Rural Communities and Pervasive Advertising

Nick Taylor[1] and Keith Cheverst[2]

[1] Culture Lab, School of Computing Science, Newcastle University

[2] School of Computing and Communications, Lancaster University

Abstract   Digital signage is most commonly seen in urban environments target-
ing large groups of viewers. We believe that there is also a role for pervasive tech-
nology in smaller communities, including in rural areas that are typically late to
receive the benefits of new technologies. This chapter describes a recent pervasive
advertising display deployed in Wray, a village in North West England, which was
developed with the involvement of community members and evaluated 'in the
wild'. Our research contributes an exploration of rural communities as a site for
pervasive digital signage, including our experiences relating to the design of the
display and findings relating to its use in the community.

1 Introduction

As the technology required to realise pervasive displays becomes readily available
and affordable, digital signage has become a common sight in urban areas, par-
ticularly when used for advertising purposes. However, this proliferation of perva-
sive technologies has largely omitted rural areas; while many rural residents are
finding that technology can help to solve issues caused by their remote location in
a society that is increasingly centred on large cities, the technologies readily avail-
able elsewhere are not always accessible. This is most apparent in the case of
broadband Internet, which is often unavailable in rural areas, but also extends to-
wards technology research: the vast majority of research into pervasive technolo-
gies takes place in urban areas, university campuses and workplaces, and the fruits
of these labours may take many years to reach rural areas, if at all.

To address this disparity, our work is primarily concerned with how digital
signage in public spaces can be utilised to help support the community in a rural
village by displaying community-generated content, which might be used to pro-
mote a sense of community and awareness of events in the village. Over a four
year period, we have worked closely with Wray, a village in North West England
with a keen interest in technology, where we have engaged the community in the
development of a series of iterative prototypes to explore the domain. Initially, de-

ployments took the form of a photo display used to show a community-generated collection of photographs in a public location, but feedback led us to consider the use of such a display for other types of content—namely, for advertising and event listings. This has led to the development of WrayDisplay, a public display that allows residents to share event listings, advertisements and photos with other members of the community via two displays in public spaces.

In this chapter, we explore the process of engaging the community that led to the development of this display and describe results from a six month period of deployment. We present WrayDisplay as a case study to illustrate numerous insights into the role of pervasive advertising displays in rural communities and factors to take into consideration when developing such displays.

2 Background

Our work builds upon a wealth of public display research, much of which is aimed at supporting community in some way. This section will briefly explore related work in the field, including existing research into community displays in both the workplace and more social environments, and introduce our own previous work in Wray that led to the development of WrayDisplay.

2.1 Community Displays

Digital signage has formed part of the pervasive computing vision since its inception. However, it is only within the last ten years that the technologies required to realise large, public displays have become commonplace. Since then, many digital signage projects have emerged supporting community, initially based in the workplace and typically with the ability to post content that might be of mutual interest to colleagues (Greenberg and Rounding 2001; Snowdon and Grasso 2002; Churchill et al. 2003; McCarthy 2003). Although these displays each had different means of submitting, displaying and bringing content to the attention of passersby, each found that displays quickly became valuable additions to the workplace community.

Outside of the workplace, a number of more recent projects have begun to explore digital signage as a means of supporting neighbourhood communities. These have included both urban and suburban social spaces (Churchill et al. 2006; Redhead and Brereton 2009) and rural areas in developing nations (Frohlich et al. 2009; Maunder et al. 2011). Typically these displays have been deployed in public social spaces, such as cafés or community centres, often described as 'third places'—locations distinct from the home and workplace where people gather and socialise (Oldenburg 1989). Deployments in the wild rather than in the researchers'

own workplace naturally introduces new complexities and a need to better understand deployment environments, and several of these projects have thus sought to engage community members in the design process by various means, including participatory methods.

2.2 The Wray Photo Display

WrayDisplay builds on the Wray Photo Display (Taylor et al. 2007; Taylor and Cheverst 2009), a previous public display developed for Wray that centred on sharing community-generated photographic content between residents, deployed in the village's post office/shop over a period of over three years since August 2006. This was intended as a technology probe (Hutchinson et al. 2003), designed to help us understand the rural environment while allowing behaviour to emerge over time and providing residents with a concrete example of the technology in action in their community to inspire feedback and suggestions. Our approach to working in Wray has been to use a participatory methodology to engage residents in iteratively improving these prototypes, in order to create a useful technology for the community while improving our own understanding of the issues surrounding rural technologies (Taylor and Cheverst 2010).

The Wray Photo Display was initially deployed as a simple application for displaying photos uploaded by residents. Following deployment, we observed usage in the community and logged interaction with the display, as well as collecting feedback through various means, including a comments book, meetings with residents and deployments at public events. Based on feedback from participants, the display's functionality slowly developed to meet the community's needs and the content of the display grew to include over 1,500 photos depicting both the village's history and recent events. We discovered that digital signage had a clear potential for supporting a sense of community spirit and awareness by sharing content in public spaces.

