

“Your place or mine?” – Connecting communities and public places through networked public displays

Nemanja Memarovic
Faculty of Informatics
University of Lugano
Lugano, Switzerland
nemanja.memarovic@usi.ch

Marc Langheinrich
Faculty of Informatics
University of Lugano
Lugano, Switzerland
marc.langheinrich@usi.ch

Abstract—Public spaces connect people in their everyday life and foster the growth of communities by providing a common space for people to bond and interact. However, while different communities or social groups may share the same public space, they may not interact between each other due to perceived differences or prejudices. At the other end of the spectrum, members of the same community or social group could be scattered across physically separated public spaces. We argue that networked public displays can represent an important tool for bridging social and physical distance, in order to connect people across social, temporal, and spatial barriers. The following article summarizes relevant current research in urban design, community informatics, and public displays, and presents four scenarios that illustrate the potential of networked public displays in such settings. We then outline a research agenda for realizing this vision.

Keywords: *public displays; communities; public space; communication; community informatics;*

I. INTRODUCTION

Public spaces are a common setting in our everyday life: we walk on the streets on our way to work or school, we meet friends in the city center to browse around the stores and chat, or we take a walk in the park to relax. Public spaces have a lot to offer: they create a sense of belonging, provide a place where we can socialize, relax, and learn something new [1]. Because of these properties, and many others, these spaces often form an important building block in creating local communities: people with common interests and values that share an emotional connection to each other, based on their sense of belonging to a place. However, often enough, a single place is frequented by multiple communities that, even though they occupy the same space, have difficulties in communicating and connecting with each other – e.g., teenagers and elderly citizens that both frequent a public park [2]. At the same time, a coherent social group might be scattered across multiple physical centers, which in turn diminishes the sense of the community [1].

Public displays may have the potential to bridge such gaps between and among communities, both *within* and *across* public spaces. The significant price drops in large LCD panels have led to a massive proliferation of digital public displays in public spaces: they present special offers in shopping malls, list interesting facts and events at universities, display schedules and news in metro stations, or advertise a brand new product on an entire building facade. Although these displays today typically represent singular units that show static images,

power point presentations, or product videos off some locally connected PC, it is not hard to imagine that all of these installations will soon be permanently connected to the Internet. Thus networked, and additionally empowered not only with output but also input capabilities (e.g., sensors or ad-hoc connections with mobile phones [3]), public displays could eventually form a novel and powerful global communication medium.

We envision that such a medium could be highly beneficial for connecting communities. With the two parameters of community and place, there are four different opportunities for the use of networked public displays: 1) *Identity Cognition*, i.e., raising the awareness and connection between local community members, i.e., from within; 2) *Local Connectivity*, i.e., promoting social diversity and connect communities that occupy the same public space; 3) *Remote Connectivity*, i.e., shrinking the distance between distributed communities by enabling synchronous and asynchronous communication between them; and 4) *Identity Infusion*, i.e., instilling a sense of community in a social group through connecting it with (and contrasting it to) remote communities, i.e., infusing it from without. These four cases are summarized in Table 1 below, as well as illustrated in Figure 1.

TABLE I. COMMUNICATION BETWEEN COMMUNITIES AND PUBLIC PLACES THROUGH NETWORKED PUBLIC DISPLAYS

		Community	
		Intra-/Within	Inter/In Between
Place	Intra	Identity Cognition Increase community awareness between local members	Local Connectivity Increase awareness of social diversity between local communities
	Inter	Remote Connectivity Connect spatially distributed communities with similar interests	Identity Infusion Enrich local community through exchange w/ remote communities

This paper serves as a research agenda on how to achieve this vision. We will begin by illustrating our above four cases through four matching scenarios. We then look into the definition of communities, and enumerate the challenges for community interaction in public spaces, in order to better operationalize subsequent research steps. We will finally present a blueprint for moving the vision into reality through analysis of current research on public displays and communities.

