Supporting Community Awareness with Interactive Displays

Nick Taylor
Culture Lab, School of Computing Science, Newcastle University, UK
nick.taylor@newcastle.ac.uk

Keith Cheverst
School of Computing and Communications, Lancaster University, UK
k.cheverst@lancaster.ac.uk

Abstract Interactive displays in public spaces have significant potential to support communities by promoting awareness of others and sharing content that is of mutual interest to community members. In this article, we survey the use of interactive displays in communities, focusing on the long-term deployment of a photo display and digital noticeboard in a rural village. Over several years, this deployment highlighted how displays can support awareness, local history, visitors and newcomers.

Keywords situated displays, interactive displays, community, rural, awareness.

Public displays of information already play a large role in community life: road signs, bus timetables and noticeboards of advertisements and upcoming events are plentiful in most towns and villages. Although large, usually non-interactive, digital displays have made significant headway into the commercial advertising market in recent years, there has been far less proliferation of display technologies into other domains. These include the plethora of smaller, grassroots or ad-hoc noticeboards that allow community members to share information and promote awareness of activities within the community. This is despite many potential advantages that technology might provide to these displays, such as interaction with mobile devices or social networking, for example, or larger collections of 'smarter' content that can be browsed at will or displayed when most relevant.

Research into the use of interactive displays in community contexts has already begun to explore this potential by investigating behaviors, content and interaction techniques that can be utilized in this domain. In this article, we survey the use of interactive community displays and draw on our own experiences in exploring the use of a rural community display across a period of over four years to highlight a number of roles that interactive displays can play in community life.

WORKPLACE COMMUNITIES

We can trace the use of interactive displays in communities back to the very beginnings of ubiquitous computing, where much of the initial research was carried out in researchers' own workplaces. While these displays were most commonly used as large workspaces for both collocated and remote collaboration, technologies such as Portholes [1], where video streams were left running to provide a window into colleagues' offices, demonstrated that productivity-oriented technologies could equally-well support workplace activity in more subtle ways. Notions of 'awareness' of what is happening in a shared environment have subsequently been a key factor in Computer Supported Cooperative Work research and wider research relating to communities. Supporting awareness has proved to be a task to which interactive displays are particularly well-suited, due to their ability to provide peripheral awareness and casual sharing of information.

Some of the earliest amongst these workplace displays were CommunityWall [2] and the Plasma Poster Network [3], which both allowed users to share content with their colleagues, such as web pages or conference papers and promote a "serendipitous form of information discovery" [2] that augmented the traditional noticeboard experience. Various other projects have used this noticeboard analogy, including the Notification Collage [4] and GroupCast [5]. These projects noted the impact of location on the displays, both in terms of levels of interaction—which were typically higher in social venues and where potential users would spend time rather than simply pass by—and the type of content that was popular and deemed appropriate. This highlights the situated nature

of these technologies, meaning that interactions with the display are influenced by both the spatial and social context of the installation.

NEIGHBORHOOD DISPLAYS

As social technologies demonstrated potential in the workplace, they were also demonstrating their potential in local communities and neighborhoods. Long before social networking gained popularity, community networks [6] had been envisioned as online augmentations of existing communities that could act as an additional information resource and channel of communication. Perhaps the best known amongst these was the Blacksburg Electronic Village, an attempt to provide online community resources to a small town using a web-based portal. This allowed anybody in Blacksburg to create pages with the aim of increasing "access to and participation in community life" [7]. Despite success with this system, there are issues surrounding the use of the web to support communities. Even today, a digital divide exists between those capable of easily accessing the web and the considerable segment of society that are not. More critically, use of the web generally requires that users actively seek out information and does not easily allow the type of peripheral awareness that had made workplace displays successful. As a result of this, research into community technologies has often looked to install interactive displays in public spaces. For example, interactive displays were one element of Campiello [8], a system designed for use in areas of Venice overwhelmed by tourism to make both tourists and locals more aware of the community's identity. Café environments have also proven to be a popular setting for neighborhood community displays, including EyeCanvas [3] and CoCollage [9]. EyeCanvas was installed in a San Francisco café/art gallery that allowed the venue to advertise upcoming events and showcase the work of local artists, while allowing customers to communicate using spontaneous 'scribbled' notes. CoCollage displayed a selection of photos determined by the customers currently in the room, aiming to counteract the effect of laptops and wireless networks that have caused these venues to become less sociable. Elsewhere, Nnub [10], a noticeboard-like appliance deployed in a suburban shop in Brisbane, aimed to provide a central repository of community information, while Big Board [11], deployed in a South African community learning center, explored the potential for interactive displays in developing countries where literacy and access to technology are much lower, exacerbating the disadvantages of web-based solutions.

