OpenWindow: Citizen-Controlled Content on Public Displays

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ABSTRACT

In this paper, we investigate the true 'public' potential of public displays by shifting the responsibility to create or control content from the traditional central authority to the citizen. To evaluate the potential value of this concept, we have designed and deployed a set of small public displays behind the street-side windows of three separate houses, of which the households were each invited to provide their own content. During a three-week, in-the-wild field study, we have analyzed the impact of citizen-controlled public displays on both participants and community members, and have observed the relationships between the public display and the neighborhood. Our analysis shows how delegating the control over content on a public display to members of the community can influence social cohesion in the immediate environment as it offers an additional opportunity for discourse. Observations also highlight how the effectiveness of citizen-controlled public displays can be dependent on pre-existing social, cultural or linguistic issues. This experiment aims to illustrate the value of a more socially- and location-relevant integration of public displays in our urban neighborhoods as a multifaceted yet democratic medium of public communication.

Categories and Subject Descriptors

H5.m [**Information interfaces and presentation (e.g., HCI)**]: Miscellaneous.

General Terms

Human Factors, Theory, Design.

Keywords

Public display, public space, urban screen, community, social issues, media architecture, smart city, public participation.

1. INTRODUCTION

Public space is a social environment that is open and accessible to all, a place that is specifically designed to host and share a wide range of civic activities. In recent years, the attention towards using technology to exploit the potential value of public space to spur social interaction and sustain social cohesion has been steadily increasing (e.g. [19]). Consequently, in many Western societies authorities have been installing public displays at densely travelled points of human convergence. Next to their obvious purpose for advertising, entertaining and communicating information, these displays have been promised to potentially stimulate social interaction in their immediate vicinity by bringing playful experiences (e.g. [4, 8]), by facilitating new forms of public and cultural engagement [15, 24], or by extending traditional communication media platforms [3, 4].

However, while a 'public' display is by definition freely perceivable, its accessibility in terms of content is mostly a well-kept secret. For the large majority of current public displays, citizens are unable to participate in the creation of content. Even though the obvious potential of public displays is to address 'everyone', regardless of socio-demographic background or technical proficiency, the process of creation, maintenance or supervision of content mostly resides with a single, central authority. More often than not, citizens do not even know who that authority might be, or how to contact it. Instead, citizens often seem to take content on public displays for granted, which might be explained by a general lack of interest, or by some common agreement to what is shown. In fact, the basic question of what citizens actually wish to see on public displays has not been definitively answered. For instance, one could imagine an open and participative process in which transparent and democratic mechanisms allow citizens to control the content on public displays by making suggestions or participating in creation. More idealistically, full control and supervision over content could even be completely turned over to the public at large.

If citizens would be given this opportunity, what would they show on a public display? How would it differ from what is currently shown on public displays? What would be its impact on the community? We believe such knowledge is required to truly capture the social potential of public displays, i.e. their role in enriching social life in the communities that surround them. We argue that by shifting the content creation process from a central authority to community members themselves, public displays may become more relevant and integrated in their surroundings, as they will better reflect the local values and attitudes. More 'accessible' public displays may subsequently foster a stronger reciprocal relationship between the displays on themselves, the content that is shown and the local context that hosts the displays. This may elicit, renew or strengthen social interactions among inhabitants through dialogue, discussion or even new experiences.

As one of the first steps towards the 'ideal' of citizen-driven content creation on public displays, our first experiment has been relatively limited in scope and technological complexity. To overcome obvious censorship, privacy and security concerns, we developed a custom-made system, coined *OpenWindow*. This consisted of a small public display that was installed behind the street-side windows of three separate houses. Each house was located in a different urban neighborhood, and the resident households were invited to completely determine the textual content that was displayed. We build upon feedback that was

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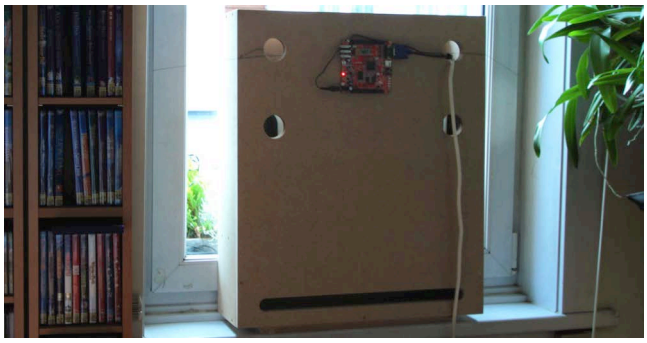

Figure 1. Display casing with attached mini-computer, cable to power supply and ventilation holes.

acquired from participating households and community members to describe how a citizen-controlled public display has the potential to impact the social and cultural fabric of a neighborhood. Finally, we propose a set of considerations for future endeavors in citizen-controlled public displays.