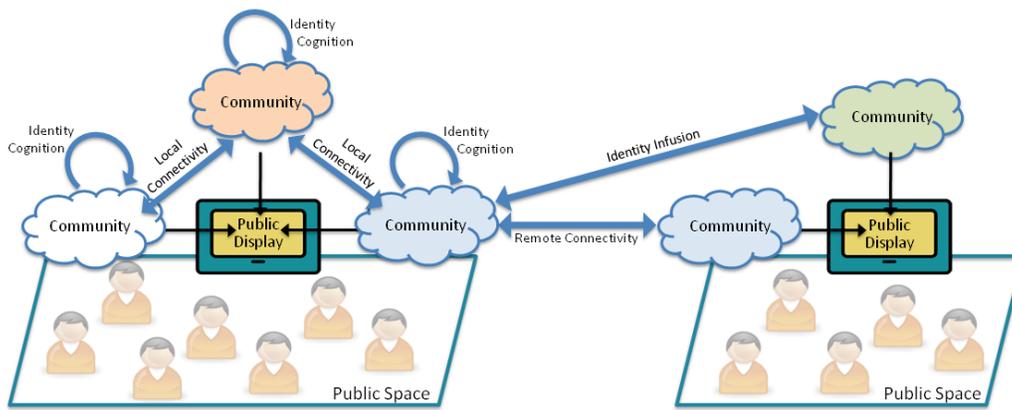


Figure 1. Communication between communities and public places through situated networked public displays.

II. NETWORKED PUBLIC DISPLAY SCENARIOS

Although currently public displays are deployed as singular installations and display mainly advertisement, in our vision of the future, public displays are more than just “ad pushers”: they are situated, networked, and capable of supporting both direct and indirect communication. They portray a novel communication medium that can form some sort of ‘community’ glue that can both help strengthen the sense of social coherence in existing communities, and bring hitherto socially separated communities closer together – whether it be due to their spatial, temporal, or even social separation. We illustrate their potential in four short vignettes¹ that correspond to the four different cases described previously.

A. Identity Cognition: “How cool is your skate park?”

Eric is a teenager on vacation with his family. How dull is that, he thinks. He would rather be at SK8, his favorite skating park back home, hanging out with his friends and kickin’ some cool flips with “Mercedes”. “Mercedes” is the name of his skateboard and he never leaves home without it. When he exits the hotel he sees something that looks like a skate park nearby. When closer inspection shows that it is one, Eric is first thrilled, then anxious: ‘What if all the people inside are, like, amateurs?’ He is pretty good with Mercedes and he only wants to hang out with skaters that are as skilled as or even better than him. Luckily he sees that there is a public display at the park showing some of the recent tricks performed at the park. “Skull” just did an “Air walk grab” this afternoon, and “Death at the disco” is usually doing “Kickflips” around this time. He is also surprised to see a large number of girls featuring in their various leaderboards and featurettes that flick across the various installed displays. After scanning the displays for a while, Eric notices that he feels quiet at home in the place already, and he decides to give it a try.

B. Local Connectivity: “Surprising hobbies”

Maria is a 76 years old retired librarian. When her first grand kid, Barbara, was born 10 years ago, Maria often took care of her during the day, sitting in the park with her and feeding birds. Even though Barbara has since moved away with her parents, Maria still enjoys going back to the park and feeds the birds now and then, since it reminds her of the time spent with Barbara. When she comes to her favorite spot a little later than usual, she notices a number of teenagers sitting in the

grass nearby, dressed all in black. Maria sits down uncomfortably, watching the kids out of the corner of her eye as she is quite intimidated by their looks. While occasionally glancing at a nearby public display, however, she begins to notice some follow-me community-ads that apparently belong to those black-clad kids. Can it really be that they are advertising their classical music concert? Indeed, it seems that most of those teenagers are actually in a youth orchestra, as Maria notices, which will give an open-air concert in the park later this week featuring Bach compositions. ‘Well,’ Maria decides, ‘if they like classical music then they can’t be that threatening after all!’ She makes a small mental note to call her daughter later and invite her over for the concert – this might be a good opportunity to see Barbara again!