Despite the overall success of photos on the display, feedback consistently pointed towards news and events as a possible area for expansion. In this sense, the Photo Display had succeeded as a technology probe in demonstrating the potential of public displays and eliciting feedback on how they might be used, leading us to begin designing a replacement display with a wider range of content.

3 Designing the Display

Throughout the process of iteratively designing and evaluating public displays in Wray, we have attempted to engage the community in the process as much as possible, drawing requirements for the display's functionality directly from discussion

with residents and revising prototypes based on feedback collected through a variety of channels, including group meetings with participants. The following sections describe the process of developing a new display following repeated expressions of interest in news and advertising content from residents, from surveying existing noticeboards in the village to probing the possibilities of digital displays and gathering feedback leading to the development of a new display.

Fig. 1 An existing noticeboard outside the village hall in Wray

3.1 Survey of Existing Displays

While photo sharing behaviours were not prevalent in Wray prior to the introduction of the Photo Display, the same could not be said of news and advertising content. Existing public noticeboards were located outside the village hall (Fig. 1), church and both outside and inside the post office. Although some were locked and reserved for official notices, others were freely accessible and widely used to post advertisements, typically for small local businesses, items for sale and upcoming events within the village. Other notices on display showed information about local services, maps, wildlife and activities, as well as information about health services and charities that may be of interest to residents. This was often

highly localised, not only to the local area, but also to the vicinity of the display: for example, the display outside the church was used exclusively for church information, while a series of displays near footpaths outside the village showed information about walks and wildlife. The village was also served by the Wrayly Mail, a monthly newsletter edited by a volunteer and distributed to residents, which mostly contained very brief adverts and event listings for the coming month.

However, residents had reported issues with the use of existing noticeboards and newsletters within the village. For example, several participants had told us that the noticeboards were filled with expired notices that made it difficult to identify new and relevant content. Furthermore, those living outside the main village on farms—who were still considered to be part of the community—were unable to see the content on a regular basis without making a lengthy trip into the village. The monthly distribution of the newsletter also meant that information had to be submitted far in advance, which was not always possible. Many of these problems seemed to indicate that a digital display might be capable of augmenting the distribution of community information to address these issues.

3.2 Working with the Community

Based on feedback from community members and problems identified in the previous section, a meeting was held with residents to determine exactly what features might be desirable on a digital noticeboard. This was aided considerably by two events that had recently occurred in the village: in the first, a suspected con artist had visited Wray and sold an elderly resident £1,000 of frozen fish, a significant event that quickly passed around the village as people encountered each other on the street, or as they arrived at our meeting; in the second, a consultation meeting for a new wind farm development in the area was advertised in the newsletter, but had been forgotten by the time of the meeting and was missed by several interested residents. Both these events were used to illustrate possible scenarios for use of the display, such as distributing urgent news that could not wait until the next issue of the newsletter, or bringing notices to the attention of residents as relevant dates approached.

In response to these requirements, a modified Photo Display was rapidly developed that added a news ticker along the bottom of the display (Fig. 2). Items could be scheduled to appear on the ticker between two set dates by the designated administrator, our primary contact in the village, and other residents were able to email submissions to her for inclusion on the display. Like the original Photo Display deployment itself, this was not intended as a fully-functional feature, but as a very basic function that would help residents to explore issues surrounding news submission and generate feedback to inform the design of subsequent displays.
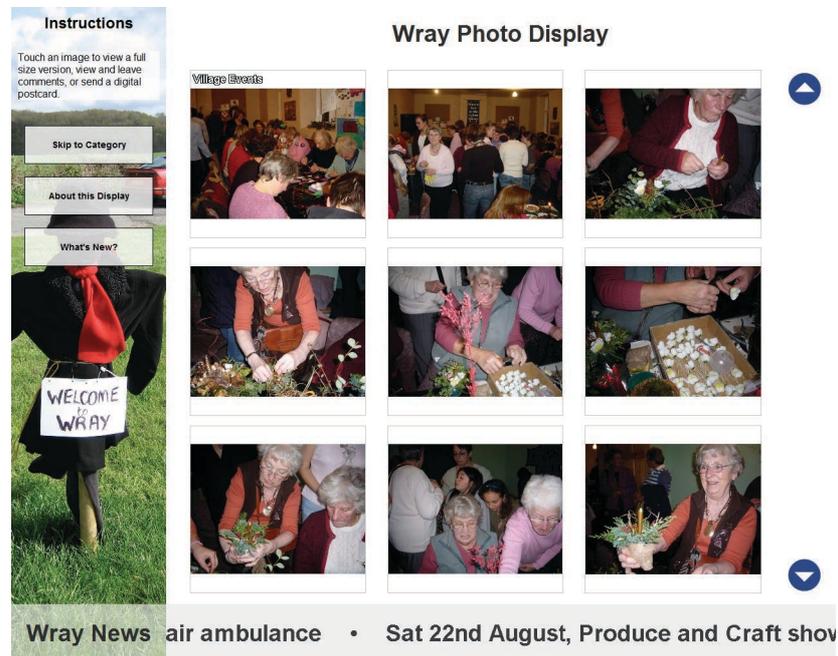
Fig. 2 A modified Wray Photo Display with news ticker

This modified prototype was trialled in the village post office for several months, during which a total of 44 messages were posted. However, despite generally positive feedback, it appeared that few residents had taken notice of the new addition, suggesting the need for a more salient means of displaying news content, and it was decided to proceed with a display that would combine the existing Photo Display's content with more prominent news content.