2. BACKGROUND

Public displays form a novel platform for social interaction [3, 28]. Previous research has highlighted their potential to alter our collective experience and use of public space. For example, analysis of large-scale interactive display installations has revealed how their spatial configuration can support the 'place-making' process [8] and how they can provide a common platform for strangers to socialize [20]. At the same time, public display installations that have provided an open forum for discourse have also proven to support civic engagement and general awareness of community issues (e.g. [22]). This has resulted in design guidelines for motivating dialogue and encouraging participation among citizens by controlling content on public displays through, for example, the use of mobile phones [14] and social networks [10], play [7], or voting interfaces in public spaces [26].

Recent experiments have hinted at the potential of "open display networks" [6] where a single viewer can engage with a public display by administering its content based on his or her own set of preferences. However, to fully exploit interaction by multiple viewers (i.e. community members) and to aid in community building, public displays should be designed for a rich diversity of situations that might occur in the environment [21], for example through participative content creation or moderation, similar to traditional public notice areas [1]. Such deployments in work and education environments (e.g. [12, 17]) have enabled public displays to aid in the creation of social information spaces that support collaborative work. Deployments in social settings have indicated how delegating responsibility over multimedia content to members of a rural community has encouraged sustained interaction with public displays (e.g. [25]).

Similarly, public displays should maximize the possibilities for interaction among and with the audience by preserving a balance between the location of deployment, the type of screen, and the content that is shown [24]. Public displays showing localized content have proven to engage spectators in dialogue with others [16] and interaction with the display [22]. One of the challenges in sustaining a meaningful interaction with public displays lies exactly in the appreciation of content by the audience. For example, content that does not adhere to expectations from the intended audience may potentially contribute to an aversion towards displays, i.e. 'display blindness' [11, 18]. This may however be resolved by a more pronounced evaluation of the context that surrounds public displays, including the content that is shown [27], by allowing them to sense their environment and deliver content that is adapted to the dynamic characteristics of the environment [2, 5], or by embedding mechanisms that allow public displays to respond to changing requirements over time [9].

3. CONTENT CONTROL PATTERNS

To describe the 'public' potential of public displays, we first analyze the different forms of control over content from a stakeholders' point of view, which typically are: 1) the entity that owns the display, 2) the entity that creates and/or publishes content, and 3) the display audience.

Centralized control. A central authority (e.g. local government, commercial agency) pushes content to the public display it owns. In this pattern, processes for content suggestion are rarely in place, thereby discouraging local inhabitants to voice desires or concerns. Therefore, this pattern for content control is optimal to prevent misuse (e.g. undesired content), and keeping the authorship anonymous, leading to neutral or objective content.

Citizen control. One citizen or household controls content, hereby explicitly externalizing the relationship between the content and its author(s). Opportunities to suggest content for all other citizens are implicitly (e.g. via conversations in the street) or explicitly available (e.g. via social networks). The supervision process may either be based on guidelines that are provided by the central authority that still owns the display, or by personal preferences of the supervising resident. As the supervisor is immediately identifiable, the risk for misuse is limited, yet content can be interpreted from multiple viewpoints, which might not be necessarily perceived as being objective or democratic in nature.

Community control. The authority of content administration is democratically shared by a larger subset of a community, or individually distributed among a subset of members. The sharing of authorship increases the chance that content will be perceived as contextually relevant, and may even spur competition, content variance and creativity. This scheme also has the highest potential for misuse, although the authority to curate content might also be shared, for instance by borrowing methods from social media.

4. CASE STUDY DESIGN

We present the design and methodology of our pilot study and consecutive in-the-wild field study to capture and analyze the impact of a citizen-controlled public display.

We constructed three self-sustained public display systems, each consisting of a 24" landscape LCD monitor that resembled a typical public display, dimensioned to the scale of a house. Each display was attached to a single-board mini-computer for providing the visual output and network connectivity (Figure 1). An IP-camera was installed on top of each monitor to record video of the outdoor environment when detecting motion. A custom-made plywood box encased the installation to protect and conceal most technical parts. The display opening (50cm x 22cm) was made smaller than the traditional 16:9 aspect ratio on purpose, in order to avoid the obvious visual connotation to a traditional desktop computer monitor and hide the screen's bezels.

