Proceedings of the 2nd Media Architecture Biennale: Participation
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Occupation of The 'Open City'

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ABSTRACT
This paper proposes to view the concept of an 'open city' in the light of an occupation by 'the smart city' that rules out conflict. Through an analysis of IBM's presentation of "A Smarter Planet Initiative" and "Smarter Cities Challenge", and with references to social apps, it presents and deconstructs smartness, open data and participation as technological myths for a contemporary anti-urbanity, and finally proposes to build urban technological design on a perception of openness that includes the conflicts inherent to the urban experience.

Categories and Subject Descriptors
J.5 Computer Applications, ARTS AND HUMANITIES. K.4 COMPUTERS AND SOCIETY

General Terms
Design, Experimentation, Human Factors.

Keywords
Open city, smart city, open data, participation, public, interface criticism.

1. INTRODUCTION
'Openness' is an often-used term in contemporary urban planning. The term resonates with the great urban activist and theorist Jane Jacobs' influential book *The Death and Life of Great American Cities* from 1961. A city is not just made of bricks and walls, she claims, but the complex life of the people who inhabit it. Pavements are but one example – they demarcate a separation of the publicness of the street and the privacy of the buildings, and are planned to provide sae protection from traffic. Over time, this safety is extended to a feeling of trust between the neighbours, overlooked by shopkeepers standing in the doorways. In addition, many neighbourhood pavements also represent a beautiful visual chaos of activities, buildings of various ages and a mix of people. A city breeds life as an organism does, allowing dissonance, variation and discrepancy, and will produce not only the most sustainable social environments, but also the best solutions to challenges such as traffic, crime, garbage, supplies, etc.

Jacobs' book was aimed at the urban planners of the time, who aimed at controlling the complexity of the city, and of modern life, through 'functional' design. Urban planning and so-called 'urban renewal' was inspired by Le Corbusier's *Plan Voisin* and *Ville Radieuse* where Paris as we know it was to be replaced with large building blocks and parks connected by a grid of roads for automobiles. The city was functional, with segregated areas of use, separating the city into commercial, residential, and industrial districts. Also, people would live in districts based on their class (*Plan Voisin*) or family size (*Ville Radieuse*). In this perspective, known as "brutalism" in architecture, a city consisted of efficient roads and homogenous buildings, and the quality of life was represented through statistical information (crime rate, infant mortality, level of unemployment, etc.).

Though Jacobs' depiction of a street life with playing children and shopkeeper-nannies in many ways appears as romanticism today, her vision remains. Numerous architects and planners have maintained her heritage, and today many cities perceive themselves as 'open' in the sense that they resist functionalistic and "brutal" urban planning, and favour 'the urban feeling'. Urban planning today often mixes different houses of different age and purpose, and seeks to appeal to creative people who not only dress alternatively but also use a space in creative and unforeseen ways. The intention of this paper is to keep Jacobs' vision as a valuable ideal and compare it to a life with smart phones, social media, etc. How does the vision of creating a "smart" digital city compare to the ideals of an open city?

With broadcast media, the public – as Jacobs envisioned it, placed on the pavement – disappeared from the city and was removed to the couch in front of the TV. When mass media now becomes networked, ubiquitous, mobile, etc., the city – many believe – opens up to public life [1]. However, in this paper we will argue that the relation between the openness to the diverse desires and use of the city and the closed, functionalistic control of the city's complexity is far more entangled and connected when digital technologies are introduced. 'Openness' has even become a myth that hides a potential brutal control of the life of the city. This connection between openness and control relies on an understanding of 'openness' that relates to occupation. In order to prevent destruction in war, cities (such as Paris in 1940, for instance) may declare themselves as 'open cities', signalling that they have abandoned all defensive efforts. Likewise, the open city – relying on the presence of networks, computers and screens in the open and on open access to data – not only signals openness to life but also to an occupation that might permit diversity but rules out conflict.

Conflicts (along with cacophony and noise) are, we would argue, an intrinsic part of how a city breathes. As Jane Jacobs also demonstrates through her life as an urban activist, a city is a contested space and one cannot imagine the open, living city

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without also allowing the dispute of who belongs in an area, how things look, and how a place is used (anything from yelling in the street to a city riot would count here). Strangely, the application of software in the city tends towards ruling out these conflicts. This article is about this occupation of the open city by software.

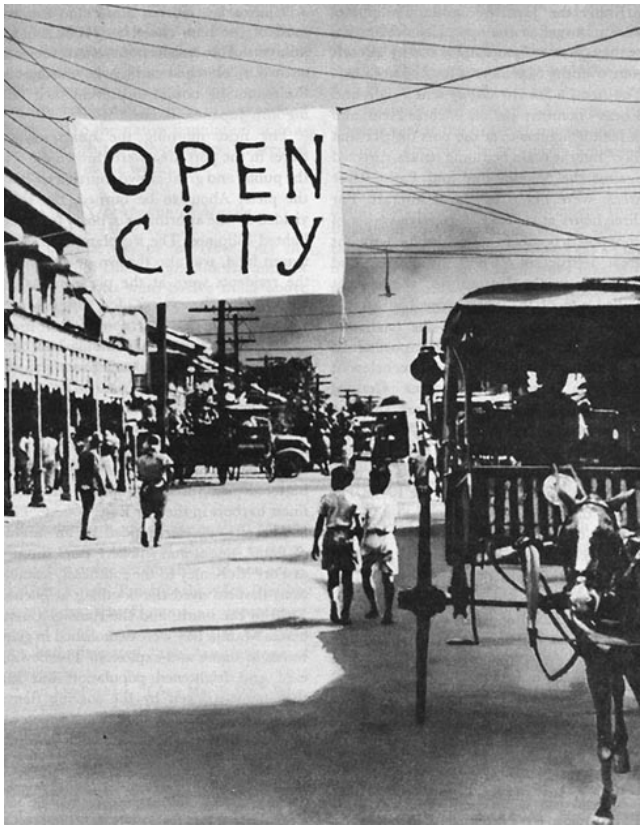


Figure 1. Manila declared an 'Open City' in 1942.

2. THE CITY IS A MYTH

Roland Barthes famously described myths as 'second-order' signs. A city is identified by the composite myriads of streets, buildings and people, but it also relates to an ideal life – a 'bourgeois' way of perceiving the world (in Barthes' terms). Quite often media plays an important role in the creation of these myths. In the 19th century when cities where growing and becoming obsolete, the panorama (a building 360 degrees in size, with a painted view of landscapes, cities or historical events) appeared as an illusion that recuperated this lost overview. This became part of the architecture of the city as a continuous creation of spectacular media-saturated experiences in and of the city. For instance, in 1914 at Potsdammer Platz in Berlin *Haus Vaterland* offered a western saloon, a Turkish coffee house, and a Rhine terrace with artificial thunder [2]. Even today, façade media at the Sony Centre and other buildings contribute to Potsdamer Platz' panoramic myth.

However, the aim here is not to speculate on the intentions behind the bourgeois myth of the panoramic city, but to emphasise that visions of media and technology in the city generally partake in the construction of myths around cities. This does not mean that, for example, the spectacular city does not exist, only that it is used rhetorically to construct an image of a city, and that it can be deconstructed. According to Roland Barthes, myths are powerful constructs that shape our reality. Also, the techno-myths of cities construct a world for us, and our place in it. Similarly, myths around urban, ubiquitous, networked computers shape our reality and construct worlds where we control the city in 'smart' ways, or are 'open' to the life and creativity of the city. When it comes to software, the two myths are closely tied together in a very powerful formation (who would not admit to being "smart" or "open"?). But in fact smartness and openness also mask conflicts, and represent a particular set of values. The following case study of IBM's smart city clearly illustrates this.

2.1 'Smart'

Many small and midsized cities, especially in Europe, seek to establish themselves as 'smart' as a vehicle for growth. But what a smart city means can be rather ambiguous and hard to comprehend for both citizens and decision-makers. For this reason, companies like IBM willingly offer their vocabulary and vision. In their video presentation of the "Smarter Planet Initiative" they knowingly construct a myth of a better place [3]. Powered by oceans of data and advanced computer analytics to make sense of it, they depict a future where people will no longer have to spend time in traffic jams, will have access to cheap products, and will have financial stability. What kind of planet is this (apart from a smart one)?

Towards the end of the presentation IBM proclaims, "Let's build a smarter planet". What does this implied 'us', that shares and builds this planet, refer to? As IBM does not present any particular software to a user (we do not see any software interfaces), we might assume that it does not refer to you and me together with IBM. The slogan is perhaps not an invitation to participate in the development of a smart city as such, but more an invitation to leave it to the specialists – 'you don't have to worry', let 'us' do it. In other words (and perhaps not surprisingly), IBM implicitly addresses their customers: the managers of the planet who deal with traffic, banking, energy consumption, etc. As also noted by urban-system designer Adam Greenfield, IBM's Smarter Planet Initiative does not compare well with Jane Jacobs' perception of the city [4].

IBM's vision relates to a wider myth of cybernetic information control. As described by Norbert Wiener, the 'new industrial revolution' perceives the machine 'not as a source of power, but as a source of control and a source of communication.' [5] Computer technology simulates the world, and is able to predict and control future events within markets, territories, production processes, etc., and thereby generate public and national wealth and safety. IBM plays a historical role in the myth of cybernetic control, and was for instance deeply involved with the US military. The air defence system SAGE (Semi-Automatic Ground Environment) was built by IBM and presented in informational films that constructed a myth where technology would protect people from Armageddon caused by a nuclear war [6].

Though IBM's smarter initiative is a vision of a coming world, the future in some ways is already here. In a more general term, it appears as surveillance. In surveillance systems (monitoring traffic, crime, credit card transactions, access to wireless networks, etc.) registration is compulsory. In order for actions to take place (i.e. to be computed) in the smart city, things and people must be identified as data-objects at the other side of the interface.

The smartness of the software systems appears to benefit mankind (making traffic safe, identifying criminals, preventing terrorism, protecting copyright, increasing productivity, etc.). However, the secret operation rooms and the structural surveil-

lance systems also express attempts to control the complexity of the city in a formal and systemic way. Also noted by Norbert Wiener, cybernetics has a tendency to conceal the human [7]. It is built to control the future, our destiny, thus taking the place of a God. According to Wiener, in the technocratic and administrative way cybernetic systems do this, they put God's creature, the human, in danger: humans are supposed to enter into a symbiosis with the system but they are translated into the system, and ultimately this marks the end of their free will. The history of IBM and their involvement in the punch card technology for the concentration camps of Nazi Germany also illustrates this dark side of computer technology as human and social control [8].

Envisioning humans in a smart world as mere computable entities ('people') is, of course, not the whole story. Users do exist, and are asked to join and participate.

2.2 'Open Data'

In the 'Smarter Cities Challenge' experts from IBM are working together with the leaders of selected cities to deliver recommendations on how to make the city smarter. In 2012 it was awarded to Helsinki for a vision of the smart city where all citizens have become information workers with open access to the data of the city. The report from Helsinki features a number of case studies with imagined personas [9]. One of them, Pekka, worries about the missing snow removal in his neighbourhood and calls the city's Public Work department, where he is put in a queue. To avoid the stressful situation of waiting in line, he can see a visualisation of how many people are in line, and what issues they are reporting. By making data open, IBM seeks to overcome people's alienation to the city by thinking of it as an interface. Computational processes of software constantly running in the background (of a call line, for instance) adds to the complexity of the myriad of signs appearing in the modern city. Anything from seeing what the weather is like to booking a table at a restaurant or maintaining a social relationship has become infused with operational signs.

In IBM's myth-making, people are not only peacefully cooperating with the city but are also actively contributing to the smartness of the city. They are information workers. Another persona, Ville, worries about a bridge in Helsinki that slows traffic. He visits a public website where "information related to the decisions made by the city are available for everyone to search and visualize." He is interested in the budget information, and "uses the city's social visualization platform to create a visualization of budget and predicted traffic density, and posts it for the entire city to see." The visualization becomes popular and generates public discussion. In other words, people are not only expected to read data but also to write data themselves.

Ville, Pekka and other people in the smart city are users and producers of what Bruno Latour and Emilie Hermant name 'oligopticons'. In order to "dominate it at a glance" and calculate its flows, the city first has to become very small – as in a bird's eye perspective (*oligo,* meaning little in Greek) [10]. In their analysis of Paris as "the invisible city", they document how water, electricity, telephony, traffic, meteorology, geography, town planning, etc. all have oligopticons in the form of control rooms with panels and screens. Though the oligopticons may display the entire city, they also express blindness. The rising and descending signs appear with great precision, but the multiplicity of signs makes it impossible to capture everything at once. The users only see signs and connections. At the same time, the "information worker" is also in a dilemma, and has to choose between looking at the screen and looking out the window, seeing a partial view of the city: "If their gaze wanders onto the bright green lawns, the flower beds or the strolling couples they'll never be able to say what the weather is going to be like." [10]

To Latour and Hermant, the oligopticon – the ability to make the city small, and to see only the information and the connections – creates a new urban experience. However, subsumed by the myth of smartness and openness, as seen in IBM's smart city software, the oligopticons of the smart city also divert attention away from what is usually associated with an urban experience: waiting in line, traffic jams, noisiness of streets, quietness of parks, etc. They are, in Barthes' terminology "second order signs" that refer to an anti-urban experience where the life of the city is replaced by a myth of peaceful and smart control.

2.3 'Participation'

In contrast to IBM's software, and Pekka and Ville's peaceful cooperation with the smart city, the architect Markus Miessen provocatively states that "participation is war" [11]. Architects often have a strong sense of the kinds of spatial conflicts their design implies. However, "there are frequent examples where critical engagement conflicts with the realities of business interests," and architects are often expected to be political oblivious mediators. In contrast, Miessen proposes that architects insert friction and ask questions: participation – pro-actively becoming part of something – is usually understood as solidarity but should be considered a critical platform.

Rather than viewing participation as harmonic 'cooperation', Miessen views it as 'collaboration' between enemies. In this, he quotes the net activist and theorist Florian Schneider: "As a pejorative term, collaboration stands for willingly assisting an enemy of one's country and especially an occupying force or a malevolent power. It means to work together with an agency or instrumentality with which one is not immediately connected (…)." [12]

Though open data and IBM's social visualization platform may produce conflicts in the sense that Helsinki City Council's decisions may be questioned if Ville discovers a discrepancy in the relation between traffic densities and allocated money, it is remarkably non-violent and non-critical in overall terms. The cooperation between Ville and the system is based on a predetermined and mutual agreement on the logic of decision-making (including the kind of data decisions are based upon). Ville reads and writes data, 'the smart way' – with no alternative. Traffic density is solved by the allocation of money to construction work, and, for instance, not by encouraging people to bicycle (a solution Jane Jacobs probably would have argued for) which would involve an entirely different spatial conflict, let alone rebelling. In IBM's software for smart cities the citizens peacefully cooperate with the logic of cybernetic control that rules the city, and their attention is diverted away from conflictual alternatives. Conflicts become smart management.

3. THE OCCUPATION OF THE PUBLIC

In the public sphere of the smart city, the relation between private interests (participation) and governmental or corporate regulation (control) ideally takes place as reasoned debate in the institutions of a democracy (a parliament, for instance). However, in reality this debate takes place in all types of collective meaning formation, even in everyday life: "The public sphere is proletarian" (as Oskar Negt and Alexander Kluge have expressed it [13]). Potentially, the imagined smart city software in Helsinki could form one of those everyday situations where we negotiate the conflictual relations between private interests and

management of the city. However, it appears peaceful cooperation on the premises of the 'smart city'.

What alternatives are there? Mostly, people do not use software that relates to smart city management (as IBM imagines) but services and applications that relate to their own individual lives. They use Facebook and other social media to configure their own space on their personal laptops, tablets or smartphones. In theory, people have access to all the data in the world, and they continuously participate in the production of data, but in practice they need to seal off information. For this, they use software that can construct personal 'oligopticons', lists of friends or music, news feeds, etc. The more of these personal apps and gadgets people have, the better they can map data and deal with their digital life. The presence of vast amounts of personal oligopticons indicates that the proletarian public sphere first and foremost is defined by a market of social and participatory software. The public sphere has become a public sphere of production, or 'controlled consumption' [14] where people's behaviour and everyday life experiences remain in a private sphere. In other words, the relations between private interests (participation) and governmental or commercial regulation (control) are never discussed in the framework of social media.

The digital city seems to lack a sphere where the heterogeneity of everyday life is being processed *collectively* and *collaboratively* in response to the inherent spatial, social, financial, ecological or moral conflicts. In this respect, participatory urban software design will need to present an infrastructure between the social and the technical that does not rely on mere corporate standardization of purposes, it will need to present critical platforms.

What does technology that acknowledges conflicts look like? This will remain an open question for now. However, a few closing remarks on the issue will be made. First of all, 'opening up' to collective and collaborative software is often incompatible with the dominant values in software design that regulate the relation between private interests and governmental or corporate control in the form of, for example, copyrights. However, urban systems design based on conflicts does not need to be regressive and destructive; rather, conflicts can be seen as incitements for critical engagement (which also Miessen suggests). Secondly, the free and open source movement is a prime example of this. The social anthropologist Christopher Kelty has performed an extensive study of the movement and describes, for instance, the movement's notion of the network, how the movement deeply cares and critically engages in the formation of networks, and often presents competing alternatives [15]. Thirdly, artistic experimentation with urban hardware and software might also be considered innovative in this respect. This may, for instance, be found in alternative approaches to networks such as *unCloud* by INTK/Rui Guerra – an application that enables anyone with a laptop to create an open wireless network and distribute their own information. Another example of an urban hardware and software design that acknowledges an exchange-oriented culture and is open to the inherent spatial, moral or other conflicts in the city can be found in *Talkaoke* by The People Speak. *Talkaoke* is a public talk show for 3 to 10 people, mimicking a television studio with cameras, screens, live streaming, and video annotation. The platform is mobile, and passers-by are invited to join in, talk, listen, argue or develop new perspectives on the world. What is intrinsic to *Talkaoke* is its ability to reflect the discourse that characterizes a place, who belongs there, and how it is used – often including people's personal narratives [16].

In order to deconstruct the myths of urban technologies, we need software and hardware that does not just serve openness and smartness but also engages citizens in discussing and criticizing the current schemes of the smart city. Artistic software and hardware might offer these platforms for a future digital city.

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The Implied Producer
Investigating an Emergent Typology in Participatory Culture

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ABSTRACT
Whereas many good things can be said about the ability of digital media to facilitate the public access to cultural material, there has been no significant development in the theoretical understanding of ubiquitous digital media's potential for participatory culture – and what human typologies emerges from this reconfiguration?

The small Swedish Biennale, Electrohype run an impressively straight line of investigations into the participatory spaces of art – thereby also facilitating the dissemination of the, at that time, almost unnoticed field of media art.

It appears, from the Electrohype Biennales, that we are not 'just' dealing with a 'new' genre or style within the art category; on the other hand we are not dealing with a pure commercial culture either (the abstract notion of 'the user' has its limits); what is becoming evident is that the 'implicit' roles of the participatory 'actors' in culture and art are being transformed.

This paper investigates this emergent 'persona' in the post-digital participatory culture, and names it 'the implicit producer'.

Categories and Subject Descriptors
J.5 [**Copmuter Application**]: Arts and humanities – *Architecture, fine arts, linguistics.*

General Terms
HCI Design, Human Factors, Post Digital Phenomenology, Theory.

Keywords
Museums, participation culture, experiments, interaction design.

1. INTRODUCTION
Art museums all over the world have tried to adapt to the reality of digital media. The commonplace attitude among users of museums is that the art museum should be something other than a 'boring' archive. But this tendency is hazardous and museums run the risk of competing with the nearby Shopping Mall if they do not address the real challenges of a post-digital society. Whereas many good things can be said about the ability of digital media to facilitate the public access to cultural material, there has been no significant development in the theoretical understanding of ubiquitous digital media's potential for real participatory culture, where the production of content and context is implied in every reconfiguration.

The small Swedish Biennale, Electrohype [4], is a practice-based exception to this general picture. From the first show at the Bella Centre in Copenhagen in 2000 (here represented by the Augmented Reality Project by Boxiganga) to the show at Malmö Konsthal in 2008, and the latest show at Ystad Konstmuseum, run a straight line of investigations into the participatory spaces of art.