Common amongst these neighborhood displays is their placement in a community hub, such as a café or local shop. These venues, 'third places' separate from the home and work life that constitute the "core settings of informal public life" [12], offer an attractive location for any community display. They may be frequented by many

THE CASIDE PROJECT

Our own interactive display deployments formed part of the CASIDE project, which explored the use of interactive displays for coordination and community. The core aspect of this project was *Hermes* [1], a constellation of small interactive 'door' displays situated outside offices within Lancaster University's Computing Department that supported the sharing of awareness information. Users of this system responded particularly well to being able to share photos on their displays, which led to the development of the *Hermes Photo Display* as a single central display to allow the owners of displays to share these photos with colleagues and visitors. The project subsequently investigated how related displays might be used to support a climbing community, intimacy between distant family members and indoor navigation. The project's final deployments, described in this article, took place in Wray, initially as a photo display similar to the Hermes Photo Display [2], which subsequently expanded through close work with the community into a digital noticeboard that remains in use today [3].

1. K. Cheverst *et al.*, "Exploring awareness related messaging through two situated-display-based systems," *Hum. Comput. Interact.*, vol. 22, no. 1–2. pp. 173–220, Jun. 2007.
2. N. Taylor *et al.*, "Probing communities: study of a village photo display," in *Proc. 19th Australasian Conference on Computer-Human Interaction*, Adelaide, 2007, pp. 17–24.
3. N. Taylor and K. Cheverst, "Rural communities and pervasive advertising," in *Pervasive Advertising*, J. Müller et al., Eds. London: Springer, 2012, pp. 269–286.

members of the community who are accustomed to socializing and taking part in community activities there, in addition to spending time rather than just passing through.

INTERACTIVE DISPLAYS IN WRAY

Our own research has concentrated on rural communities, with the broad goals of exploring the roles that interactive displays might play in rural areas, issues surrounding such deployments and methods of working and designing with communities. To investigate this, we have undertaken a long-term exploratory project in Wray, a small rural village in North West England with a population of approximately 500 people located twelve miles from Lancaster University's campus (Figure 1). In recent years, Wray has acted as a testbed for computing projects, starting with the installation of a wireless mesh network across the entire village, which had previously been limited to dial-up Internet access. This had generated considerable goodwill towards the university and made the village an ideal deployment location. A local technology enthusiast agreed to act as a 'champion' in the community and work with us

Figure 1. Wray during the annual village fair.

to deploy technologies and organize meetings with other residents.

Wray boasts a strong community spirit, exemplified by the annual week-long Scarecrow Festival, when many residents build and exhibit scarecrows outside their homes based on a common theme. This leads up to Wray Fair, an annual village fête, including live entertainment, a parade of giant scarecrows, fairground rides and craft stalls showcasing local businesses, which is attended by thousands of visitors from across the region. Social facilities in the village where interactive displays might reasonably by deployed include a village hall, two pubs, a small shop and a café, most of which play a central role in community activities.

The Wray Photo Display

The first *Wray Photo Display* was deployed in Wray's village hall in August 2006 as a means of demonstrating interactive displays to residents and exploring how they might support the community. The first display was an extremely simple but reliable prototype: a touchscreen display connected to a concealed computer showed pages of ten thumbnail photos and users could move back and forward through the photo collection using on-screen controls. Photos could be transferred to and from the display using Bluetooth file transfers from mobile phones. This display was initially installed in the village hall, where a comments book was left for residents and visitors to write feedback. To provide some initial content, the display was seeded with photos from that year's scarecrow festival taken by one of the authors.

As intended, this simple deployment elicited a wide range of feedback through the comments book and via our champion. Many of the comments were very positive, referring to the ability to provide an overview of recent events ("I missed the last couple of days of Scarecrow Festival and this gives me the opportunity to see some of

the activities and scarecrows I missed", "great way of catching up with what has gone on in the village recently and in the past year"). Other comments related to types of content that they would like to see, particularly historical photos of the village, or functionality suggestions and issues with the prototype. Chief amongst these was discomfort with Bluetooth as a method of transferring content. Instead, a web application was suggested as an alternative method of upload. While the lack of peripheral awareness meant the web was not necessarily the most appropriate tool for distributing this community content, there was a clear role for it as a secondary means of interacting with the display. Early feedback and discussion also led to the addition of categorization, the ability to view photos at a larger size and the ability to play videos.