However, as the Photo Display was well-established and used by this point, we were somewhat hesitant to dramatically alter it in ways that might prove unpopular. To address this, residents were presented with several suggestions for a redesigned display to judge their reaction and gather input. We were particularly interested in how much display space for photos participants would be willing to sacrifice in favour of notices, and the designs presented were intended to provoke comments on the division of photo content and notices, the proportion of each type of content and navigation between them.

Contrary to our expectations, residents wanted the majority of the display to focus on news content rather than photo content. Where our designs had featured one third news, it was instead suggested that this should be reversed. One participant explained that he and other residents had already seen most of the photos, which were not time-sensitive, and it was more important to see notices and advertising on a regular basis.

4 WrayDisplay

A revised display based on design input from the previous meeting, dubbed WrayDisplay, was developed to replace the existing Photo Display. This combined the existing photo content with notices that could be posted by members of the community and displayed this content in public locations in the village.

The main component of WrayDisplay was a touchscreen display running a full-screen application, which showed the top three current news items along with the most recent three photographs submitted to the display (Fig. 3). Each news item comprised a headline, short summary and optional image, which were shown on the front page, with an optional text field for further details that could be accessed by touching the news item to open it. Each news item had a start date and end date, between which it would be shown as an active news item, and an optional 'reminder' date on which it would receive renewed prominence by returning to the top of the news queue. Users were also able to post comments on notices using an on-screen keyboard, or send notices as an email to themselves or others. In addition to current notices, it was also possible to browse through archived news items by month.

WrayDisplay's content was stored on a central server, which allowed multiple individual displays to share the same content by synchronising their content with this server, caching local copies to reduce reliance on an Internet connection. Residents could submit content to the server using a web application, but were also able to email the administrator directly and request that she input a notice. All notices were checked and approved by the administrator before appearing to the public, due to strong feedback in meetings indicating that this was necessary.

Displays were deployed in two locations in the village. The first deployment replaced the existing Photo Display in the village post office, located near existing paper noticeboards (Fig. 4) and utilising a 21" portrait touchscreen display. Shortly after this deployment, we began discussing the possibility of a second deployment with the owner of a local café that had been identified by residents as a suitable location. After the owner responded positively, this was deployed on a smaller, 19" display, initially on a trial basis.

Upon deployment, there was interest from both business proprietors in having a dedicated section on the display for their own content. As a preliminary means of exploring this requirement, the display was modified slightly to ensure that the latest news item submitted by each proprietor would always be displayed in the top-most notice slot on their respective displays. We also received feedback from the café's owner suggesting that she might like to be able to moderate content herself in addition to moderation conducted centrally by the administrator. A need for this later became evident when an advert for a new coffee machine in the post office was shown on her display, which was reportedly perceived as competition by a displeased café owner.
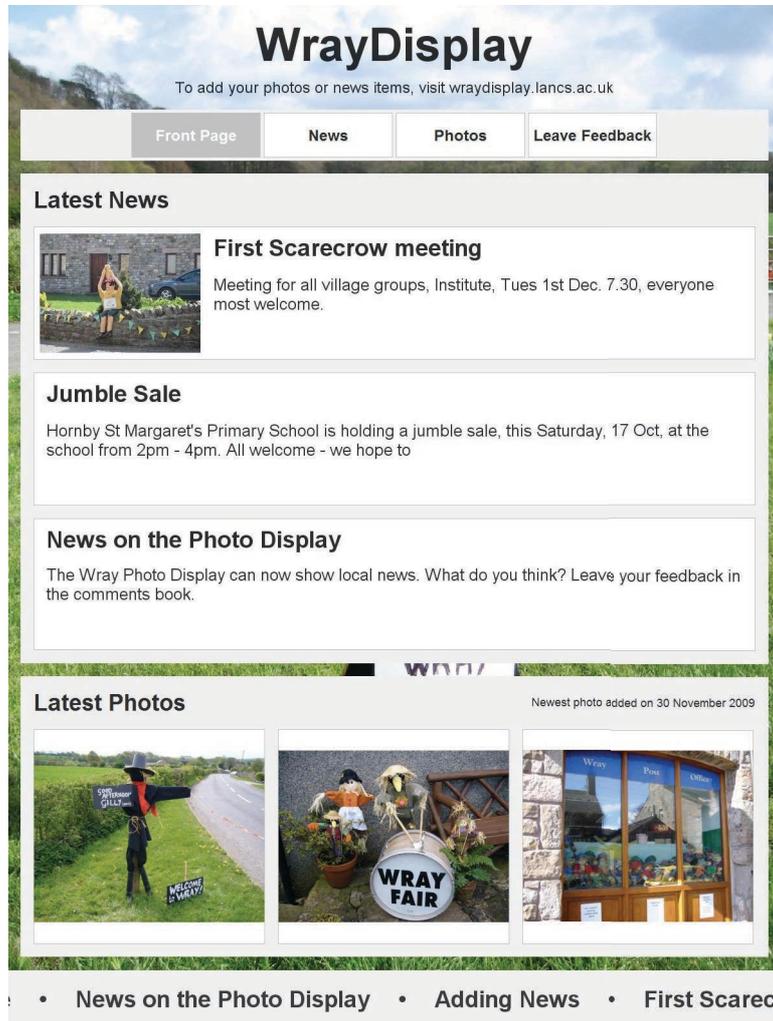
Fig. 3 WrayDisplay home page showing photos and notices

