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What's in it for me: Exploring the Real-World Value Proposition of Pervasive Displays

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ABSTRACT

The future of pervasive public display networks is loaded with high expectations. Non-commercial displays are commonly envisaged as proliferating in numerous contexts and domains, where they offer various uses for a variety of everyday users. In this paper we discuss why this vision is perhaps over optimistic and the realities of deploying, designing and understanding such systems should not be taken for granted. Understanding the value of public display deployments in respect to location managers, and the real-world costs of longitudinal in-the-wild deployments are both commonly overlooked in much of the related literature. Within this paper we develop a discussion in reference to several real-life events by presenting examples from the past five years of running the open UBI Oulu initiative in Oulu, in northern Finland. The purpose of this research is to raise awareness about these aspects of in-the-wild display deployments and to be support the research community in creating sustainable public display deployments.

Categories and Subject Descriptors

H.5.m [**information interfaces and presentation**]: Miscellaneous

General Terms

Design, economics, human factors

Keywords

Public displays, repurposing, context, value networks

1. INTRODUCTION

Much of contemporary research surrounding interactive public display deployments focuses on controlled studies in semi-public settings. Typically, the setup for such studies includes introducing a display into a space where no such technology previously existed; either by recruiting or unobtrusively observing peopleusing the display for a given period of time; and then removing the display. Typically these prototype displays run a single application or service, in order to uncover specific aspects of the interaction that occurs between the users of the system and the displays.

Within the research literature there are studies that have examined long-term deployments of public display network. These have been purposed for research (e.g., the UBI Oulu initiative [21] and e-campus in Lancaster [24]), as well as for commercial use. These longitudinal research deployments have been used for more than one specific application, i.e. hosting multiple applications, either simultaneously (selectable through a menu-structure) [21], or consecutively, where one application follows another temporally [8, 24]. Commercial deployments are still mostly used for broadcast advertising, or directory services in shopping malls and airports.

In this paper we focus upon public displays in-the-wild in respect to their proposed value. What added value can public display deployments bring to the location in which they are site, in respect to; the location managers; the display managers; and the people inhabiting these spaces? We point out that for non-commercial public display deployments to proliferate in-the-wild, as envisaged commonly in much of the recent related literature, they must be capable of providing strong value to the location managers. In addition, we encourage readers to consider the realworld costs of a longitudinal display deployment carefully. These issues are overlooked in much of the current public display literature, where value for display users, and especially the declining hardware costs, are implied to be the key drivers behind the numerous future deployments in public spaces.

Public spaces are messy: a nexus of people, rules, regulations, costs and benefits. As such, deployments in this space are also more complex than a lot of the current public display literature has fully appreciated; the various actors involved in the value network of any deployment should be taken into consideration from the projects' initiation. Finally we note that, in such locations, we should not be technology driven, but instead spend a considerable amount of time and resources in order to better understand the deployment locations.

2. IN-THE-WILD PUBLIC DISPLAY RESEARCH IN 2014

Interactive public displays have been a research topic for roughly three decades, during which new technological improvements and constantly declining deployment costs have allowed new research trends to emerge. Currently researchers have high expectations of what future pervasive-display system might have to offer. Permanently deployed displays in cities are forecast as bringing the next wave of social change and to, "bring back the interactivity"

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that has largely now shifted to the online domain [17]. Davies et al. complement this vision by comparing this potential impact on society to those of the radio, TV or even the Internet [10].

The declining hardware costs have also enabled larger and longerterm display experiments to be deployed outside the safety of laboratory environments, "in-the-wild". This is certainly not specific to only public displays. Indeed, HCI as a research field seems to be evolving new methodologies in order to evaluate technologies in contexts where people use them naturally as parts of their daily lives [9], without even necessarily acknowledging the presence of research as a prototype.

Longitudinal public display deployments have certain benefits over shorter-duration deployments. As permanent deployments are often seen as natural parts of the surroundings, studies with such displays can result in novelty-free results from users [2]. One of the more surprising benefits that the authors have noticed during the past years of managing the Open UBI Oulu initiative, in northern Finland [21], is that often other interested organizations take the initiative themselves, and suggest cooperation in the form of new use-cases for the displays. This opens new research opportunities and ideas that researchers could not have necessarily envisioned without this input.

