Designing for Neighborhoods: Lessons Learned from Paper-based Bulletin Boards

Claudia López
University of Pittsburgh
135 North Bellefield Av
Pittsburgh, PA 15260 USA
cal95 @ pitt.edu

Rosta Farzan
University of Pittsburgh
135 North Bellefield Av
Pittsburgh, PA 15260 USA
rfarzan @ pitt.edu

Abstract
Many local information systems struggle to remain viable over time. The low volume of new content that is generated each day in a local community places burdens on the sustainability of such systems [2]. To shed light on designing for local communities, we investigated the content, design and significance of paper-based bulletin boards as sustainable local information systems. We found that their viability is built upon several design strategies such as announcing information about local services and small-scale events; a dual strategy of supporting sense of community and information discovery; and using a flexible, but strategic definition of the communities' geographical boundaries. Future work will investigate these design strategies in online settings.

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Community systems; Hyper-local; Design decisions

ACM Classification Keywords
H.5.m. [Information Interfaces and Presentation (e.g. HCI)]: Miscellaneous

Introduction
Cities and neighborhoods provide a rich context for information sharing and HCI research [2]. City

governments, local organizations and residents generate and share information to be consumed by others. More than 70% of Americans report to follow local news closely [7]. The most popular sources of community information are local traditional media, worth-of-mouth and Internet [7]. In the era of social and pervasive computing, many software practitioners and researchers have designed systems to better support information sharing among people in a local context. Earlier community networks [4] have been followed by online forums [1], virtual local communities[1] and digital public displays [3].

While several local systems have been adopted successfully [6], other attempts have reported challenges in engaging enough users and content [1]. Lack of enough participation and content has forced several for-profit community sites to close[2] or become part of bigger multi-purpose systems[3]. Engaging enough contributors and maintaining a reliable stream of content in social information systems is challenging [5]. This is particularly difficult for place-based systems because their audience is limited to people who live in or are visiting the specific place. Furthermore, new local information is created at low rates per day and it usually generates insufficient interaction online [2].

In this abstract, we report on our study of paper-based community bulletin boards as exemplars of sustainable local information systems that rely on user-generated content. We conducted content analysis of the information posted during a period of three months in 21 community bulletin boards. Additionally, we interviewed the bulletin boards' managers regarding the management and significance of these information systems. Our results show that community bulletin boards also face the challenge of low volume of new contributions. To ensure their sustainability despite this challenge, bulletin boards exhibit some organically-developed design strategies. First, they have valuable information about local services and small-scale events that is usually dispersed online. Second, they support two informational goals: supporting a sense of community and local information discovery. Finally, while they provide local information, the geographical boundaries of the communities are defined flexibly according to the neighborhood's characteristics. The presence of these design strategies is supported by both quantitative and qualitative analysis of the collected data. Our future work will investigate the effectiveness of such strategies in online local systems.

Method

We sampled 21 bulletin boards located in five adjacent neighborhoods in Pittsburgh, PA. The sampled neighborhoods vary in terms of population size and demographics. The chosen neighborhoods were Lawrenceville, Bloomfield, Shadyside, Squirrel Hill and North Oakland. For each neighborhood, we sampled four to five bulletin boards.

In our search for community bulletin boards, we learned that they are located in different kinds of organizations. We strived to sample bulletin boards belonging to each type in all neighborhoods, but that was constrained by some limitations such as difficulty in obtaining permissions to collect data or the absence of libraries or community centers in a neighborhood. Overall, our sample included seven coffee shops, six

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[1]`https://nextdoor.com/`
[2]`http://www.everyblock.com/`
[3]`http://nabewise.com/`

stores, three libraries, one community center, two laundromats, and two bulletin boards located on the streets. The locations of these bulletin boards are shown in Figure 1, color-coded by the types of location.
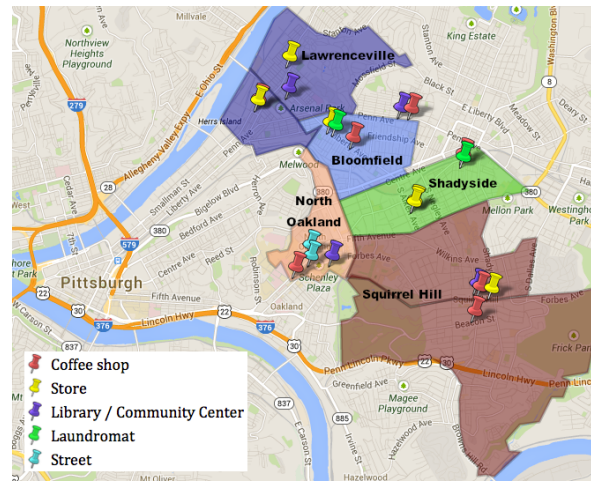