Electrohype exhibits a different perspective on how to perceive a post-digital culture embedded with technology and 'new media'. It appears, from the Electrohype Biennales, that we are not 'just' dealing with a 'new' genre or style within the art category; on the other hand we are not dealing with a pure commercial culture either (the abstract notion of 'the user' has its limits); what is becoming evident is that the 'implicit' roles of the participatory 'actors' in culture and art are being transformed.

In the following, I will use some examples from the Electrohype Biennale to further investigate this transformation of typologies structuring our cultural landscape, from the hypothesis that 1) the idea that the 'implied reader', instead of being replaced by a consumer, is replaced by the 'implied producer'; 2) That the 'implied producer' emerges in-between the human and computer, and 3) how this 'implied producer' challenges the common notion of consumer society in ways that points in the direction of a participatory cultural paradigm..

2. NEW SET OF RULES
Electrohype is pointing towards what Boris Groys [2] has claimed to be the emergence of a new paradigm for art and cultural institutions – and that this situation builds upon a new 'logic' and 'epistemology', maybe even a new social system. Thus, 'amplifications' of reality and new constructions of representations from post-digital culture are taking place in aesthetics as well as in the broader cultural context.

The most resent theoretical discourses about participation have mainly taken two paths, which crudely could be described as

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issues concerning media with or without art. The first path (Eco, Barthes) focuses on participation as an aesthetic and/or expanded work-category. The notion of 'production' is implicitly placed with the artist curator, thus identifying the discourse of most of modern art curating in museums.

The second path locates the issue of participation in the strategic and sociological transformation of media-convergence into the commercial-cultural domain (Henry Jenkins). Participation is based on active consumer-users.

However, what I am proposing is a different perspective on matters, a fresh analysis, as it were, of participation as a combined media-and-art practice. This perspective takes it starting point in participation as something practiced in everyday life.

Far from suppressing criticism of everyday life, modern technical progress realizes it. This technicity replaces the criticism of life through … those actives which rise above the everyday, by the critique of everyday life from within: the critique… of the real by the possible and of one aspect of life by another. [7]

Since Lefebvre's comment in the foreword of the second edition of Critique of Everyday Life (which originally came out in 1947), new media has certainly realized a situation where technology repeatedly is pushing the limits of reality of everyday life to new frontiers. This, it seems to me, is the true ubiquity of technology: That the modalities of criticism (and critical thought) become transitory, fugitive and invisible. This means that cultural artefacts and e.g. works of art do not carry the same 'implicit' authority anymore – it is not possible to assume an implicit reader of literature or an implicit visitor at an art museum that share the same fundamental cultural norms and values, and habits, of the author or curator. A circuit of cultural order has been broken.

One of the key features of the post-digital field is the fact that technologies, in the words of Mark Weiser, are disappearing, because "they weave themselves into the fabric of everyday life until they are indistinguishable from it." [10] Furthermore, this development is often described as the ubiquity of computing everywhere – or ubiquitous computers that on the one hand is entering our world and becoming 'as natural' as trees in the forest, as Weiser has it…:

Computer access will penetrate all groups in society […] ubiquitous computers will help overcome the problem of information overload. There is more information available at our fingertips during a walk in the woods than in any computer system, yet people find a walk among trees relaxing and computers frustrating. Machines that fit the human environment, instead of forcing humans to enter theirs, will make using a computer as refreshing as taking a walk in the woods [10].

On the other hand, this 'hidden but always present' becomes a metaphor for the emergence of completely new parameters of reality and patterns of communication. Ubiquitous computers are the hidden texts, the unwritten parts, of art in the expanded digital field. In the words of Lev Manovich, 'What before was ephemeral, transient, unmappable, and invisible become permanent, mappable, and viewable' [8].

Therefore, Manovich writes, art and artists, as well as their users, viewers and readers, receive a new role – '… content, a cultural object, cultural production and cultural consumption – are redefined …' [8]. Art is not about representation anymore, but about participation in and production of real/tangible connections and relations in an increasingly distributed and technologically motivated world..

3. THE IMPLIED PRODUCER

When Wolfgang Iser wrote The Implied Reader the relation of the human and the computer was not implied in his thoughts and patterns [6].

Wolfgang Iser wanted to take the critique of literature in the direction of the processes of communication that took place outside the text – and he explicitly saw this as a phenomenological project [6]. If we have to approach the situation of the implied producer, however, the phenomenology is less clear – the complexity of the human/computer relationship, or interface, is changing the epistemological rules as well.

But since Iser's focus was on the novel as a medium of communication, investigating the intricate patterns of the sender and the receiver as well as those of the intermediate 'aesthetics' of the novel, the journey is not that far from the implicit reader to the user of 'ubiquitous' computers as would be expected. Indeed, the intermediate role of the medium and mediated communication which is taking place between humans carried out in a still more sophisticated and intricate digital network of computers is a shared situation. In fact, I would argue that the same fundamental problematic, as those patterns that Wolfgang Iser points out with regards to literary communication, are involved in the framing and positioning of the user of the expanded museum space; this will become apparent in the analysis of that which is being produced and communicated in the expanded field of 'electrohyped' art and culture – only, and this is what interests me, the 'reader' behaviour seems to have been intensified and radically altered. Instead of an implied reader the 'electrohyped' field operates with a new role-player: The implied producer.

Wolfgang Iser is focusing on the novel as a 'new' medium, and on the 'meaning production' coinciding with 'reader involvement'. The implied reader is an active reader set out on a journey to discover meaning in texts. Just as, according to Iser, it should be up to literary hermeneutics to map the topography of the no-man's land between text and theory, it should be our purpose to map the forms of production in the expanded aesthetic field of 'electrohyped' art and discover their patterns of meaning, like hermeneutics. But then, we must ask, what would be the framing of the hermeneutics of the post-digital culture?

Although digital cultural artefacts may be interpreted as 'texts', insofar as they represent some kind of symbolic system that we share the (allusive) meanings of, this notion does not apply well to the hyper complex 'electrohyped' field.

We may need, in the process of discovering the hermeneutics of the post-digital culture, to point out that the development of media is not in any case determining human cultural future, but it is without any doubt transforming culture (and society) into something different. The result being that the 'implied reader' is not so 'implied' anymore.

Hence it is my hypothesis that, out of this 'crisis' the 'implied producer' emerges as a new structuring typology for cultural action. In the following, I will attempt to further identify this new structuring typology – beginning with The Augmented Reality Project from 1998.

4. THE AUGMENTED REALITY PROJECT 2000

According to Iser, the activity of accessing the unwritten part of a text is a process of creativity – a 'game' of 'gaps', even:

The fact that completely different readers can be differently affected by the 'reality' of a particular text is amble evidence to the degree of which literary texts transform reading into a creative process that is far above mere perception of what is written. [6]

There is a hint of the implied producer in this formulation by Iser, since it presupposes the activity of the reader involving imagination as well as relating to (the construction of) reality (in the text).

Augmented Reality Project by the Danish media performance group, Boxiganga (a.k.a. Kjell Petersen and Karin Søndergaard) is a project designed to investigate the invisible patterns of communication in a museum space. It is also an experimental research project concerning augmentation as a strategy within the paradigm of reactive media where the focus is on the experiences that take place on the edge of our senses, as they put it:

In this project, visitors will come into contact with a series of staged and choreographed, high technology installations that can sense their presence. These 'sensitive' sculptures are likened to pieces of furniture in a room. But the installations, each in its own way, don't only sense they also react. Thus they promote relationships through experiences that may take place at the edge of the senses.[4]

This edge, the fusion of performing mind and technological body, is clearly visible in the practice and artistic strategy of Boxiganga. In 1998, they formulated the principles for an environment for exploring the use of the relation between humans and computers in an artistic/ performative exploration of the museum space. Building from a tradition of Noh drama and "classic" performance art practice in the 1980s, the augmented reality project was shown at the first Electrohype in Bella Center in Copenhagen. Working with a network of Apple G3-computers, the basic principle was to place the computer and data processing in the background; and thus achieving the illusion of reality in the "human-computer interaction". Art, the way Boxiganga sees it, is conceived as a network of open systems. And this is also where we find a significant parallel to Wolfgang Iser's project – that of the process of creativity. But whereas Iser's intention is to point out the fact that we read as much as we do not read (the unwritten part of the texts are as important as the written part), which requires involvement and an activity by the reader to imagine the required amount of norms of reality that are represented) the 'users' of the works by Boxiganga are asked to be 'producers' of 'relational patterns' of communication. And Boxiganga is supplying the framework for doing just that:

We intend to develop relations-orientated multimedia works, which function in the social realm, in which we as people continually recreate and reinvent our existence — in relations between people. This is 'relations technology' as opposed to functional or manifested technology; open systems in which content and relevance is directly dependant on involvement.[4]

The Augmented Reality Project is organized into four complex, spatial constructions, of which I will mention here *I think You — You think Me*. Each construction – or: augmented installation - plays with the notion of constructing the preconditions for how we are experiencing actual phenomena and relations in physical space, through hidden data processing.

In our multimedia set-ups, the computer is relegated to a place where data is recorded, processed and transmitted. We can then be concerned with multimedia in a context of Augmented Reality, with creating spatio - sensory, perceptive and reactive constructs.[4]

The reactive edge of Human/computer experience is investigated in *I Think You – You Think Me*. Here, the reactions themselves are staged by two rather aggressive computer-generated personae – Robert & Roberta. They react to any person entering their stage (looking like a basketball court); first, by being mildly curious; but then, as you move closer to one of them, by showing more and more feelings of the more angry kind – i.e., the closer you get to Robert, the more aggressive he gets (at least, that is our conventional interpretation of their reactions). This points towards the important notion that what really is being augmented in the Augmented Reality Project are the users themselves. The human/computer relationship is not so much about the interface itself, but about how relations may occur and develop between digital and human phenomenological systems – how they react on each other from implicit patterns created by the media architecture in the space:

In fact, the basic function of the installations often requires that two visitors enter into a relationship and investigate an interpretation of the contents of that relationship. These installations then are situations for augmented relationships.[4]

Thus, the Augmented Reality Project highlights the unwritten texts of human-computer interaction. HCI, the science of Human-Computer Interaction, is traditionally based on the placement of the user within a system of computer-based relations. However, through the expansion of 'invisible' computers in the world and a gradual development of more 'intuitive' interfaces, the computer becomes an intrinsic part of cultural activity. It is not only about the user anymore, but also about what constitutes that user's context and social existence. Several different attempts of critical analysis have looked further into the 'cognitive' 'phenomenological' levels of HCI. Most significantly, Paul Dourish who, in 2001, focuses on "the embodied practical action in the world as the foundation of our conscious experience" [3]. The notion of embodied interaction is also present in the 'Augmented Reality Project' – however, the premise is based on participation and a body-practice, which is reaching beyond phenomenology. The relation of humans and computers consists of 1) extended sensing (the body using technology to sense and discover what is outside the grasp of our normal sensing apparatus); and, as Mark B. Hansen has pointed out, 2) affective communication (technology receiving consciousness features using the body) [3]. In effect, what we have is a redefinition of the art museum as a reactive interface – a new media that involves the public in an active communication on the edge between past and future values. Phenomenology is expanding – into non-sensory, unwritten, ubiquitous fields.

In the Augmented Reality Project the body and senses as well as the 'tangibility' of communication are activated on the edge of our 'normal' perceptual system. This is the condition and critical impetus of the 'implied producer': It augments the unwritten texts of human-computer experience.

5. ELECTROHYPING THE MUSEUM…

The museums of post-digital culture are 'media platforms'. The ubiquity of computers runs across those platforms as a precondition of their aesthetics and architecture.

A number of typologies are emerging on, or between, the media platforms – like the 'gamer' or the 'hacker' [9], which share at least one common denominator: They produce the content as well as the contexts and the strategies for the communication of that content. Today's cultural user is a producer, in his/her own right. And the museum is one framing where this cultural typology may play out it's potential, and utilize the implicit production of culture. Provided, that is, that the museum is capable of meeting the 'unwritten' conditions of this emergent typology – playing the 'game' of unwritten texts, as it were.

At Electrohype 2008, technology is actively hyping the modernistic space of Malmö Konsthal. The interactive passage through the exhibition is like an adventure game with the artworks as the game site, and you as the gamer. The game begins by Rechnender Raum (Calculating Space) by Ralf Baecker and Rule number 30 by Kristoffer Myskja. They point out the basic rules of the game, which have to be accepted before the game can continue: 1) Humans and computers are related, and 2) technology enhances and transforms the human faculties of perception and understanding.

The visitors are the implied producers of the game-field in a double sense: The museum space is 'electrohyped' into a physical landscape through which different paths may be chosen – with different outcome. At the same time, the physical landscape, and especially the visitor's journey through that landscape, performs a cognitive mapping of the relations between human and computers.

Thus, you might encounter a reactive landscape that pulses and moves as if it was alive: The German artist Kerstin Ergenzinger has collaborated with scientists to create this work where people's movements in the exhibition, as well as other movements in the ground coming from outside the museum – are registered by a seismograph. This data is then 'translated' into 'feelings' by a custom made program, that through different algorithms create energy-exchanges with the material (grey and black felt and cloth on the floor) in the landscape, thus creating the 'movements'.

Bill Vorn's *Evil/Live 2* consisted of three large panels of electrical bulbs that each represents a life (light) that is created and dies (turned off). This visual movement of light is based on an algorithm called 'game of life' which, in the context of the exhibition creates a meta-comment on the position you are in as visitor: you are playing a part, being a producer, in the 'game of life'.

The digital algorithm of simulated reality is everywhere – but this ubiquitous evolution of digital life is being represented in Bill Vorn's installation, making the implicit producer visible and part of an electronic perception of the world.

This points towards an alternative, albeit hazardous, new road: the 'electrohyping' of the art museum actively focusing on the audience as 'implicit producers' of the reality-spaces of art.

Jessica Field's *Semiotic Investigation into Cybernetic Behaviour* heavily underlines the potential powerful dialectics of the 'implied producers'. Two robots, ALAN and CLARA are built from miscellaneous materials and media (new and old). Both are limited in the possibilities of 'sensing' and 'perceiving' the world – but not in the same way. ALAN can only 'sense' movements and CLARA can only 'sense' distance. They try to help each other (they are linked by a network) so that they may interpret what is happening around them when someone is approaching them. They are not very successful in finding out what is going on, or anything else for that matter, and their reactions are bordering the paranoid giving us a sense of 'a couple of poor robots alone in the world' – 'is anyone there?' 'Someone is moving close to us' etc. Like Boxiganga's *Robert and Roberta*, *Semiotic Investigation into Cybernetic Behaviour* is pointing technology back at us, alone in front of the installation in the middle of a process of understanding. Their limits are our limits, in the sense that we know as little about them as they know about us.

What the cybernetic system is 'afraid of' is the 'users', and it exhibits some interesting anxieties about interacting with the extra-cybernetic world. But, of course, the very act and interpretation of anxiety is the metaphor of user-interaction per se: a cultural space of participation in which the semiotics of cybernetics reality cannot be fully contained or controlled.

6. CONCLUSION

In this paper, I have argued that a new typology emerges from the participatory possibilities and set-up of ubiquitous digital technologies: The 'implied producer'. I have approached the implied producer from two angles: 1) Compared the productive role of the user in the Augmented Reality Project by Boxiganga Performance Group at Electrohype Biennale in 2000 to Wolfgang Iser's notion of the 'implied reader' which has shown that, although there are many parallels to the analysis of the text as communication, there are some important differences: The involvement of the physical body, the ability to augment reality outside the imagination, and – above all – the interactions between humans and computers which increasingly are becoming 'invisible' and part of (and partly defining) the post-digital culture. 2) Again with a parallel to Wolfgang Iser's notion of the creative process and 'game' of perceiving the unwritten text (and construct a reality), the analysis of *Electrohype 2008* led to a short outline of the new rules that are shaping cultural production, art as well as users: The production of real, tangible relations across technological and social platforms – framing the double-action implied by the 'metaphor' of 'electrohype'.

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Framing the Media Architectural Body

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ABSTRACT

This paper develops an argument about transformations in the experience of the urban as a consequence of the rise in, so called, augmented public space. Contemporary media spaces of which media architecture now plays center stage. The argument is this: that through artistic and creative interventions that deploy these technologies and the spaces that they are embedded within can have a direct impact on issues such as the mediation of place and locality and consolidates the central role of the body as a frame in contemporary media spaces. The intention is to map the potential of a media architectural body.

Keywords

Media Architecture, Augmented Urban Space, site-specificity, urban screen, framing, embodiment.

1. INTRODUCTION

If one of the core principles associated with our attempts to define media architecture rest on the possibilities inherent in "encounters and intersections between digital technologies and our physical surroundings", then it is first necessary to make key distinctions in relation to the object that we are questioning here. This is done in the first section of this paper by considering the recent genealogy of attempts to articulate meaningful interpretations of such phenomena an "augmented urban spaces" [1] as both of these concepts (media architecture/augmented urban spaces) are, in many respects, cognate. The research literature is still relatively new, yet many trends have been articulated in and make clear reference to debates on "articulating the electronic city" [2]. Lev Manovich also provided a possible "poetics of augmented space" [3] that at least, in part, accounts for some of the media technologies and infrastructure that has given rise to the many transformation in the experience of space and the urban. In addition, the consumption of television in public space has been dealt with in relation to new contexts for considering visual culture by Anna McCarthy [4] and the consumption of pervasive media as a cultural form and its impact on the experience of the urban in relation to the use of small-scale mobile devices has been considered in some depth by Moores [5] as well as Scott McQuire who has considered the potential at least of large-scale media displays on forms of public engagement and civic participation [6].

This paper will contribute to this notion of the integration of media technologies with the built environment in the following ways. It provides some preliminaries towards a possible understanding of the transformations in the experience of the urban in the face of the ever growing integration of digital media and electronic media spaces in the urban environment - media architecture. That is to say, that a phenomenology of contemporary media spaces is attempted here and one that considers the role of the body and embodiment as key to an understanding of the concept of "participation" that forms the central theme to this conference. Participation, as it is understood in this paper, involves the analysis of the following. First, there is a need to understanding the function of place and locality in contemporary urban media spaces and the role of both commercial and public organizations in this process. Second, establishing how participants are 'embodied' within their surroundings and the key function that technology has to play in this. In the light of both, attempting map salient features of a 'media architectural body'.

2. THE MEDIA ARCHITECTURAL BODY

One of the earliest exemplars of media architecture is a fictional one, it's a still taken from an early scene in the film *Bladerunner*. It provides an extreme example of what media architecture might become in the not too distant future: dystopian vision of Los Angeles. If nothing else, the film is visual expression of post-modernity and many features of the film articulate a highly visual and technologized urban landscape where high rise buildings are superimposed with media displays on a massive scale supporting advertising and grand political messages from a 'big brother'. Another example used within the discourse of media architecture is a real and more down to earth one, Jaume Plense's *Crown Fountain* in Chicago, where two columns made up of LCD 'bricks' sit opposite each other separated by a shallow pool of water inviting the engagement of passers-by to both view the images of local inhabitants displayed on the screens and to play in the water. What makes these two examples so important is that already there is the potential for the development of a potential archaeology of new media and of media architecture. They can be used to account for some of the extremes that are present in the concept of media architecture; they represent something of dialectic in our description of urban media spaces: paranoia, on the one hand, agency and play. They both, in their different ways, testify to the transformative potential of the presence of large-scale media in urban space. Both at least provide a starting point

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for the investigation of a media archaeology of urban media spaces similar to that argued for by Erkki Huhtamo and others in Huhtamo and Parikka [7]. That is to say, an archaeology of the present that attempts to establish the rules of engagement associated with urban media spaces at a deep level. Thereby establishing what, in Huhtamo's and others' terms are the "screen practices" and the "social formations" that occur around and within these sites. For example, what "discursive practices" and "social formations", such as the relations of power and institutional interests give rise to specific forms of participation? As such, participation is not a neutral phenomenon and a media archaeology of these spaces will uncover these and lay bare the genealogy, the development of specific interests, in these structures. From the fictional representation in a film such as *Bladerunner* to the investigation of real architectural spaces and real forms of social engagement exemplified by the *Crown* Fountain project in Chicago that lie on a continuum of participation and one that at least begins from the starting point of the position and location of the body, at play, or in other ways in which engagement and participation can be seen to be structured, institutionalized, orchestrated by the existence of particular form of architectural space and the media that are superimposed onto them.