The biggest drawback of such deployments are the expensive maintenance costs, both in terms of funding and the labor needed e.g. to constantly replace failing hardware and keeping the infrastructure operational and fit for use by the general public. Also, constantly acquiring fresh content to keep displays interesting over long periods of time has been found to be surprisingly challenging [19, 24].

Other examples of longitudinal deployments include The Wray Photo Display, in Wray, UK [25], and the e-Campus display network in Lancaster, UK [24]. Wray Photo Display has managed to engage the local communities especially with civic interests in mind. It was designed around user-contributed photos, and its many iterations over the course of four years have managed to serve a variety of different purposes, including documenting local heritage, serving as a noticeboard, providing an ad-hoc digital advertising medium, etc. Most importantly, it is a textbook example of how longitudinal display installations get repurposed by their users.

E-Campus is deployed in a campus area at Lancaster University, it facilitates a range of different public display research cases. These have included, among others, traditional digital signage, interactive applications, games, and novel experiments with social media. The seminal work by Storz et al. also highlights several key considerations that researchers who plan to install permanent deployments of ubiquitous technologies have to take into consideration [24]. They reported on the management of user expectations, problems of content acquisition and management, the importance of monitoring systems, and these have since proven to be accurate descriptions of the everyday issues with permanent display deployments.

More recent public display installations in-the-wild were discussed by Schroeter et al., who presented a set of case studies covering a wide range of public contexts, including the Federation Square in Melbourne Australia [23]. Their prototype, Discussions in Space, was designed to allow its audiences disclose public opinions directly on the screens about a predefined set of topics. Specifically, they found content, location and people as the three key factors influencing the success of public display deployments in general.

Display deployments of course do not have last long to obtain good results; they can last from just a few hours to days. Such deployments are often carefully managed and overseen by researchers conducting the trials. This is important, as it means that users of these kinds of deployment can be guided in order to engage in specific activities and can therefore be observed whilst taking part in such activities. The results from such sessions are often very insightful and detail-rich, as such observations often go unnoticed in other types of deployments. However, as with any researcher-led study (with the researcher being part of the study) the results obtained from such studies can be biased and suffer from participants wanting to please researchers with "good results" [5].

Participants' bias towards giving good results can be mitigated against by having a more open, less directed intervention. This approach was adopted in the research carried out by Chamberlain et al. [6] in their paper 'Island Life'. In the project, the authors took an approach that firstly used a pervasive touch projection to understand issues around living in an island community, and to understand the issues around the data use of some of the islanders. The system was then repurposed the following day by some of the islanders to launch a heritage app. This type of happenchance usage allowed the researchers to further understand how such systems might be developed and deployed in such settings.

Naturally, public displays have been harnessed for more "lightweight" and leisurely purposes. A recent good example is by Chatham and Mueller [7], who successfully deployed a screen in a basketball court, to motivate and support the players. Although digital screens are nothing new in sports arenas and halls, the customization and unique features of the screen, such as appropriate language of "motivational slogans" that were displayed to the players, made the deployment a success. In this respect, games, both purely digital and ones that involve physical activity from users are of interest from a public display research perspective.

3. GOING FORWARD

The related work presented above naturally cannot, and is not intended to, cover the entire spectrum of currently ongoing interactive public display research. Instead, our purpose is to exemplify the existence of several different stakeholders in all public display deployments.

Two key stakeholders seeking to directly benefit from public displays can be identified: the display managers (in charge of *installing and managing the displays* and their services) and the location managers (who *own or administer the locations* where the displays are, or will be, situated). In the current typical in-thewild deployments these two are seldom the same. The displays, managed and owned by researchers, are often situated outside of their laboratories: in cafes, pubs, lobbies of corporations, museums, pedestrian streets, etc. The value to either of these stakeholders is then generated from the users of public displays, their audience. In research, it is often found in the form of novel, hopefully generalizable, findings about the deployed prototype and the study itself.

