

Tethered or Free to Roam: The Design Space of Limiting Content Access on Community Displays

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ABSTRACT

Many design decisions need to be made when creating situated public displays that aim to serve a community. One such decision concerns access to its contents: should users be able to access content remotely, e.g., via a web page, or should this be limited to users who are co-located with the display? A similar decision has to be made for community content upload: do posters need to be co-located with the display or can posts be made from any location? In other words, content display and creation can be ‘tethered’ to a display or it can be ‘free to roam’, i.e., accessible from anywhere. In this paper we analyze prior community display deployments in an attempt to explore this space and produce a taxonomy that highlights the inherent design choices. Furthermore, we discuss some of the reasons that may underlie these choices and identify opportunities for design.

Categories and Subject Descriptors

H.4.3. [Communications Applications]: Bulletin boards; H.5.3. [Group and Organization Interfaces]: Theory and Models; H.5.1 Multimedia Information Systems;

General Terms

Design

Keywords

Public displays; content; collocation, communities;

1. INTRODUCTION

When creating public display systems for supporting communities, one of the many design decisions that has to be made is whether to ‘tether’ the display’s content and functionality, i.e., to tie the display of content and the creation of new content to collocation with the display, or whether to enable content to be ‘free to roam’, i.e., to have the content and/or its upload functionality

accessible from multiple locations, e.g., email, dedicated websites, or third party services. Similar choices have to be made when designing mobile applications that support digital storytelling within place-based communities [35].

To illustrate these options, consider the examples of BigBoard [20], Hermes [4], and Ubinion [13]. The BigBoard system (also known as “SnapAndGrab”) was a standalone public display system designed to support a ‘learn to earn’ community in a township on the outskirts of Cape Town. The main functionality provided by the display was to support free media sharing among community members: trainees working within the ‘learn to earn’ community could upload or download media files, e.g., business cards, instructional videos, or audio books, to/from the BigBoard display using Bluetooth-enabled mobile phones. The functionality of BigBoard was *tethered* to the display: all content uploads and downloads had to be done at – or close to – the display (i.e., within range of its Bluetooth radio).

A more complex setup was used in the Hermes system. Hermes allows employees in a university department to post awareness-related information on small displays placed outside their offices. Typically, such awareness information included personal context relating to future presence, e.g., “Gone to Gym – back at 2.30pm”. This information was *tethered* to the display, i.e., it was only visible to visitors standing in front of the actual office door. Early interviews had revealed that a majority of lecturers did not wish to have their shared personal context available on-line, e.g., on the Web or even just the department intranet. However, uploading a status messages for a display at one’s office door could be done from anywhere using the Hermes website (given the appropriate account credentials) or even by simply sending a text message from a mobile phone, e.g., texting “stuck in traffic” while in the car. The functionality of uploading content for office owners was thus *free to roam*.

Visitors could also upload content to a Hermes display: they could leave messages for the owners using the touch screen of the Hermes display – this content upload was thus *tethered* to the display. Again, during interviews lecturers had explicitly stated that they wanted this restriction. The typical reason for this was that given the semi-public setting a form of social policing would reduce the likelihood of inappropriate messages being left (see [8] for more discussion on this key issue relating to display placement and content submission). Finally, office owners could view these messages using the Hermes website, thus making their content consumption *free to roam*.

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As a final example, consider the Ubinion system. Ubinion was a set of networked public displays deployed at a number of youth events in the city of Oulu, Finland. Each display allowed visitors to snap a picture of themselves with an attached webcam and annotate it with a “speech bubble” or a “protest sign” and custom text entered via an on-screen keyboard. The goal was to solicit feedback on municipal issues for local youth workers, as the “official” feedback methods of paper forms or personal visits to a youth office were not being used. The collected images would then be automatically posted to a dedicated Facebook page, allowing for further commenting. Similar to both BigBoard and Hermes, Ubinion also featured *tethered* content uploading, i.e., users had to be in front of a display in order to create a feedback message. On the other hand, content viewing was *free to roam*, i.e., accessible from anywhere using the publicly known Facebook page of the project (where all pictures were posted to) as well as its public Twitter account (where the text messages were posted).