This paper attempts to map out a context for a 'media architectural body' that has participation and, to be more precise about this, a theory that has the affective relations that are implicit in the relation of the body to its surroundings, where media architecture can be seen to "expand the body's margin of indetermination" [8]. This argument, takes account of the body as the "centre of indetermination", whereby, in sensory or affective terms, the body's relation to the world around it is extended and indistinct. In addition, that technology, and media technologies in particular, can be seen as critical tools that can extend this margin between the body and the world. This argument, originally developed in relation to film in the work of Bergson and later Deleuze, and further formulated by Hansen in as a way of distinguishing what is new about new media. Here, I am suggesting, that the same argument can be applied to media architecture and the "framing function" just introduced, where the body and the position of the body in space becomes fundamental to our understanding of the medium, especially if our aim is to prioritize participation as a key concept within this.

To take another useful example of the creative use of urban screens, Peter Aerchmann's installation *Augenblike,* presented as part of the exhibition events at the Urban Screens Conference in Manchester in 2007 is an example of how the body is always engaged in interaction and the important role of proximity in this. A large screen displays a small crowd of bodies, people accumulated in the space on the screen. As the viewer moves around the space in front of the screen, motion tracking sensors track the motion of the viewer that, in turn, forces the bodies represented on the screen to gradually move, creating an uncanny impression on the viewer. These affective relations are dependent on this "framing function" of the body. Participation, in this installation, is a function of proximity and the signification of closeness and distance and the movement of the body of the participant and the image on screen. Here, many of the qualities of the media architectural body presented in this paper are manifest from the consideration of the place and locality, the body as frame, and articulated through the interactive qualities of the medium.



Fig. 1 *Augenblicke*: by Peter Aerschmann (installation demonstrated at the Urban Screens 2007 Conference, Manchester – photo by the author).

3. PLACE AND LOCALITY

Anna McCarthy has argued that the relation between television and its integration into public space, into sites such as cafes, shops, information displays, travel interchanges, in public areas and in the build environment in more general, is a site specific one. Whilst it is dangerous to consider any correlation between television and the existence of urban screens, after all, one of the main differences between domestic consumption of television content and the use of urban screens as a broadcast medium is the sense of liveness that is associated with the latter. But what this quality of site-specificity gives rise to is the fact that there are important aspects associated with the location of the display and its role as a site of and that place and locality has a bearing on how that media is received and consumed by an audience or onlooker and in this sense it is always sensitive to the local context and that the site specific nature of television consumption in public space is similar in the sense that bit gives rise to the "variability of television's relationship to the space in which it appears" [9].

What follows is a brief case study based on the consideration of the 'Big Screen', so called, Bradford's Centenary Square and its surroundings. This screen is part of a much wider network of a total of 22 screens across the UK. The physical location of the screens is critical and each one is unique in the sense that the physical location in each case determines key aspects of its design, evolution and, therefore, to the variable nature of the local environmental context, as earlier mentioned. Even relatively simple physical features such as the height of the screen, in the cast of the Bradford screen it is fixed to a wall, the space behind occupied by the *Impressions Gallery*, a major photography gallery

in the city. The base of the screen is approximately 20ft high from the ground below. Its position in the built environment and its relations to passers-by will also have an impact and will be determined by features in the landscape such as the position and direction of pedestrian walkways or the location of bars and cafes, as in the case of the Bradford screen. As you approach the screen from the eastern side of the main square the screen is visible from all approaches. Entering the space from the opposite side the experience is entirely different. Unless passersby intentionally turn to face the screen, they might miss it completely. The area around the screen has recently been re-structured and the screen is now adjacent to what is now called the *City Park*. A large space devoted to water, with fountains that are deployed in a daily, choreographed cycle.

Screen management and curatorial practices are also often determined by the local context. The 'Big Screen' network - aka "Public Space Broadcasting" - involves partnerships between the Broadcaster, local authorities, and hardware developers. Programming of content at the moment at least is, by and large managed, remotely by *Locog* but is still supported by local Live Events Managers employed by the BBC working in partnership with cultural programmers across the network. In addition, local partnerships for content providers and artist groups have enabled more informal and home grown content to be provided for these screens. Many local organizations are involved in presenting content. Similar arrangements occur across all of the screens where local organizations, schools, universities and arts organizations can influence, to some extent, the nature of at least some of the content and in many instances there is a local flavor to these offerings. A local arts development agency - Fabric - regularly screens content created by local artists in regular curated 'slots'. In addition, the screen is used for projecting content for live events, including public art, sometimes using interactivity through connectivity with mobile devices or through the use of motion tracking to elicit the engagement of passers-by.

Questions of visual identity arise from the local and regional context and the positioning of content that in the built environment in the site of display. Again using urban screens as an example of this we can see that the physical location of the screens and their proximity to salient features within the local environment as well as the structures that employed in their management, as well as the organization of content, are just some of the features of the screens that embed them within the locality. In addition, with the framing of content and it formal arrangement and composition on these screens clearly marks off the locality in each instance and there are, therefore, many cues to indicate location.

Early examples of more creative uses of the screen include working with arts organizations, festival programs and photographers. For example, on many occasions, since 2006, the Bradford Grid Project has used the big screen in Bradford to 'augment' work on display in a gallery setting. On occasions the Project has been commissioned to provide visuals and installations intended for the display on the screen exclusively, but always associated with other events occurring in the locality, always in reference to the city center environment Here, then, we see the migration of artistic content away from the formal confines of the gallery setting and an immediate re-conceptualizing of that content to serve the site specific nature of consumption and participation in the local environment and to enter into a dialogue with visual representations of the city.



Fig 2: Framing national broadcast content for a local audience.



Fig 3. Stills from the STIR festival installation by the Bradford Grid Project, 2007.

4. FRAMING AND EMBODIMENT

There are other ways of applying the concept of locality to these spaces. The site specific nature of place and locality and the fixed and contextual nature of all media representations – as is true of any augmented space - rests ultimately on the location of the body and that the body will always be located in real space-time however much it might be in interaction with representations that occur outside of the physical location. The body in many discourses, especially those generated largely across the visual, spatial and tactile modalities, is the ultimate frame for information. This, "leads to considering how only a blurred distinction seems to exist between space and information, as elements of space increasingly are powerful conveyers of information, whilst information - materialized into them - becomes more and more spatially related" [10].

To put this in phenomenological terms, there is a blurred distinction between the body and the world, and, in Hansen's terms, sees "technology as a means of expanding the body's margin of indetermination" [11]. Proximity has an important hand to play here and if we return to the earlier example of *Augenblike* we saw that intimate relations of closeness and its corollary,

distance, occur as central to the experience, indicating affective relations between the participant and the media that they interact with. It is the relation between the screen, the media, and their proximity that is important here and in a phenomenological and affective way fixes the body even further into the location where it is placed. Therefore, one of the most critical questions to come out of this discussion rests on where to locate the body within augmented space. One way might be in relation to an inhabitant's interaction with content, for example, displayed on urban screens. Here there are similarities to what Manovich has described in relation the interaction inherent in the engagement with new media artefacts as "cinematic vision" [12] but with one fundamental difference. For him, the body is usually fixed at a single location similar to that that of a viewer sitting in a cinema, sat in a fixed location, watching a movie, hence the term "cinematic vision". In this alternative context of augmented space, the body is often highly mobile, both in terms of its transit through the space, but also in relation to any virtual interaction taking place outside the space.

The body itself acts as an interface both on a sensory level in terms of its reception of information from the environment and in terms of receiving information from many technological artifacts, from personal stereos to mobile phones, all of which, can be argued, augment the body in some way: "expanding the body's margin of indetermination". The consumption of media, therefore, becomes part of the augmentation of the body through the use of these artifacts. Featherstone stresses the "importance of the body as a framer of information and this has become more urgent with digitized media" [13]. Thus, framing and the framing of information ultimately becomes a question of the body and its location in space. Like a mirror, the body is both the site of representation and is a representation itself. This runs almost counter to much recent debate about the virtual whereby it is assumed that the greater the emersion into virtual spaces, the greater the disembodiment and disassociation from the real and from real space. Far from the latter, however, the body still has to be the site of consumption, through participation and interaction and therefore, interpretation: the point at which affect, mobility and action can occur.

There are two sets of current theoretical issues that impact on how to conceptualize the media architectural body. Firstly, navigation and mobility need to considered in a specific ways, namely in relation to how the body and its position in space, its relations to the space that is occupied by it, and its proximity to the medium. Secondly, the distinction between the real and the virtual through an examination of recent theories of human action can easily be applied to navigation and the body and incorporated into framing as a theoretical strategy. The body has a sense of itself; it inhabits real space and is positioned at a specific location at any one time. It also becomes an individual element, a node within a network of relations, especially when associated with the consumption of and interaction with media technologies. It consumes and interacts with representations, as part of the structure of experience, for example. Yet the body itself must be represented in some way, as an appearance or an image.

5. CONCLUSION

How does this relate to the overall argument presented in this paper? In order to conceptualize the media architectural body we must establish the following terms. First, there needs to be an acceptance of the agency of technology. Experiments in the in the use of motion tracking, gaming technologies and mobile media, for example, all have this potential in fixing the body within the location that it finds itself and, as such, mediate both properties of place and locality. Or, I others terms, what role do forms of surveillance and social control have to play in terms of constraining and limiting the movement of the body in urban space? Second, there is a growing need to understand some of the discursive properties relating to the use of these spaces and how the body is positioned, say, by the need to police, control or limit the use of these spaces or to facilitate consumption by those passing through the space. By this it is meant that there are certain aspects of control and of mediation, for example, through the curatorial and editorial relations that occur in public space that form constellations of interest that determine their use and as such censor the kind of content that is available as well as control its representation: its framing. In this paper, what I hope to have achieved is a possible mapping of participation within urban media spaces, media architecture, and to at least have introduced the potential of a theoretical understanding of the body in space, towards a possible media architectural body.

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Towards Visualising People's Ecology of Hybrid Personal Learning Environments

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ABSTRACT
Ambient media architecture can provide place-based collaborative learning experiences and pathways for social interactions that would not be otherwise possible. This paper is concerned with ways of enhancing peer-to-peer learning affordances in library spaces; how can the library facilitate the community of library users to learn from each other? We report on the findings of a study that employed a participatory design method where participants were asked to reflect and draw places, social networks, and activities that they use to work (be creative, productive), play (have fun, socialize, be entertained), and learn (acquire new information, knowledge, or skills). The results illustrate how informal learning – learning outside the formal education system – is facilitated by a personal selection of physical and socio-cultural environments, as well as online tools, platforms, and networks. This paper sheds light on participants' individually curated ecologies of their work, play, and learning related networks and the hybrid (physical and digital) nature of these places. These insights reveal opportunities for ambient media architecture to increase awareness of and connections between people's hybrid personal learning environments.

Categories and Subject Descriptors
Human-centered computing → Participatory design,
Applied computing → Interactive learning environments.

General Terms
Design, Experimentation, Human Factors

Keywords
Ambient Media, Urban Informatics, Responsive Architecture, Personal Learning Environments, Free-Choice Learning, Informal Learning, Library Studies, Visitor Engagement, Participatory Design

1. INTRODUCTION
It is out of lived experiences and through applied meaning that people as groups or as individuals change spaces into places [11, p.120]. Architecture as a discipline is concerned with informing the design of physical infrastructure in a way that accommodates the conceived function of a particular space, therefore creating place. Information and Communication Technology (ICT), in particular social media, helps to overcome proximity and time challenges within physical space, thus affording social interactions that would not be otherwise possible.

Ambient media are a combination of both, architecture and ICT, combining assets and affordances of the physical as well as digital space. Ambient media is said to "convey knowledge distributed in time and space throughout the natural environment of consumers through a digital overlay morphing with physical daily objects" [30, p.338]. Ambient media has the ability to create an embodied hybrid space with publicly visible and accessible properties that form part of the physical environment. This can be done using digital assets, allowing people to bridge spatial, temporal, and social barriers as part of their situated spatial experience. In contrast to mobile phones or laptop computers, ambient media is, similar to physical architecture, continuously perceived in the periphery of people's attention. The nature of ambient media shapes people's spatial experience when at a place, rather than just providing information. The adaptation of location-based services, social sensor networks, ubiquitous computing devices and the Internet of Things, promises semantic ambient media installations [40] that are capable of providing context-aware, personalised, and interactive services.

The design space of ambient media embraces both bits as well as atoms. Hence, ambient media designers make use of skills and practices from traditional architecture as well as ICT and digital media. This gives rise to a new discipline that is specifically concerned with the design of ambient media. We hereinafter refer to this discipline as "ambient media architecture." Ambient media architecture provides opportunities for situated experiences and social interactions by combining digital space with physical place. However, similar to traditional architecture and media development, the design of ambient media architecture needs to be informed by the socio-cultural nature, needs, and issues of the place that the artifact is targeted at.

This paper aims to inform designers how ambient media architecture can augment public library spaces in their role as informal learning environments. By examining the opportunities for ambient media architecture to reveal personal learning environments, the library user experience can be enriched.

2. BACKGROUND LITERATURE
Informal learning is learning that happens outside the formal education system, such as by visiting a library, zoo, museum, or reading a book during one's leisure time. Public libraries, as traditional advocates of open and free access to knowledge and learning, try to attract people from all kinds of professional, cultural, and socio-economic backgrounds. This exposure to diversity has been shown to generate trust, tolerance, and social capital among people in the local community and society at large

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[4, 14, 22], but also claimed to be a fruitful platform for the peer-driven creation and co-creation of knowledge [2, 46, 48]. In addition to the socio-cultural diversity of its user community, the library as a place provides opportunities for serendipitous discoveries and learning. For example, library visitors find a particular book and are exposed to other books, magazines, community event brochures, and co-located visitors that are dispersed within the library space. These encounters provide affordances for people to serendipitously stumble upon information that they would not otherwise browse or explicitly search for [9, 10]. Such room for game and serendipity is a useful quality of the library as a place, and a reason why people often prefer it to e-library services.

Björneborn argues for libraries to provide design interventions that encourage divergent (explorative) information behaviour across physical, digital, and social library interfaces [9]. However, serendipitous exploration of physical and digital information resources is limited by their ambience and visibility in the physical space that library visitors are exposed to. Open bookshelves, signs, posters, and event brochures are examples to facilitate divergent behaviour. In terms of online resources, a sign or a pointer to a URL somewhere in the physical space increases the chances for being serendipitously stumbled upon by an interested user. With social library interfaces, Björneborn refers to the librarian as an additional information resource who can be consulted by visitors for questions and issues. Recent research studies recognise libraries as attractive meeting places [1-3, 5], not only librarians, but in particular other, co-located library users are seen as potential information resources and facilitators to acquire new knowledge.

This paper is concerned with ways of enhancing such social library interfaces; how can the library facilitate the community of library users to learn from each other? Information, knowledge, experiences, and skills of co-located users in the library, which might potentially trigger interest, shared encounters and serendipitous discoveries, remain invisible and hard to identify. While online spaces, such as blogs, forums, wikis and social networks are more transparent and provide powerful tools to search and discover specific (social) information, they lack the richness of face-to-face encounters, and all benefits of immediate social interaction. Ambient media architecture has the potential to combine the benefits of online and physical spaces by materialising relevant information through digital fabrication, interactive public screens, 3D projection mappings, amplified or augmented reality, and other technologies in the hybrid space.

This research matches learning theories with opportunities provided by ambient media to augment the library as a place for social and informal learning. What are the opportunities for ambient media architecture to tap into the knowledge of its user community and provide it as an additional (social) information resource to other, co-located library users?

2.1 Informal Learning Environments

Learning is situated in and facilitated by different environments. Formal learning environments such as schools or universities are highly institutionalised and follow a strict curriculum. Non-formal learning environments are based on voluntary participation outside the formal education system, but are still organised and coordinated by a central institution with a fixed curriculum, such as schools providing cooking classes, driving lessons, and language lessons.

However, not all learning occurs in the classroom. Informal learning environments are often places of physical, emotional, and social comfort that provide stimuli to the senses outside of the typical educational setting. In contrast to formal and non-formal learning, informal learning is learner-centric, driven by the learner's personal needs, interests, and motivations. Livingstone defines informal learning as "any activity involving the pursuit of understanding, knowledge or skill which occurs without the presence of externally imposed curricular criteria" [29, p.4]. The significance of informal learning is substantial. According to Grebow [23], 75% of the knowledge and skills people acquire and adopt through their lifetime, are based on informal learning activities, as opposed to only 25% through formal learning. Learning is more effective when driven by intrinsic motivation and interest, rather than extrinsic motivations such as grades or certificates.

Schugurensky describes such self-directed learning as "learning projects undertaken by individuals (alone or as part of a group) without the assistance of an 'educator' (teacher, instructor, facilitator), but it can include the presence of a 'resource person' who does not regard herself or himself as an educator" [42, p.50]. Learning can take place anywhere, anytime, but what is critical for informal learning is that the learner decides when, where and how they learn [39]. There are many places (i.e. informal learning environments) that facilitate different types of learning. Falk and Dierking [18] define such environments "Free Choice Learning Environments" (FCLE). FCLEs such as history and science museums, wildlife parks, zoos, or aquariums facilitate learning, but leave it to the individual visitor "to control what to learn, when to learn, where to learn, and with whom to learn" [18, p.6]. However, the physical and socio-cultural context of the space [18, p.37] stimulates, facilitates, and supports learning.

In accordance to that, Schugurensky [42] highlights that informal learning does not always have the form of dedicated learning projects that follow intentional and conscious activities. It is often incidental and socialised, embodied in physical and social experiences that we make through interactions with the external world and the social system that we are exposed to. Such learning often happens serendipitously and sometimes without the learner being actually aware of what they have learnt. It is part of human nature to learn through sensuous connections and relationships with the physical environment and the social world. Thus, different types and qualities of learning environments, places or spaces – physical or virtual – can provide alternative learning experiences [15, p.507, 32]. Mathison et al. [32, p.206] found that addressing emotional states and stimulating the senses triggers brain function and assists in the learning process. The informal learning process is an individual experience where different types of environments are suitable to different types of people.

Crucial to the success of informal learning environments is the creation of communities around these environments and their development. Communities are not defined by fixed or homogenised collectives but are fluidly created by the diverse people that act within the group through informal networks [15, p.509]. "Context is relevant to informal learning. It involves the interrelationships of people and place" [15, p.507].

2.2 Physical and Digital Learning Environments

Physical, digital, or hybrid environments can facilitate learning, where the digital and physical properties augment each other. The matrix in Figure 1 provides an overview depicting how different environments facilitate formal, non-formal, and informal learning.

Universities exist as physical places, however sometimes also offer dedicated e-learning platforms to pursue courses or entire degrees over distance that do not require physical attendance. Non-formal learning environments such as language schools exist as purely online or offline services. Many universities have joined the open courseware consortium [36], providing free and open study materials to the general public. These materials still follow a structured curriculum and evaluation tools, but in contrast to enrolment in official university programs, they do not require previous schooling and do not offer an official degree upon completion.

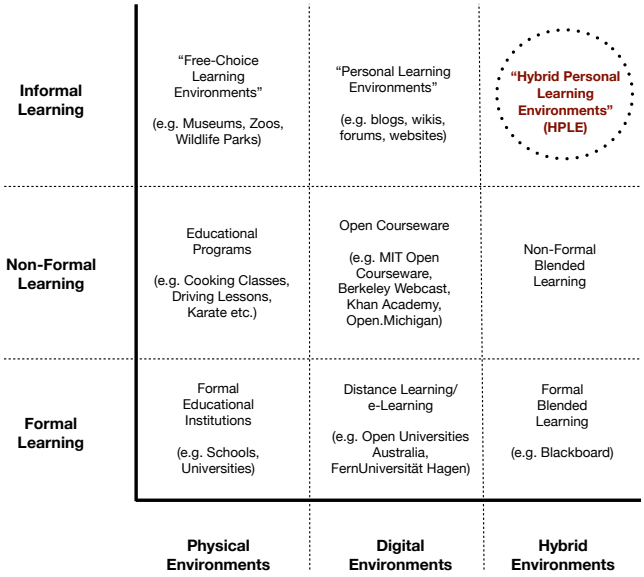


Figure 1: The physical, digital, and hybrid nature of formal, non-formal, and informal learning environments

Formal learning institutions have recognised the benefits of blended (or hybrid) learning. Schools and universities increasingly provide digital platforms that complement their offline courses with supplementary learning materials, links to external resources, online communication channels between learners and teachers, etc. Those tools are often controlled by the educational institution, and provided as integrated parts of the courses.