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3.1 The Problem with the Current Premise

A trending vision in public display articles is such that technologies, along with the presented novel use cases, will inevitably proliferate in our surroundings in the near future, or is already doing so. This is commonly accepted as a reasonably accurate forecast. We feel, however, that there needs to be a degree of caution in taking this vision for granted.

Let us consider the following: For a display to be installed longterm outside of the research lab, “out there”, and to be funded by someone else than research groups, it absolutely must offer real, concrete value to the administrators of the space where it is situated, to the *location managers*. In reality, what we as researchers find and report in articles, as valuable and interesting can differ radically from the interests and perceptions of these administrators. Ultimately, for a deployment to be selfsustainable, and thus justifying its existence, the location managers are, in fact, the primary stakeholders that absolutely must find value in a deployment.

A good example of this comes from the UBI Oulu display deployments. Over the years we have deployed a number of large interactive displays in Oulu. During the same time, we have also received numerous requests to move a deployed display back to the laboratory from its location, simply because the location managers did not experience or understand the value that the display might offer in the space. These requests came as a surprise, as we were at all times collecting rich log data for research, observing the displays being used by large numbers of people, and thus under the impression that we are doing a good job overall and that all is going smoothly. Obviously, we were wrong.

Initially, public display deployments can be easy to “sell” to location managers. The value proposition can be backed up by articles presenting success stories from similar deployments and, of course, City authorities and other organizations are initially open to research, to "support a good cause". However, it is the long-term sustainability of a deployment where problems really surface. This is what happened to us right after the initial buzz and enthusiasm, i.e. novelty, wore off and the mundane operational tasks and duties began. The crucial question to really consider when making claims about a display deployments’ potential to proliferate “out there” is why should the location managers of a deployment allow it to stay there, long-term?

This question, we feel, is unfortunately overlooked in literature, where public displays are of described as feasible and proliferating merely due to the falling costs of off-the-shelf equipment. While this is certainly true -- a display panel these days is not expensive -- cheap hardware costs simply do not equate to a sustained deployment. And even if a display is used on a daily basis, the location managers do not necessarily appreciate it, particularly from the perspective of other stakeholders.

Another related issue has to do with evaluation methodologies of public displays and their services. Even well-received prototypes that have been successful for years can see a drastic and unwelcome decline in popularity and perceived usefulness by the general public after researchers stop actively supervising and promoting them. Recently, Taylor et al. reported on this issue [25], and, again, we have had similar experiences to this. Many of our services that have been successes in terms of research goals while we were administering them (e.g. [15]) have been quickly left without sustained use when left on their own, on the very same public displays where the supervised trials were conducted. Thus, while providing high value to us -- the display managers -- and the research community in general, their perceived value for the location managers, or, in the end even the users, has not been so promising. Similar concerns about mismatching stakeholder interests have been voiced in the context of in-the-wild CSCW deployments [13].

The point we wish to raise here, returning to the common future vision of public displays, is why exactly would e.g. city officials, commonly in charge of the use of public spaces where displays are anticipated to proliferate, let such deployments “invade” their city? As a mental exercise, we invite the reader to contrast this with the currently dominant use of public displays, i.e. broadcast advertising or digital signage. Advertising already now has an immensely powerful and very easy-to-use value proposition: money. And the advertising industry certainly is not stuck in the past, increasingly creative ways of leveraging public displays for pervasive advertising are being constantly introduced [1]. This being said, we believe that if we wish to see the next generation of interactive public display services becoming common in the fashion they are now envisaged in research literature, much more attention needs to be directed to the possible ways in which the services can co-exist with the “competition” of commercial deployments.

