will allow us to identify generally applicable aspects of our current infrastructure and interface design, and will offer insights regarding potential roles for public, community, content sharing technologies.

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