PROCEEDINGS PAPER

Exploring the Effect of Spatial Layout on Mediated Urban Interactions

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ABSTRACT

In this paper we focus on the spatial configuration and emergent social interactions in two locations in London mediated by interactive and networked urban displays. Our analysis draws upon interactions mediated through displays we implemented in the real world connecting four urban spaces [1]. We outline our case study and the methodology we implemented, including the analysis of the spatial layout on the micro/local scale in two sites, followed by the observations of social behavior and technologically mediated interactions by actors, spectators and passers-by during two community events, before finally outlining the following identified interaction zones: 1) direct interaction space surrounding the display (direct); 2) the surrounding public space (wide); and 3) across spatial boundaries i.e. the remotely connected space through networked displays (connected) over time. We highlight site-specific interactions and compare them to the more generic types of interactions, thus contributing to the understanding of mediated social interactions. We suggest that the properties of the spatial layout play a significant role and, to a certain extent, frame the type of interactions mediated through public displays. We highlight in particular the dynamic and interconnected nature of this mediation, defined through the spatial layout, people, type of social activities, and time of the day.

Keywords: Urban Displays, Connected Spaces, Shared Encounters, Spatial and Social Configurations, HCI

1. INTRODUCTION

The city is increasingly mediated through pervasive and emerging interactive and networked digital technologies. An important feature of interaction spaces, like the ones generated through public displays, is that they are defined both by the characteristics of the architectural layout and the space in which the displays are situated, along with the properties of the displays [2]. For example, within a public place, different social interaction spaces are created depending on the various architectural areas identified within the layout [3, 4]. The urban display would then create an additional public interaction space, which, together with the type of social activities that the architectural layout supports, may influence the performer role in different ways [5].

As part of our effort to explore the potential of networked urban displays for communities and culture, we outlined the need to consider more clearly the social, spatial and temporal properties of urban space to successfully implement public display interfaces. Overall our approach is driven through research-by-design, including the design, implementation, and reflective evaluation, which in turn feed back into the design cycle [1]. In this respect we designed and deployed four networked urban screens: two in East London (The Mill and Leytonstone Library) and two in Nottingham, UK. The macro site analysis and the decision on screen placement within the urban space are beyond the scope of this paper.

The screen hardware consists of a TV sized public display (46"), which is fitted with a touch foil, speakers, a web camera and an IP night vision camera. The format of the screen is portrait to enable full body interactions. The foil is attached to a display window and the screen and hardware sits in a case behind the shop front. Currently we are running three alternating experiences on all four screens.

In this paper we focus on two sites connected through our networked urban displays and address 1) how the architectural layout may support different interaction zones that influence the nature of the mediated interactions (physically, socially, and technologically); and 2) how public display influences the dynamic change of performer role (actors, spectators and passersby). In order to explore these questions we have conducted a case study based on two community events and observed direct interactions with and around the networked public displays, the wider spatial and social context, and with the remotely connected space. We

compare the role of two different architectural layouts in framing the interactions, and the types of social activities and the emerging interaction zones they may support over time. In particular we highlight: 1) social behavior such as social learning and role-play of actors, spectators and passers-by [6]; and 2) the type of interactions (direct, wide, connected). Our findings are based on onsite observations, image and video capturing and note taking. We discuss these findings with regard to spatial relationships and stress in particular the dynamic nature of these configurations.

2. BACKGROUND RESEARCH

In the eighties artists were already creating public communication portals such as the one connecting New York and LA [7], and more recently 'The Telectroscope' connecting London and NY, while in a larger context, 'Connected Cities' interconnects several European cities with an existing infrastructure of urban screens and media facades [8]. Extensive research has been done exploring the challenges of deploying public screens in urban space. The technical challenges of deploying display technology in public space have been summarized in [9]. Behavior related to the 'honey pot effect' i.e. the social effect of people attracted to the public display through the presence of other people close to it was identified, along with the 'transition zones' between the phases of interactions [10, 11, 14] and the notion of discovery in public spaces and social interactions by the community [12, 13]. On the urban scale the role of space, social proximity and full body performative interactions in shared spaces [14, 15, 16] or in remotely connected spaces [17] have been addressed. Ways to attract passers-by to public displays and what is required to notice interactivity in urban space have been explored in detail [18, 19]. Through introducing 'urban HCI' the spatial aspects of urban media installations have been described [20, 21]. Brynskov et al contributed to the understanding of flexible social interactions by addressing urban interaction - in relation to distributed attention, shared focus, dialogue and collective action - calling for a need to take into account multiple viewing and action positions [22]. The contextual characteristics of media architecture were addressed, including parameters that impact on its integration into the existing social fabric from a socio-demographic (*environment*), technical (*content*) and architectural (*carrier*) perspective [23].