3.2 The "Myth" of the Declining Costs

The often-argued “declining costs of display deployments” also deserves a second look. An important point to consider with (semi-) permanent public display deployments is that they are very resource-intensive to run. First, there is the cost of the hardware. This, albeit declining, can still be substantial, depending on how robust and rugged the device needs to be -- outdoor displays especially need to be fortified against varying weather conditions and possible vandalism. With permanent outdoor deployments, installation costs are also high, especially if construction work such as digging up streets to install anchors or run cables is required (see Figure 1). The next thing to consider is the maintenance costs: electricity, Internet, cleaning and insurance, among others. Then, of course, there are various personnel costs: designers, architects, software engineers, hardware engineers, project managers; all the people required to develop, deploy, and maintain the installation. In addition to development efforts, a lot of red tape needs to be “cut through” in order to gain permission from authorities to install such displays. This bureaucracy takes a lot of time and requires a dedicated person to “sell” the idea to officials, fill out the required documents, negotiate the required contracts, handle tendering of devices, etc.

The point we wish to emphasize here is that public displays are, in a word, still expensive -- and will continue to be expensive. It is exactly these hidden costs that hinder the wider adoption of interactive public display deployments. To put it bluntly, displays need to earn their keep -- that is, they need to provide enough perceived value to the location it is deployed in, as judged by the location managers. By extension, the display also needs to provide value to the people in the location -- customers, as it were -- since

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customer opinion reflects quite quickly to the opinion of the location managers. And customers, the users of public displays, as we have again learned the hard way, can become agitated fast. A single piece of user generated content that should have been moderated more carefully, or a short period of display downtime both sound like small issues in the larger scale of things, but both have caused much more serious problems than we possibly could have anticipated, when the "wrong" customer happened to experience them.

Figure 1. One of the Oulu displays being installed.

Essentially, public displays are more problematic than is implied in much of the literature. Many of the proposed services have not really been time-tested to provide value to the location managers, who are in fact the stakeholders that matter the most. However, our intention is by no means to paint a grim picture for the future, and to suggest that there is no room for the prototypes and concepts that the research community is producing -- not at all. On the contrary, we merely wish to point out that there is often an observable difference between the academically valuable contributions and prototypes that can immediately offer easy-tounderstand value to the stakeholders that, in the end, are crucial for the realization of the hypothesized future of interactive public displays.

4. Discussion

One take-home point, or a concern, we wish to convey is that cities and other public organizations hosting future public display deployments may not be eager to fund the currently popular and important public displays in terms of research themes, such as interaction research, games, or "lightweight" prototypes to foster communities. One means of mitigating this problem is to attempt to identify and build deployments for issues for which location managers are already spending substantial amounts of money and effort.

4.1 In Search of Real-World Utility

One of the trends in public display research has been exploring societally beneficial activities, such as civic engagement and urban planning, with dedicated workshops for technology mediated civic participation being organized in leading HCI conferences in 2013 [3, 14]. Leveraging public displays for this purpose also opens a potential avenue to get the local City councils interested in giving their support (financially and otherwise), as these are issues that are both challenging and topical, and in which cities are constantly dedicating both funding and human resources to.

One possibility to get the citizens, the users, interested in such deployments is leveraging altruism. As an example, altruism has been used to motivate crowdsourcing on public displays [11]. Several reasons why public displays can be a good fit for crowdsourcing can be identified: i) they allow tapping into local knowledge [12, 23]; ii) they are often used in a serendipitous manner [26] and iii) users tend to approach displays without precise motives in mind [20]. Therefore, these displays can reach users that could otherwise be hard or borderline impossible to reach. From a civic engagement perspective, this has been demonstrated in the past by bridging citizens and city officials through public displays [15]. In the study, 67% of the users who used the display to communicate with officials had never before had any kind of earlier contact with them, providing a strong value proposition the location managers (the local authorities). Similarly, the works by Schroeter et al. and Valkanova et al. managed to effectively intercept users for civic purposes [23, 26].

One of the most popular research avenues with public displays has been, and still is, engaging and fostering communities, as recently explored comprehensively by Memarovic et al. [19]. Focusing on providing high perceived value to the end users, as often successfully demonstrated with such studies, can indirectly lead to increased value to the location managers as well, but only in the case that the community reaping the benefits of the deployment is the core clientele, "customers", of the location. A good example of this is the earlier discussed basketball-court deployment [7], where the deployment serves both the interest of the location managers and its users. However, what is missing in community engagement studies in general is systematic, long-term evidence of sustained engagement and that they are indeed worth all the hassle to maintain in the long run. Most of the deployments in the literature are, again, severely limited in length and the results are explored mainly from the perspective of the users.