After a web application for uploading and downloading photos from the display was added, the collection of photos expanded rapidly. Most prominent amongst these were historical photos of Wray, covering a wide variety of time periods: the oldest photos dated from the early 20th Century, while others were only decades old. Many of these related to a flash flood that had swept through the village in 1967, destroying several buildings. Photos were uploaded depicting the damage wrought by the flood, as well as images of the village as it existed beforehand. These had previously existed only in private photo collections and were scanned for the explicit purpose of uploading them to the display, bringing these images to the public for the first time.

Iterative Development

After this initial period of research, the display was moved from the village hall to the local village shop in October 2007 (Figure 2). The shop was visited frequently by a large proportion of the population, but it was also a location where many members of the community met, discussed local issues and accessed information through noticeboards and conversation. Based on the findings of prior research discussed above, this was a location that was highly suitable for display deployments, and our own logs showed five times the level of interaction in the month following the move compared to the month before.

With the display in place, it continued to act as a probe to learn about the community and villagers' use of the display, collecting community-generated content and logging all interaction. This allowed us to identify types of content that were popular in the village and approximate patterns of usage. To gain a deeper understanding beyond this data, we continued to meet with residents at regular intervals to discuss their thoughts about the display, how it was being used by the community and how they would like to see it improved. We also regularly attended community events, such as the annual village fair, where we would deploy a duplicate display mirroring the shop display's content. This gave us an opportunity to see the display

Figure 2. The Wray Photo Display in the village shop.

being used by a large number of people over a short period, which was otherwise made difficult by the long-term real-world deployment location. These discussions and observations led to the user interface being redesigned and the addition of a variety of new features that had not been present in the original display, including the ability to leave comments using an on-screen keyboard, or to send an image to a friend by email as a digital 'postcard'.

Between 2006 and 2009, the photo collection continued to grow to encompass approximately 1,500 images covering all aspects of village life. In addition to the historical photos that had been prevalent at the beginning of the deployment, residents also uploaded hundreds of contemporary photos of the village, typically showing significant community-centered events. These included annual events, including photos of every scarecrow displayed in the village, and irregular events, such as day trips, snow storms and weddings. After the addition of commenting features, this was often used to post additional information about the photos, particularly identifying the people pictured. Our logs over this period showed approximately 3,300 sessions of interaction with the display and almost 14,000 individual photo views, demonstrating steady levels of use across the entire length of the study.

WrayDisplay Noticeboard

From its inception, the Wray Photo Display had always been intended to expose residents in the village to interactive display technology and explore what roles such displays might play there. While many of our findings had related to the act of sharing photos with the community, residents had also expressed interest in other functionality that extended beyond the scope of a photo display. Residents regularly talked about the potential for the display to act as a noticeboard for local advertisements, such as upcoming events, or as a digital version of the village newsletter ("can it be extended into an on-screen

WORKING WITH COMMUNITIES

Designing community displays requires knowledge of the deployment environment and input from community members. To quickly gain an early insight into life in the village, we used *cultural probe packs* [1], consisting of diaries, scrapbooks and instant cameras, that residents could use to record their thoughts and experiences over a period of several weeks. These packs were then discussed in a group meeting to inspire designs. The initial photo display deployment was designed to act as a *technology probe* [2]: a very simple prototype intended to demonstrate an unfamiliar technology, inspire feedback and ideas, and learn about the target environment. Finally, we made extensive use of our 'champion' as a *human access point* [3], who was both a member of the community and an avid technology user. Our champion could act as a bridge between researchers and residents, while also supporting prototype technologies that were deployed in the field. Underlying all these methods was an ongoing effort to build a relationship with residents through regular meetings and attendance at community events.

1. B. Gaver *et al.*, "Cultural probes," *interactions*, vol. 6, no. 1, pp. 21–29, Jan. 1999.
2. H. Hutchinson *et al.*, "Technology probes: inspiring design for and with families," in *Proc. SIGCHI Conference on Human Factors in Computing Systems*, Fort Lauderdale, FL, 2003, pp. 18–24.
3. G. Marsden *et al.*, "People are people, but technology is not technology," *Phil. Trans. R. Soc. A*, vol. 366, no. 1881, pp. 3795–3804, Oct. 2008.

version of Wrayly Mail or village noticeboard?"). In focus groups exploring the potential for these features, residents identified a number of issues with existing noticeboards, such as cluttered and outdated content, which resonate with similar problems identified in workplace noticeboards during the development of the Plasma Poster Network. Other issues were raised with the village newsletter, particularly its lack of immediacy and visibility. For example, a consultation that had been advertised in the previous month's newsletter had been forgotten by residents by the time the event occurred.