Other feedback from both the café owner and residents suggested an advertisement feature, although it had been intended that the existing features would perform this function. The ambiguous term 'news' had been used on the display to indicate that any type of content could be posted, much like a normal noticeboard, but a large number of event listings had been posted early in the deployment (further detailed in the next section), leading residents to believe that this was the purpose of the new features. This eventually led to notices being separated into 'adverts' and 'events', where adverts operated as before and events were listed chronologically as a village calendar.
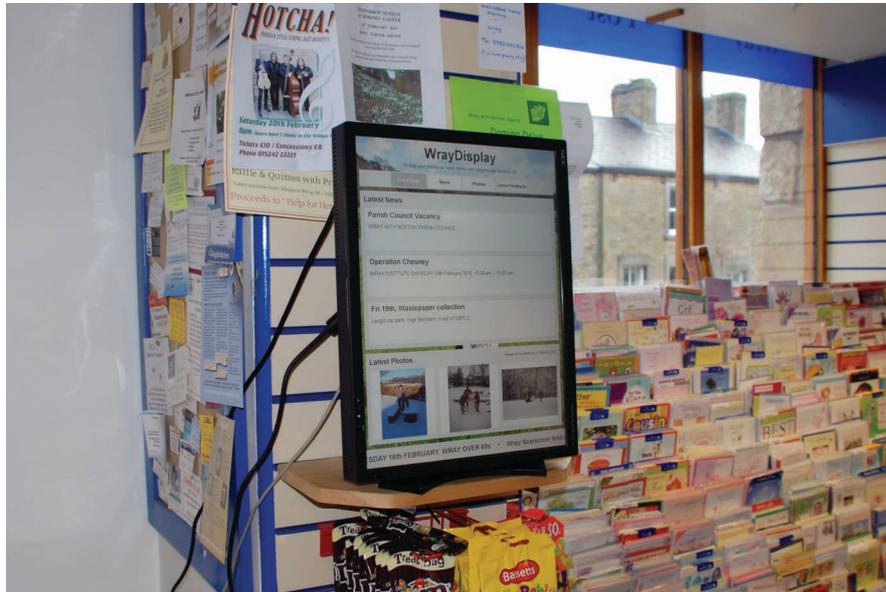
Fig. 4 WrayDisplay in the village post office

5 Usage and Content

WrayDisplay was deployed in the post office in February 2010 and installed in the café one week later, where they are both still deployed as of January 2011. During this period, 190 individual notices have been posted, a number which continues to grow, and both displays have seen regular use by village residents and visitors. The following sections describe the type of content posted by users and analyses usage levels of the two displays.

5.1 Adverts and Events

Despite the apparent desire for a digital noticeboard, posting of content was initially somewhat lacklustre. Initially, the vast majority of content was posted by our contact, who imported the listings directly from the Wrayly Mail as she received each copy. Although it had been expected that she would add any information submitted for inclusion on the village website she ran, it had not been anticipated that she would copy Wrayly Mail content across en masse, but this meant that a wealth of potential content was already available without requiring any extra ef-

fort from the originator, including content from those who might not otherwise have used the display.

Overall, 148 (78%) of the notices posted were event listings, compared to only 42 (22%) that were adverts, largely because the majority of the notices in the newsletter were event listings and our contact was particularly interested in the use of the display as a village calendar. As described in the previous section, this appeared to have the effect of discouraging other types of content, such as advertisements, until the notices were split into two distinct categories. Prior to this split, advertisements accounted for 17% of the notices posted, but 33% of the notices posted afterwards when alterations to the display encouraged use for advertisements.

Event listings typically included a date and title in the headline, with a brief description including the venue and any entrance fee. Where they had been copied from the Wrayly Mail this was usually the only information available, as the newsletter only had brief listings, but those community members who added their own events normally included a longer listing. The following examples show typical events posted on the display:

> **Mon 22nd Feb, Ewecross Historical Society**
> High Bentham Town Hall, 7.30 pm, Mark Rand 'The Settle-Carlisle railway'. Membership £5 a year, visitors £2 per evening.
>
> **Fri 26th Feb Domino Drive 7.30pm**
> Wray with Botton Sports Committee in Wray Institute. Refreshments provided.