Several custom-built software packages were installed to allow real-time communication between the participant household and the display. Our system only allowed textual messages to be published. After a new text message was submitted it was pushed in real-time to the display and a central database system along with metadata (e.g. layout). Upon successfully rendering the

Figure 2. Small public displays behind front windows of residences in neighborhood A (left), B (middle) and C (right) around Antwerp, Belgium.

message on the display, a confirmation message was sent to the device from which the submission originated.

4.1 Pilot study

A seven-day pilot study in a residential street in Leuven, a mid-size city in Belgium, allowed us to evaluate our first prototype installation for its technical and practical feasibility (i.e. reliability, readability, usability) and participation success (i.e. content, input methods). The working yet preliminary prototype was placed behind a ground floor street window, allowing household members to submit text messages of up to 80 characters via either an attached keyboard or a dedicated online interface. 121 unique messages were published. Over half of these (n=71) aimed to interact with passers-by (e.g. "*Hello there, on the other side!*"), while others (n=29) were more philosophical (e.g. "*A smile is the cheapest method to look fantastic*"). 21 messages were personal, general observations or comments on the news.

We considered these preliminary results as promising, also because some passers-by voluntarily mentioned they had been reading the messages on a daily basis, and regretted that the display was removed. Based on participant feedback, we optimized the online interface and added immediate visual feedback in terms of authoring (e.g. allowing text editing), and messaging (e.g. confirming when the message was successfully rendered on the display), as well as multi-device access. We also added various styling options, such as a choice of typeface (i.e. sans serif, serif or handwritten) and high-contrast color palette choices for text and background (i.e. yellow on black, black on yellow, white on blue or white on green). The textual scrolling was configured to animate upwards continuously.

4.2 In-the-wild field study

The three displays were deployed with three separate households, each living in a different neighborhood of Antwerp, a relatively large city in Belgium (see Figure 2). The three neighborhoods were carefully chosen to encompass a wide range of social, demographic and cultural differences.

As shown in Table 1, the neighborhoods can be classified as: residential (A), recently gentrified (B), and containing a rich ethnic diversity (C). More specifically, in neighborhood A, the display was installed in a recently renovated townhouse, which is separated from the sidewalk by a narrow front yard. The household was composed of a married couple (controlling the display) with two teenage daughters. In neighborhood B, which is characterized by high-earning inhabitants, the display was placed in the shop window of a local coffee shop and controlled by the bartender. A nearby museum attracts a substantial amount of tourists. In neighborhood C, which is characterized by a high population density, a high number of immigrants as well as a high unemployment rate, the display is deployed in a single-family house in the middle of a small, narrow dead-end street with a lot of local car traffic. The family consisted of two adults (one of whom controlled content) and three young grandchildren.

Table 1. Socio-demographic characteristics of neighborhoods.

Neighborhood	A	B	C
Density (pop. / km^2)	8.500	1.000	**21.000**
Employment	64 %	**65 %**	52 %
Avg. yearly income (EUR)	**25.000**	17.300	24.500
Immigrants	19.5 %	30.2 %	**70.4 %**

Before deployment. We conducted a semi-structured interview with each of the participating households to provide us with an understanding of the perceived neighborhood characteristics, enthusiasm for the study, as well as the technical facilities that were available on-site.

During deployment. The displays were deployed during 21 successive days. After 14 days, we distributed 400 leaflets among the residents in the immediate vicinity of the displays, which invited people to participate in an interview, in return for a small financial reward. Answers were submitted in the letterbox of the participating household.