In fact, we are not aware of a single long-term "community fostering" deployment that has been running for years and providing constant value to the location managers. This can be contrasted to the various digital screens in cafeterias, pubs, and restaurants that are used to simply display the daily deals and offers. In other words, it is traditional advertising. Why is this? Although the potential certainly seems to be there, we, as the responsible research community, need to be up for the challenge and simply do better job in first uncovering and then documenting the real-world impact of these deployments to the location managers, and not only to their users.

Besides designing for a specific purpose that ultimately yields high value to location managers, another approach is to just deploy and let the users repurpose the services, in the hopes of "stumbling upon" something that, in the end, turns out valuable for all involved stakeholders.

4.2 Adaption and Repurposing

So, how can we, as researchers and display managers, design and develop systems that are adaptable and that also lead to sustained use? One potential avenue is to develop systems that allow a degree of appropriation, and that are purposed as a provotype [4] and in this respect allow both researchers and participants to understand the ways in which such systems might relate to the mundane activities that they often take for granted. Further, how can we as researchers increase the real-world value of pervasive display systems? Many such systems seem to be 'locked off', that is they are able to only do specific tasks (possibly due to the nature of the screens being public, moderated and so on), but is there any way

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that the screens and services can be opened up and used in ways that might promote more serendipitous use or could be re-purposed?

In Chamberlain et al.'s work, the research system was adopted for a real world purpose [6]. However, this is because the system was flexible, unpurposed and there were staff that could quickly change the set-up and support the new use-context. This is not often the case with fixed/permanent urban displays that are not staffed and have a dedicated use. However, it is not impossible to see how one might use such screens in a multitude of different ways. Allowing such systems to be used and appropriated in ways that reflect the context and locale of use may support the long term adoption of the technology and engender users to re-purpose and routinely use such systems. It's not always the case that there needs to be a moderation, censoring or validation. Sometimes providing technology to people in a more 'open' way can be much more democratic and lead to long-term real world use.

In addition to encouraging repurposing of public displays, a perhaps more controlled approach being investigated currently is to provide a range of different applications on a single display for users to interact with. In practice, there are two options for this: either provide the applications sequentially, one at a time with the help of a scheduling system [8, 24], or offer a variety of applications to the users at all times to choose from [21]. A key benefit of both of these approaches is that users can be, at least in the optimal case, offered services that best fit the context of the display. In this regard, the approach described by Clinch et al. seems desirable: to allow display owners to choose the applications they want to offer from a specific "public display app store" [8]. After all, no two contexts are the same, implying that a display will certainly benefit from very context-specific applications.

4.3 Context Matters

Typically, public displays are accessible to a heterogeneous group of people with different skills and interests. Therefore, at the early development stage of any public display project, it is important to reflect on the needs and requirements imposed by the location and the needs of the location managers deciding about the eventual fate of the deployment. Naturally, this is not to say that we must not look at the needs and requirements of the potential user of a public display system. We must aim to better understand where we are designing for, in order to navigate the rules and roles different spaces impose on both the people in those spaces, and the technologies we add to them [18].

From a theoretical standpoint, the details which constitute the physical and social contexts are often not well understood, at least not in a way that would help inform the design of new ubiquitous computing technologies [22]. Understanding the human experience better can help guide public display designers in building links between people's activities and the context in which they operate. This contextualization will be crucial in bringing real-world value to the location managers, by helping them to better serve their customers in the long-term.

What this means is that a public display deployments should never start as technology-driven. Putting the technology first can lead to a situation where a prototype is developed in a laboratory, and a location for testing it is then selected post-hoc. This in turn can potentially lead to deploying the wrong technology in the wrong place, and instead of complementing and augmenting the existing practices, the technology may clash with them (see e.g., [16]) and in fact this can decrease the value of the system, instead of adding value to it.