However, communities of practice and informal learning evolve due to the nature of mobile devices and increasing possibilities to connect virtually outside of the physical classroom [47]. Students augment their social learning experience by connecting through their selected online environments of choice such as Facebook or Skype rather than the digital platforms and infrastructures provided, mandated, or supported by the learning institution [7, 25]. Mobile learning by way of iPad, iPhones, smart phones, and other intelligent devices affects how and when students learn. Many students of today have embraced using technology to communicate, socialise and access information [8]. Such practices, as Beetham puts it, form an "underworld" [7, p.465] of informal learning outside the "classroom," but are frequently enabled and sustained by the use of technology.

Siemens [45] describes connectivism, a learning theory that builds upon the self-directed style of informal learning, the social aspects of learning highlighted by social constructivism, and the significance of digital tools and media and communication channels as part of the learning experience. Connectivism values learning as knowledge that does not reside in an individual's head, but rather spread across a complex environment of many external resources, for example social networks, online databases, fact sheets, books, videos, and blogs. Hence, learning in this sense is based on the learner's ability to recognise and connect to specialised nodes of other knowledgeable people and information sources. As Siemens describes, one of the core principles of connectivism is that the "capacity to know more is more critical than what is currently known" [45, p.5].

Every learner creates their own Personal Learning Environment (PLE) according to their needs and preferences. In contrast to a Learning Management System that is course-oriented and controlled by the educational institution, a PLE is an individually curated ecology of online tools (search engines, social bookmarking platforms, etc.), sharing services (YouTube, Flickr, WordPress, etc.), information resources (wikis, databases, e-books, e-journals, etc.) and communication channels (instant messaging, video-conferencing, forums, etc.) that people use to assist, document, and share their learning progress [16]. The nature of PLEs, evolved through the rise of Web 2.0, are interactive and collaborative in a way that they enable learners to provide feedback and comment on each other's content. Such connections between PLEs form a Personal Learning Network (PLN), a network of individual people and their PLEs established to support and accompany each other's learning processes.

2.3 Hybrid Learning Environments

Most literature on informal learning environments study informal learning either as a phenomenon that is situated in the physical space, or online. Former are focused on the design or nature of physical settings that facilitate learning, such as in museums [6, 17], wildlife [19] and other educational leisure environments [38], libraries [31, 34, 44], and dedicated learning environments in general [12, 13, 28, 35]. Connectivism and PLEs are described as purely online-based networks of tools, platforms and services.

Blended learning as a phenomenon that is fertilised by both the richness of physical face-to-face interactions, as well as opportunities and connections provided by digital tools, is mainly discussed in formal learning literature. Behling and Klinger [8] question the appropriateness of technologically rich tools within formal learning environments to support face-to-face learning. Osborne et al. [37] investigate the effect of blended learning environments on architectural education and conclude that blended learning has different levels of success within the formal education of architecture based on factors ranging from pedagogy, technology, and environmental compatibility. Attention needs to be paid to the range of learning environments – face-to-face and blended learning – to allow for different experiences for students with different learning styles.

3. RESEARCH QUESTION

The learning theories described previously point out that informal learning is facilitated by many factors, in particular personal context, physical context, socio-cultural context, digital tools, and media, to collaboratively create, share, discuss, interpret, and evaluate information, skills, and knowledge. Individuals shape their personal ecology of learning environments in the physical as well as digital space. The ecology's curation is made up of physical places to read, work, socialise, and to pursue personal hobbies and leisure activities; through the choice of one's social environment such as meetup groups and community clubs; as well as through digital channels of choice, such as blogs, wikis, forums, or YouTube channels. We call an ecology of learning environments that is diversified and spread across digital and physical spaces: *Hybrid Personal Learning Environment*, Fig. 1.

The public library as a space strives to facilitate peer-to-peer learning, and embrace its user community as an information resource and asset for fellow library users. One way of doing this is to expose people's personal learning environments and networks to each other. When these are exposed and communicated to each other, they can be enriched and built upon by others. Seeing objects or places that are relevant to an individual may attract others with similar interests and lead to a face-to-face interaction based on serendipitous discoveries of new topics and interests. Ambient media architecture provides tools to morph such social user information with the physical space of the library building.

This is the point of departure for our study which asks, what should these mediated, social interfaces look like? What content and information should they provide? And, how should they be represented? In order to provide answers to these questions, we employ a participatory design research method that asks participants to reflect on their personal learning environments.

4. METHODOLOGY

Rather than restricting the insights to learning resources within the library, the method focuses on revealing any personal places, activities and social networks where people *work* (being productive, being creative), *play* (having fun, socialising, enjoying, being entertained) or *learn* (being inspired, acquiring or modifying knowledge and skills), as well as the relationships between these environments. The vision is an ambient medium within the library that visualises a collective network of personal learning environments and resources, enabling library users to explore, serendipitously stumble upon, and be inspired by each other's learning environments. The insights from this study will inform the design of such an ambient medium.

In response to our research question a participatory design [24, 43] method was devised. Participatory design is used in many fields including architecture, urban design, and computer systems design with the common goal of including stakeholders' participation in the exploration and development of a design problem. Our main concern revolves around how participants communicate their personal learning environments. As discussed by Sanders et al. [41, p.195] the participatory design method can be utilised to generate a starting point for subsequent development. Based on the framework for participatory design created by Sanders et al. [41] we can describe our participatory design activity as a creative intervention.

The method is designed with two goals in mind: First, it aims to shed light on people's perceived geography and ecology of their learning environments, and how learning is embodied across their everyday lives, activities and places. Second, the methodological design aims to close the gap between ethnography, which is often regarded as a "prolonged activity" [27, p.59] that causes time pressure if particularly dedicated to inform system design, and "quick and dirty" ethnographic methods, such as short term observations or quick user interviews. The method consists of a 30 minute + 30 minute activity with 1-2 researchers and 5-10 users to provide a first overview of people's learning environments. This serves as a stepping-stone to better direct follow-up ethnographic research or in-depth user interviews. We designed the method in particular to inform the role of ambient media architecture installations within an individual user's ecology of personal learning environments, however it might also be useful for researchers, curators, and managers of informal learning environments to inform other design interventions.

4.1 Research Participants

The *form* of the intervention was based on making tangible things such as drawings, followed by focus groups, allowing participants to describe their drawings. The *purpose* of the activity was to get a deeper understanding of participants' experience of places associated with work, play, and learning. The *context* involved face-to-face sessions with two different groups of people. Both sessions were conducted in participants' own usual environment. The first intervention was conducted with a meetup group that meets on a weekly basis at The Edge, the digital culture centre and collaboration space of the State Library of Queensland in Brisbane, Australia. The group is named "Hack The Evening" (HTE) and consists of 14 people that regularly attend the meetings every week, including 3 high school students, and one young woman. The rest of the participants are male ranging in age from 22-55 years. During the meetings people usually socialise, exchange and discuss news, and collaborate on projects related to interactive technologies and media. Some of the participants have known each other from the Hackerspace Brisbane (HSBNE), a workshop space open to like-minded people interested in DIY technology and hacking. The HTE meetup group has been meeting weekly for approximately 18 months and participants are familiar and friendly with each other. This comfortable atmosphere may have assisted in the high level of engagement by all participants.

The second intervention included a group of five higher degree research (HDR) students that work together in a research lab at Queensland University of Technology, in Brisbane. The group consisted of 4 men between 25-38, and one 31 year old female participant. These participants have known each other for approximately 12 months or more. The HTE meetup group and HDR student group were selected as participants who are likely to have a rich established network of informal learning resources, hence providing valuable insights as pilot groups for the exercise.

4.2 Participatory Design Exercise

The participatory design exercise was developed utilising basic and familiar materials such as coloured markers, paper, and stickers. These materials were intentionally chosen to be low tech so that any person could relate to them. The use of coloured markers and stickers were used to distinguish information but they also gave the intervention a sense of fun and playfulness. The participatory exercise was explained to the participants asking them to draw places relating to three key themes: work, play, and learning. It was our primary concern to make participants feel comfortable with the drawing exercise; therefore the quality of the drawing was secondary.

In accordance with the theories described earlier, informal learning is a messy process, distributed across various physical places, online tools, platforms, and social networks embodied in other everyday activities, such as hobbies or social events. In an attempt to capture the full body of informal learning experiences in people's everyday lives, we asked the participants to focus on places and activities where they work, play, and learn. Work, play, and learning places are not mutually exclusive, but can overlap. We, for example, introduced "work," not only as one's business office and workplace activities, but rather any environment and activity where one feels as being productive or creative. Similarly, we introduced "play" for people to reflect on places and activities where they have fun, socialise, enjoy themselves, or are entertained. "Learn" relates to any places or activities where people feel inspired, acquire or modify knowledge and skills.

The same process was employed with both groups. The participants were given a series of six instructions directing their reflection process during the drawing phase. First, participants were asked to think about the work, play, and learning places, which are part of their daily lives. They were asked to draw these places on a piece of paper and then notate and label the places with keywords indicating the nature of the place. On a sheet of trace paper participants were asked to draw activities that are not attached to a particular place. Then, participants used between 1 and 3 coloured dots to indicate levels of intensity of work, play, and learning that related to the places and activities that they had drawn on their papers (1 dot = low, 2 dots = medium, 3 dots = high intensity). The drawing exercise was followed by a focus group where participants discussed their drawings. Each phase, drawing and the focus group discussion took approximately 30 min. The following guidelines were used to assist the execution of the participatory design exercise.

A. Drawing Activity (30 min): Let participants draw on an A3 sheet of paper guided by the following instructions:

1) Starting with the place you are in now, draw a diagram of places where you engage in working, playing or learning activities [use colour 1].
2) Write down keywords of your activities / interests that you pursue at these places [use colour 2].
3) Grab a trace paper, write down keywords of any other activities/interests/social networks (that are not necessarily fixed at a particular physical place) [use colour 3].
4) Place between 1-3 dots depending on how productive (work: blue dot), how much fun (play: yellow dot) or how much you learn (learn: green dot) at the different places / activities.
5) Place between 1-3 red dots depending on how relevant physically co-located people are for your work, play, learn experience at the different places / activities.
6) Add anything else to your drawing that seems important to you as part of your work, play, learn experience.

B. Focus Group Questions (30 min): Discuss with fellow study participants the following aspects of the drawings:

1) Explain your drawing and what you did in order to communicate your relevant places and activities.
2) Explain the relationship between work, play, and learn at different places.
3) Explain the role of co-located people at your relevant places and activities.

5. FINDINGS

The participatory design intervention provided rich data and insight into the way that people perceive and communicate a wide range of physical and digital places that are a part of their everyday lives. The findings are broken down into two main sections. The first one discusses how the participants represent places for work, play, and learning through the act of drawing. The second section examines the relationships of places for work, play, learning, and the informal learning environments, which participants choose to occupy.

5.1 Analysis of Drawings

Through the making of a drawing it is possible to observe how people visualise and communicate their understanding of places for work, play, and learning. When examining the drawing of places, four common trends emerged: the use of objects, symbols, shapes, and plans, all of which can be seen in Figure 2.



Figure 2. This drawing shows a combination of drawing techniques to communicate different places

Common attributes of drawing approaches are categorised into four groups: hierarchy of place, geographical relationships, sub-location, and time. The hierarchy of place is communicated in the drawings by a range of approaches including size, position, and order. Placement on the paper in order of importance is evident with some of the drawings, where the most significant place is at the top of the page followed by lesser important places. The size of the place drawn also indicates hierarchy, for example Figure 3 shows how one participant drew home as a large circle in the middle of his paper indicating it is central to his everyday life.

"I drew my home in the centre as a big circle, because that's the centre of everywhere, I am either going to or from home," (J1).



Figure 3. Drawing of home as central to everyday places

Geographical relationships are communicated in some of the drawings by including major geographical features such as a river. Places are drawn and positioned on the paper in relation to the river, therefore indicating the geographical relationship of places with one another and their location within the city.

"I draw a map essentially, it's not (to) scale. I have a river in the middle, that's that line. Well, Brisbane river… because I live on the south side, but mostly places I go to are on the north side as well," (JN1).

By combining drawing techniques some participants began to draw sub-locations or smaller parts of larger places. Different activities occur in different sites within home or work (Fig. 4).

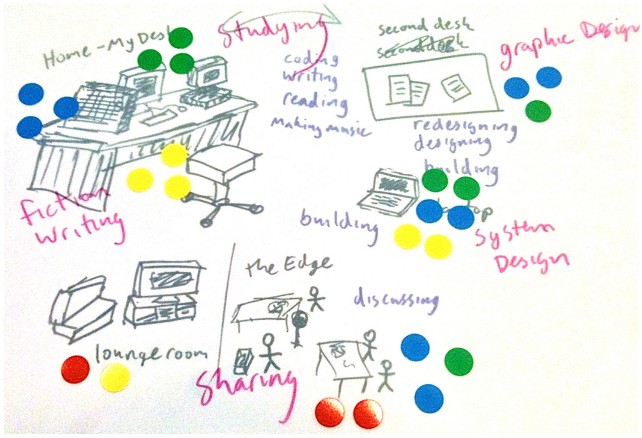


Figure 4. This drawing shows different desks with different activities occurring in the sub-locations

Often participants drew computers and TV screens acting as portholes to digital media and the Internet. The Internet itself is sometimes drawn as a separate place or cloud, indicated through a description of online activities such as "gaming," "reading," or "blogs."

One participant organised his drawing based on time. Examining Figure 5, it can be seen that the positions of places on the paper were drawn in a cyclical manner based on a typical day.

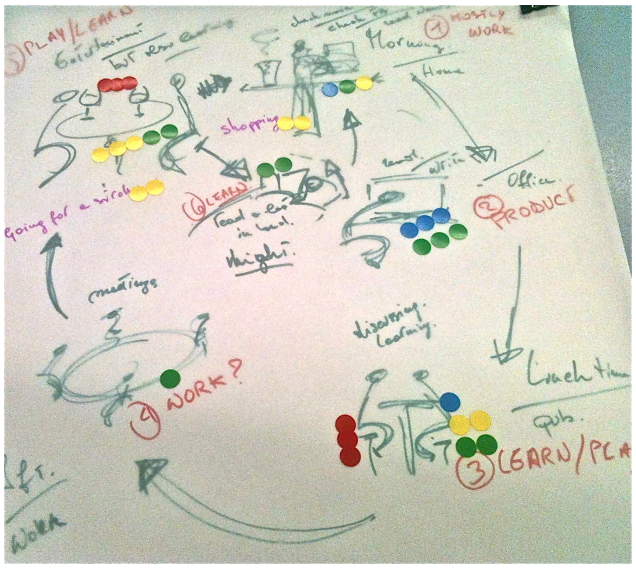


Figure 5. A drawing of work, play, and learning places based on time

The top of the cycle began with the morning where the participant drew himself at the breakfast table reading the newspaper and checking his phone. This is followed by the morning at a desk at work. Midday or lunchtime is positioned at the bottom of the paper. The afternoon shows a meeting room where work meetings take place and the cycle ends with dinner followed by the participant in bed reading. In the focus group this participant described how he negotiates the amount of play in his day based on how productive he has been during the day. He allows himself to read a fun book at night if he has been productive at work, if not he reads a heavy book that is work related and therefore ending the day with increased productivity.

5.2 Relationship among Work, Play, Learn

Examining the drawings gives an overview of the sorts of activities each participant engages in at the places they have drawn. The intensity of work, play, and learning associated with these activities is indicated by the participants' use of coloured dots. Typically places are characterised by a range of one or more activities associated with work, play, and learning. Rarely would a place have only a dot of one colour. This reveals a cross-correlation of such activities within multiple places.

The drawing from one of the participants in Figure 6 shows that he drew the coffee shop with associated blue dots (work) and yellow dots (play). The participant did not include any red dots meaning there is no importance of co-located people to his experience at the coffee shop. His experience of that place is purely personal. This same participant drew a pub, which did include red dots (co-located people) indicating there is an importance of co-located people to his experience at that place. Although both the pub and the café are public spaces typically associated with social activities, it can be noted that these places have different meanings for different people.

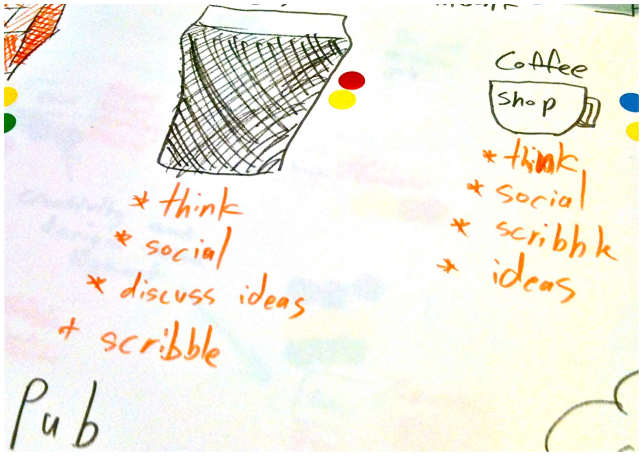


Figure 6. The importance of co-located people

Another example of this is highlighted when examining how participants represent their home. For one participant home is the central and largest place on his drawing (Figure 3) indicating it is very important in his life. His home has elements of play as well as socialising, revealing it as a fun place dependent on the other family members who are at home.

One of the participants dedicated a large portion of her drawing to home (Fig. 7). She seems to do everything at home including crafts, gaming, reading, and daydreaming. She spends a lot of time playing and learning at home, indicated by yellow and green dots. Home appears to be a creative place for this participant as many activities are described by key words such as making interactive dolls and 3D printing. Her home has a sub-location represented by the drawing of her bed, a place for other activities such as reading, web browsing, sewing, learning, playing iPad games, and listening to music.

"I've got my studio at home which is where I do the most stuff, and I have the most fun and I do a lot of learning. I drew a lot of stuff that is in that room and it's the biggest," (A1).



Figure 7. Home is drawn to show where a lot of different work, play and learning activities take place

Conversely, for another participant home was not even drawn on his paper.

"I haven't mapped out home, because even though I am there outside of work it's not really anywhere I do anything specific in…" (B1).

When examining the participants' drawings and looking at the workplace, the intensity of work indicated by blue dots varies from one person to the other. Some of the workplaces include elements of play (yellow), some include learning (green), and some include the importance of co-located people (red). For one of the participants the workplace can be understood as a fun place with high amounts of play (yellow) and learning (green). However, play and learning are not dependent on other people as there are no red dots. The actual work itself is fun for the participant without needing to interact with anyone else.

"…because I love going to work, it's a great place... I ahm... don't like all the people at work. Basically I go there to work, and I sort of keep to myself. Cuz I am the only one who does what I do at work, so I don't need to interact with anyone," (J2).

The intensity and range of dots tended to correspond to how much people liked their place of work. Places of work with high levels of play and social elements seemed to be more enjoyable places than those with only elements of work (blue) and learning (green). For some of the participants the workplace is purely about producing or conducting a service (Fig. 8).

"…I've defined my work as the 'grind house' because it really is… you get a task, you do a task, consistently, repeatedly, so yes you are being productive, but not in a way that actually feels to me as being productive…" (B2).

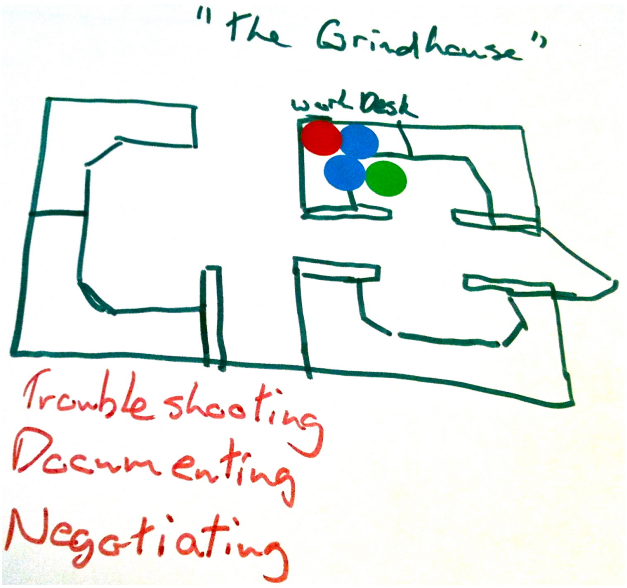


Figure 8. Drawing of work as the "Grindhouse"

Places that are marked with all colours are associated with work (blue), play (yellow), and learning (green). Per definition, those places provide an experience to users where they feel creative, entertained, and have a social experience all at the same time.