After deployment. All messages were analyzed according to categorization methods used in Grounded Theory [23], and mapped along a timeline to investigate any publication patterns. The people that reacted positively on the leaflet invitation were visited at their homes for a semi-structured interview, which consisted of 30 half-open questions about the display and its contents, and 30 questions pertaining to five domains of social cohesion [13] (i.e. civic culture, social control, solidarity, social networks and place attachment). Answers to the latter, rated by participants on a 5-point Likert scale, assist in gauging a sense of

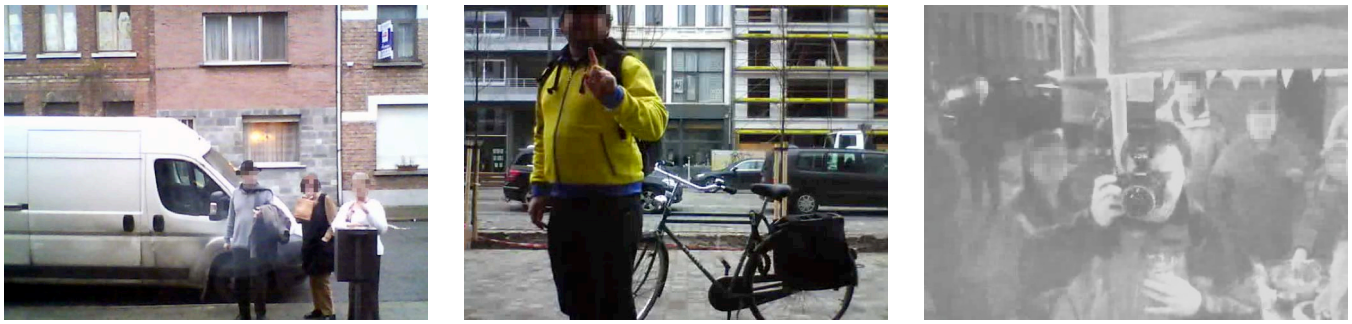

Figure 3. Citizen response to content shown on public displays in neighborhoods A, B and C.

community cohesion. In addition, a representative sample of five full days was selected for further video analysis. Each video clip was manually coded to reveal the number of: 1) all passers-by; 2) people who looked at, or watched, the displays; and 3) people who interrupted their walk to observe the display. Only pedestrians and cyclists were taken into account. Any other remarkable event was noted for future reference.

5. RESULTS AND DISCUSSION

Our analysis revealed several findings on the influence of the deployment on the community and the participant households.

5.1 Impact on community

Analysis of post-deployment interviews allowed us to compare the strength of community cohesion across the different neighborhoods in the study (see Table 2: a higher percentage denotes a stronger cohesion), and its influence on the appreciation of the public display. The community cohesion was only measured after display deployment.

To reveal differences between the neighborhoods, an ANOVA was performed, which revealed significant differences between participants of different neighborhoods ($F_{2,23}$=12.22, p<0.001). To reveal the nature of these differences, a post-hoc Tamhane T2 test (a conservative test for unequal sample sizes with assumed unequal variances) showed the sense of community cohesion to be significantly higher in A (73%) than B (43%) or C (45%) (p=0.029 and p<0.001, respectively). A high correlation also exists between the sense of community cohesion and the appreciation of the public display (r_{23}=0.59, p=0.002), and the desire to respond to messages (r_{21}=0.54, p=0.008).

Table 2. Public display usage and neighborhood response.

Neighborhood	A	B	C
Published messages	**64**	45	59
Message analysis			
Small talk	***48 %***	*7 %*	*44 %*
Entertainment	*23 %*	***44 %***	*24 %*
Involvement	*23 %*	*18 %*	***30 %***
Self-disclosure	*4 %*	***31 %***	*2 %*
Video observations			
People walking past	*72 %*	*76 %*	***88 %***
People watching	***22 %***	*21 %*	*10 %*
People standing still	***6 %***	*3 %*	*2 %*
Distributed leaflets	100	150	150
Interviews	**15** *(15 %)*	5 *(3 %)*	10 *(7 %)*
Sense of community cohesion	**73 %**	45 %	43 %

Content relevance. Many messages were directly based on events or narratives that concern the neighborhood (e.g. "*Request to the potential buyer of number 9: Please keep the pear tree, the pears are very popular in this street!*" (A), or "*Good night, and don't forget to put your garbage bags out!*" (C)). Unsurprisingly, we discovered that these sorts of messages proved to be the most memorable by passers-by. However, a relatively large part of neighborhood C's population rarely felt addressed, because they could not understand the native language. For this part of the population, only two messages could be remembered, which were written in foreign languages with some help from neighbors of foreign origin (e.g. "*[...] Idah Saidan Wa Sanah Jadidah!*", Arabic for "*Happy Eid and happy New Year*"). This language barrier may explain the relatively high number of people that walked by yet did not look at the display in neighborhood C, a hypothesis that was also repeated during three interviews.