C. Remote Connectivity: “In the nick of time”

“Where is he?” Jane thinks while she is waiting for Mike, her violin partner for tonight’s concert. Jane is a senior and plays piano at Roosevelt High. She and Mike are supposed to perform for her end-of-the-year recital. ‘The concert is starting in 10 minutes. Did I send him the right address?’ she wonders. The problem with her recital started yesterday when her standard violin partner, Stan, caught the flu. They had practiced Strauss’s Sonata for Violin and Piano in E-flat Major together during the last few weeks. When she got Stan’s message she immediately posted a message looking for someone to replace him to the new “EduNote” system, which connects public displays in high schools throughout the city. Mike was the first one to respond to her post – her message caught him as he was on his way to violin practice and he got interested in meeting someone from Roosevelt High who shared his interest in Strauss. ‘In the nick of time!’ she thinks as she sees Mike carrying his violin. ‘If he plays well as he looks maybe I’ll get an A.’

D. Identity Infusion: “Go Itasca!”

For tourists from up north who stop there for a short break off the I-35, on their way down to Austin, San Antonio, or Mexico, the small village of Itasca, Texas, might not be much to look at. John, however, quiet likes his life there. A few years ago, he wasn’t particularly fond of his birthplace, being somewhat of a backwater right in the middle of Texas. But ever since they installed those ‘VillageLink’ systems in town – one down at the Dairy Queen, the other one right next to Bob’s Tavern – John began to see his little town with other eyes. It all started with his bull riding feats being featured in other mid-Texan VillageLink systems. Suddenly, everybody started talk-

¹ Some of these scenarios were adapted from [4].

ing about him when he appeared at one of his regional bull riding contests. Then, their own Joe Zawinsky, who had been doing Elvis impersonations ever since they were in middle school together, got picked up by that little village up in northern Japan. Turns out they are crazy for Elvis there, running a yearly Elvis festival with more than ten thousand visitors, and Joe's moves were apparently running all over their VillageLink system up there. Go figure! And while Bob's Tavern recently started offering sushi each Saturday, their own "Itasca Quesadillas" recipe begun to get loads of five-star ratings from those Japanese when shown on VillageLink. It really is a fun little town after all, John thinks, as he realizes the many hidden talents of his fellow neighbors. Go Itasca!

III. SOCIAL INTERACTION IN PUBLIC SPACES - CHALLENGES

There is a strong and unambiguous connection between communities and public spaces [1][2]. After all, public spaces are "the common ground where people carry out the functional and ritual activities that bind a community... it is the stage where the drama of communal life unfolds." [1]. They also "allow people to meet on ostensibly neutral ground in planned and unplanned ways, to interact with others within the context of the whole community." [2] We can again group the various problems that communities encounter in-and-across public spaces into our four categories described in Table 1.

A. Weakening Connections Within Local Community

Traditionally, communities were formed within a certain locality [5]. People on the street knew each other, shared news, helped each other, and created a common identity. Today's highly mobile lifestyles make this harder and harder. People relocate more often than they used to, and free time is often spent traveling to distant places. The 'common identity' and integration that existed within the communal life tends to get lost. While modern telecommunication allows friends to keep in touch through mobile phones, email, and social networking services, getting to know one's neighbors and one's local community gets harder. Much has been written about how your Facebook friends are unable to help you out with a tablespoon of sugar when you need one [6].

B. Time-Sharing and Community Avoidance

The many different people that occupy public spaces often belong to different social groups and communities. These groups frequently "time-share" public spaces, sometimes out of convenience as they are free at different times, but sometimes also in order to avoid others. A good example might be elderly citizens and teenagers [2]. This separation within public spaces sometimes even forces certain groups to find their own place within the 'gray' or 'slack' areas, such as remote hallways or walkways [7]. Ideally, public places can support the "provision of difference," i.e., they successfully and concurrently cater to the needs of different groups, instead of becoming socially homogenized. Holland et al. point out that "being able to be seen in public – and to be able to see different types of social groups – may go some way to enabling everyone, and children and young people in particular, to observe difference, and thereby perhaps, promote tolerance for social diversity." [2]

C. Weakening Connections Among Distributed Communities

People like to remain connected to their geographical roots, and to the public life within them. Places have the power to emit connections that exist within a larger society, e.g., Washington Monument and the Statue of Liberty symbolize the connection within the US-American nation [1]. Places are thus a core driver for enabling people to connect within larger communities, yet today's high rate of mobility often physically disconnects people from such local roots. Although virtual communities (e.g., online social networks) provide one way to connect distributed communities, their "hiding-behind-a-screen" access model runs the risk of isolating users in turn from their local communities.