In light of this feedback, the display was extensively redeveloped in 2010 to integrate noticeboard-style content with the existing photograph collection. During this process, design exercises with residents revealed that while residents valued the photo collection, local notices and very recent photos were seen as more appropriate content to be displayed by default—current and relevant information that passersby might not already be aware of, rather than older content that they might already have seen. The revised *WrayDisplay* allowed residents to post advertisements and event listings by providing a title and message with an

optional image. Users could also specify the dates between which the advert should be displayed as well as a 'reminder' date when the entry would receive renewed prominence. The majority of the screen was devoted to this content, favoring new content and content close to its 'reminder' date, while a single strip of photos along the bottom of the screen showed the most recent uploads. For the first time, a second display mirroring the same content was also deployed in the village café.

Use of the noticeboard functionality was initially slow by comparison to the uptake of the first photo display, with the majority of the notices taking the form of event listings copied directly from the existing village newsletter by our champion. Based on early confusion over what types of content could be posted, the notices were split into two sections for events and adverts. This had the intended effect of stimulating more varied postings, while also creating a village calendar, a feature that had actually been suggested during design workshops. Typical examples of notices posted on the display were upcoming fundraising events or public meetings, items for sale locally and services provided by residents. One resident in particular made extensive use of the display to advertise her jewellery business, while others had success selling small unwanted goods and the proprietors of both deployment locations posted their own adverts. In the café, which was primarily used by visitors from outside Wray, the display took on a different role by advertising and acting as a showpiece for the entire village.

ROLES FOR INTERACTIVE DISPLAYS IN COMMUNITIES

Throughout our research in Wray and previous research literature on interactive displays, a number of roles have emerged that utilize the affordances of interactive displays. Foremost amongst these is the awareness of recent activity and upcoming events in the community that is provided by the very visible nature of public interactive displays when situated in regularly-trafficked areas. Our research also highlighted the ability to act as a repository for community history that is easily accessible and can act as a catalyst to promote content sharing behavior. These functions are useful not only to existing members of the community, but also to new residents and visitors who may wish to gain an insight into life in the village.

Awareness

By viewing photos on the display, residents were able to see recent village events whether they were present at the event or not, maintaining awareness of events and activities that are important to the community. For those who were present, this content further allows reminiscence about activities that they were a part of and, furthermore, the public nature of the display means this can be a shared, collaborative experience. We observed numerous examples

of this occurring, where two or more residents would spend considerable lengths of time discussing and reminiscing around the display. This very much reflected results from previous display research in workplaces, where displays promoted awareness of both the people in the community and the things that define that community and bind them together. In the longer term, the photos build an ongoing record of activities in the village: one resident described this process as creating a "living history" of Wray. These are important activities in building and strengthening ties within the community.

Where photos provide a flavour of recent events in the community, notices and advertisements provide awareness of events and other activities that will occur in the future that residents may still choose to participate in, as well as goods and services currently available in the local area. Unlike photo sharing, which had not previously been well-supported in Wray, the posting of notices and advertisements was already common on a variety of noticeboards, a regular newsletter and the village website. Because of this, WrayDisplay did not serve to inspire this type of activity, but instead augmented it, providing additional channels for those who wished to utilise them without interfering with existing sources of information and increasing the visibility of content that might normally have been obscured. For example, content copied from the newsletter was displayed prominently in a public space rather than as a small text item in a newsletter, while notices that might otherwise have been placed on a traditional noticeboard benefited from being automatically cleared as notices expired to increase the visibility of those that remained.

History

A shared history is one of the defining components of a community, representing the events that have bound them together. Photographic records can therefore potentially play an important part in preserving the history of communities and yet, while large collections of historical images and newspaper clippings appeared to exist in private collections in Wray (e.g. Figure 3), only a small number of these that were displayed in the village hall or local pub were available to all residents. The addition of the Photo Display to the community provided a prompt for residents possessing these collections to make them public, which several have done enthusiastically.