The background research presented, however, has not addressed a number of highly significant aspects - in particular those relating to the dynamic nature of urban space [24, 25, 26] and their potential impact on the design of public displays.

In this paper we focus in particular on the role of performers and how the spatial relationships framed through the building layout and the social function change dynamically during two community events at two locations in East London, UK.

In the following section, we provide a brief introduction to our case study and describe the characteristics of the two locations (The Mill, and Leytonstone Library). In section 4, we analyze the spatial layouts we found. Section 5 presents initial findings from our field trials, describing patterns of emergent interactions and identified interaction zones.

3. CASE STUDY

The aim of the case study is to identify physical, social and technological aspects that mediate the emergent interactions in two locations. Our approach includes: 1) analyzing the existing spatial layout and social function; 2) observing qualitatively social interactions and identify actors, spectators and passers-by behavior; and 3) exploring the spatial relation in regard to the connected public displays. Finally, through cross-referencing and merging the analysis of the spatial layout and the social function with the observed interactions, we have identified various interaction zones (explained in detail in section 5). Using spatial observations, plotting/mapping and image analysis, we looked at behaviors such as 1) head and body orientation towards the screen, 2) speed of walk modified due to screen, 3) pointing or gesturing towards the screen, 4) discussing screen content with others and 5) brief or long touch interactions.

In this paper we compare two events which happened within ten days and during similar weather conditions. It is important to note that the researchers were embedded in the social ecology and became part of the event, observing the interactions passively and attracting as little attention as possible. In the following section we analyze in depth emerging interactions at two locations during two events: 1) The Mill's birthday and 2) Car Free Leytonstone.

3.1 The Mediator (Networked Urban Screens)

Our networked displays are running three alternating experiences. In this paper we focus on 'SoundShape' - an application which allows simultaneous and collaborative music-making across all displays through touching various pads with individual sounds. At any time there are four live

video feeds implemented on the bottom of the display showing the close space around each of the displays.

3.2 The Context: The Mill

The Mill in the East London Borough of Waltham Forest was established in 2011 for the local community and by the locals. It defines itself as a hub where various groups meet - residents can share information and services in a self-determined way. Currently over 40 different groups gather regularly for different purposes such as poetry, knitting, photography or over 65s' social life improvement. The digital display is on the premises of the Mill, behind a window display near the main entrance to the community center (Fig. 1).

The event: The Mill's birthday

The Mill hosted a large event celebrating their first anniversary on September 6th, 2012. As part of this occasion we promoted interactions through our networked public display. The event was announced as 'family friendly celebrations' from 4pm until 9pm. During this time the local community gathered and contributed through bringing their own food to share. Various activities for all age groups were offered such as music performances, an art exhibition or make-up sessions for kids. Fund raising was running in parallel as well.

Fig. 1 Simultaneous interactions: (1) man locking bike, (2) children collecting donations, (3) people inside the building, (4) man observing a group, (5) child watching live video feed, (6) man looking into distance, (7) group watching the screen.

Over the course of the event (4pm – 9pm) two researchers were present at The Mill. Their tasks included observations through video, pictures and note taking. Three researchers resided one at each of the other locations. Their responsibility was to attract passers-by on their end to engage with users at The Mill across the networked video feed or simply react to the interactions triggered by

users at The Mill. One researcher assisted remotely with supervising the networked system.

3.3 The Context: Leytonstone Library

Our second urban digital display is located 4km south east of The Mill, in the district of Leytonstone, which is part of the Borough of Waltham Forest. Whereas The Mill is situated in a former library building and in the meanwhile organized by residents themselves the Leytonstone Library is under the leadership of the Waltham Forest Council. The public display is in the premises of the library building, behind a window display, which belongs to the Housing Department.

The event: Car Free Sunday at Leytonstone

On September 16th, 2012 between 1pm and 7pm the council organized the Car Free Sunday. For this event Church Lane and Kirkdale Road were closed for traffic and local groups were allowed to set up stalls offering arts and crafts and local products as well as divers street food. A music stage and various street performers were present as well. Overall the event was well attended.

4.2 Leytonstone Library

Similar to The Mill the public display in Leytonstone is framed by other visually attracting displays (Fig. 3 - below). However, all displays are in line with the façade. On the right side the 'Stone Space Gallery' attracts many passers-by through art installations. On the left side of the public display a window display shows drawings and images by local artists. Two additional community notice boards are set up on the pavement in front of the digital display.