"…there is band practice which I have been doing lately with my friends, that is interesting because it's a bit of learning and also equal parts learning equal parts play, there is a bit of work there because, um, writing songs are being constructed…" (K).

We are interested in what such personal "buzzing" places have in common, and filtered them accordingly. The criteria for a "buzzing" place are a minimum of two dots of each colour. The resulting locations turn out to be places such as friend's houses, the library, public urban places, particular suburbs, the internet, as well as hobbies, leisure activities, community places or meetup groups such as a dance performance group, local board games / cards club, where people come together and interact based on their common interests. The common factor amongst these places is that they are places where people can meet face-to-face and rely on these encounters to be productive, to learn from one another, and to enjoy the company and knowledge of others.

"I was going to say about The Edge, I am not sure I would come here if there was no one else here, because… if I wanted to work on something that didn't need anyone else's help, I would do it at home, but you come here because you want to talk to other people because you want to or because you need their help, their opinion," (K1).

Figure 9 shows a drawing that depicts a "buzzing" place, the Hackerspace Brisbane (HSBNE), a workshop space for like-minded people interested in DIY technology, tinkering and hacking.

"…the space [Hackerspace Brisbane] is probably where I spend a lot of my efforts. I get a lot of work done there, a lot of play done there, I get a lot of learning done there, because there is a lot of like minded people that know a lot more about some things than I do and I know a lot more about some things than they do so it's very much a collaborative environment…"(B3).



Figure 9. This drawing highlights places with dots from each category highlighting "buzzing" places

6. DISCUSSION

The drawings illustrate how informal learning occurs across a network of online and offline learning environments that are particular to each user. In contrast to the separation in research literature, informal learning is not a purely online or purely offline experience. It is shaped by an individual's participation in activities and social networks across virtual, as well as physical environments.

Furthermore, informal learning does not exclusively take place at dedicated informal learning environments (e.g. library, museum, etc.) or during dedicated learning activities (e.g. reading a book), but rather embodied in everyday activities and places that involve social interaction, productivity, and fun. Every individual is involved in a range of physical places, online spaces, activities, community groups, social networks and technologies that facilitate access to, interaction with, and across those networks. Individual needs and interests shape the choice and intensity of involvement in such networks. Hence, each person's informal learning experience is a personalised patchwork of online and offline networks that facilitate learning in one-way or another. Previous literature has used the term 'communicative ecologies' [21, 26] to describe social communication and interaction patterns as experiences that are formed, shaped and maintained across different media, technologies and physical environments. Similarly, the findings in this paper give rise to the assumption that informal learning is formed, shaped, and maintained as learner-specific ecologies of hybrid personal learning environments.

These findings provide a starting point to understand how people experience, create, and maintain their personal ecologies of learning networks and environments. Figure 10 is a diagram of the nature of people's ecology of hybrid personal learning environments (HPLE) as personal selections of networks across three different layers (HPLE 1-3): Technology, place, and people [20]. Each layer and the connections between the layers differ from person to person, as these connections create HPLE networks particular to the individual. This initial study provides empirical grounding for the theoretical concept of HPLEs.

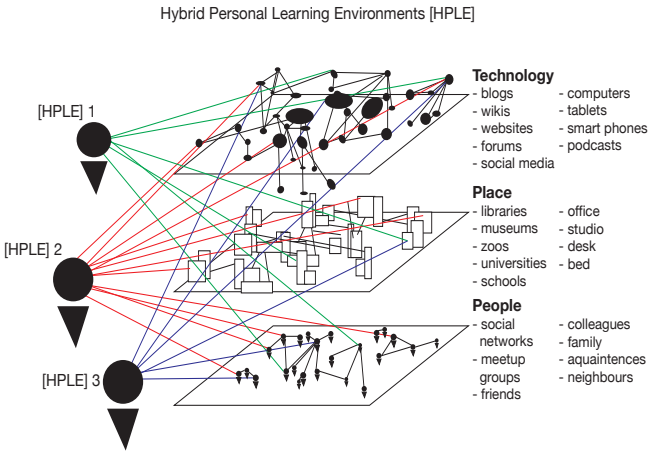


Figure 10. Hybrid Personal Learning Environments are personal selections of networks across different technologies, places and people

What do these findings mean for the design of ambient media architecture in libraries?

Our participants, for example, outlined interests and hobbies such as interactive doll making through microcontrollers, circus performance practices, the making of laser light shows, or strategy card games. Each of those activities is bound to particular places, community groups, or other networks.

Ambient media architecture that reflects such ecologies of HPLEs, for example, through representations of people's places, social networks, hobbies, activities, communities, subcultures, special interests groups, tools, media and technologies, may provide valuable insights, inspiration and serendipitous discoveries of new topics and interests to other library users. Such ambient media architecture would provide an interface to the social capital within the community of co-located library users. An example would be a digital wallpaper that tells all users "who knows what" to facilitate connections to people with similar interests or complementary skillsets. However, how can the individual networks of learning environments be visualised and fed back to the user community? What design language can or should be used for communication?

The findings from the participatory design exercise reveal ways that participants intuitively represent their own learning environments and networks. Through the process of making a drawing, participants had to reflect upon their personal learning experiences in order to visually communicate their work, play, and learning places. These drawings – similar to a rich picture [33] – provide insights into the ways in which non-designers visually communicate. From the drawings it can be seen that many of the participants rely on the use of symbols and objects to signify place. Written words were also used to describe the places and activities they drew. The use of different fonts and graphics helped participants communicate a hierarchy of importance and emotion. From this we can begin to derive a design language that is in direct response to the stakeholders' perceptions. The design language used to create ambient media architecture should speak in a language that is understood by the stakeholders to encourage their interest and participation. This design language will develop as a result of the design process and the input from the participants. The opportunity for ambient media architecture in the library space will be to visualise the urban ecology of personal learning environments and feed it back to the community.

Furthermore, the drawings and follow-up focus groups identify personal "buzzing" places where people learn, but also feel they are creative, entertained, and having a rich social experience all at the same time. The Hackerspace for example appears to be one such place for some people. Three of our participants report the Hackerspace as a regular hotspot for them to socialise, be creative, and learn new things through copious interactions, collaboration, and exposure to other likeminded members with complementary skillsets. The identification of such buzzing places provides a step towards further research about what happens when people engage in work, play, and learning activities at the same time.

Further in-depth ethnographic research at different "buzzing" learning environments (e.g. Hackerspaces) will provide insights about people's interactions and learning experiences at these places. Why do some people perceive such environments as "buzzing"? What makes those people feel creative, entertained, and having a social experience all at the same time, and others do not? What is the nature of the physical and digital infrastructure at such places? What do the interactions at such places look like, and how do work, play, and learning activities combine and potentially cross-fertilise each other? Shedding light on these questions will help inform ambient media architecture as well as general design interventions towards making libraries more attractive environments to engage in informal learning activities.

Finally, the drawings also provide an understanding for how people organise their personal learning spaces. Our participants for example have different desks at home to pursue different activities, such as fiction writing, graphic design, coding, or 3D printing. Beds are used to surf the web and read blogs on iPads while relaxing at the same time. Such insights inform how the library as a learning space can be organised towards better accommodating people's learning styles, needs, and habits. Designers might for example consider creating different zones for different activities, such as noisy areas for socialisation; small desks for focused individual work, and day beds to accommodate relaxed learning activities.

7. CONCLUSION

This paper presents a participatory design research method that asks participants to reflect on their personal learning environments. The participants reveal personal places, activities, and social networks where they work (being productive, being creative), play (having fun, socialising, enjoying, being entertained) or learn (being inspired, acquiring or modifying knowledge and skills). The findings give rise to the assumption that informal learning is formed, shaped, and maintained as learner-specific ecologies of hybrid personal learning environments (HPLEs). Informal learning is embodied in everyday activities and places that involve social interaction, productivity, and fun.

The results discuss opportunities for ambient media architecture to augment public library spaces by reflecting representations of people's HPLEs, hence provide affordances for divergent information behaviour, serendipitous encounters, and inspirations between fellow library users, which would otherwise remain invisible.

This research will inform our further work. We plan the development of two design interventions, which sit within the domain of ambient media architecture: *Gelatine* and *Fraggle Rock*.

Gelatine is a check-in system that allows public library users to "check-in" with a personal HPLE profile confirming their presence at the library. Public screens and 3D projections will reflect a collective representation of all checked-in library users' HPLEs. Observations about user interactions and perceptions of the installation will provide further insight and feedback about the value of such ambient media architecture in library buildings.

Fraggle Rock uses digital fabrication for participatory media architecture in order to produce an interactive installation in a library. The installation will incorporate digital fabrication methods to translate social media data into physical artifacts to be used and combined by participants to represent their hybrid personal learning environments and networks. The artifacts are inspired by the crystal structures made by the humanoid 'Doozers' in the *Fraggle Rock* TV series. The purpose of the installation is to expose the interests and activities from each participant to each other by collectively building a physical construct. Once the networks are revealed and made public, participants can make connections with one another based on common interests. Based on the findings in this paper that people's learning experiences benefit from social interaction in physical places, the research aim of *Fraggle Rock* will be to examine how ambient media architecture crossing digital and physical representations can facilitate face-to-face encounters and social interactions in public places.

8. ACKNOWLEDGMENTS

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Odenplan – a media façade design process

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ABSTRACT
In this paper we present an example of how to work with the challenges inherent in media façade design processes. We base the paper on our experiences from the creation of a series of design proposals for a media façade on the Odenplan subway station in Stockholm, Sweden. We approach the question of how to design for media façades by discussing how we have structured our design process to address specific sets of challenges outlined in previous literature in the field of media architecture. In our view, such research is valuable in that it helps establish common ground for researchers and practitioners in a developing field by building a repertoire of approaches, as well as highlight important issues that need to be addressed in this emergent field.

Categories and Subject Descriptors
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, Human Factors

Keywords
Media façades, design process, experiences from designing

1. INTRODUCTION
As the design of interactive technology evolves there is a growing interest in urban informatics [16]. Media façades are part of this developing area, and in recent years different media façades have entered public life, supplemented by a number of studies into understanding how these affect civic life ([4], [10], [41]). For researchers and practitioners in the field of media architecture, the many examples of media façades and the studies of their impact and potentials can help establish what Schön [36] calls a *repertoire* for designers to draw upon when creating new media architecture as well as for evaluating already existing concepts.

In the past, we have worked on a number of media façade projects, ranging from to small-scale, transitory installations to large-scale displays permanently integrated into prominent buildings [9]. In our work with the Odenplan media façade, we have drawn upon these insights in order to orchestrate a design process that addresses the particular complexities that this type of interactive architecture encompasses.

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Such studies can be supplemented with research into the design process that leads to the creation of interactive media façades, and what specific challenges are important to address. In this paper, we offer an account of a design process in which we developed proposals for a media façade for the metro station Odenplan in Stockholm, Sweden. Our focus here is not to discuss the specific design proposals for the façade in themselves. Rather, we wish to provide practitioners and researchers with a detailed example of how we approached a subset of the challenges identified by Halskov and Dalsgaard [8], in a specific design workshop.

We hope our contribution can provide researchers and practitioners with input as to how to design media façades, which may serve as springboard for further research and as a starting point for discussing these challenges within the community of practitioners. When returning to the discussion of our findings, we will elaborate further on what specific experiences we find useful to bring into new research and design projects.

In what follows, we first briefly touch upon our underlying approach to the design case, followed by a brief discussion of related work. This will lead to a condensed description of the important design challenges, before going into depth with the design case. Finally we will discuss our experiences and draw a short conclusion.

1.1 Approach
In our work with the Odenplan case, we approached the project with two aims: We wanted to examine the different aspects in the underlying design process from a design research perspective as well as contribute to the Odenplan subway station with an interesting and relevant media facade, designed with the specific context, building and future use in mind. We thus wanted to generate insights which enabled us as designers to generate ideas and concepts for the particular design case, leading to the final media façade, *and* examine design methods and the process as whole, as a way of contributing to the field of media façades and beyond, on a more general and theoretical basis. We consider our approach research-through-design, (e.g. [2], [27], [43]) where real projects and creation of interactive concepts drive our research, while at the same time we use our research insights actively in our design work.

During the project, we documented each step of the process using a locally developed tool called *Process Reflection Tool* [7], in which each member of the team can create notes, upload resources (in example pictures, video, sketches) and reflect on the overall process. At the central workshop in the Odenplan project, we used Project Reflection Tool extensively to capture each step. Furthermore, part of the workshop was recorded on video in order to capture the ideation phase. This enabled us to work consistently as designers in the process, as well as return to the documentation, notes and video in the role of researchers, and re-examine the unfolding process based on our initial research questions.

2. RELATED WORK

From a practitioner's point of view, Vande Moere and Wouters [41] argue for taking three perspectives into account when analysing the context for implementing a media façade: *The environment*, *the content,* and *the carrier*. Following four case studies, they discuss important aspects of each element. In relation to the environment, they call for an increased awareness of the social-cultural context and the fact that context changes over time. The authors argue for a detailed analysis of the social-cultural context, and involving inhabitants in the development of the content, preferable *prior* to the design of both the media façade and the content. Furthermore, they point out that this new development within the field of media façades should focus on making practitioners, architects and urban designers aware of the challenges and complexity of this hybrid media. This is echoed by Fatah gen. Schieck [15], who argues for a more sustainable approach to the implementation of urban screens, while listing a set of key issues in the implementation of screens in the urban space. The author places a special emphasis on understanding the relationship between the built environment and stakeholder involvement as a criteria for the success of content. Finally Fatah gen. Schieck highlights the potential in seeing the screens as a tool for engagement with the community rather than (just) a sender/receiver.

In relation to our contribution, the Vande Moere and Wouters [41] call for new methods and tools in relation to creating content, and ensure the continuity throughout the lifespan of the façade. We recognize this need for methods and tools, in that the design of a media façade requires ways of working with very large systems and environments, that in some ways challenges does not easily lend itself to traditional design methods, such as for instance mockups [13] or prototypes [31], while still capturing the lifesize scale that is vital in designing media façades. As will be clear below, we have tried to tackle these challenges through the appropriation of a series of approaches during a design workshop.

Similarly, Diniz et al. [10] have proposed a framework for interactive media media façades, that offers ways of analysing the role of the display, who the users are, where the users are, and how interaction is created. The key elements discussed by Diniz et al. [8] echo many of the considerations implicit in our process. Furthermore Brynskov et al. [4] has conducted an extended analysis of interaction patterns in and around the media façade *Aarhus by Light*. They highlight three aspects of the interaction: *initiation*, how people engage the installation at first, i.e. pass and notice or walk-up-and-use; *interaction style*, from basic exploration, over embodied engagement, to unintended use; and *relation* - individual, group, family etc. These aspects resemble some of the perspectives from Diniz et al. [10], and are basic factors present in our considerations throughout the design process. Brynskov et al. [4] observed that the main part of users entered into social relations of some sort through interaction – either as part of a group or new relations with strangers. To us this is a key observation to keep in mind when designing interactive installations for an urban setting, in the sense that we are designing for the existing situation and movements in the urban space, and should therefore offer something that will emphasize social settings and interaction in relation to the media architecture.

3. DESIGN CHALLENGES

In their work with the design, development and production of media façades for urban settings, Dalsgaard and Halskov [8] have identified eight key challenges for the particular area of urban interaction and HCI. Each of the challenges are present in various development projects within diverse areas and domains, and we find them highly relevant, and prominent in our work with media architecture. In figure 1, we have reproduced a short description of these challenges. The list captures and describes the central point of each challenge. For a more thorough account and discussion, see the original publication.

Each of these challenges is present throughout the work with media façades and its entire lifespan, but they are also more prominent in specific phases of the design and development. While stakeholder alignment is more dominating in the beginning of the project and when final decisions regarding cost, design and content are to be made, physical integration and robustness are more relevant challenges when actually building the installation. Similarly, the challenges of content, situations and (un)intended use are highly relevant in the concept generation and ideational phases of the process. While each of them can dominate at specific points in the process, they are, as Dalsgaard and Halskov [8] describes, also intertwined in practice.

1. New interfaces: urban settings prompt new forms of interfaces or alternative assemblies and uses of existing ones

2. Integration into physical structures and surroundings: New installations and systems must be integrated into existing physical surroundings.

3. Increased demands for robustness and stability: Shifting light and weather conditions over which designers often have little or no influence must be taken into account.

4. Developing content to suit the medium: The content has to fit the format of the display and the kinds of interaction intended to be supported.

5. Aligning stakeholders and balancing interests: Exploring, negotiating, transforming, and balancing stakeholder interests can be critical to the success of a system.

6. Diversity of situations: A very wide variety of situations occur and overlap in the city - how does the media façade fit into the assemblage of situations in a given location?

7. Transforming social relations: The introduction of new technologies can cause disruptions and transform social relations and protocols.

8. Emerging and unforeseen use of places and systems: Media façades will likely be used, perceived and appropriated in different ways than designers intend.

Figure 1 - Dalsgaard and Halskovs challenges for designing media façades.

To us, lists of challenges such as the one in Figure 1 have the potential to act in what Rogers [34] calls a generative role. Rather than present an exhaustive picture of what challenges specific practitioners will encounter, they act as heuristic tools that allows us as researchers and practitioners to reflect and learn from others. This way of using the list of challenges mirrors that of Grudin [20] who identifies challenges for developers of CSCW software, or Bødker [6] who discuss the challenges of moving from what she calls "second wave HCI" to "third wave HCI". As such, this paper can be seen as an example of using such sets of challenges

for research purposes, in order to create generate new insights by building on previous work.

4. Case: Odenplan

In the following we describe the Odenplan media façade design process. We first touch upon the background of the project and give a brief overview of the process, before going fully into details with the main workshop, where a series of experiments created the foundation for the three final design concepts for the media façade.



Figure 2 - The imagined future Odenplan building

Odenplan is a projected new metro station in Stockholm, Sweden, see figure 2. The entry building is designed by Danish architects 3XN and is meant to be light, open and with a low footprint on the Odenplan plaza in Vasastan, in the centre of Stockholm. 3XN approached us, wanting suggestions for a potential media façade for the metro station, either for the roof inside or somewhere outside. The concepts we came up with concepts would then later be further developed in collaboration with 3XN for a presentation for the city architect of Stockholm, who will make the final call.

The initial design brief was quite constrained, in the sense that we could only work on specific parts of the building, and not change the current structure and we had no control over surfaces, light design and little room for technical integration. These conditions were partly due to our late involvement with the project, meaning the main features and the lightning designs and interior was already decided upon. Furthermore the project developer had set strict constraints on the interior layout, such as lightning, ease of access and a high focus on not disturbing the flow leading to and from the metro platform underground.

4.1 Process

In the following we present a brief account of the overall steps in the design process prior to the key workshop. As indicated by figure 4, the process is comprised of several events leading up to the design workshop, and some succeeding events.

In mid April 2012, we had a meeting with the primary architects, 3XN, on the project. They approached us with the intention of discussing the design and integration of a media façade on the Odenplan metro station. After a brief introduction to the project we were presented with their initial ideas, the scale model of the metro station, and different samples of materials planned for the interior and exterior of the building. The main focus of the meeting from our perspective was to uncover the conditions and requirements in the project, meaning the aforementioned constraints as well as questions of major milestones as well as what stakeholders should be considered and what technologies were feasible. Furthermore we set out the frame for our collaboration.

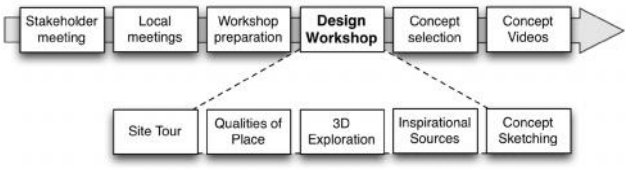


Figure 3 - Process overview

We agreed on a parallel process, where we produced a series of concepts for the metro station and presented these to 3XN, before seeking final approval from the Stockholm city architect.