BigBoard, Hermes, and Ubinion illustrate different points in the design space of providing content access and provisioning for community-oriented public display systems. BigBoard used only a single metaphor – tethered access – while Hermes offered either tethered or free to roam access based on a user’s role (visitor vs. office owner, respectively). Ubinion used an asymmetric setup. Table 1 locates these three systems in the design space.

Table 1: Content access in BigBoard, Hermes, and Ubinion

	Content Input	Content Output
Tethered	BigBoard Hermes (Visitors) Ubinion	BigBoard Hermes (Visitors)
Free to roam	Hermes (Owners)	Hermes (Owners) Ubinion

In this paper we explore the design space that centers around these notions of ‘tethered’ and ‘free-to-roam’ content provisioning and consumption, and consider the population of the design space given a representative sample of deployed public display systems. The set of analyzed systems focused primarily on those designed to support communities. After presenting our sample of public display systems in section 2, we analyze the systems and derive a taxonomy for talking about the notions of ‘tethered’ and ‘free-to-roam’ content access and provisioning in section 3. Using these units of analysis, we will then discuss the implications of ‘tethered’ and ‘free-to-roam’ content access and provisioning in section 4. Finally we present the concluding remarks in section 5.

2. SYSTEMS DESCRIPTIONS

In our analysis, we have looked at over three dozen public display systems built for community support that have been reported in the literature. In this section, we briefly present the considered systems, grouping them along their intended community uses.

The largest group of systems we looked at is clustered around *displaying community relevant information*, e.g., historical images [34], stories [31], maps with community relevant places [11], and community relevant news [5][6][7][14]. A representative example system would be the Wray Photo Display [34] that showed historical images of the Wray village as well as news items and stories contributed by the community members (in both cases). Another large set supported *content exchange within the community*, i.e., content upload and download using a mobile phone [1][2][16][20], a USB stick [4], or remotely [12]. The BigBoard system [20] described above is a prominent example.

Hermes [4], also described above, is an example of *community messaging*, i.e., sending directed or undirected text messages between community members and showing them on a display. While Hermes supported multiple ways of leaving a message on the display (touch input, SMS, website), others used only SMS [19], a dedicated website [19][27], IM [15], Twitter [27], or used an attached camera to support “picture postcards” [13][29].

Another set of systems aimed at supporting *commenting and voting* on displayed content [3][13][25][32][33]. Good example of such systems are not only the above-mentioned Ubinion [13] but also the Opinionizer [3], which allowed people to create avatars and post comments on topics shown on a display (avatar creation and commenting was done through a keyboard attached next to the screen). Usually, these systems display topics related to the setting and support situated on-display interaction [3][25][32] or remotely through a mobile device [33] or widespread third party service – Facebook and Twitter [13].

One popular service is providing *presence information*, i.e., information about who is in a particular space. CoCollage [23] is a prominent example of such systems. Café patrons ‘checked in’ by either swiping their loyalty card or by connecting to the local WiFi network and choosing the ‘check in’ option. Their profiles then appeared on a display in the café. Other systems retrieved presence data from an online profile [18][23][24], by sensing if the user is in the space using badges [22] or Bluetooth [9][17], or by allowing the user to project a live video feed on the display [12]. Other systems also showed the connections between people in a display’s vicinity [24].

A final group of systems showed *content from third party services*. For example, City Wall [30] displayed location-based images from Flickr. Other systems used Flickr to show images for a particular user [17][21]. FunSquare [25] merged content from multiple sources, such as weather data and network traffic.

3. ANALYSIS

We analyzed the above systems along the following two properties: (1) the type of content originating to and from a display (cf. Table 2) and (2) how content display and upload are restricted to co-location with a display (cf. Table 3). The numbers listed in each table correspond to the bibliography. Numbers in round brackets (in the left-hand columns) indicate total count.