D. Sense of Isolation in Remote Communities

Although better connections within local communities are usually desired, there might be cases where too strong a focus on one's own social group can actually weaken the sense of community. Remote communities such as rural villages often see their members feeling "left out" and wanting to see what lies beyond their part of the world [8]. Connecting such groups to other remote communities might not only help to "spice" up social life, but could also help to instill a new sense of "connectedness" and camaraderie within a local community.

IV. COMMUNITIES AND PUBLIC DISPLAYS

As stated in the beginning, defining a community and its needs is a challenge. The same implies to building a system that supports any kind of community interaction. The importance of *co-realizing the system with the community* for whom the system is being built has been stressed throughout prior research [8][9][10][11][12]. Without gaining insight and understanding a particular community's needs, the system is not likely going to be supported by the community. Also, the system needs to be built *on top of existing behavior and practice* [13][14][15]. Getting community members to learn a new pattern to perform an existing habitual action will most likely not work.

At the outset, networked public displays will need to come already filled with content [10], and they will require a number of strongly motivated initial users that would spark community interest in the system's use [12]. Taylor and Cheverst note that promoting such a system with an event explicitly organized around it can help to jump-start its acceptance [10]. In their deployment of a photo sharing service, the promotional event helped people overcome their fear of embarrassing themselves by knowing that it is new and that others also do not know how to use it. Direct and indirect interaction with displays should also be supported by a variety of techniques and devices, thus allowing users to choose the interaction technique that they feel most comfortable with [16][12]. Equally important is to have the location of the display in mind, as this strongly influences how its function is perceived [17]: if the display is located near a workplace it is more likely to be associated with work, whereas if it is located near a cafeteria it is perceived to convey more leisure content. One source of inspiration for choosing display locations can come from traditional (non digital) notice boards [18][19]. This can also provide insights as to what type of content is important to a local community. The distance between viewers and display also plays an important role, as

larger, far-away displays typically do not invite people to interact directly with the display. This could be exploited as in O'Hara et al.'s "visibility zones" [15], where, e.g., only the most critical information is visible from afar and details are only revealed upon close inspection of the display.

Storz et al. list many more important technical lessons from real-world deployments [20]. One of their main findings is that creating original content is a difficult thing, and that having a source of existing content greatly simplifies deployment, as people are typically more comfortable when they interact or manage already existing types of content.

A. Supporting Identity Cognition

The first type of community communication aims at strengthening community bonds and raising awareness from within. However, what defines a community and its needs differs widely among communities. This influences the way this type of communication can be achieved. For example, in communities with tight bonds where people meet on a regular basis, like in rural places, previous work has shown that community members value the history of the place [8][10]. Images of important historical events that have happened and that the local community as a whole has experienced, like a flood, signalize the community's strength and unity. These pictures can also help to 'introduce' the community to outsiders. A more engaging activity is to promote collaborative work on a joint effort, e.g., a community newspaper as demonstrated by Houde et al. [29]. Although Houde et al. looked at a workspace setting, creating a local newspaper and displaying it in a community center could also raise social awareness in, e.g., a rural community. However, community members in rural areas do not necessarily understand the technology and may need more explanation on the system, especially involving security issues. Bury et al. found that rural communities place very different values on different part of the system: for example, a user's reputation inside the community was of the highest priority, while identity theft was not considered a danger [11]. Note that this type of well-knitted community can also be found within urban neighborhoods [9]. What makes these two types of communities easy to target is the availability of a physical community center, i.e., a message hub where people regularly meet, which can then be used to easily access a networked public display.