Following these initial meetings we established a local design group, consisting of design researchers with an interest in the specific case and media façades in general. In a series of local meetings we gathered relevant information, such a 3D/CAD drawings and technical constraints, identified design openings, considered virtual prototyping tools, and planned the process according to the project milestones. An important outcome of one of the first meetings was the decision to work with the outside stairs of the metro, as the primary part of the media façade. This required a change in the stair lighting, and 3XN agreed on the choice and approved our request to change the specification of the LED lights in the stairs, to suit our technical needs.

4.2 Design workshop

Prior to the main design workshop, each step was carefully discussed and planned during a preparation meeting, see figure 2. While planning the workshop, we discussed methodological approaches in relation to the relevant challenges faced at Odenplan. Each step in the workshop was carefully planned to broadly address the specific challenges and provide a better understanding of the particular domain, context, usage and situations possibly unfolding around the metro station.

	Site Tour	Qualities of Place	3D Exploration	Inspirational Sources	Concept Sketching
1. New Interfaces	x	Planned	Planned	Planned	Planned
2. Integration into physical structure	x	x	Planned	x	Planned
3. Robustness and stability	x	x	x	x	x
4. Developing content to façade	x	x	Planned	x	Planned
5. Aligning stakeholders	x	x	x	x	x
6. Diversity of situations	Planned	Planned	x	x	Emergent
7. Transforming social relations	Planned	Emergent	x	Planned	Emergent
8. Emerging and unforeseen use	x	Planned	x	Planned	Emergent

Figure 4 - Relationship between challenges and workshop phases

As shown in figure 4, each part of the workshop aimed at addressing a subset of the eight challenges, while other challenges emerged as part of the individual phases, the discussion and the unfolding events. Two challenges were not touched upon during the workshop, as they seem more present when working with hardware and implementation (3) or when negotiating with stakeholders on crucial design requirements (5).

Figure 4 gives an overview of the relationship between the challenges and the steps in the workshop, and we return to this relationship between each challenge, the phases of the workshop, as well as their relation to the design insights in the final discussion. The workshop conducted as a full day activity to avoid interruptions from other activities, to establish continuity between the individual phases, and to ensure the retention of impressions and design insights throughout the workshop. We, the authors, participated as designers with a few extra participants, all design researchers from our research lab, CAVI [21].

In the following we describe each phase within the workshop thoroughly. We will introduce the approach used and present the explicit considerations behind the choice of method, describe what happened and highlight the design insights from each step.

4.2.1 Site tour

The workshop was initiated with a *Site Tour*. A Site Tour lets the workshop participants go to the site they are designing for or to a site that resembles the same characteristics as the design site - either in physical shape or in the actions or situations taking place. The purpose is to make the participants aware of site-specific elements through a bodily, sensual and emotional experience of the particular site. Along with impressions created through the bodily presence of the participants, stories or information connected to the specific site can be introduced. This specific approach was aimed at addressing the challenges of understanding the existing situation and social relations, as well as bringing the experiences of the particular site into the present situation with the designers.

The idea of being there and engaging oneself with, understanding and analysing the potentials of a particular site relates to Paul Dourish's concept of *Embodied Interaction* [12], and to Klemmer et. al [26] who underlines how our physical bodies play a central role in shaping human *experience* in the world, *understanding* of the world and *interactions* in the world. Specifically about walking Ochoa argues that "the physical walk allows the mental walk, stimulating the thought and making possible the contact of the body, as element of measure, with the space" [33].

Further, design methods such as *Bthere or Be Square* [14], and *The Design Space Explorer* [9] encourage the facilitation of design on-location in order to better understand the unique context of the design. These methods have their focus on how to maintain the analytical outcome of being at a site, by capturing it either on physical maps or in a table. The Site Tour's focus on bodily experience was inspired by Laursen [28] who argues that being on-location and sensing the distinctive site's specific characteristics is important when gathering inspiration for designs. By introducing the designer to the site through their own bodies the Site Tour, strives to make the knowing that emerges from embodied engagement enrich the design process and the end results which in line with Wilde et al. [42] can become an important part of the design process. Furthermore Anderson [1] argues for conversations taking place while walking for generating a 'collage of collaborative knowledge'.

The purpose of the Site Tour was to give us an embodied experience of a site that resembles the same characteristics as the integrated stairways at the new Odenplan building. The stairways at the Odenplan building is characterized by tall curved steps broken by a number of steps of medium height at the middle. A stairway close to our research laboratory holds the same physical characteristics and was chosen as site for the Site Tour.



Figure 5 - Site Tour, sitting on stairs

At the stairways, the facilitating designer, asked us to take a seat on the stairs, one by one and as if we did not know each other. We positioned ourselves on the tall steps and with great space between us, see figure 5. Then we were asked to take a seat as a group. The group had a non-verbal negotiation and then sat down – again on the tall steps in three rows. The facilitating designer had prepared a short talk about good places to sit in urban space, stairways and secondary seating inspired by architect Jan Gehl's work on well-functioning city areas and 'sitting landscapes' [17]. The purpose of the talk was to make the stay at the stairway meaningful to the participants not only as an embodied experience, but also by introducing a common vocabulary to articulate the experience and understanding of the site in the following events in the workshop.

The Site Tour was the first of five events during the workshop and the focus was particularly on the qualities and constraints connected to a stairway area and its use as sitting area. It made the participants reflect on architectural elements such as the difference between the tall and the middle height step. Also the introduced terms such as 'secondary seating' and 'the edge effect' was used as a common reference frame throughout the workshop.

Also social elements of stairs as sitting areas, resting/waiting and meeting space at the city square came to the participants' attention and was further supported by the spatial properties discussions later in the workshop. The physical experience of being on the stairs was most clearly seen as the participants discussed the 3D model of the building in the panorama cinema where the above-mentioned elements enriched the participants understanding of the virtual models. The coupling of real life and 3D perspective thus enriched the understanding of the design site.

4.2.2 Qualities of Place

The next part of the workshop was called *Qualities of Place*, and aimed at helping us re-consider forms and uses of stairs. This relates to the challenges of the diversity of situations, as well as unforeseen and emerging patterns of use of stairs, apart from sitting on them. We found pictures of different uses and forms of stairs, which we discussed. We specifically focused on evocative images, meaning images of uncommon forms or uses of stairs thereby helping designers relate to both the existing use of stairs, in the domain as well as enabled them to see it as an alternative interface – a media façade. The discussion ended in a series of immediate design insights that we could use as inspiration as well as a broadened conception of what stairs could be.

The rationale behind this part of the workshop were the idea of using the images as generative metaphors [35], encouraging

alternative ways of seeing-as [36] in order to broaden our conceptions of stairs. Thus the purpose was not the generation of specific ideas, but rather opening up the design space, by identifying specific qualities of stairs as places, that we'd like to use later in the workshop when sketching ideas. Building on the physical experience of the Site Tour, this phase first equipped us as designers with new ways of seeing-as for the rest of the workshop, as well as discuss qualities that we found interesting. Thus, the rationale for discussing different forms and uses of stairs in this phase was not for narrowing down specific ideas, but rather seeding the ground for the next phases in the workshop.

This approach is influenced by other work in using images as sources of inspiration in order to open up the design space, such as for instance Mood Boards. While we did not address this during the workshop, the images were intended for what Lucero [30] calls paradoxing, the research into conflicting alternatives. To this we would like to add, that where Lucero primarily focus on the selection and exploration between different alternatives as the main role of paradoxing, we actually aimed at placing ourselves in a paradoxical situation, which we could then later attempt to resolve in differing ways for the rest of the workshop.

We were seated around a meeting table while two of us showed different images as well as explained the motivation for inclusion. The entire phase took roughly thirty minutes, and consisted of 14 images being shown. As each image was shown we would discuss and elaborate on what thoughts and ideas the stairs brought to mind. A common structure to this discussion was an initial sense of puzzlement at the image, followed by a short discussion that explicated any doubts and let participants exchange views on the image, thus underlining the use of the images as paradoxing [30]. For instance, images of three young rappers on stairs lead the participants to see stairs *as* [36] a stage, rather than a transit area, which was our initial understanding. This expanded perception was the result of a brief discussion, where we agreed that this could be a potentially interesting path to take for the Odenplan building. In another example, we used an image of a parliament to see the stairs as a potential site for discussion or making statements. Both are examples of the generative role of the images, serving to expand our potential design space, which we utilized later in order to narrow down finished ideas.

In summary, the experiment in itself was very simple, but also functioned quite well, in that we, the participants, were able to discuss a series of interesting qualities, which we would like to consider for use later in the workshop. Furthermore, we all carried an expanded sense of what the Odenplan stairs could be used for.

For us, this phase highlights the value of opening up the design space through concrete examples that can then be used as shared points of reference throughout the rest of the design process. It is not enough to merely point out that "stairs can be something else than just for walking or sitting on" – we all know that, but having concrete examples of what that "something else" could be, had a good effect in our workshop. It was added to the common vocabulary for the day in the same way the Site Tour gave us a common frame of reference. We did encounter a challenge too, in that our gains from this workshop was perhaps not carried over into the next phases as well as we would have liked.

4.2.3 3D exploration

Following the exploration of the qualities of place, we moved onto a more concrete exploration of the yet unbuilt architectural structure through a 3D exploration of the metro station. The rationale for this phase was to establish an understanding of the spatial issues we were addressing by simultaneously exploring and discussing a virtual model, and our intention was to get a general sense of scale, and of how the building and our potential interactive elements would be perceived by people depending on where they were in relation to the building. Furthermore, it would enable us to be aware of the future structure, the possibility of integrating or placing technology and sensors, without obstructing the use of the space or the façade. This in turn, would help us gain a thorough understanding of the façade in relation to the future content. Instead of having set up a specific path or series of views, an open 3D exploration would enable us to explore issues and opportunities in an on-going dialogue. Our use of the 3D cinema in this manner is inspired by Kjems' work on virtual reality in urban planning [25], and Nielsen's research into 3D in spatial design [32], among others.



Figure 7 - 3D Exploration, discussing future use

Some of the specific questions we hoped to address were the following: How does the structure appear from different angles, how is it situated in relation to the surrounding urban area, including both buildings, spaces and infrastructure such as traffic lanes, how does it present itself for people with various movement trajectories in the space. In the terminology of Gedenryd [18], the 3D exploration phase can be construed as a so-called situating strategy, a move made to bring the future situation alive in the design situation: "… these techniques re-create the various parts of this situation that do not yet exist... the designer has to create her own working materials; before the world can become a part of cognition, the designer has to create it." [18:157].

The 3D exploration was carried out in a dedicated 3D cinema in our research lab. Drawing upon a 3D model of the metro station and blueprints of the building in the urban plan that we had received from the architects, we imported and refined the model in Unity3D [29], a 3D game engine. Unity enables users to set up a series of physics parameters (e.g. making surfaces solid so that you cannot move through them) so that the model can subsequently be explored in free-form walkthrough modes. One of the benefits of this approach is that it is quite straightforward to navigate through the model, once the physical parameters have been established, and thus all participants could take control to point out specific areas of interest during the exploration. In the model, we had mapped out a series of lights that corresponded to a specific placement and distribution of LEDs on the basis of talks with the architects and a supplier of interactive LEDs. This allowed us to not only explore the raw 3D model, but also to see

how different intensities, colours, patterns and transitions of the LEDs would appear from various points of view.

During the exploration, all participants except for the person controlling the camera movements around the 3D space stood in front of the wall-sized display and were free to move around to point out specific features for discussion. In our exploration, we navigated the metro station and surroundings with a particular focus viewing angles, perspectives and movement vectors related to the stairs in which we intended to integrate the LED arrays. In the initial phases, we moved around the plaza surrounding the metro station to get an impression of the scale of the building in relation to the urban landscape, and to get a better understanding of how people in the plaza would move about. We then moved closer to the building, exploring it outside and inside, and finally we focused on the stairs, viewing them from different angles outside of the building, moving past them, and moving onto the stairs in order to explore different points of view for people sitting or standing on the stairs.

Whereas the earlier phases of the process had been relatively abstract and conceptually oriented, the 3D exploration phase prompted a much more concrete focus on the specific architectural form, for better or worse. This focus led to a number of insights that were crucial in the subsequent design process. First, our exploration of the 3D model revealed a major difference in how people seated on the stairs perceive of the LEDs, compared to passers-by or people seated in front of the stairs in the plaza. This emphasised the need to consider how to design different modes of interaction for different sweetspots - or potentially to create modes of interaction that do not favour one privileged sweetspot, but rather appeals to people regardless of where they are positioned. Second, it became clear that there was a need to develop subtle modes of expression, both in terms of colours and light intensities, as well as in the dynamics of the visuals. By trying out a series of different clips displayed on the simulated LEDs in the mode, it became clear that a display of this type could very easily become too tacky and busy. This can overpower the form and expression of the physical architecture, and while this can be an interesting strategy in certain situations, we also knew that the architectural firm we collaborated with were unlikely to accept an installation that did not have a good fit with their overall vision.

Taking a step back from the specific project findings, the 3D exploration proved to work well for understanding viewing angles, perspectives and movement vectors. One of the main challenges in projects of this nature is to get a sense of the scale and architectural form as perceived in a human scale, and the use of the 3D cinema offered a level of immersion that was on a different order of magnitude than our previous explorations of the building via physical scale models or 3D renderings on traditional displays.

4.2.4 Inspirational sources

For the subsequent part of the workshop we consciously worked with sources of inspiration as resources for stimulating the generation of design ideas. This is not directly related to a specific challenge in terms of working with the media façade, but more a way of rethinking the potential role of and interaction with the façade. With that in mind, we included this phase in the workshop to address the work with media façade as a new or alternative interface, as well as trying to discuss the impact on the existing usage in the future design and the potential in emergent and unforeseen use as a design quality. The approach taken is rooted in Schön's [37] design theory according to which a designer rather than looking for standard solutions sees the situation as something already present in his/her repertoire of paradigm cases, examples, and previous situations. Several other researchers, including Sanders [38] and Halskov & Dalsgaard [22] have specifically argued that inspiration plays a prominent role in experience design.

We have in previous projects applied the inspiration card workshop technique intended for the early stages of a design process during which professional designers and their collaborators develop potential future designs [23]. The original design technique is a semi-structured process based on creating and combining technology cards and domain cards. In the case of the Odenplan project we did not conduct a full-scale inspiration card workshop but confined ourselves to taking advantage of the potential of consciously bringing sources of inspiration into the process. In that way the approach also addressed the challenge of creating content for the unique interface, and even explore potential uses of the stairs and façade.

For the preparation of the workshop one of us selected three cases: Body Movies, Blinkenlight and Love Doodles. The three sources of inspiration were chosen on the basis that they offered people a participatory role in shaping an experience.

Rafael Lozano-Hemmer's Body Movies [5], a media architecture classic, transforms public space with projections on a buildings façade measuring between 400 and 1,800 square meters. Photographic portraits are projected onto the façade, but the portraits only appear inside the projected shadows of the passers-by, whose silhouettes can measure between two and twenty-five metres depending on how close or far away, they are from powerful light sources positioned on the ground. But as discussed by Dalsgaard and Halskov [8] people were more interested in playfully engaging in shadow play with each other rather than using it to uncover portraits, which where the original intentions by the artist.

Blinkenlights, a well-known media architecture installation, is a setup in which the windows of a building on the Alexanderplatz in Berlin constituted the individual pixels of a huge, low-resolution display, to which people could upload animations to be displayed on the building's façade, or on which users could play Pong using their mobile phone [3].

Love Doodles is an interactive installation developed for ARoS, a Danish art museum [29]. Museums visitors is offered the opportunity to be part of a mosaic of images by writing or drawing on a glass plate with a regular whiteboard pen, positioning oneself in relation to the drawing, and then pushing a button making a image of the users with an overlay of the drawing appear on the mosaic.

For the workshop each of the sources of inspiration was presented by showing a short snippet of video. Body Movies and Blinkenlights were both familiar to all workshop participants and required only little introduction whereas Love Doodles required more careful introduction.

The inspiration materials helped the us shape the overall direction of the design process by agreeing on and making explicit four qualities of what to design for: 1) an open interactive installation with the potential for emergent and unforeseen use; 2) social and playful interaction where people not only interact with the media architecture but also relate to each others; 3) the opportunity to leave trace; 4) simplicity.

4.2.5 Concept sketching

The final phase was the concluding concept generation. By including a mix of techniques, we sought to combine and include the elements and insights from the prior steps, as part of the concept generation. Several of the preceding elements were included directly in this phase while others had a more subtle role by acting as common points of reference throughout the session. The explicit aim of the final step was to develop the possibilities in the display as a new interface, the featured content and interaction, if any. The approach to the concept generation was a combination of sketching each concept and verbally explaining the constituents, e.g. interaction with or content for the façade.

The input and inspiration from the previous steps in the workshop, helped the designers in building a shared virtual world. Goodman [19] describes different ways of visioning and creating virtual worlds, through the use of different compositions, weighting, ordering, deletion and supplementation. As described earlier, the previous steps provided the designers with a series of shared experiences, metaphors and a vocabulary – a shared understanding of the overall situation designing for – which in turn serves as the materials of the situation in a Schönian sense, available for creating new compositions. Schön [36] describes the sketchpad and the act of drawing, as such a (shared) virtual world, which offers a medium for experiments, without invoking actual changes. The different components and elements of the situation, the seeing-as, can be rearranged, ordered and supplemented in such a way, that the designers are able to envision different designs and concepts for the particular domain.

Sketching serves several functions in design, especially within generative group sessions. Sketches are a way of communicating ideas and concepts. Van der Lugt [40] describes how sketches can enhance access to ideas and act as a collective graphic memory, and Dix and Gongora [11] describes how drawings on the most basic level can be *informal* and communicate the shape and experience of a building or idea. Furthermore, Dix and Gongora argue that sketching can act both as *formational*, *transformational* and even *transcendental* – sketches can help designers seeing ideas more clearly, using the external representation as a way of gaining a new understanding of the problem or situation, or even seeing the elements of a drawing as something entirely different. In a group setting, van der Lugt [40] describes this, not only as an individual relationship between the designer and the sketching, but also as existing on the group level, where the act of sketching can stimulate the designers to re-interpret each other's ideas. According to Dix and Gongora, any externalisation, for instance, verbal descriptions, images, names etc., can serve the functions described above, making the relation between the verbal explanations and sketches a key relation, where only the sketches are preserved.

The setup for the final part of the workshop was comprised of a whiteboard as the primary sketching surface, a projector superimposing the 3D model on top of the whiteboard, and a camera for documenting each concept. A second display in the background enabled us to display the inspirational sources throughout the session, keeping them available as common points of reference and allowing them to continue to inspire us. During the workshop the participants could change both the inspirational sources in the background, as well as the viewing angle and position of the 3D rendering of the model.

During the session, we took turn sketching different ideas, while explaining each element, the overall concept and possible interaction. This was done in rapid succession, only interrupted by the documentation of each concept. Some of the sketches were very simple in form and concept, while others prompted questions and supplements from the group. Throughout the session, we often changed perspective on the superimposed image of the 3D model – shifting from at frontal view, over a view from the side of the stairs, to a view from above. Similarly the secondary display was used to recall elements from the previous steps, and for using images as a means of explaining certain features of a concept.

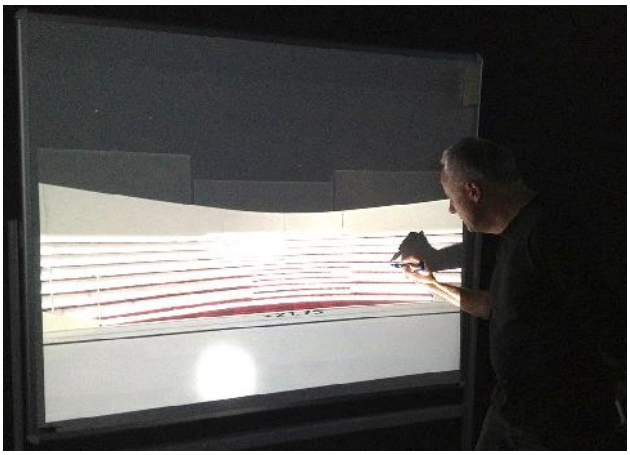


Figure 10 - Sketching on the 3D projections

The final phase of the workshop was aimed at creating a setting where we could generate a series of design concepts for the media façade placed on the stairs of the metro station. Furthermore, the intention with the setup was to facilitate a more direct and decisive role for the inspiration and insights from the previous steps in the workshop. The final session was very productive in terms of quantity, as we created 12 concepts in 45 minutes.