Content type originating from and being uploaded to display

The most dominant type of content in the analyzed systems is content provided by the users themselves: 15 systems supported user-generated content, e.g., user-generated pictures (9) and user-generated stories and comments (9). However, only a subset of these systems had a direct connection with the community or place: three systems showed images of community places, two showed community-generated audio and video, and three supported commenting on locally relevant topics. A typical example of a system that showed images of a community’s space is the Wray Photo Display [34], while a typical representative for commenting on locally relevant topics is the Opinionizer [3] and Ubinion [13].

Some of the systems went beyond allowing user-generated content and tried to inform the community about relevant events (5), as well as who is present in the community’s space (presence information, 4). Information about upcoming events was pulled from intranet pages and calendars [5], or was even custom-created for display viewing [7]. Typical examples would be the eCampus system [7] that displayed events at Lancaster University across a

Table 2: Types of content shown on/uploaded to display

Content originating to and from a display	
Type of content	Systems
User-uploaded pictures (9)	4, 5, 6, 15, 21, 28, 30, 33
3 rd -party services content (4)	16, 20, 24, 29
Presence information (4)	4, 9, 11, 16, 21, 22
User generated stories and comments (9)	3, 12, 13, 15, 18, 26, 30, 32, 33
Upcoming events (5)	5, 6, 7, 14, 33
Shared media (2)	2, 19
Advertisement (2)	1, 27
Topics of interest (3)	21, 23, 24

display network on campus and CoCollage [23] that allowed its users to ‘check in’ and announce their presence.

Table 2 lists the analyzed systems, their respective content, and the total count per content type.

Content access limitations

An almost equal share of systems had content appearing only on a display (14) or on both a display and another device and/or place (17). Interesting to note is that two systems, Ubinion [13] and UbiPostcards [29] had used the displays as an input device, i.e., to take photos, and showed the content somewhere else (in case of Ubinion content was shown on Facebook and Twitter, while in the case of the UbiPostcards content was forwarded through email). Most of the systems that supported “untethered” content showed the content both on the display as well as on a dedicated website. For example, the Wray Photo Display also featured a website that had similar content as shown on the display. Some systems also forwarded content to third party services (e.g., Ubinion’s) or were accessible via text messages. Some systems, like Digifieds [1], allowed content upload and download through multiple devices, e.g., the display, a website, and a dedicated smartphone app.

Some of the content upload restrictions came from actually having to use the display in order to create or upload content, e.g., for UbiPostcards and Ubinion. This general approach – “tethered” content upload but “free-to-roam” content viewing – was popular: six systems supported this. Only few systems had content viewing and uploading completely tethered to the display. For example, systems that used Bluetooth (2) required users to be collocated with the display. Users of the BigBoard system had to be in the display vicinity in order to upload or download the content via

Bluetooth, while Cityware showed local Bluetooth names on the display, i.e., client devices had to be close *and* the viewer had to be in front of the display to see the names.

Only two systems used the ‘free-to-roam’ principle for both input and output. For example, the Discussions in Space [33] and SI Display [27] had content accessible from the Web, and allowed content submission via Twitter, i.e., content could have been submitted from any location to a display and could be seen from any location via the Web.

4. DISCUSSION

The rationale behind design choices of having content and functionality ‘tethered’ or ‘free-to-roam’ was not always clear in previous research and was often not reported. Available information was extracted and is summarized in Table 4 and Table 5.

When analyzing the set of research papers describing the public display systems we typically found only limited discussion and justification regarding the decision to adopt a ‘tethered’ or ‘free-to-roam’ approach. For some systems, the decision appears to be the result of explicit requests from a particular set of users, e.g., ‘owners’ of the Hermes displays (visitors requests not being canvassed) who wanted to reduce the likelihood of receiving inappropriate messages but also (in some cases) to be sure that the person leaving the message (typically an undergraduate student) had indeed made the trip to his/her office. For other systems the decision was strongly based on an ethnographically informed understanding of the target user group and their available resources. For example, when discussing the needs of the target user group for their BigBoard system, Maunder et al. [19] state, that “*we needed to create a system that would allow users to download relevant media at no cost to themselves. Nor should costs be incurred by forcing users to purchase special hardware or state of art smart phones.*”, and, “*...as the target users are not familiar with the internet (and cannot afford large download fees) the distribution system would have to work in ways that the users are familiar with*”.