Fig. 2 Simultaneous interactions during the Car Free Sunday in Leytonstone: (1, 2) non-display related interaction, (3) child watching another child touching the digital display, (4) child interacting with the display, (5) man observing the children, (6) man at one of the pop-up stalls, (7, 9) women selling their products, (8) security person.

Fig. 3 Window displays of The Mill (above), Leytonstone Library (below): WD1/WD3 framing WD2, which includes the public display and creates a continuous display. WD2 at The Mill sits back from the façade, WD2 at the Leytonstone Library is in line with the other WDs.

Compared to The Mill's spatial layout there is no additional enclosed area in front of the digital display. The direct interaction zone is part of the pavement and directly impacts the pedestrian flow. The display stands behind a window display in an office space. In contrast to The Mill, there is no public access to the space behind the digital screen.

During the event one researcher was present in Leytonstone between 3pm and 6pm. His tasks were observing interactions, image and video capturing as well as supervising the system. A second researcher was at The Mill to attract passers-by and to respond to remote interactions through the live video feed.

4. ANALYZING THE SPATIAL LAYOUT

4.1 The Mill

The façade of The Mill is divided into three display windows (Fig. 3 - above) which attract passers-by for different reasons: Behind WD1 is an event space, WD2 includes the main entrance, provides the screen and is used as the communities notice board. WD3 shows the kids room and attracts with a colorful cardboard dinosaur. The digital display is positioned on the left side next to the main entrance to the Mill behind the window (WD2). This part of the building front is roofed and sets back from the façade. This position impacts the screen's visibility and therefore defines the different interaction zones. People who walk from left to right will notice the screen much later in comparison to the ones who walk from right to left, moreover, the setback creates a semi-enclosed corner (a kind of semi-private space). The building front is in line with other houses in the street. Between the façade and the pavement the Mill has an additional semi-enclosed paved area, which, is among other things, furnished with bike stands and pot plants creating a semi-public space. This semi-public space has an impact on the spatial configurations and the type of social interactions it affords.

5. DISCUSSION

Overall, both cases (The Mill, and Leytonstone Library) offered a stage for rich social, cultural and demographically divers range of participating local citizens, which provides an ideal foundation for deploying networked urban displays. During both events our displays became part of the social fabric and were continuously used by various people who, over time, demonstrated a variety of mediated interactions. The fact that we were attached to an existing social infrastructure and special event allowed us to observe interactions without active involvement of the researchers or setting up signifiers or attractors. We were able to observe various activities around the digital display, either directly related to the display, next to it or inside the building as well as through the networked displays to the other remote locations. Our observations indicated complex and nonlinear interactions and we were able to categorize these social behaviors and technology mediated interactions into site-specific and generic ones. Further we were able to plot these observations onto the analysis of the spatial layout in order to identify different interaction zones.

5.1 Identified Behavior

During both events we observed social behavior and interactions that were similar (generic) and others more site specific: Most strikingly children were early adopters and interacted the longest with the display. Constantly children were exploring new experiences the digital display intended to provide or not (role play) such as trying to reach the video camera for the live video feed. Teenagers were showing children where the live video camera is placed on the screen (social learning). After a while the same children lost interest and

were replaced by other users of all age groups. Actors were using various props to communicate with the other side. Paper was used to write messages on in order to show them to users on the other side or type letters on the screen whilst using the 5 by 5 grid of touch pads on the 'SoundShape' application. However, it seemed to be difficult to type complete messages.

Fig. 4 Group interaction in direct interaction zone: (1) waving through video, (2) collective interaction- touch video, (3) create sound/approach video, (4) play/touch video, (5) competition.

Unintended interactions were identified as well; for instance, a girl was throwing a tennis ball

on a string repeatedly towards the camera - demonstrating a kind of appropriation of use. Others were virtually sharing their food by showing it to the camera. Other forms of communication included imitating movements or gestures of actors on the other side or simply remote mediated dancing. Over time we observed that actors gained more confidence in performing. Sometimes the temper induced actors to challenge the remote counterpart though rude gestures. Children seem to make up their own rules on how to use the application. Competitive behavior was observed in the way that at least two actors tried to interact faster with the user on the other side of the screen (Fig. 4: (5)). Smaller children tried to reach the upper touch pads, which was a repetitive behavior observed very often. Adults on the other hand were less responsive, and a few of them could not get the point of the experience, others needed more information before starting to test it for themselves. Touch was a big attractor for both adults and children who discovered touch as they responded to sound and color and continued exploring it whereas adults had to adjust to the idea that they are allowed to touch the glass. On both sites there seems to be a hesitation to approach the direct interaction zones by adults when children were interacting, which created a sort of apprehension [14] in particular if the children were not related to them, one adult asked 'is this for adults as well?, as if she was looking for an approval.