Although existing online photo album services could certainly have provided a solution to these issues, these are not without their own problems—such as being difficult for novice users—and no such usage appeared to exist prior to the Photo Display's deployment. It was not until after deployment that the owners of these collections began to upload them for the rest of the community to see, in response to early requests for such content written in the comments book by fellow residents. The very public nature
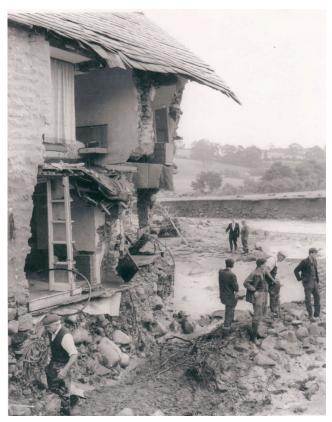
Figure 3. An example of a historical photo posted to the display.

of the display and its salience, visible to residents during their day-to-day lives and in spaces associated with the community, also appeared to invite use, while online albums are typically not encountered unless the user is intentionally seeking that information. In many cases, residents who have not searched for it or who are unfamiliar with the technology might not be aware that such online resources even exist. Alternatively, the display could be seen to provide a novelty factor that is otherwise missing, making the sharing of photos an exciting and interesting activity. The presence of the display also inspired subsequent use of online services, when content that had originally been scanned and collated for the expressed purpose of uploading it to the display was repurposed and posted online. As with other photo sharing behaviors that emerged, the fact that this did not happen until the display was deployed suggests that it acted as a catalyst to inspire online photo sharing where there was clearly a desire for it, but no previous attempt to make it possible.

When being browsed, these photos served a number of roles: for example, photos of the village flood served partly as a memorial of a significant and traumatic event that occurred within living memory of many older residents, but also as a means of educating the village's children about Wray's history, seeing use for research by local schoolchildren. Many of the photos were portraits or group photos and residents using the display would often try to identify both ancestors and images of living residents when they were younger. Many photos simply showed buildings or street scenes, which users would often attempt to reconcile with the modern village—a task made more difficult due to the number of buildings destroyed by the flood.

Visitors and Newcomers

In addition to supporting existing residents, the display's content serves to support those who are not familiar with the community, but who might wish to gain an insight into the village or develop stronger ties to the community—namely visitors and new residents. As an idyllic country spot within reasonable distance of an urban area and close to two national parks, Wray naturally sees a number of visitors passing through, and many suggestions were made relating to content for these visitors, such as maps and guided walks. During the lifetime of the deployment, our champion reported that a number of visitors had stopped to spend time browsing the display's content in the shop, some of whom had previously lived in the village themselves or had family members who had once lived there.

From this role, it follows that the display might also support new residents who have moved into the community. Like visitors, new residents might want to learn more about the village and attain a sense of what Wray is 'about', including learning about its history, or about recent and upcoming events, all of which are served by photos and notices on the display. This is reminiscent of the role that Campiello played in Venice by making visitors aware of the area's heritage. In this sense, the display might serve as a starting point for new residents hoping to gain a foothold in the village. Various comments from residents in meetings and the comments book, including one resident who was relatively new to the village himself, suggested that they felt the display was capable of fulfilling this role, and the shop was suggested by participants as a location in the village where new residents might ask for advice or information, largely due to the shop being the facility that they are most likely to use after moving in.

Clearly, looking at photos and notices on a display is no substitute for actually becoming involved in community events and talking to other community members, but the display certainly demonstrated the ability to act as a conversation starter, helping to bring residents old and new together over content that is of mutual interest, acting as a gateway into the community. This was observed first-hand at one village event, where a new resident and old resident discussed the village's history while searching for photos of the new resident's house. In this instance, the display served the dual purposes of introducing two strangers and

instilling knowledge of the village's history in the new resident.

SUMMARY

In this article, we have briefly summarized research into interactive displays to support communities, focusing on a series of deployments in Wray, where the displays have been integrated into village life. These displays supported community in a number of ways, primarily by providing awareness of upcoming and contemporary events and sharing of history. Several years after the conclusion of the project, the final WrayDisplay prototype is still installed in the village shop, where it receives continued use to share photos and notices.

One challenge that remains is exploring how communities themselves can utilize interactive displays with the ease of traditional noticeboards. While both our displays in Wray and other projects have been developed and maintained by researchers, the nature of research projects can often place limits on how long they can be supported. We might wish to consider how communities could create technologies that require very little maintenance and, like traditional noticeboards, can even be created on an ad hoc basis with no 'official' approval or support. If this can be achieved, interactive displays could potentially become similarly common fixtures in communities.

BIOGRAPHIES

Nick Taylor is a research associate in Culture Lab at Newcastle University. He received a PhD in computer science from Lancaster University. Contact him at nick.taylor@newcastle.ac.uk.

Keith Cheverst is a senior lecturer in the School of Computing and Communications at Lancaster University. He received a PhD in computer science from Lancaster University. Contact him at k.cheverst@lancaster.ac.uk.

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