On the other end are larger-scale urban communities. While in rural areas, the sense of community lies within its locality and tight-knitted bonds, urban areas see people that typically know only few of the many faces that they see on the street. One way to increase community awareness in such settings is to engage people locally, e.g., by allowing them to post messages to a place [21], to display search queries from local users [22], or simply to "check-in" (e.g., Forsquare.com). In a sense, the mere act of installing a public display might already help urban residents to form "temporal communities", as any kind of "special feature" in a place – an art installation, or a particular event such as a parade or concert – gives people a reason to talk and discuss [1][12][23][24][25]. However, integrating actual information about local community member might help to form longer lasting connections. Another complication arises from the fact that people in urban areas are

often highly mobile, also on a daily basis, implying that they are regularly moving between multiple communities. However, signaling community membership, or awareness, typically depends strongly on the local context of a place. In technically more advanced places, like workspaces, prior work has "connected" people by displaying their topics of interest [26], by letting them post interesting material [18] or place-related messages [16], and through audio-video connections [27][28]. It is interesting to note that not all the content that was posted to these community boards in the workspace was actually posted to individuals: often enough, messages were simply posted to "the place", i.e., to no one in particular, but to anybody who happened to be around [18][16][29], indicating that even without known recipients, place-based messaging might be useful. Posting interesting material could also provide a simple notion of the liveliness of a place. It has also been shown that displaying one's topics of interest [30] as well as posting messages to a place [21] did raise community awareness. Audio-video connections, on the other hand, are not only technically challenging [24] but also raise a lot of privacy issues [28], making them ill-suited to create community awareness in public space.

Cheverst et al. found that community members have different sharing preferences towards "insiders" and "outsiders" [31]: depending on how comfortable they are with a particular community in a place, they might want to share less or more of themselves and their interests. This implies that users will need to be able to control the type and amount of personal activity that gets shared with any one place. McCarthy et al. suggested the use of different profiles: one personal profile, one community profile, and one "public" profile [26]. This profile management would also be useful when introducing yourself to a new community (like in the 'How cool is your skate park?' scenario).

B. Supporting Local Connectivity

Connecting local communities aims at raising social diversity between communities occupying the same space. In tight-knitted rural communities this might not be necessary. However, in urban places, people do not necessarily form uniform communities. Some of the methods discussed above could also be used to raise the awareness of different communities in the place. For example posting messages to a place [21] and showing user queries [22] could illustrate the diversity of a place. Both McDonald et al. and McCarthy et al. demonstrated how the intersection and union of users' interests could work [30][26], as it allows not only for the introduction of people with similar interests, but also offers insights into different interests.

One advantage of using user interests as "food" for a public display system is that much of this data is readily available from existing social networking accounts. Showing user profiles from one of these sites, or creating new hybrid profiles by combining multiple social networking sites, might be a quick way to promote social diversity [33]. This way people can see other people's interests, ranging from music to books to beliefs and political interests.

C. Supporting Remote Connectivity

Remote connectivity tries to keep or even re-establish ties between community members that ended up in separate places, e.g., immigrants and their home cities, or members of a local sports club that moved elsewhere. What binds this type of communities is usually common history, but may also be based solely on common interests [31] (e.g., people interested in Japanese Mangas). Community members are usually engaged in activities that are of interest to a larger distributed community, not just its local chapter. Conversely, local members are usually interested in information that the ‘other’ place has to offer. Previous projects have investigated such settings mostly with professional groups, such as emergency responders, fire fighters, ER staff, or police officers [13][14]. Also, prior work mostly focused on work efficiency, such as scheduling doctors more efficiently, based on their location and current activity.