Content conversations. Some of the public displays have facilitated initiating contact between acquaintances and strangers. For instance, dialogues between customers of the coffee house (neighborhood B) increased, often escalating into group conversations about the next message to be published (e.g. "*Fibonacci series, fill the blanks: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34,...*"). A leaving customer noticed this particular message, thought it over, went back inside for a few seconds to answer the question, and subsequently left smiling. Erroneous messages often led to animated discussions (e.g. "*Next I will listen to the Beatles, a band from London*"). This particular mistake was revealed by a passer-by who indicated through gesturing that the content was wrong (see Figure 3, middle). A corrected message was agreed upon and published half an hour later: "*Haha, of course The Beatles are from Liverpool! Even though there probably is a cover band in London...*". During a neighborhood festivity in neighborhood C, the participating household published 8 messages over the course of two hours that personally addressed attendees. These messages were published to show off the possibilities of the display, but also to facilitate dialogue and laughter (e.g. "*Smile! P., the photographer is here!*", see Figure 3, right). Remarkably, local residents from neighborhoods A and C regularly sent text messages to the participants to thank them for having published joyful and personal messages.

Social interaction. In neighborhoods A and C, local residents also elaborated and philosophized about messages that were published. Messages such as "*When women regularly look into the mirror, it might not be vanity, but bravery*" (A), and "*Friends are like flowers on the path of life, watching over you in good times and bad*" (C) spurred some passers-by to discuss the meaning of the message in front of the display (see Figure 3, left). Discussions also occurred among family members and on online social networks. Moreover, the discussions about the messages breathed new life into neighborhood A's existing discussion group

on Facebook as the neighbor across the street of the display voluntarily committed herself to duplicate published messages online. Her primary motivation was to allow neighbors from adjacent streets to know what was published, and to get involved in discussions without necessarily having to make physical detours. This also resulted in the suggestion to start talking groups in the neighborhood for reflecting on such aphorisms and sayings.

We observed that the profound and sustained conversations that formed in neighborhood A, contrast with the predominantly short-lived conversations in neighborhood B. Most of the customers of the coffee shop were tourists, who mostly noticed the display once, and then only in a transitory state. This prevented passers-by to form a relation with the display. Our results thus indicate that the existence of a pre-existing social fabric seems to correlate with the perception and acceptance of a public display, as well as the profoundness of response it elicits among community members.

Annoyances and disagreements. During one interview, a resident in neighborhood A pointed out that she felt wronged by not having a message published on the display for the occasion of her daughter's birthday, despite such messages being published for others (e.g. "*Happy birthday S., have a great day!*"). In neighborhood A, three interviewees also indicated they had wanted to participate in providing content, but regretted not being contacted. The underlying frustration seemed to be existing frictions between groups of inhabitants from various streets in the neighborhood, despite a seemingly high sense of community cohesion: "*Why do these people have the chance to participate, and we do not?*", as expressed by two interviewees.

Security. Participants were invited to publish messages through a personal web page, which was deliberately not secured by any authentication mechanism. An intermediate interview in neighborhood B revealed that some nearby residents had attempted to gain access to the message publication interface, but had failed and abandoned their attempts. The participants considered this to be an implicit request to take part in message creation. Unfortunately, we were unable to interview the "hackers" and learn more about their underlying motivations.

Overall, we can observe that a citizen-controlled public display – by providing a situated platform for sharing thoughts and concerns – has the potential to strengthen the social cohesion within a neighborhood, at least on the scale of a street and in particular in a situation where a high – yet latent – sense of community already exists. However, there are obvious concerns in keeping access to such a public platform truly 'open', as some messages may be interpreted as neglecting the views, opinions, beliefs or desires from other community members. Here, the choice and social position of the controlling citizen might be deterministic in its success, as sub-communities might pre-exist, and/or approaching the controlling citizen is not perceived as obvious, or without any social risk.

5.2 Experiences of participants

A total of 168 messages were published, which we categorized according to a coding scheme with four distinct categories (see Table 2): small talk (i.e. about the weather, current events or wishes to people, e.g. "*See? The sun is already peeking through the clouds!*" (A)), entertainment (i.e. to inspire people by making them think or laugh, e.g. "*Did you know hot water freezes faster than cold water?*" (B)), community involvement (i.e. to actively interact with passers-by and involve them in the community, e.g. "*Don't forget there is a Christmas drink tonight, starting at 7 PM*" (C)) and self-disclosure (i.e. revealing what happens inside or expressing personal opinions, e.g. "*Tonight I'll be eating pasta with tomato sauce and pancetta. Winner!*" (B)).