For some systems a tethering approach was initially supported but then removed once its lack of usefulness was revealed. For example, the Wray Photo Display initially supported a facility that enabled Bluetooth upload/download of photos to the display following an explicit request from an early design workshop but this feature was removed in subsequent development iteration due to its lack of uptake by users in the target community.

Table 3: Content consumption and provisioning with respect to collocation with a display

	Content In	Content Out
Tethered	<ul style="list-style-type: none"> - Picture taking (2): 12, 28 - To upload/download content (6): 1, 2, 4, 15, 17, 19 - Scribbling/text messaging (3): 4, 6, 31 - Bluetooth information (2): 9, 16 - Commenting and voting on the content (2): 3, 24 - Get more details or more content (3): 24, 30, 33 - To announce their presence (5): 11, 17, 21, 22, 23 - Content appears only when user around (2): 20, 23 	<ul style="list-style-type: none"> - Localized messaging (7): 4, 9, 14, 16, 18, 22, 26 - Content collage (5): 5, 6, 7, 11, 21 - Presence information (6): 4, 9, 16, 17, 21, 22 - Custom created content for a display (3): 7, 17, 24 - Content filtered from a 3rd party service (3): 16, 20, 29 - Content cannot be taken (2): 7, 13
Free to roam	<ul style="list-style-type: none"> - Text messaging/sending text (3): 4, 18, 26 - Content from a 3rd party service (3): 16, 20, 29 - Multiple input sources, e.g., email, web pages, images, and/or video (5): 5, 6, 7, 11, 21 - Info from an online profile (2): 17, 20 - Info from a website (2): 13, 33 - Commenting and voting (2): 12, 32 	<ul style="list-style-type: none"> - Content sent through a dedicated service (5): 4 (various services), 12 (Facebook and twitter), 28 (email), 26, 32 (twitter) - Content can be taken away (8): 1 (QR and numeric code), 4 (mobile phone), 5, 6 (email), 7 (email), 15, 19 (Bluetooth), 24 (QR code), 27 (mobile phone).

Table 4: Design rationales for tethered and untethered content (assumed)

(a) Tethered: rationale behind the design decision	
Implication	Systems
To support current interaction practices and to preserve the locality of the content (2)	1, 17
Owners' desires to restricted information to the persons co-present with the displays (1)	4
Simplicity, no need to manage multiple views (2)	3, 33
Legislation (1)	33
To spark social interaction (3)	20,23,24
To support minimal cost of interaction (2)	16, 28
To make content exclusive and to leverage information coming from display surroundings (1)	24
To understand what type of audience likes what type of content on a public display (1)	27
To engage audience locally with the artist (1)	31
To allow situated content (2)	9, 16

(b) Free to roam: rationale behind the design decision	
Implication	Systems
Access desired communication channel (3)	12, 26, 32
Allow remote members to access the system (1)	11
Support wider use of the application (1)	30

This contrast in uptake of the Bluetooth media transfer feature between BigBoard and the Wray Photo Display provides a clear illustration of the need for designers to carefully consider the abilities and requirements of their target user community and that it is not sufficient to make design choices relating to 'tethered' vs. 'free-to-roam' based simply on the design choice made as part of another system with a different target user community.

One of the main reasons for having content tethered to a display is to spark social interaction (3). All three systems tried to provide some form of 'topic of interest' for the users in order to spark social interaction. Another reason for having content tethered to a display is because of current interaction paradigms that display is trying to mimic. For example, the Digifieds [1] system required users to be collocated with the display in order to post and retrieve content from a digital version of the public notice board. This behavior is similar to current practices with analog public notice area. Similar functionality was chosen for the 'Poster' application of Instant Places [18], which went a bit further and required place owners approval before the poster would become visible.