A case in point was when one of the displays that we had been asked to withdraw in Oulu was placed at a local library. Months since the initial deployment, the library managers finally considered the display to be too disruptive, and wanted it removed. This was mainly because users started using the display heavily as a gaming platform and for purposes other than it was intended for in the context of the public library (education, index services, promoting culture, etc.). We had promised to carry out a project to customize the display in order to better serve the library customers, and most importantly, the location managers and their goals. After a complete overhaul of the content and services on that display, the library managers were very pleased with the new offering, happily allowing the display to remain and serve the customers in a way that was deemed appropriate for a public library.

The main idea we wish to convey here is that the current strong technological focus in the field sometimes skews the way we interpret these technologies; that is, as if they somehow existed in a vacuum, apart from the final contexts in which they operate. This focus detracts from the fact that public displays, situated in meaningful places have to respect and add something to that location to succeed in the long-term. Only by doing so the perceived value arises, and technology, people, and location meet in a way where the technology enhances the human experience of the place in which it is deployed.

5. Conclusion

In this paper we raise discussion on the commonly envisaged future of pervasive public display networks in our everyday environments. We argue that, for that vision to become reality, more attention needs to be directed towards the value proposition of such displays to the location managers. They are ultimately the ones who need to get sustained positive return-on-investment from technology deployments on their territory. Initial good intentions -- the basis for many of the current in-the-wild installations -- are in the end only good for supporting a temporary deployment. And although such deployments often make undeniably great contributions to the research community, they are not sustainable in-the-wild and not fully in unison with the commonly accepted vision of pervasive displays. We illustrate all these points with a set of observations and events from the UBI Oulu initiative, which many of the authors of this paper have been overseeing for several years, since late 2009.

Finally, as a more philosophical takeaway, public display research in-the-wild, has matured beyond being a purely engineering subject. Unlike many fields of computer science where researchers strive to minimize external effects such as location, time of day, season of the year, etc. on their experiment in favor of a stable, predictable and controllable laboratory setting, public display research deals with everyday life on a day-to-day basis. Therefore it is challenging to accurately forecast what is the real-world, long-term impact and value of a deployment that has been initially studied in supervised conditions. Further, we have to operate at the intersection of places, people, and technologies, and this complexity illustrates the need for understanding the various stakeholders and actors involved in a

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public display deployment - display managers, location managers, and users.

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7. REFERENCES

[1] Alt, F., Müller, J., Schmidt, A. (2012) Advertising on Public Display Networks. IEEE Computer, 45(5), pp. 50-56.

[2] Alt, F., Schneegaß, S., Schmidt, A., Müller, J., Memarovic, N. (2012) How to evaluate public displays. Proc. PerDis 2012, Article 17.

[3] Bertelsen, O. W., Bødker, S., Brynskov, M., Le Dantec, C. A., Kanstrup, A. M., Pipek, V. (2013) Participatory Publics: Civic technology and local communities. Workshop in ECSCW 2013.

[4] Boer, L., Donovan, J. (2012) Provotypes for participatory innovation. Proc. DIS 2012, pp. 388-397.

[5] Brown, B., Reeves, S., Sherwood, S. (2011) Into the wild: challenges and opportunities for field trial methods. Proc. CHI 2011, pp. 1657-1666.

[6] Chamberlain, A., Malizia, A., Dix, A. (2013) Engaging in Island Life: big data, micro data, domestic analytics and smart islands. In Workshop on Human Interfaces for Civic and Urban Engagement, in Ubicomp 2013, pp. 721-724.

[7] Chatham, A., Mueller, F. (2013) Adding an interactive display to a public basketball hoop can motivate players and foster community. Proc. UbiComp 2013, pp. 667-676.

[8] Clinch, S., Davies, N., Kubitza, T., Schmidt, A. (2012) Designing application stores for public display networks. Proc. PerDis 2012, Article 10.

[9] Crabtree, A., Chamberlain, A., Grinter, R., Jones, M., Rodden, T., Rogers, Y. (2013) Introduction, The Turn to the Wild, ToCHI 20(3).

[10] Davies, N., Langheinrich, M., Jose, R., Schmidt, A. (2012) Open Display Networks: A Communications Medium for the 21st Century. Computer 45(5), pp. 58-64.