We assume that the described observations are not framed by the spatial layout. However, we also could identify site-specific ones. At The Mill, for instance, children were using props that belonged to the community center and were placed at the semi-public enclosed space in front of the window displays as part of the celebration. A common behavior overall is to treat the camera as a microphone or to try to cover it and see the effect on the video feed. They were stepping on chairs to come closer to the speaker above the screen in order to make their voice heard to users on the remote connected location indicating appropriation of use and expressive performance. One child, for instance, was standing on a chair shouting to one of our researchers on the other side 'Who is the man in the blue shirt?' (Fig. 5: (3)).

Fig. 5 Site specific behavior at The Mill afforded through the spatial layout – semi protected

corner- and social context – link to community event: (1) a parent capturing interaction on camera, (2) offer biscuits to remote people, (3) shouting: amplified behavior with an attempt to communicate remotely, (4) night time offer better display visibility: teens cluster in the corner and make up their own games.

5.2 Identified Interaction Zones

Through our observations we were able to identify different zones, which were more suitable for direct interactions mediated by the networked urban display, interactions not related to the display and zones, which are transient (pavement). In each of the identified zones performers may change their role from actors to spectators or passersby whilst entering a different zone.
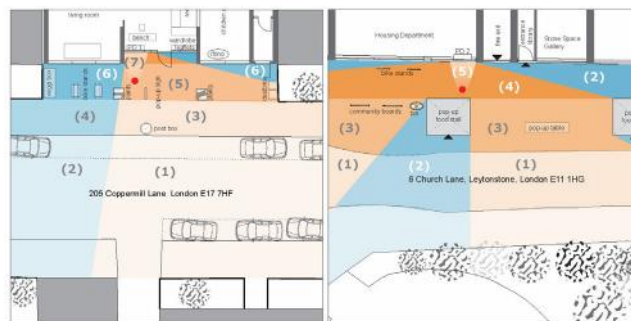

Fig. 6 Interaction zones: LEFT at The Mill (1,3,5,7) visibility of public display (VoPD), (2,4,6) without VoPD, (3) transit space with VoPD, (5) spectator zone with VoPD, (7) direct interaction space, position for full-body display interaction (red dot). RIGHT at Leytonstone Library with stalls during the Car Free Day (1,3,4,5) VoPD, (2) zones without VoPD, (3) spectator zone with, (4) direct interactions zone including transit zone, (5) position for full-body display interaction.

5.2.1 Direct interaction space (zone 1-direct)

At The Mill the direct interaction space (Fig. 6: left (7)) was continuously occupied by all age groups, whereas children entered this space more often, for a longer period of time and in a higher density compared to all other age groups. People in this space were mostly actors playing with the application, or smaller children not able yet to reach the screen and parents enabling toddlers to touch the screen (Fig. 7 (6)). In comparison to the direct interaction space in front of the Leytonstone display, no collisions have been observed between actors, spectators or passers-by.

Fig. 7 Social behavior and technology mediated interactions at The Mill: (1) single experience (2) social learning from others (3) testing (4) competition (5) social learning (6) assistance.

During the Car Free Sunday at Leytonstone the display's direct interaction space and the surrounding public space partially overlapped due to the dense spatial layout (distance between stall and screen ca. 2.5m) Once in a while passers-by even felt offended by actors (mostly kids) who used all the space in front of the screen to interact with the people on the other side.

Fig. 8 Social behavior and technology mediated interactions (1) interacting kids collide with a passer-by (2) attract attention - brief encounters and change of role from passer-by to spectator with a temporal 'honey pot effect' (3,4,5) dense passage with actors, spectators and passers-by over time.

5.2.2 Surrounding public space (zone 2-wide)

The surrounding public space includes the inside of The Mill (visibility through the big windows) as well as the semi-public space and the pavements on both sides of the street. In the space around the screen people, mostly grownups, were either watching the activities at the screen or chatting with one another (Fig. 1: (7)). Over time these spatial configuration changed. Direct interaction zone around the display (Fig. 9: left) changed from direct to implicit, as groups around the area first interact then continue chatting, followed by interaction. People cluster around the door creating static activity zone, or move on the pavement creating a transient one (Fig. 9: right).