Groups within the village, such as the Women's Institute and Over 60s group, regularly used the display as a means of advertising their activities both by listing upcoming events and by posting photographs of past events. At evaluation meetings, both these groups felt that the display was useful for advertising their events to a wider audience, where previously they had typically been spread by word of mouth.

Following the addition of an explicit advertisements section, use of the display for this purpose grew considerably. One resident posted numerous advertisements for her homemade jewellery business and later posted a hen hut she was attempting to sell that was quickly purchased by another resident. Further items for sale have subsequently been posted by this user and others, including a successfully sold tumble dryer, and even a car. The following advertisements are typical of content posted into this section of the display:

> **Part Time Job Vacancy**
> There is a part time job vacancy at Bridge House Farm Tea Rooms.
> Come and be part of the team at Bridge House Farm Tea Rooms. We have a part time job available. This is just for one day a week at the moment but

possibly more hours available as the season becomes busier. The job will involve general front of house duties. For more information contact…

Hen hut for sale
Wooden hen hut, about 6 years old, wind and water tight, perch, water feeder - £50

Interestingly, the photo section was also used for advertising during this period, where it had not been in the past. The resident who had posted adverts for her jewellery business also created a photo category on the display and uploaded photos of her goods. We had always been slightly surprised that the Photo Display had not been appropriated in this way, particularly given the obvious desire for advertising content, and it appeared that the addition of advertising functionality encouraged this behaviour.

5.2 Display Usage

In addition to the content itself, both displays logged all interaction, allowing us to track use of the prototype and the relative popularity of different types of content and different locations. Based on logs running for six months from deployment, the display amassed some 33,497 touches spread across 784 individual sessions (where a session is defined as a series of interactions after the display has been dormant for at least ten minutes). While many of these interactions related to the existing photographic content on the display, there were also a total of 736 notice views in 370 sessions—very roughly four notice views and two sessions each day. This might seem to be a somewhat low number, but given the size of the community, the possibility of peripheral awareness and the fact that the display is only one of many information sources in the village, we believe this represents a satisfactory number of direct interactions.

Fig. 5 shows the number of notice views per month in each location: in the first three months, it is clear that use of the new café display far surpassed the existing post office display. Clearly this is at least partly due to novelty, as the café installation was new while the post office display had been in place for several years, and usage did appear to level out during the second three months. However, the café could certainly be considered to be a location more conducive to interaction, given that customers are likely to spend time relaxing and socialising there. Conversely, the post office display might be considered to better support more peripheral engagement, due to the higher number of people passing the display, albeit only briefly.
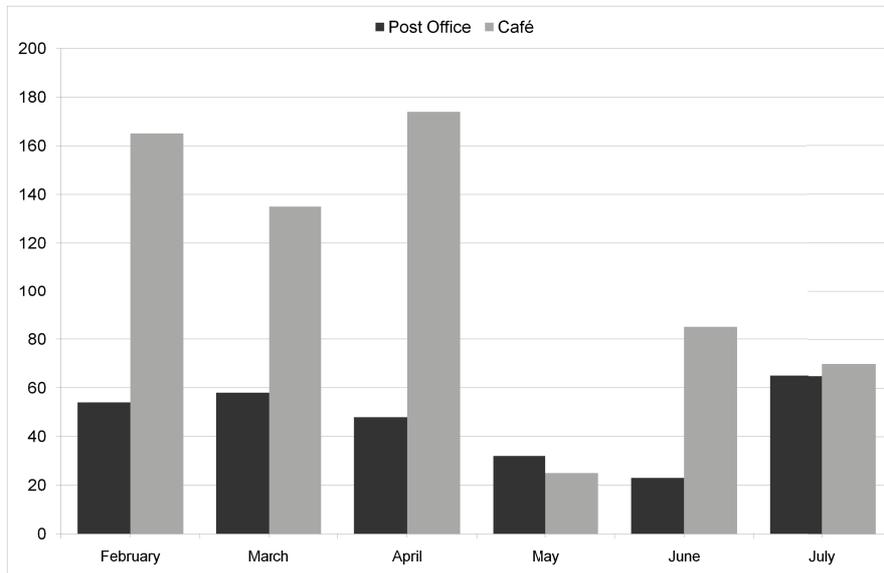
Fig. 5 Notice views in the post office and café

When talking to the owners of the post office and café, both said that the display saw use on most days, and the post office owner reported that people would often enter discussion around it. Although our logs show that a majority of sessions were primarily made up of photo viewing, it is important to remember that usage logs do not tell the entire story: many listings visible on the front page of the display convey all the necessary information without the user needing to open the notice or physically interact with the display, possibly to the point of enabling peripheral awareness. For this reason, the proprietors' observations are particularly useful.