[11] Goncalves, J., Ferreira, D., Hosio, S., Liu, Y., Rogstadius, J., Kukka, H., Kostakos, V. (2013) Crowdsourcing on the Spot: Altruistic use of Public Displays, Feasibility, Performance, and Behaviours. Proc. UbiComp 2013, pp. 753-762.

[12] Goncalves, J., Hosio, S., Ferreira, D., Kostakos V. (2014) Game of Words: Tagging Places through Crowdsourcing on Public Displays. Proc. DIS 2014, to appear

[13] Grudin, J. (1988) Why CSCW applications fail: problems in the design and evaluationof organizational interfaces. Proc. CSCW 1988, pp. 85-93.

[14] Hosio, S., Goncalves, J., Kostakos, V., Cheverst, K., Rogers, Y. (2013) Human Interfaces for Civic and Urban Engagement: HiCUE 2013.Adj. Proc. UbiComp 2013, pp. 713-720.

[15] Hosio, S., Kostakos, V., Kukka, H., Jurmu, M., Riekki, J., Ojala, T. (2012) From school food to skate parks in a few clicks: using public displays to bootstrap civic engagement of the young. Proc. Pervasive 2012, pp. 425-442.

[16] Korn, M., Bødker, S. (2012) Looking ahead: how field trials can work in iterative and exploratory design of ubicomp systems. Proc. Ubicomp 2012, pp. 21-30.

[17] Kuikkaniemi, K., Jacucci, G., Turpeinen, M., Hoggan, E., Müller, J. (2013) From Space to Stage: How Interactive Screens Will Change Urban Life. IEEE Computer 44(6), pp. 40-47.

[18] Kukka, H., Luusua, A., Ylipulli, J., Suopajärvi, T., Kostakos, V., Ojala, T. (2013) From Cyberpunk to Calm Urban Computing: Exploring the Role of Technology in the Future Cityscape. Technological Forecasting and Social Change 84, online first.

[19] Memarovic, N., Langheinrich, M., Cheverst, K., Taylor, N., Alt, F. (2013) P-LAYERS -- A Layered Framework Addressing the Multifaceted Issues Facing CommunitySupporting Public Display Deployments. ACM Trans. Computer-Human Interactions 20(3), Article 17.

[20] Müller, J., Alt, F., Michelis, D., Schmidt, A. (2010) Requirements and design space for interactive public displays. Proc. Multimedia 2010, pp. 1285-1294.

[21] Ojala, T., Kostakos, V., Kukka, H., Heikkinen, T., Lindén, T., Jurmu, M., Hosio, S., Kruger, F., Zanni, D. (2012) Multipurpose interactive public displays in the wild: Three years later. Computer 45(5), pp. 42-49.

[22] Paay, J., Kjeldskov, J., Howard, S., Dave, B. (2009). Out on the town: A socio-physical approach to the design of a context-aware urban guide. ToCHI, 16(2), Article 7.

[23] Schroeter, R., Foth, M., Satchell, C. (2012) People, content, location: sweet spotting urban screens for situated engagement. Proc. DIS 2012, pp. 146-155.

[24] Storz, O., Friday, A., Davies, N., Finney, J., Sas, C., Sheridan, J. (2006) Public Ubiquitous Computing Systems: Lessons from the e-Campus Display Deployments. IEEE Pervasive Computing 5(3), pp. 40-47.

[25] Taylor, N., Cheverst, K., Wright, P., Olivier, P. (2013) Leaving the wild: lessons from community technology handovers. Proc. CHI 2013, pp. 1549-1558.

[26] Valkanova, N., Walter, R., Vande Moere, A., Müller, J. (2014) MyPosition: Sparking Civic Discourse by a Public Interactive Poll Visualization. Proc. CSCW 2014, pp. 13231332.

Simo Hosio, Jorge Goncalves, Hannu Kukka, Alan Chamberlain, and Alessio Malizia. 2014. What's in it for me: Exploring the Real-World Value Proposition of Pervasive Displays. In Proceedings of The International Symposium on Pervasive Displays (PerDis '14). Association for Computing Machinery, New York, NY, USA, 174–179. https://doi.org/10.1145/2611009.2611012