D. Supporting Identity Infusion

At first sight, different communities in different locations might not have all that much to relate to each other. However, supporting such a type of communication may offer novel sources of identity for local communities, not based on local events and local activities, but by contrasting and representing local communities with remote ones. Prior work has found that people in rural places often have a need for learning more about the ‘outside’ world [8]. As rural villagers often do not easily engage with outsiders and/or with new technologies, it is critical to find common interests and simple concepts to engage local citizens. A study by Khalid and Dix showed that “photo-lurking”, i.e., simply watching posted photos on photo sharing websites without commenting them online but discussing them with ‘offline’ friends, brings new topics to the table and ‘spices’ up a conversation, and that it works well for “online-shy” people [32]. Incidentally, Taylor and Cheverst [10] found that villagers very much enjoyed a public-display application that allowed them to share photographs among each other, and with outsiders. This also helped local businesses to gain wider popularity outside of the local community, which in turn helped increase their pride in the local community.

V. SETTING A RESEARCH AGENDA

From the previous discussion we can readily identify a number of interesting research avenues, some of which we try to outline below.

A. Supporting Identity Cognition

While previous work already addressed aspects of raising community awareness, these projects typically employed carefully selected, individual content. When scaling public display based communications to a regional, if not global level, however, creating custom-tailored applications quickly becomes unmanageable. Consequently, we will need to find content types that would help us to provide *identity cognition* for very different communities, i.e., a common set of applications that could be used to represent both communities in a rural village and in an urban city area. Or the other way around: are there community needs that are common for all communities, for communities with certain shared parameters (e.g., rural), or at least for communities with well-defined attri-

butes? Ideally, required content would either have to be found somewhere within existing applications, or be easily (and voluntarily) be generated by community members during use.

B. Supporting Local Connectivity

Although posting messages or pictures is easy enough and creates a colorful representation of the people in the place, this can quickly become simply a clutter of information. A major challenge in providing *local connectivity* between different communities will be to create a shared understanding between them. How can we properly represent an entire community on a public display in any meaningful way? How are static and dynamic aspects to be represented? And how are individual communities in a space identified? Will this need to be done explicitly, or can the system implicitly detect communities, based on some sort of network models?

C. Supporting Remote Connectivity

Existing attempts in connecting spatially distributed communities were typically done in a single location with carefully crafted applications. However, in our envisioned *remote connectivity* scenarios, we will need to connect communities on a larger scale. Consequently, we will need to let community members know about “matching” remote communities, explicitly or implicitly, and do so in a privacy respecting manner. One option might be to display certain anonymous properties of a place, which in turn could convey community-relevant activities in a place that would then trigger manual or semi-automatic information exchange. We will need to properly investigate the social acceptance of different acquisition and presentation options in this context.

D. Supporting Identity Infusion

Prior research indicates that the act of *identity infusion* can be supported by both community contributed content, such as pictures, and the explicit offline discussion of local and remote content within the community. How can we extend this into other fields of information exchange, and how do we acquire the content needed for this? Can we automatically gather community-relevant achievements and activities and properly distribute them so that relevant links to remote communities are established? Would this require explicit browsing of activities by community members, or could the system automatically select relevant activities and share them between well-matched communities?

E. Additional Challenges

Obviously, general application use also comes with its own set of questions. For example: how would people move throughout an urban area with dozens, if not hundreds of these displays? Can we describe sets of preferences for different areas, or is there one set of preferences for the entire network? Such preferences would need to describe the user’s various communities, so that these could be matched against “local settings” in order to properly detect the various support needs described above (e.g., *Identity Cognition*). And what exactly “describes” a community? Obviously, both the preferences themselves as well as their exchange would need to respect the privacy needs of all stakeholders. And how would a user know that her presence was recognized by the system? ‘Welcome Ms. Anderson’ sounds awkward at best.

VI. CONCLUSIONS

Public spaces play an important building block in the fabric of communal life. They provide a place for social encounters, entertainment, and relaxation. However, communities that occupy the same space often do not “play well” together, while other, spatially separated communities might work well together, but are too far removed from each other. At the same time, local communities might benefit from increased awareness of their members, and by presenting their own community to others.

Public displays have the ability to enrich community life by providing in situ community awareness and social diversity, by ‘shrinking the distance’ between distributed communities, and by adding additional diversity in homogeneous communities. Based on a literature review, we created four scenarios to illustrate the potential of situated networked public display for improving social coherence. We then presented our initial ideas for realizing this vision. We are currently in the process of designing a testbed in order to trial some of these applications with real-world communities.