From our own anecdotal observations, both locations appear to be well-used, particularly given the village's location. The post office is usually busy during our visits, and on one occasion when we spent half an hour inside the café, at least one group of customers was seen using the display in that period alone as they entered the building and waited to be served.

6 Discussion

Following six months of deployment in the wild, we have been able to use Wray-Display to illustrate a number of insights into the role of digital signage in rural communities. This section discusses these findings, including methods of engaging the community in the design of such displays and design considerations for future displays.

6.1 The Role of Advertising Displays in Rural Communities

Even before the deployment of WrayDisplay, local advertising played an important role in village life, including advertising upcoming events, local businesses and available services, as well as facilitating small, local transactions such as items for sale. This is demonstrated by the prevalence of existing noticeboards, newsletters and websites serving the community—services that exist in many other similar villages and neighbourhoods.

Despite this, there certainly seemed to be a role for digital signage in the village as well. Naturally, we do not wish to replace any of these existing means of advertising with digital alternatives, but to augment them to improve the distribution of this content through the community. Input during the design stage showed that there were a number of issues that could be addressed by digital displays, such as outdated content, the need for timely 'breaking news' and reminders, and better support for those outside the village proper. Selling items in a local newspaper was also reported as being problematic, due to the distance that people in nearby towns had to travel to collect goods, and participants had felt that the ability to advertise goods on a very local scale would be helpful.

WrayDisplay did not simply inherit existing behaviours surrounding the sources of information it was augmenting. Although the post office display was located adjacent to existing noticeboards used to post items for sale and local services, it developed its own identity as a place for events listings, taking on the role of a village calendar. These unique aspects of a digital display were further evidenced by the contentious coffee machine advert: it is unlikely that the post office owner would have attempted to post such a notice alongside other adverts in the café's window, but the distributed nature of the system led to unexpected results. Other features unique to the display proved to be more beneficial: in one case, the commenting features were used to mark an item for sale as sold, something that would not be possible on a newsletter listing.

The display was also particularly useful for those outside the village, including residents of nearby villages and farms. Many who could be considered to be part of the Wray community did not pass paper noticeboards regularly and consequently could miss important information. Our contact, for example, lived on a farm close to the next village and was heavily involved in community activities in Wray, but complained that she had no way of regularly seeing noticeboards without travelling to the village hall or post office. For these residents, as well as those further afield, such as expatriates who still wish to remain abreast of events in the village, this is a valuable resource.

6.2 Engaging the Community in Designing Displays

Rather than a general-purpose display suited toward widespread deployment for advertising purposes, this project has sought to develop a display tailored to the needs of an individual community through the use of a participatory approach and the iterative development of prototypes. This process of deploying functional prototypes, collecting feedback and improving the deployments has proved to be very successful in creating a technology that is well-suited to its deployment environment. Although we designed to support certain types of behaviours that we expected would occur based on our fieldwork, our prototypes have been flexible enough to allow behaviour from the community to emerge over time. The approach also appeared to create a sense of ownership of the display by the community, and one participant in an evaluation meeting said that the village was proud to have a facility that their neighbours did not, suggesting the café display itself acted as an advertisement for the entire village when seen by visitors.

This approach has also made frequent use of our primary contact as a "human access point" (Marsden et al. 2008), an individual who is a part of the local community but also comfortable with technology who can act as a bridge between researchers and participants, as well as promoting the technology and helping people to use it. Although we must be careful not to be too reliant on this individual, it proved to be an excellent means of accessing the community. Our contact also served as a curator and moderator for the display, ensuring that nothing unsuitable was posted and importing listings from other sources. While this role could have been fulfilled by a researcher, having a member of the community acting as an administrator meant content was far more likely to be appropriate and grounded in the community's needs.

Although our approach has meant the development of the display has been centred on Wray, it is reasonable to expect that other communities and neighbourhoods, particularly rural villages, will have similar requirements. Further study would be required to determine to what extent our observations hold true in other communities and how suitable the technology developed for Wray is elsewhere, but we believe WrayDisplay could be easily adapted to other environments.

6.3 Harnessing Existing Flows of Information

Previous work with digital signage has identified the importance of fitting in with existing routines to ensure users were able to integrate displays into their existing practices with as little personal cost as possible (Cheverst et al. 2007), and this proved to be equally true of advertising displays in Wray. But whereas this previous work found that particular technologies, such as email and instant messengers, were important in harnessing these practices, we also found that particular indi-

viduals could act as gateways to existing information. Our contact, for example, was already a gatekeeper for information on the village website and this role further allowed her to acquire early copies of the Wrayly Mail from its editor (who otherwise eschewed attempts to update her methods of creating and distributing the newsletter) in order to ensure its content was also added to the display.

Although it had not been anticipated that content from the Wrayly Mail would be imported wholesale, this did ensure that there was always current content on the display to ensure it remained useful. However, as the display was designed with occasional individual posts in mind, large batches of content meant that some items would be immediately pushed off the front page. This also led to an ebb and flow of content on the display, as large amounts were posted at the beginning of the month but gradually expired towards the end prior to the next batch being posted. Future displays might be designed to better support this behaviour.