Figure 1: Sampled neighborhoods and bulletin boards.

We conducted a longitudinal data collection of the content posted on these community bulletin boards from November 2012 to February 2013. For each location, we planned to take pictures of their posters every other week during a period of three months. We collected photos of six visits for 14 of our sampled bulletin boards. The data collection in the remaining locations was sometimes limited by reasons such as business closing, or building renovations. Overall, we have photos of 117 visits from the 21 sampled community bulletin boards.

The content of each poster was manually annotated to assess the volume and the kinds of information found

in each board. Moreover, using data available online, we coded the location and business goals of the bulletin boards' information providers (e.g. individuals and local organizations).

To complement our content analysis, we conducted interviews with seven of the bulletin boards' owners. The goal of our interviews was to (1) understand the purpose of the community bulletin boards, and (2) validate our initial findings (based on content analysis) about underlying bulletin boards' design decisions.

Sustainability of bulletin boards

We observed a strong indication of sustainability of paper-based bulletin boards in our sample. Among 3,719 coded posters that were posted during a period of three months, bulletin boards had 30.9 posters on average (range: 10 - 110) with very small dispersion from the mean over time. The standard deviation was much smaller than their mean number of posters in most cases (from 3% to 40% smaller). The two bulletin boards located on the streets had larger variation (around 70%) due to the fact that all of the posters were removed from the boards once during our data collection process. The stable number of posters across many bulletin boards supports our assumption about their sustainability.

Similar to online local systems [2], paper-based bulletin boards receive low volume of new information. In absolute numbers, the mean number of new posters was 16 posters in two weeks (range: 2 - 23). This means that the proportion of new posters in each subsequent visit was 47% on average (range: 11% - 78%). Bulletin boards that have larger numbers of posters usually had smaller rates of new posters.

Although the number of posters found in the bulletin boards are significantly smaller than the contributions reported in large-scale online social systems, these local information systems that rely on user-generated content have persisted over years, even in the era of Internet, pervasive and social computing. The viability of these bulletin boards as community information systems can be also explained by what was reported by all of the bulletin boards' owners who we interviewed. There is a firm belief that community bulletin boards are valuable to the local community, as well as to the organization that host them. Our interviewees described the value of bulletin boards in terms of providing information about local services, artists and events that is highly fragmented online; encouraging a sense of community; reaching new audiences through supporting information discovery; and connecting with a population that is not online.

Design strategies

Below, we describe design strategies that contribute to the value and viability of community bulletin boards despite the small volume of new local information.

Local services and small-scale events
Although managers believed that most of the content was about local services, artists and small-scale concerts, the big picture of the information shared in the bulletin boards was more nuanced. Bulletin boards had mostly information about events (mean: 65%, std. dev.: 24%) and services (31%, std. dev.: 22%). Contrary to the managers' expectations, services covered a smaller share compared to events.

Confirming the managers' perceptions, the events were indeed predominantly located in small-scale

entertainment and art venues. On average, entertainment venues such as bars and restaurants hosted 29% of the events posted in the bulletin boards; art galleries and small theaters held about 24% of the events. Larger entertainment and art venues posted much smaller numbers of events. Arenas, stadiums or hotels were the venues of only 3% of the posted events. Large art centers, with capacity of more than 800 guests, hosted 11% of the events.

Sense of community and information discovery
All of the observed bulletin boards exhibited a mix of unique and duplicated information. On average, about half (49%) of the posters in a bulletin board were unique (range: 16%-92%); i.e. not duplicated in any other location.This means that each bulletin board divide their space into a considerable amount of information that is highly exclusive to a particular location, but they simultaneously provide room to announce information that is relevant to a wider geographical audience.