While the explicit aims (see figure 4) were fulfilled, in the sense that we produced concepts to the façade as well as discussing the interface and integration, several discussions emerged in relation to each concept. In the case of the stairs as a façade for passers-by, we discussed whether people would be intimidated by the disruption of the stairs as a place for waiting and socialising, or whether ideas with a high degree of interaction could facilitate emerging and unforeseen use.

While it is hard to draw a direct line between each concept and the sources of inspiration, our impressions are that each of the steps did contribute to the final outcome. It can be difficult to assess whether this was due to the initial steps alone, the inclusion of the inspirational sources directly into the final setup, or a combination. The only previous step not included directly in the final phase – the site tour – still played a role in several of the concepts where we worked with the relationship between the distance between the individuals, their placement on the stairs, and the media façade. This could indicate that the insights from the previous steps linger on in our shared experience.

4.3 Final concepts

Subsequent to the ideation workshop, we met to discuss the twelve concepts in relation to the different themes, interaction styles and the prospects of creating a series of video prototypes for the final presentation for 3XN, the architectural firm we collaborated with. We had previously decided to create three concept videos, aiming at simplicity and ease of communication in order to show what can be done with an LED media façade.

During the time between the workshop and this meeting, a few new concepts ideas emerged and were presented briefly. Following a discussion of each concept, we categorized and grouped these in terms of the interaction style and content. Several concepts fell under each of these groupings, and we decided to produce three different videos, illustrating each of the main themes: one presenting visual effects on the façade, and two showing different levels of interaction with the façade.

The three concepts were not merely chosen due to our individual judgment of the overall quality, but weighed against our assessment of their communicative qualities and the ability to reflect the broadness possibilities with the Odenplan media façade. Furthermore, we discussed how the stakeholders would receive the concepts. We wanted to show both simple and clear concepts, as well as the more inventive.

Each of the concepts was presented in a video to 3XN produced using the same 3D model as used in the workshop, and aiming at showing the core visuals and interaction. The final concepts each address specific features of the façade and interaction styles. The final concepts are as follows:

Contours

This concept aims at playing with the spatial features of the stairs and creating an illusion with the LEDs and the façade. During a short period of time, the façade is used to draw specific lines along the stairs, emphasizing the contours, stairs and the architectural expression. It begins with lines drawn around the edge of the stairs, followed by each step being lit slowly upwards, and a similar fade out after a few seconds. This is replaced by a fade in of the central part of the stairs, followed by a slow fade in of the entire surface. Finally Contours conclude by pulsing up and down for a few minutes, before the pattern is repeated.

Playhead

This concept uses the position of the users on the stairs as input. The stairs acts as a musical score sheet, with each step representing a line, or pitch in relation to the key, and the position of a user indicates when the note is strung. Users sitting on different stairs will result in different notes being played, and the space between them represents the time interval. Every now and then, a play head moves horizontally along the stairs, and plays a note for each person occupying the stairs. The note is accompanied by a visual effect, such as a bursting bubble or fireworks.

Traces

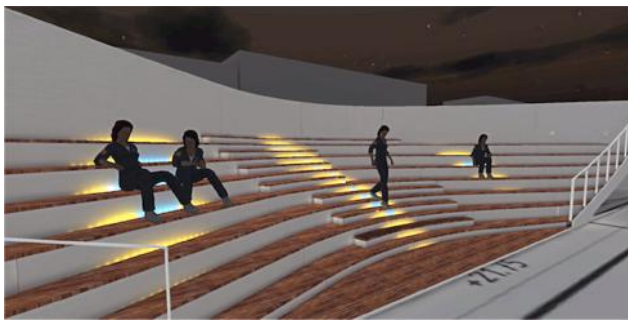


Figure 11 - Concept example Traces, captured from video

This concept revolves around the footprint or traces that the users of the stairs leave behind. When a person or group of people are seated on the stairs, they generate an aura or circular light around where they sit. If they move to another part of the stairs or leave, they light up new parts of the stairs as long as they are at the domain. The aura itself fades away slowly when no one is sitting in it. That way previous use of the stairs will linger on in the form of these auras for some time, creating traces of the use of the stairs as seating area.

5. DISCUSSION

We now turn to a discussion of the relationship between the different phases of the workshop and the challenges for media façades outlined above. From this discussion we condense a series of insights that can act as input to other researchers and practitioners within the field of media façade design, as well as highlight future research questions.

Our first design insight is the value of distributing the complexity of the intertwined design challenges for media façades. Our workshop as a whole did address many of the challenges outlined by Halskov and Dalsgaard [8]. However different challenges were tackled in different phases, which worked rather well. This approach, however, also brought along the problem of ensuring coherency among the many different threads brought up during the different parts of workshop. A specific problem we faced was capturing the bodily insights from the Site Tour and bringing them along in the next phases. This highlights an interesting area of research, as we have experienced this problem in other areas than media façade design, in example when trying to capture the richness of a verbal discussion on concept posters in an inspiration card workshop [23].

Our second design insight is closely tied to the interplay between the individual phases in the workshop. While each step were planned towards addressing specific challenges, several of the steps included discussion of emergent themes and elements. For instance, some of the images presented in the Qualities of Place session, prompted a discussion on the social patterns and possible impact on usage, when regarding the metro station as more than just a stair. Similarly, the sketching of the final concepts brought a range of themes from the previous steps in to play, as we elaborated on each concept. When we sketched the rough idea of what eventually became Playhead (see above), we discussed the relations between number of occupants on the stairs and the quality of the audio. Would a large number of users disrupt the audio and visual qualities of the concept? Many of the emergent themes echoed both the general focus of our work with media façades (e.g. [4], [9]), as well as reflecting individual research and design research, such as the qualities formulated as part of the Inspirational Sources part of the workshop. At the same time we see this as part of the workshop progression, where each event was planned and tied together by the overall ambition of building a common vocabulary and reference throughout the day.

Our third design insight is the complexity of the relationship between inspirational sources and the projected building, which is quite hard to capture as well as keep focus on during the workshop. This may complicate the session in three aspects. First, the actual setup is complex and involves both equipment and time consuming preparation, second it is overwhelming to relate to all three elements actively during the session, while still producing ideas and sketches, and third, from a research perspective, it is complicated to reconstruct the strands of inspiration in relation to the generated concepts and evaluate how each challenge was addressed in particular, as well as the entire workshop from a process perspective. It is very hard to assess what parts of the workshop played a prominent role, and what parts drifted into the

background. While we did not take elements directly from the Site Tour into the sketching session, as we did with the images from Inspirational Sources and the list created during Qualities of Space, it still played a significant role to us, as designers, in terms of a shared repertoire and vocabulary.

Our fourth design insight is the importance of making explicit the dialectical relationship between the present and the potential when working with buildings that are not yet realized. This was underscored in our workshop when insights from the Site Tour was brought into the 3D Exploration part of the workshop – and elements from that discussion were still part of our vocabulary during the final generation of concepts. While the importance of this dialectical relationship is nothing new in designing interactive systems, we consider this issue to be extremely relevant in designing media facades, since they are often radical interventions into civic life that can hardly be ignored by the users of the Stockholm Metro. An interesting area of future research could thus be how we can work with areas and buildings that are still in the planning phase, since the context is not available here. We consider the purposeful work with external representations one way of helping us and other participants in a design process working with this particular kind of complexity.

While we did try to address as many of the challenges we found relevant within the context of the workshop, two where intentionally left out. First, we did not find it relevant to address the third challenge, namely the issues regarding safety and robustness, since in revolves around the integration into the built environment, as well as preparing the installations for wear and tear in the lifetime of the installation. This challenge will be left to tackle, when the final concept is chosen and process moves into installation, testing and final operation. Second, the fifth challenge, namely the alignment of stakeholders and balancing interests, are more prominent in the beginning of the process, around requirement and initial agreements, and in the final decisive parts of the process, where this project is at the time of writing. While the selection of the proposed concepts, where assessed against our impressions of the key stakeholders and geared towards what we perceive as interesting in their context, the city architect in Stockholm still have to give their final verdict. In that regard, we intent to develop the workshop format towards including key stakeholders and users in the workshop, as part of future experiments and research.

6. CONCLUSION

We have presented our work with the Odenplan media façade, in order to contribute with experiences and examples of how to address a range of different challenges faced when designing media façades. Specifically we have shown how different challenges are salient during specific periods of the design process, as well as given examples of how designers and media architects can go about creating, iterating and capturing ideas for media façades. We underline how different design artefacts, such as 3D models, can be used during the design process to meet some of the challenges outlined by Dalsgaard and Halskov [8], and we have shown how different kinds of inspiration [22] can be used to open up the design space and create new ideas for media façades. Adding to this we have consciously worked with mixed reality approaches, in example by sketching on a whiteboard on top of the 3D model. Such examples has the power to inspire and enter into the repertoires [36] of researchers and practitioners alike, and we have discussed how we ourselves are inspired by others in the field.

Our contribution also highlights the fact that media architecture and media façades in particular are developing fields, and we consider our work here to be of value for helping lay the ground for understanding how the design work of media façades unfolds. With that in mind, we follow Vande Moere and Wouters [41] by calling for the creation of new methods and tools for designing media architecture, in order to help researchers and practitioners build their design. We are ourselves working on refining both the sketching and 3D exploration methods as ways of working with buildings that are still in the planning phases, as well as doing on-going studies into the ways sources of inspiration can be brought into the design process of media façades. The challenges faced when designing media façades are in that sense typical for the more general development within HCI and interaction design, in that the technological development opens up new domains, creating the need for new understandings, methods and tools.

Of further interest to us, are also ways of involving stakeholders more directly in the design process via workshops like the one described in this paper, as part of field studies or in the later prototyping phases. While it was relatively easy for us to use methods like 3D Exploration, it remains to be seen whether this is a good way to involve stakeholders and users less well versed in using information technology. This highlights how participation as a topic comes to the fore, as technology for media façades becomes more available and the façades begin to permeate everyday lives of the general public.

7. ACKNOWLEDGMENTS

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Designing for Collective Participation with Media Installations in Public Spaces

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ABSTRACT
One of the greatest challenges that designers and artists face when deploying interactive media displays in the urban space resides on finding the right level of audience participation. In many cases this includes the challenge of designing for sustained interaction over an 'ideal' time period. It has been acknowledged that questions concerning the meaning and purpose of public displays are expected to be addressed thoughtfully with respect to the surrounding environment, its architecture, social conventions, and the values and habits of its inhabitants and visitors. Consideration must be given to the role played by both the social context and cultural values shared by the community, since those may influence proxemic aspects [7] of the interaction and in consequence impact the designed collective experience. This paper analyses the effect of contextual constraints such as prominence and length of the exhibition on two interactive light installations. Both installations adopted media displays as a tacit element to sustain awareness of the collective experience promoted by the public space interventions. Following a nested action research approach we studied the installations in the field, which led us to formulate interaction goals and content strategies for designing the collective participation in interactive artworks. More specifically we link the identified parameters to the two extreme categories of performative and ubiquitous interaction and discuss their value for designing interactive, public media.

Categories and Subject Descriptors
D H.5.2 [**User Interfaces**]: Interaction Styles; H.5.2 [**User Interfaces**]: User-centered Design; I.3.6 [**Methodology and Techniques**]: Interaction Techniques

General Terms
Design.

Keywords
Public space, large displays, crowd interaction, user experience design.

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1. INTRODUCTION
The recent popularisation and widespread adoption of electronic displays, combined with the increasing affordability of tracking technologies like sensors and depth cameras, has created new opportunities for creating proactive environments [12]. Such environments often consist of media screens, or can also take the form of electronic, artistic installations intervening in the public space. Compared to the more wide-spread, passive public screens, they not only provide an interface between the media and the audience, but are designed to facilitate interaction in response to changing conditions in their surroundings and handling variations on audience flow and engagement at real-time.

In this paper, we present observations derived from two field studies we conducted in the form of public, artistic installations. In each study, we intended to encourage specific patterns of audience participation by carefully adjusting a range of design parameters that we identified in the early phases of the design process, based on given constraints and a review of relevant literature in this space. In the following sections, we first discuss the related work as well as the methodological approach adopted for the research. We then go through the details of each installation, explaining the context existing at the time of their conception and how such contextual constraints raised specific design concerns. Next, we present the results of each field study and discuss the interaction goals adopted in each scenario, as well as the design decisions taken in response to the given context and established interaction goals. We then conclude by presenting a framework for assessment of public interactive installations and parameters to be considered when designing proactive contextual interventions in the public space.

2. RELATED WORK
Designing interactive systems that encourage participation and situatedness has been a recurrent concern in human-computer interaction research. Already in the late 90's, Ishii and Ulmer [10] highlighted the noticeable shift in interactive experiences from 'traditional' graphical user interfaces to more participatory and pervasive tangible experiences. Making the case for a reality where interaction should be brought back to haptic and natural user interfaces, they elaborated the concept of ambient media as stepping stone towards a more ubiquitous form of computing. Moreover, they stressed the importance of a holistic view of interaction design arguing that, "subconsciously, people are constantly receiving various information from the 'periphery' without attending to it explicitly".

A similar investigation of the subtle – and often unconscious – impact of proxemics on people's behaviour was explored by ten Bhömer et al. [17]. Analysing the social dynamics in the context of family and friends having dinner together, they introduced a new photo device, *4Photos*, designed to be a centrepiece for a dinner table and spark conversation between the guests by exploring the potential of digital displays as instruments for directing crowd focus. Careful medium placement and content programming managed to bring people together in a social context around a digital display, thus serving as a highly relevant example of effective use of design attributes for initiate and subsequently tune collective participation around media displays.

Brignull and Rogers's seminal behavioural analysis on audience interaction with public displays [3] introduced the concepts of 'activity spaces' – *periphery awareness*, *focal awareness* and *direct interaction* activities – as well as particular crowd dynamics around public displays, such as the *honey-pot effect*. Further investigating the challenge of inciting spectacle for self-sustaining participatory experiences around public displays, Bedwell and Caruana [2] noted that participation can be encouraged by allowing spectators to observe non-experts to perform. Their study also suggested that spreading relevant content across the interactive space invites the audience to more thoroughly explore the overall environment and, consequently, through multiple cycles of appreciation, to better understand it.

Vande Moere and Woulters [18] analysed aspects related to the integration of media architecture with their geographic and social surroundings. Considering the various stakeholders with decision power over its utilisation – such as the carrier (the building where the media is installed at), the content (the physical display as well as the message it conveys) and the dynamic environment around the media architecture – they discussed real case studies where lack of focus and coordination during design process led to pointless utilisation of the technology.

It is our aim to unveil the potential for maximising the collective interactive experience through the thoughtful utilisation of public displays. Building on the presented body of work, we envisage to offer a contribution to the ongoing analysis with a consideration of contextual and proxemic aspects [7] on the design of collective participation in the public space.

3. METHODOLOGY

As discussed by Alt et al. in their analysis on methods for evaluation of public displays [1], "there are aspects, such as effectiveness, social effects, audience behavior, and privacy implications that are almost impossible to measure in the lab". The creation of public installations for studying the dynamics of public participation is of inherently experimental nature. We therefore conducted *field studies* exploring different research conditions as a method for gaining insights into relevant design parameters while still ensuring a high ecologic validity for the data.

We structured our work according to the *nested action research* framework [1], whereby we collected the results of the first field study and fed them back into the process of unveiling new evidences and posing new research questions. The research questions emerging out of this first iteration were used to inform the second field study, thus combining action and research.

4. THE FIELD STUDIES

For the analysis leading to the framework and design parameters discussed later, we selected two works we developed, *Liquid Light* and *Chromapollination,* mainly due to the strikingly different characteristics in terms of their scale, placement in the public space, and the general context constraints associated to each of them. The two works were developed over the course of four months and six months respectively, and deployed around the same time but one year apart. As discussed in greater detail in the following sections, the rationale for such selection stems from our perception that the two works epitomise very distinct interaction models.

We define *performative interactions* as those centred on human spectacle taking place in the public space, driven by the interactive installation and designed with the objective of bringing a community together through playful experiences. It aims to create an event where members of the public can step out of their usual circumstances and, grabbing the attention of their peers, be socially rewarded by this action.

Ubiquitous interactions, on the other hand, are centred on the environment itself and designed to enrich ordinary experiences by overlaying digital elements on concrete and familiar items. They act as facilitators for serendipitous collective experiences and catalysts for deeper – and often not explicit – connections among members community and between them and their surroundings.

We argue that *Liquid Light* stands as an example of largely performative interaction, while the interactive dynamics afforded by *Chromapollination* are largely ubiquitous.

4.1 Liquid Light

4.1.1 Background

Liquid Light was conceived as part of an electronic art exhibition night. The event consisted of about 10 light installations running sequentially on a large LED screen installed in a public space, each one given a slot of 15 minutes to be presented. The exhibition was planned so that it could potentially travel around and be reedited in different venues (Figure 3); the two sites originally targeted included the Grid Gallery – off a busy commercial street in the Sydney CBD – and the courtyard of a Faculty building at the University of Sydney. The two environments were therefore vastly different and, consequently, attracting very different audiences.



Figure 1. Performers and spectators interacting with *Liquid Light* during an electronic art exhibition night

4.1.2 Conceptual Framework

Liquid Light aimed to address the feeling of physical disconnectedness paradoxically on the rise as modern society gets increasingly connected through technology. The ubiquity of mobile technology, social networks and online services – albeit bringing us together in a continuous social dialogue – often also isolates us from people in our immediate surroundings.

Drawing upon the concept of *familiar strangers* – the people who frequent the same places we do and who we encounter on a regular basis, recognise, but do not personally know [13] – we envisaged to use technology to create a sense of connectedness. To that end, we used a depth camera to capture the audience in front of the screen and displayed their silhouette as glowing auras gliding on dark water. As soon as more people stepped into the scene, all their auras got connected through the representation of their heads on the screen by shining halos that stayed on for as much time people's auras stayed visible on the screen (Figure 1). At the back of the interaction zone we installed a water mister, which switched on once the amount of people interacting with the screen reached a certain threshold [9].

4.1.3 Design Considerations

We identified two main concerns during the design of *Liquid Light*: 1) the ability to re-exhibit the work in multiple contexts; and 2) the ability of adapting the installation's interactive mode to continually address the audiences with a meaningful content, independent of the number of people interacting with the work at the same time. The positioning of the water mist at the back of the interaction zone was an attempt of achieving the latter through *elastic design* [9] (Figure 2).

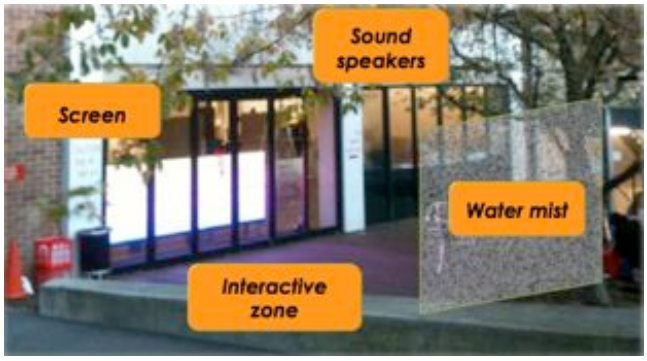


Figure 2. *Liquid Light*'s original setup



Figure 3. *Liquid Light* adapted for a conference environment

4.2 Chromapollination

4.2.1 Background

Chromapollination was commissioned as part of the 2012 edition of Vivid Sydney, a large art, music and ideas festival hosted annually during winter nights in Sydney, Australia. The festival strongly encourages the development of situated artworks that make innovative use of lighting and interactive technology to create engaging public installations. Vivid's light installations are spread along a large area of the Sydney Harbour's foreshore and are on every night over a period of 18 days. The 2012 edition of Vivid is estimated to have attracted more than half a million visitors overall.

The site chosen for *Chromapollination* is situated under a large elevated expressway running above Circular Quay station, the city's busiest transport hub – an interchange equipped with bus and ferry terminals connected through a rail station serving thousands of commuters every single day. The area under the expressway works mainly as thoroughfare for people coming to and from the public transport terminal and, other than being delimited by garden beds with shrubs and tall trees, it is reasonably neglected and lacks any minimally remarkable architectural feature.