Our contact had also previously expressed concerns about what would happen if she were unable to continue acting as a moderator for the display, fearing that it was too dependent on her—a common problem identified by Redhead and Brereton (2006) in their survey of community communication. For these reasons, community systems should make use of key individuals, but not rely on them alone.

In terms of technology, a web application was a suitable means of submitting content for many residents, as using simple web applications was part of their existing computer use. For others, unfamiliar applications were a considerable barrier to use. Even those who embraced technology were often only familiar with particular applications that they used regularly—such as their webmail—and were not confident using new services. For this reason, we intentionally stressed that news could be submitted via our contact due to her existing role in distributing this type of content. This meant that those unwilling or unable to use the display's website were still able to submit their content by email instead, a medium that most in the village appeared to be comfortable with. For those who weren't, notices could naturally be submitted by non-technical means as well.

6.4 Importance of Location

It should come as no surprise that location was an important factor in the deployment of displays. The effect of location on the usage of displays, in terms of both volume of interactions and type of content, is well represented in public display research and the "interaction between technology and its location" (O'Hara et al. 2003) is central to our understanding of public displays. Our experiences confirm the findings of past research, particularly the observation that 'waiting' spaces attract use (Churchill et al. 2003), but also note that different locations bring differing audiences and senses of appropriate content.

At the simplest level, the impact of location was visible in the usage statistics. The original Photo Display was briefly deployed in the village hall prior to being

moved to the post office, where it subsequently saw far greater levels of usage due to its increased visibility by the large number of residents passing through the shop. Likewise, the deployment of a second display in the café initially showed higher levels of usage than the post office, likely due to the novelty of having a display in this location and the more varied audience who are less likely to have seen the display before, although usage did flatten out after several months.

The display's audience also differed significantly by location. While the post office reached an audience that was mostly local, the café received far more visitors from other villages and further afield. Although we had initially feared that this might make the café display less useful, feedback from residents indicated that reaching a wider audience was seen as a welcome effect of this deployment, suggesting that it might be advantageous to intentionally harness this effect to target adverts at particular audiences. For example, some groups might only want to advertise their events to residents within the village, while others might be actively trying to encourage visitors from elsewhere to use their services. The suitability of different locations for adverts targeting different groups is something that community members appeared to be well-equipped to judge for themselves.

Beyond this, appropriate content also varied between locations, again exemplified by the coffee machine advert. While this was perfectly acceptable in the post office, it was not appreciated in the café due to the perception that it was promoting their competition. The differences in appropriate content across locations is also reflected in existing paper noticeboards in the village by a noticeboard outside the church, which was unlocked but only contained church-related material. In this case, either residents recognised that posting other content was inappropriate or any unauthorised notices were taken down. This is behaviour that could be replicated in a digital display by allowing notice posters to choose which displays their content would be shown on, or by allowing individuals in the deployment venues to remove items on a local basis, rather than rejecting them from the entire system.

6.5 Terminology and Signifiers

One of our more interesting observations was the way that established content appeared to influence subsequent usage despite the display being intentionally designed to support any type of notice content, as demonstrated by requests for a 'classifieds' section so that residents could post advertisements. The high number of event listings posted to the display relative to other types of content when the display was first deployed appeared to give the impression that this was the only appropriate type of content. Furthermore, although we had used the term 'news' on the first prototype as a catch-all term for noticeboard-type content, a term that originated in discussion groups with residents, once deployed this term appeared to suggest content exclusive of advertisements.

Fig. 6 A refrigerator and whiteboard appropriated as community noticeboards. The presence of notices indicates to others that this is acceptable

Norman (2008) used the term 'signifiers' to suggest that "we know how to behave by watching the behaviour of others, or […] the trails they leave behind". This certainly appeared to be occurring in this case, highlighted by the sudden influx of advertisements when the content was divided into events and adverts, signifying that this content was permissible and appropriate. This relates to Harrison and Dourish's (1996) concept of 'spaces' and 'places', in which interactions are governed by both the physical space in which they are situated and the cultural expectations associated with that particular place.

There are many further examples of noticeboards dependent on signifiers to indicate appropriate behaviour, both in Wray and elsewhere (Fig. 6). We have often been drawn to one noticeboard in the post office, located very close to our own display, where notices have been attached to the side of a branded drinks refrigerator, subverting the refrigerator's original secondary purpose as an advertising device for the drinks company and appropriating the surface to display community content. At some point, the surface was used to post a notice for the first time, indicating to others that it was 'okay' to post notices there. In a similar example, a whiteboard in our department kitchen went unused for many years until a single message was written on it, after which the board quickly became used for doodling, banter and notices.

7 Conclusions

This chapter has described our work developing a digital noticeboard for use in Wray, based on input from community members themselves and deployed in the village for an extended period of time. From this experience, we have gained a number of insights into the use of digital signage in rural settings and the process

of engaging a community in designing displays tailored to their needs, as well as factors to consider in the design of such displays.