ACKNOWLEDGMENTS

This work was in part funded within the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 244011.

REFERENCES

- [1] S. Carr, M. Francis, L.G. Rivlin, and A.M. Stone, *Public space*, Cambridge University Press, 1992.
- [2] C. Holland, A. Clark, J. Katz, and S. Peace, “Social interactions in urban public places,” Apr. 2007. <http://oro.open.ac.uk/7445/>
- [3] R. Ballagas, J. Borchers, M. Rohs, and J. Sheridan, “The Smart Phone: A Ubiquitous Input Device,” *IEEE Pervasive Computing*, vol. 5, Feb. 2006, pp. 70-77.
- [4] N. Memarovic and M. Langheinrich: Enhancing Interaction in Public Spaces Using Situated Public Displays. *Workshop on Social Interaction in Spatially Separated Environments (SISSI 2010) at Ubicomp 2010*, September 2010
- [5] A. Clark, “Understanding Community: A review of networks, ties and contacts,” NCRM Working Paper. ESRC National Centre for Research Methods, May 2007. <http://eprints.ncrm.ac.uk/469/>
- [6] d. boyd, N. Ellison: Social network sites: Definition, history, and scholarship. *Journal of Computer-Mediated Communication*, 13(1), article 11, 2007. <http://jcmc.indiana.edu/vol13/issue1/boyd.ellison.html>
- [7] J. Gehl and A. Matan, “Two perspectives on public spaces,” *Building Research & Information*, vol. 37, 2009, p. 106.
- [8] M. Jones, W. Harwood, D. Bainbridge, G. Buchanan, D. Frohlich, D. Rachovides, M. Frank, and M. Lalmas, “Narrowcast yourself”: designing for community storytelling in a rural Indian context,” *Proc. of the 7th ACM conference on Designing interactive systems*, Cape Town, South Africa: ACM, 2008, pp. 369-378.
- [9] F. Redhead and M. Brereton, “Designing Interaction for Local Communications: An Urban Screen Study,” *Human-Computer Interaction – INTERACT 2009*, 2009, pp. 457-460.
- [10] N. Taylor and K. Cheverst, “Social interaction around a rural community photo display,” *Intl. Journal of Human-Comp. Studies*, vol. 67, 2009, pp. 1037-1047.
- [11] S. Bury, J. Ishmael, N.J. Race, P. Smith, and M. Rouncefield, “Towards an understanding of security concerns within communities,” *IEEE Intl. Conf. on Wireless & Mobile Comp., Netw. & Com.*, 2008, pp. 478-483.
- [12] S. Izadi, G. Fitzpatrick, T. Rodden, H. Brignull, Y. Rogers, and S. Lindley, “The iterative design and study of a large display for shared and sociable spaces,” *Proc. of the 2005 conference on Designing for User eXperience*, San Francisco, California: AIGA: American Institute of Graphic Arts, 2005, p. 59.
- [13] J.E. Bardram, T.R. Hansen, and M. Soegaard, “AwareMedia: a shared interactive display supporting social, temporal, and spatial awareness in surgery,” *Proc. of CSCW 2006*, Canada: ACM, 2006, pp. 109-118.
- [14] J. Favela, M. Rodriguez, A. Preciado, and V. Gonzalez, “Integrating Context-Aware Public Displays Into a Mobile Hospital Information System,” *IEEE Transactions on Information Technology in Biomedicine*, vol. 8, 2004, pp. 279-286.
- [15] K. O'Hara, M. Perry, and S. Lewis, “Social coordination around a situated display appliance,” *Proc. of CHI 2003*, Ft. Lauderdale, Florida, USA: ACM, 2003, pp. 65-72.
- [16] E.M. Huang, D.M. Russell, and A.E. Sue, “IM here: public instant messaging on large, shared displays for workgroup interactions,” *Proc. of CHI 2004*, Vienna, Austria: ACM, 2004, pp. 279-286.