We observed that the specific nature of the unique information helps to reflect a sense of community. A larger percentage of unique information are dedicated to services versus events. About 75% of the information about services was unique, while only a 33% of events' information was announced in a single bulletin board. This finding may reflect a more targeted and strategic advertisement of services to support a specific population or nearby residents. We also found that community organizations whose main goal is to provide information for the community (i.e. libraries and community centers) had a significantly larger proportion of unique information.

On the other hand, out of 3,719 posters in our dataset, there were only 1,143 unique posters. We regard this substantial level of duplication of information over time and across the sampled locations, as indication of support for information discovery. Approximately half of the content in the bulletin boards was also found in other locations. On average, 43% of the information posted in the bulletin boards was duplicated in more than one neighborhood. 36% was also found in more than one kind of organizations. This indicates that duplicated information was not specifically targeted to a location, but rather trying to reach diverse audiences.

Additionally, we observed that bulletin boards provide long-term exposure of local information. Collecting longitudinal data allowed us to measure the amount of information persisting over time. On average, 53% of the posters in a bulletin board were repeated from a prior visit (std. dev. = 24%), with 108 posters being available in all six visits. This observation was also supported by the fact that events were advertised on these bulletin boards 21 days prior to the event, on average. Thus, giving residents a rather long time to "find" this information.

Summing up, the ecosystem of community bulletin boards seems to facilitate information discovery in at least two ways: supporting duplication across different information systems and enabling long exposure of the information. This conclusion was also supported by our interviewees. The managers often expressed that they have placed the board to give voice to the community and to show their support for the community. On the other hand, several managers also mentioned that bulletin boards enable residents to "find" data about local services and artists that they didn't know about.

Flexible geographical boundaries of local communities
The paper-based bulletin boards are viewed as local information system and one can argue that they focus on advertising highly local information. We studied how "local" is their information by evaluating the location of the events posted in all of the sampled bulletin boards. We found marginally significant differences among the "locality" of the information found in different neighborhoods. As shown in Table 1, Lawrenceville and North Oakland had a higher proportion of events happening inside the neighborhood. On the contrary, less than 10% of the events posted in Bloomfield, Shadyside and Squirrel Hill were located in the same neighborhood. At the same time, these three neighborhoods had considerable amount of information (more than 10%) about events hosted in their adjacent neighborhoods (labeled with a star in Table 1).

We hypothesize that this can be explained by the amount of venues in the neighborhoods. Given the lack of local events, bulletin boards in the less active neighborhoods include events from adjacent areas. Besides showing information about neighboring sectors, all of the neighborhoods had information about events held in downtown. Other centers of events in the city such as Strip District and Oakland covered important shares of the events announced in the sampled neighborhoods. Our results show that while community bulletin boards maintain a local context, the geographical boundaries of their data is expanded as necessary to collect enough content that still addresses the information needs of their audience.

Discussion
Based on a longitudinal dataset of the information posted in 21 community bulletin boards in five

neighborhoods in Pittsburgh, PA, we have reported on a quantitative analysis of their design strategies. The managers of these information systems reported very loose moderation strategies (except in the library). This hints that the design strategies reported here have evolved organically to ensure the survival of these systems and as a response to the information providers' and residents' information practices. Nevertheless, these design strategies are highly connected to the managers' perception of the significance of community bulletin boards, which in turn helps explaining their sustainability over time.

Table 1: Location of the events posted in each neighborhood.

Neighborhood	%	Other neighborhoods with 10+ % of events	%
Bloomfield	8	Downtown	13
		Garfield*	12
		Lawrenceville*	12
Lawrenceville	25	Downtown	15
		Oakland	12
North Oakland	21	Downtown	19
		Strip District	12
Shadyside	8	Downtown	20
		East Liberty*	11
		Oakland*	15
Squirrel Hill	9	Downtown	15
		Oakland*	13
		Shadyside*	10

[†] *adjacent neighborhood.

The success of these bulletin boards over long periods of time and in presence of competition with the pervasive online information promotes them as useful case studies to inform the design of other local systems that rely on user-generated content. Our future work will focus on testing the effectiveness of these design strategies in online settings.

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