Fig. 9 LEFT: Group interaction – direct interaction with display (touch). Static activity around the entrance. RIGHT: Static interaction activity around the screen (two people talking). Transient movement of passers-by.

The given spatial layout during the Car Free Sunday in Leytonstone, the fact that the pavement in front of the display was occupied by a food stall, the view onto the screen was partially blocked. Spectators as well as passers-by had difficulties to find their position to perform. As a result the zone is ambiguous.
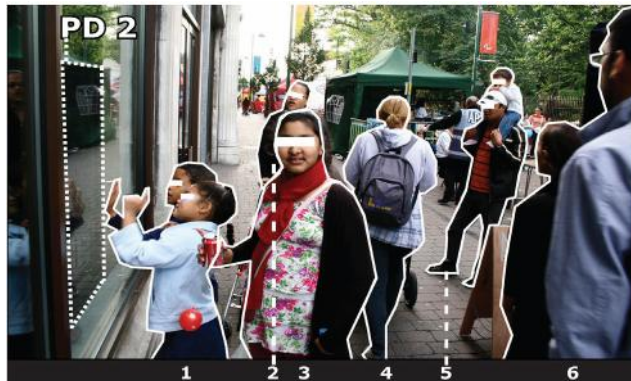

Fig. 10 Simultaneous interactions - ambiguous zone (1) two children interacting with digital display (2) young woman recognizing the presence of the researcher (3) mother watching her kids interacting with display (4,6) passers-by, (5) father with child looking at the display from distance.

5.2.3 The Networked Space (zone 3-connected)

Whereas at The Mill the digital display was embedded in the activities of the celebrations and therefore additional attractors were not necessary, when it comes to the remote connection over the video feed, the researchers on the remote location had to actively engage with passers-by to attract them to the screen, or had to engage themselves with users at the Mill's screen. Due to the small size of the live video feed on the bottom of each screen, hardly any passers-by got attracted by users interacting on other screens. In the case of networked experience, we observed that actors firstly engaged with the 'SoundShape' application and only then recognized the live video feed on the bottom of the screen (Fig. 11). Once people noticed another person on the other side, there was an attempt to engage directly through the video feed with users through the live feed before

continuing interactions through the 'SoundShape' application.

Fig. 11 Mediated remote interactions with attempts to communicate: (1) gesturing (2) touch interactions (3) watching (4) writing on paper.

During our observations in Leytonstone and The Mill we observed that actors aimed to find the right distance between the camera and themselves to allow a full body experience on the display.

In summary, our analysis showed that the networked displays encouraged successfully participation on both locations among friend, acquaintances and strangers.

Spectators and actors engaged in performing interactions and expressing desires to perform and interact in novel ways. Situating the networked digital media in the urban space, and encouraging embodied and playful use of technology, offered a stage for rich types of performative interactions that reinforced the diversity of shared experiences in the physical places. The nature of these interactions and their appropriateness are tied to the properties of the spatial layout in addition to the affordances provided by the technology.

Despite the fact that both the technical properties of our networked urban displays and the content of the interactive experiences were identical in both cases, we observed site-specific interactions which are related to the spatial layout and the social context as well as, identifying more generic behaviour, which appeared on both screen locations. We suggest that the properties of the spatial layout play a significant role in enabling site specific behavior and to a certain extend frame the type of interactions mediated through the networked urban displays.

6. CONCLUSION

In this paper, we presented findings of social interactions and related spatial configurations in a case study 'in the wild'.

We clearly identified simultaneous multi layered behavior and types of interactions (direct, wide and connected) in a given spatial setting. These differ in the ways they relate to the interaction zones framed through the spatial layout in which they are embedded and also in the

ways in which the interactions are mediated through the public digital display. The observed spatial configurations revealed a dynamic interplay of performers and their changing roles when moving across different interaction zones. Despite the fact that both the technical properties of the public display set up and the content of interactive experience were identical in both sites, we observed site specific interactions which are related to the spatial layout and the display context as well as generic behaviour which appeared on both screen locations.

Overall, we have identified clear differences between adults' response and children's response to the display presence. People appropriated the medium and performed embodied interactions in diverse contexts. The interaction process in many cases consisted of a number of phases, with transitions in between starting with one action followed by a direct and sometimes personal interaction and then followed by another related or non- display activity. Children in particular moved in and out of the direct interaction zone many times over the course of the event creating place specific rhythms [26].

We argue that the generated urban experience is strongly related to the characteristics of the architectural space and its affordances [28, 29, 30], the people use these spaces, and the social context and the type of activities that take place in addition to the properties of the media installation itself.

7. ACKNOWLEDGMENTS

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