Creativity. Our deployment did not instruct participants what content to publish, nor did it request to be creative. However, all participants experimented with the system: in neighborhood A, messages were published after the first day of installation that included Kanji characters (e.g. "*Haiku (俳句) is a form of Japanese poetry, […]*"), and hard line breaks to visually separate blocks of text on the display. Participant A explained he wanted to assess the system's technical capacities. Also, some participants were actively trying to interact with onlookers, such as by explicitly encouraging responses (e.g. "*Raise your hand if you sing under the shower!*" (B) or "*Beware of the dog!*" (B)).

Posting sustainability. Over the course of three weeks, we observed a general decrease in the frequency of message publications, which evolved from an average of 3.7 to 1.6 messages per day at the end of the intervention. This decline could be observed across all neighborhoods and was probably caused by losing interest to keep publishing original or meaningful messages. In neighborhood C, interest was slightly regained during the last days of deployment as nearby citizens suggested publishing trivia.

Sharing responsibilities. The controlling households from neighborhoods A and C suggested that they would appreciate the control to be accomplished by a larger community, rather than by a single household or citizen. This was confirmed during interviews in neighborhood A, where four people mentioned they were willing to create and control content. Sharing authorship was actually voluntarily initiated in neighborhood A, where the controlling household received suggestions for messages from residents via text messages and social networks.

Features. The option to change color scheme and typeface were not shown by default (visible only when clicking a "*more options*"-button), yet were frequently selected. Participant C and six interviewees across all neighborhoods suggested adding photos to allow for more variation, while participants A and C suggested adding emoticons, to strengthen the intensity of messages, similar to the use of facial expressions in traditional text messages. Four interviewees would have appreciated a complete overview of previously published messages, and the possibility to respond to messages via email, online discussion board or social network.

Our results suggest that a more sustained engagement with citizen-controlled public displays may be enforced through a publication process that is explicitly distributed among multiple citizens (i.e. moderation process where many can suggest content, but the authority to approve or disapprove is reserved for some), or delegated through some sort of open and democratic process (i.e. alternating or regularly changing the household in charge of the display). They also reveal that households and interviewees request similar additional features to strengthen message noticeability and to support public discussion. These include the availability of a richer variety of content types (e.g. rich text, images, emoticons), a historical view of already published messages, and the ability to cross-post messages to other digital media (e.g. social media), where discussions could continue.

6. CONCLUSION

In this paper, we have evaluated the impact of delegating control over content on public displays to one or more members of the local community. We have shown how a more active involvement of citizens in controlling content on public displays creates several

inspiring opportunities as well as potentially dangerous challenges. While our first experiment only comprises the deployment of small, relatively cheap displays and was conducted in a practically uncontrolled environment in terms of physical visibility, social cohesion, background and motivation of the chosen participants, we believe the first findings are sufficiently promising to be potentially applied in a larger scope. We also feel encouraged to promote the notion of re-assessing the traditional process of content administration on (large) public displays, and eventually, to consider its delegation to local citizens and communities. Even more, in spite of the relatively simple means of a traditional computer screen and a keyboard, at least one of our public displays (A) triggered some unexpected, constructive neighborhood cohesion activities that are still sustained today.

In essence, we believe the concept of citizen-driven public displays is conceptually similar to a small-scale social media platform, as the messages closely seem to resemble those of Facebook status updates and Twitter messages: personal messages that seem to address or appeal to the interests of others in the network. The essential difference lies in the social network itself: whereas a virtual social network is determined by one's possibility to choose friends according to personal preferences, the network of our physical reality is chosen 'for' us (because of the people that live or work nearby). As such, successful and sustained message creation is more complex and layered, balancing the values and preferences of many who might not 'network' or relate to each other. In addition, while some messages can be well meant to evoke dialogue, discussion or laughter, their understanding may be compromised because of pre-existing social, cultural or linguistic issues of the people that read them. However, we believe that many of the observed negative impacts, including the feelings of being 'excluded' in terms of control and supervision or the obvious decline in actual use of the system over time, could potentially be negated by a process of shared control, in which multiple local residents either share responsibilities and distribute the content administration tasks among themselves, or each become a sole supervisor through a rotation system. In addition, at least one 'hacking' attempt has confirmed the importance of securing access to publicly accessible systems.

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