Our observations have included areas in which Wray was not already well-served and where digital interventions could augment existing practices to address issues that exist, and the value of fitting in with existing information flows and carefully considering display locations with the village. We were also surprised by the extent to which early content on the display influenced its later usage and perceptions of appropriate content by residents.

Above all, our research has shown that there is clear potential for appropriately designed digital signage in rural communities. While public displays are often deployed in urban and workplace environments, such pervasive technologies are rarely investigated elsewhere. Work in Wray has demonstrated that displays can be successful in rural environments as well, suggesting a need for further research to explore digital signage, and pervasive technologies in general, in this area.

References

1. Cheverst K, Dix A, Fitton D, Rouncefield M, Graham C (2007) Exploring awareness related messaging through two situated-display-based systems. Hum–Comput Interact 22(1):173–220. doi: 10.1080/07370020701307955
2. Churchill E, Nelson L, Denoue L, Murphy P, Helfman J (2003) The Plasma Poster Network. In: O'Hara K, Perry M, Churchill E, Russell D (eds) Public and situated displays: Social and interactional aspects of shared display technologies. Kluwer, USA, pp 233–260
3. Churchill EF, Nelson L, Hsieh G (2006) Café life in the digital age: augmenting information flow in a café-work-entertainment space. In: CHI '06 extended abstracts on human factors in computing systems. ACM, New York, pp 123–128
4. Frohlich DM, Rachovides D, Riga K, Bhat R, Frank M, Edirisinghe E, Wickramanayaka D, Jones M, Harwood W (2009) Storybank: mobile digital storytelling in a development context. In: CHI '09: Proceedings of the 27th international conference on human factors in computing systems. ACM, New York, pp 1761–1770
5. Greenberg S, Rounding M (2001) The notification collage: posting information to public and personal displays. In: CHI '01: Proceedings of the SIGCHI conference on human factors in computing systems. ACM, New York, pp 514–521
6. Harrison S, Dourish P (1996) Re-place-ing space: the roles of place and space in collaborative systems. In: CSCW '96: Proceedings of the 1996 ACM conference on computer supported cooperative work. ACM, New York, pp 67–76
7. Hutchinson H, Mackay W, Westerlund B, Bederson BB, Druin A, Plaisant C, Beaudouin-Lafon M, Conversy S, Evans H, Hansen H, Roussel N, Eiderbäck B (2003) Technology probes: Inspiring design for and with families. In: CHI '03: Proceedings of the SIGCHI conference on human factors in computing systems. ACM, New York, pp 17–24
8. Marsden G, Maunder A, Parker M (2008) People are people, but technology is not technology. Phil Trans R Soc A 366(1881):3795–3804. doi:10.1098/rsta.2008.0119

9. Maunder A, Marsden G, Harper R (2011) Making the link – providing mobile media for novice communities in the developing world. Int J Hum–Comput Stud. doi:10.1016/j.ijhcs.2010.12.009
10. McCarthy JF (2003) Promoting a sense of community with ubiquitous peripheral displays. In: O'Hara K, Perry M, Churchill E, Russell D (eds.) Public and situated displays: Social and interactional aspects of shared display technologies. Kluwer, USA, pp 283–308
11. Norman DA (2008) The way I see it - Signifiers, not affordances. interactions 15(6):18–19. doi:10.1145/1409040.1409044
12. O'Hara K, Perry M, Churchill E, Russell D (eds.) (2003) Public and situated displays: Social and interactional aspects of shared display technologies. Kluwer, USA
13. Oldenburg R (1989) The great good Place: Cafes, coffee shops, community centers, beauty parlors, general stores, bars, hangouts, and how they get you through the day. Paragon House, New York
14. Redhead F, Brereton M (2006) A qualitative analysis of local community communications. In: OZCHI '06: Proceedings of the 18th Australia conference on computer–human interaction. ACM, New York, pp 361–364
15. Redhead F, Brereton M (2009) Designing interaction for local communications: an urban screen study. In: INTERACT 2009, LNCS, vol. 5727. Springer, Heidelberg, pp 457–460
16. Snowdon D, Grasso A (2002) Diffusing information in organizational settings: learning from experience. In: CHI '02: Proceedings of the SIGCHI conference on human factors in computing systems. ACM, New York, pp 331–338
17. Taylor N, Cheverst K (2009) Social interaction around a rural community photo display. Int J Hum–Comput Stud 67(12):1037–1047. doi:10.1016/j.ijhcs.2009.07.006
18. Taylor N, Cheverst K (2010) Creating a rural community display with local engagement. In: DIS '10: Proceedings of the 8th ACM conference on designing interactive systems. ACM, New York, pp 218–227
19. Taylor N, Cheverst K, Fitton D, Race NJP, Rouncefield M, Graham C (2007) Probing communities: study of a village photo display. In: OZCHI '07: Proceedings of the 18th Australasian conference on computer–human interaction. ACM, New York, pp 17–24