- [17] D. Snowdon and A. Grasso, “Diffusing information in organizational settings: learning from experience,” *Proc. of CHI 2002*, Minneapolis, Minnesota, USA: ACM, 2002, pp. 331-338.
- [18] E.F. Churchill, L. Nelson, and L. Denoue, “Multimedia fliers: Information sharing with digital community bulletin boards,” *Proc. of communities and technologies*, 2003.
- [19] N. Taylor and K. Cheverst, “Exploring the Use of Non-Digital Situated Displays in a Rural Community,” 2008.
- [20] O. Storz, A. Friday, N. Davies, J. Finney, C. Sas, and J. Sheridan, “Public Ubiquitous Computing Systems: Lessons from the e-Campus Display Deployments,” *IEEE Pervasive Comp.*, vol. 5, 2006, pp. 40-47.
- [21] M. Lévesque, L. Bélanger, and J. Lewis, “p2P: Cityspeak’s Reconfiguration of Public Media Space,” *Wi: Journal of the Mobile Digital Commons Network*, vol. 1, 2006.
- [22] M. Koch, “Supporting Community Awareness with Public Shared Displays,” *Proc. Bled Intl. Conf. on Electronic Commerce, Bled, Slovenia*, 2005.
- [23] H. Du, M.B. Rosson, J.M. Carroll, and C. Ganoe, ““I felt more of a member of this class”: increasing students’ sense of community with video commenting,” *Proc. of CHI 2009, Extended Abstracts*, Boston, MA, USA: ACM, 2009, pp. 4405-4410.
- [24] K.G. Karahalios, “Social Catalysts for Creating Sociable Media Spaces,” in *Media Space 20+ Years of Mediated Life*, Herrison, Ed. Springer, 2009, pp. 75-95.
- [25] P. Peltonen, E. Kurvinen, A. Salovaara, G. Jacucci, T. Ilmonen, J. Evans, A. Oulasvirta, and P. Saarikko, “It’s Mine, Don’t Touch!: interactions at a large multi-touch display in a city centre,” *Proc. of the CHI 2008*, Florence, Italy: ACM, 2008, pp. 1285-1294.
- [26] J. McCarthy, T. Costa, and E. Liongosari, “Unicast, outcast & groupcast: Three steps toward ubiquitous, peripheral displays,” *Ubicomp 2001: Ubiquitous Computing*, 2001, pp. 332-345.
- [27] S. Greenberg and M. Rounding, “The notification collage: posting information to public and personal displays,” *Proc. of CHI 2001*, Seattle, Washington, United States: ACM, 2001, p. 521-.
- [28] G. Jancke, G.D. Venolia, J. Grudin, J.J. Cadiz, and A. Gupta, “Linking public spaces: technical and social issues,” *Proc. of CHI 2001*, Seattle, Washington, United States: ACM, 2001, pp. 530-537.
- [29] S. Houde, R. Bellamy, and L. Leahy, “In search of design principles for tools and practices to support communication within a learning community,” *SIGCHI Bull.*, vol. 30, 1998, pp. 113-118.
- [30] D.W. McDonald, J.F. McCarthy, S. Soroczak, D.H. Nguyen, and A.M. Rashid, “Proactive displays: Supporting awareness in fluid social environments,” *ACM Trans. Comput.-Hum. Interact.*, vol.14, 2008, pp. 1-31.
- [31] K. Cheverst, G. Smith, K. Mitchell, A. Friday, and N. Davies, “The role of shared context in supporting cooperation between city visitors,” *Computers & Graphics*, vol. 25, 2001, pp. 555-562.
- [32] H. Khalid and A. Dix, “How photologs influence local social interaction,” *Proc. of social mediating technologies workshop in CHI*, 2009.
- [33] S. Hosio, H. Kukka, and J. Rieki, “Leveraging social networking services to encourage interaction in public spaces,” *Proc. of the 7th International Conference on Mobile and Ubiquitous Multimedia*, Umeåring;, Sweden: ACM, 2008, pp. 2-7.