Sometimes the reason for having content and functionality 'tethered' is because of simplicity, i.e., to avoid having different views/versions of the same content for different devices/places. This is best exemplified with Digifieds and the Wray Photo Display. Designers of the Wray Photo Display made an explicit decision that they are going to have a very simple system that is going to look the same on the Web and on the display. On the other hand, the designers of Digifieds decided to have their content appear on multiple devices/places, i.e., on the display, on a dedicated website, and on the phone. This involved designing and developing different user interfaces for the three as well as some tweaking of the content, e.g., content on the phone had low resolution images while content on the display and web had high resolution images.

Image size is just one of the differences between having content 'tethered' or 'free to roam'. In the case of Wray Photo display pictures of minors had to be removed from the website due to legislation issues, but were still acceptable for viewing on display.

Table 5: Desired effects of tethered content display

(c) Effects with content shown on a display	
Implication	Systems
Stimulates sense of a community (5)	22, 23, 24, 31, 33
Informal opportunity for interaction (4)	2, 24, 29, 31
Highly localized content / messaging (3)	9, 16, 19
Social embarrassment (1)	3
Honey pot effect (2)	3, 24
Introduction of a public display lead to people forgetting other places where the content appears (1)	13
Less inappropriate content when submitted through a display (1)	6

Another reason for having 'tethered' interaction is cost. For example, the BigBoard system supported content exchange via Bluetooth and did not require GPRS connection – for which users would have to pay – or WiFi connection – for which the owner would have to pay. Similarly, the EyeCanvas systems and Hermes had 'tethered' interaction and allowed their users to leave message through the display, while the Cityspeak [19] system supported 'free-to-roam' interaction that allowed users to post text messages on a display by sending an SMS or through a dedicated website (which required Internet connection).

The effects of having content tethered to a display are summarized in Table 5. Some of the research reports that having content tethered to a display stimulates and supports the sense of a community (5). For three of the systems this was tied with stimulating social interaction through public displays [24][25][32] while for the other it was associated with community [34], personally selected images [21], and presence information [23]. Others also reported the effect of stimulated social interaction through public displays [2][30]. Social interaction was stimulated by providing topic to talk about [24][25], by allowing people to 'act' in front of a display [2][30] or by joining them in a group action, e.g., voting at the same time [32].

While researchers have reported that having 'tethered' content can lead to the 'honeypot' effect [3][25] where seeing users interact with a display invites others, there have also been reports that this can create pressure and social embarrassment [3].

One of the main reasons for having content 'free-to-roam' is to have easy access to a widespread communication tool (3), i.e., Facebook and Twitter [13][27][33]. This approach usually has a lower entry barrier as it is relying on a technology that most of the users are familiar with. Potentially, this would also allow researchers to examine how public displays 'fit in' within existing ICTs portfolio, i.e., users' communicative ecology [26]. Memarovic et al. [26] looked at communicative ecology of networked public displays for communities. For the definition of the concept please refer to Foth and Hearn [10].

A similar reason for having content 'free-to-roam' is to support a wider use of the application [11], i.e., the application is 'free-to-roam' between multiple devices/places (e.g., mobile device, web, and display). As for the above, this approach could bring interesting insights into how public displays fit within existing ICT portfolios. This is an important step towards uncovering the often asked question "why would I have that on a public display and not on my mobile phone?"

5. CONCLUSIONS

In this paper we have made explicit the design space for mapping out whether content is ‘tethered’ to a given public display or ‘free to roam’. Our brief literature survey of past and current research describing public display deployments reveals that often the design choice for whether or not to tether content to the display is poorly justified/explained against any specific design criteria. In addition to mapping out the design space, we also provide evidence for the ways in which choosing a ‘tethered’ vs. ‘free to roam’ approach may meet given design criteria. For example it could ensure the appropriate degree of privacy based on the displays location, it could encourage a social congregation around a display, or it could allow the member of a place-based community, who is unable to be physically present at a display, to still access community content. We hope these research contributions encourage (and assist) future developers of public display systems to make their design decisions relating to this important aspect both explicit and informed.

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