Figure 4. People walking past *Chromapollination* towards the train station

4.2.2 Conceptual Framework

Our goal with *Chromapollination* was to create a statement about the neglected character of that particular urban location and to raise awareness about its relevance as a space shared by crowds on a daily basis. To that end, we conceived a sculpture consisting of three garden pods delimiting an enclosed area people could walk through. From each garden pod, sculptures of giant dandelion flowers embedded with fibre optics glowed with different colours. Hanging above the structure, a pixel net made of around 2,000 individually controlled LEDs was arranged tri-dimensionally and displayed dynamic light patterns.

As people moved around and across the installation, they created a 'digital wind', blowing the dandelion flowers and causing them to release 'light pollen' – represented as a flow of light of the same colour of the originating flower, animated on the overhead LED ceiling. As neighbouring dandelions were reached by such

'light seeds' they pollinated by changing to a new colour composed of their own colour and the colour of the light seeds.

4.2.3 Design Considerations

The design of *Chromapollination* was strongly determined by the site it was allocated to. The central area of Circular Quay is a prime location near the Sydney Harbour, served by a busy transport hub and a walking distance from two of Sydney's main tourist attractions: the Sydney Opera House and the Harbour Bridge. As such, it is continuously busy as a confluence point for thousands of tourists and workers in the Sydney CBD. During the period the festival is on, the specific site – for being located right at the exit of the local rail station – functions as de facto gateway to the festival (Figure 4). When discussing the work with the festival organisers, our team was briefed about the site and requested to create a piece that could be at one given time highly attractive and engaging yet creating as little impact as possible to the local flow of people.

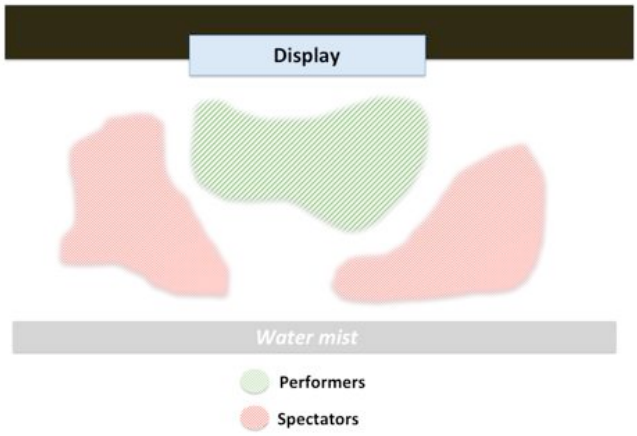


Figure 5. Mock-up illustration of general audience distribution for *Liquid Light*

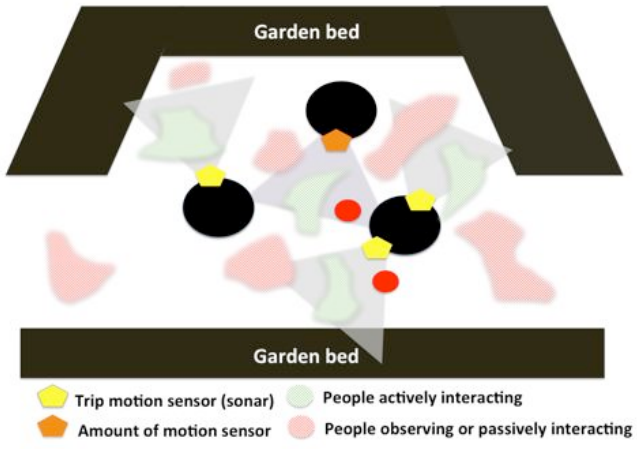


Figure 6. Mock-up illustration of general audience distribution for *Chromapollination*

5. RESULTS

The methods we chose to interpret the interactive aspects of each work were determined predominantly by their scope. Given the privacy and ethical concerns raised by public nature, video recording and direct interviews were avoided. Instead, we employed on site observation of the crowd dynamics. For *Chromapollination*, we also collected activation patterns of the proximity and movement sensors using an automated logging mechanism that was integrated into the application driving the installation.

Adopting the evaluation framework proposed by Alt et al. [1] as a guideline (for the reasons exposed in the *Methodology* section above), our main research questions regarded *audience behaviour*, *display effectiveness* and *social impact*.

5.1 Liquid Light

In the month leading up to the presentation night at the University of Sydney, we conducted weekly user evaluation sessions lasting about one hour each. Both individual and collective sessions (3 to 5 users) were run. A dry run for the exhibition was also organised, when we got the chance to test the installation with a larger audience (about 20 individuals). The actual presentation night was attended by more than 50 people, enabling a thorough test of the work with a crowd size nearly exceeding the capacity of the space.

Subjecting the installation to increasingly larger sized audiences allowed us to observe the emergence of clear patterns of *behaviour*. Firstly, we noticed the manifestation of *evolving emotional spaces*: individual interactions implied a more focused and intimate flow between the participants and the content displayed at the screen, yielding a *v-shaped interaction*; group interaction, conversely, shifted the focus of the interaction towards the crowd itself (*triangular shaped interaction*), creating a social event. The latter was further enhanced by the water mist coming out every time the crowd agitation reached a pre-configured threshold. Regardless of the number of active participants, however, the work proved to incite performance, with people right in front of the screen being watched by those in the periphery of the space, in a clear manifestation of the *honey-pot effect* [3]. From our observations during the exhibition we can claim the display proved to be *effective* to attract and entertain the audience during the period it remained on, transforming the space into a stage and highlighting social *cohesiveness*.

Further details about *Liquid Light* were published elsewhere [9].

5.2 Chromapollination

5.2.1 Observations

During the 18 nights *Chromapollination* was on, we visited the site regularly to observe how the audience interacted with the work. Site visits were spread across weekdays and weekends at different times while the installation was running.

We noticed that the direction people moved when walking past the installation was highly dependent on the time the observations were taken. For example, the festival started every evening at 6.00pm, therefore coinciding with the rush hour on weekdays. Given that the installation site was adjacent to a rail station and terminals for ferries and buses, in the first hour of the festival we could observe people walking almost exclusively in the same direction – from the city centre towards the public transport hub.

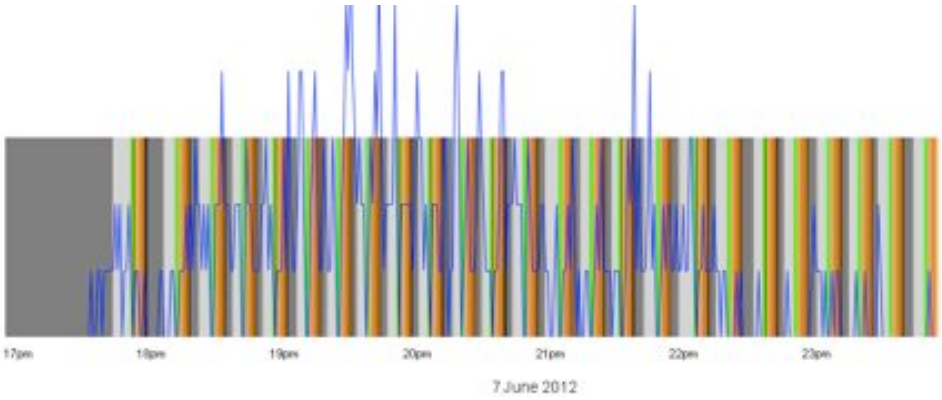


Figure 7. Audience flow during a night *Chromapollination*'s was exhibited

As the evening went by, people who came to the site specifically to visit the festival started to arrive and the flow of people became more diffused. On weekends, no specific flow pattern was observed.

In all days, the installation was almost constantly visited and hardly without people around. Many people stopped for taking pictures, often walking around the space to search for nice angles. Very noticeably, people also enjoyed to touch the sculptures and contemplate them at length. Remarkably, this contemplative state was rather dynamic, with people spread all over the site and almost constantly moving around except for pauses to take photos (Figure 8). The lack of immediate focal point and the non-obtrusive setting of the installation also meant that people often failed to realise the work was actually continuously responding to their movements. This observation indicated a clear manifestation of the *landing zone* interactive pattern [14], when only after passing by the display users realise it was actually interactive.



Figure 8. *Chromapollination* invited a slow pace interaction

From our observations, we can argue the work was highly effective for transforming the site and to create a communal joyful, albeit subtle, interactive experience with minimal disruption to the normal flow of people on the site, therefore successfully addressing our design goals and the festival requirements.

5.2.2 Application Logs

As per Figure 6, we employed two different types of sensors for tracking the audience flow: 1) sonars installed on each of the three pods of flowers for detecting when people walked into or out of the installation space (akin to trip sensors installed at shop doors); and 2) an x-band sensor detecting the amount of movement in the inner section of the space. We then used logs from the application running on the controlling computer to record those two types of data during the whole period the installation was on. Issues like stormy weather and occasional sensor fault caused some of the records to be discarded. The remaining logs were later consolidated in form of a dynamic graphical representation created with Processing, depicting the evolution of the crowd flow minute by minute during a few nights of the festival.

Figure 7 shows a graphic with the results from logs for the audience flow during a Thursday night. The blue line indicates the number of times people were detected by the sensors (thus causing the flowers to pollinate). The shades of grey represent the amount of movement inside and around the piece, with lighter shades indicating greater amount of movement. The orange bars show the periods when movement have been continuously intense, causing the installation to light all its lights white. As can be perceived from the graphic, such periods were recurrent for most of the evening, a pattern also observed in other nights the installation was on.

6. DISCUSSION

Three basic constraints shaped the nature of each installation (Table 1). The first constraint relates to the *prominence* of each artwork within its exhibition context. *Liquid Light* was exhibited in isolation, while *Chromapollination*, being part of Vivid Sydney, was exhibited amongst an array of other light installations. The second constraint refers to the length of time each artwork was actually being exhibited for – while *Chromapollination* was open to the public for about 6 hours every night during 18 nights in a very busy thoroughfare, *Liquid Light* was on for only about 15 minutes during a dedicated time slot at the exhibition night at the University campus. As a consequence, *Liquid Light* had full attention of the exhibition visitors for the whole time it was shown, while *Chromapollination*'s audience – albeit substantially larger – was more spread out during the whole period the festival was on.

The third constraint corresponds to the extent each work hindered or allowed the flow of people through the space. While with *Liquid Light* we sought to attract the audience to the site and stay

within its boundaries for the whole duration of the show, with *Chromapollination* our concern was not to obstruct the main thoroughfare and avoid clogging the area.

Table 1. Contextual constraints

Constraint	Liquid Light	Chromapollination
Prominence	Exhibited in isolation	Exhibited in conjunction with other works
Duration of exhibition	15 minutes	18 nights, 6h per night
Audience flow	Restrictive	Permissive

These constraints had direct implications on the dynamics we sought to give to the final interactive experience of the installations (Table 2). *Liquid Light* was a stage-based installation meant to be on for just a short period of time. Its high prominence and the limited amount of time for engaging the audience led us therefore to create a clear interaction giving immediate feedback to the users so that they could easily and directly engage with the work. A direct consequence of this setting, however, is that it creates a distinct separation of the audience into two groups – the *performers* and the *spectators* (Figure 1). Such levels of *inclusion* raise obvious concerns about social embarrassment and prevent some people from crossing the threshold from 'focal awareness' to 'participation', as discussed by Brignull and Rogers [3]. On the other hand, singling out an interactive zone (or 'stage') where people can easily congregate to interact with the work translates quite effectively as retention of audience in a single area for engagement with the interaction, particularly if the timeframe for enjoying the experience is constricted. Also, the delimitation (tacit or not) of a 'stage' elevates the performers to the role of *mediators* of the experience, a role swiftly acknowledged by the spectators. For the performer, the emphasis of the interaction becomes fulfilling their egos by exposing themselves in public (as if communicating their ability to overcome public embarrassment). For the spectators the emphasis is on passively participating by observing the performers on the stage.

Table 2. Interaction goals

Parameter	Performative Interaction	Ubiquitous interaction
Audience expectations	Performance, narrative	Non-interactive, permeable
Participation	Partially exclusive, honey-pot	Inclusive, collective participation
Mediation	Ego (emphasis on the self)	Empathy (emphasis on the work and its surroundings)

While fostering a narrative that could entail collective public performance was the goal of *Liquid Light*, the contextual restrictions for *Chromapollination* set the opposite agenda. Not compromising the flow of people in the area demanded the work to be permeable, allowing a crowd to walk past or through it without necessarily stopping for too long – yet, still interacting with it. Such permeable and highly inclusive participation needed to be clearly communicated to the audience so that it would not spend too long trying to make sense of the work which in this context could easily lead to frustration. We therefore decided to design the interaction to be subtle and indirect, triggering responses on the environment but not necessarily right in front of the person interacting. Mediation of the process should therefore be *empathic*, with greater emphasis on the environment around the members of the audience rather than on specific performers amongst them. In that regard, *situatedness* also became a major design concern: the aim was for *Chromapollination* to aesthetically and functionally blend with the surrounding environment, deviating as little as possible from the site's usual appearance and affordances.

Setting those participation goals as premises for the design process helped us to better articulate design parameters related to the content we sought to convey with each work (Table 3). For the purposes of the present discussion, we refer to *content* in the same sense as defined by Vande Moere and Wouters [18], i.e. encompassing both medium (e.g. an LED screen) and message (e.g. the digital content shown on the LED screen). From our observations, it can be argued that the level of *physical integration* of the media display to the rest of the work is to a certain extent encouraged by the prominence of each work within its respective exhibitions – the less prominent the work needs to be, the more the display can be integrated as a sculptural element of the installation. Conceived as a stage-based installation, *Liquid Light* therefore demanded the utilisation of the display as an unequivocal *focal point*, akin to a beacon calling the passers-by for attention. Its fleeting nature also required it to be easily reconditioned for different sites and physical settings; it favoured, therefore, the utilisation of displays as standalone equipment potentially replaced by similar devices (e.g. projectors) should new logistic conditions imply so.



Figure 9. Media display integration to convey pollination effect

Chromapollination, on the other hand, having to share the audience's attention with other installations and being on for a longer period allowed people to experience a higher level of integration with the surrounding context and a more exploratory and situated interaction, intrinsic to the site [15]. Given the audience's ability of revisiting the work over and over, *Chromapollination* could afford – and in fact benefit from – the absence of a single focal point. That in turn implied that the media displays needed to be highly integrated to the work's physical structure (Figure 9).

Lack of focal point and high tangibility are, in fact, intrinsic to participatory, ubiquitous environments functioning as ambient

media in an augmented space [10]. The 'digital wind' metaphor at the core of the *Chromapollination* concept was highly tangible in the sense it mapped a physical action by the passers-by with strong fidelity to its natural equivalent, thus adding to the ubiquity of the piece and seamlessly blending with the physical space, greatly enhanced by the sculptural elements of the work. By contrast, the performative nature of Liquid Light reduced the use of tangible elements as extrinsic accessories for shifting attention off the content on the display and into the physical space (water mist), thus balancing the interaction flow.

Table 3. Content strategies

Design Parameter	Performative Interaction	Ubiquitous interaction
Focal point	Stage (the display)	Diffused
Mapping of feedback	1 to 1	Ambiguous
Medium integration	Low: standalone	High: embedded
Tangibility	Extrinsic	Intrinsic
Situatedness	Weak	Strong

Our observations indicate that focal point features have also a direct impact on the audience's expectation of artwork. Electronic displays bring with them a strong bias towards being the focus of passive collective attention, charged by our cultural experiences with TV and cinema. When people walk into a space where they can spot a display, it is therefore their natural expectation that some sort of narrative or performance will take place, which they will (initially, at least) watch passively. Such behaviour is often validated with a manifestation of the honey-pot effect, followed by an interaction process that is at least partially exclusive – some people actively participating, while others are merely observing [3]. Interaction with a single focal point also implies the feedback from the installation to be direct, occurring around the same area where input was received and unambiguously caused by it.

Ubiquitous settings, conversely, afford a more diffused focal point. They are therefore expected to be non-obtrusive and often not perceived as being interactive altogether. As verified in *Chromapollination*, despite the fact levels of participation were high, members of the audience were mostly unaware of such participation as the feedback given by the installation is not easily perceived as beeing caused by any specific individual.

7. DESIGN IMPLICATIONS

Nature of participation. The discussion presented above suggests a direct link in the design process connecting constraining contextual conditions, such as prominence, exhibition duration and control of audience flow, to design decisions around focal point, feedback mapping, tangibility and medium integration. The results from our observation of both works compounded with the interaction log tracking collected for *Chromapollination* suggest two extreme approaches of designing audience participation for interactive, public installations. The first approach encourages predominantly *performative* interaction, while the second approach is of a more *ubiquitous* nature. Works affording greater prominence in the exhibition space are inherently more suited for being set as partially exclusive performative interactions with clear focal point, restricted tangible items, and able to be easily ported to other environments (weak situatedness). Conversely, works designed to hold a more ubiquitous character benefit from inclusive, participatory layouts with diffused focal points, highly tangible elements and promoting lengthier, strongly situated interactions. Like the design parameters discussed in the previous section, the two approaches are not mutually exclusive. In fact, specific constraining contextual conditions may require a mixed approach to achieve the appropriate form of audience participation.

Distribution of focal points. Spatial configuration of the audience and consequently their interaction patterns towards the interactive work are strongly guided by the distribution of focal points across the installation layout. Single focal points bias the interaction towards a specific direction, delimiting the playing zone and creating a stage. That, in turn, creates an immediate division of the audience between performers and spectators, with the interaction dynamics being driven predominantly by factors revolving around the human ego. Diffused focal points, contrarily, shift the awareness towards the whole work and its surrounding environment, enhancing the interplay between people and place and diluting the role of performer across the whole audience. Although less intense on an individual level, participation in ubiquitous installations becomes therefore more continuous and inclusive from a crowd perspective as, without necessarily realising, more people engage with the work for longer.

Integration between medium and message. Based on our field studies, we emphasise the existence of a direct relationship between the level of focused attention intended for the piece and the lack of physical integration of media displays into the overall work. For instance, the more prominent the work, the greater it is perceived as a stage and hence the more effective it is to use displays as standalone pieces. Conversely, the more the medium 'disappears' by being incorporated into the sculptural or architectural elements of the work and its surroundings, the more it becomes ubiquitous and part of the message itself being conveyed by the whole transformed environment.

8. RELATED FRAMEWORKS

It is possible to identify similarities between the framework derived from the findings of our research and others previously proposed in the literature, notably those presented by Ludvigsen [11] and Forlizzi and Battarbee [5].

Ludvigsen [11] looked at the work of sociologist Erving Goffman [6] to elaborate a conceptual framework for social interaction. Particularly relevant to inform the framework are the notions of (a) *occasion*: the set of accepted behavioural rules whereby people operate in a known social gathering; (b) *situation*: a particular instance of an occasion, raising specific and localised rules due to contextual constraints; and (c) *encounters*: the events when two or more people are brought together by the situation and engage into social interaction. The framework adopts the level of attention given by people to a social situation to analyse an interactive setting. It proposes a scale of engagement defined by the four categories shown at Table 4.

Ludvigsen's conceptual framework shares with ours the same core design element – the number and distribution of focal points – as determinant of how an interactive situation may unfold. Focal points function as hooks for catching people's attention and bringing them together into a unified interactive experience. The notion of *dialogue* through the shared focus is akin to our proposition of a *v-shaped interaction* developing between each two members of the audience through the installation; the

evolution to a scenario of *collective action*, on the other hand, can often find expression as our proposed *triangular interaction*, whereby members of the audience start to (often unconsciously) to use the digital work as a catalyst for direct interpersonal interaction.

Table 4. Ludvigsen's conceptual framework

Social interaction	Description
Distributed attention	Minimum level of engagement. People sharing the space but not any specific activity.
Shared focus	A person or object becomes the centre of attention, reconfiguring the spatial orientation of the participants.
Dialogue	Encounters happen and people engage in shared activities.
Collective action	Dialogues develop into stronger bonds The goals of each participant coincide with the goals of the whole group.

The nature and distribution of focal points as well as the level of integration between medium and message are also highly influential on people's behaviour. Referring to Goffman's concepts, we can argue that in the occasion of an electronic art exhibition people are already predisposed to be exposed to stage like interactive settings due to their previous experiences (e.g. arcade and video games). The utilisation of a single large display as in *Liquid Light* validates the situation and sets the stage for a performative interactive experience. Conversely, in the occasion of a large outdoor art festival as Vivid Sydney people do not normally expect having to perform in front of a crowd. The ubiquitous character chosen for *Chromapollination* – built on scattered focal points – therefore validates the situation while still allowing for serendipitous encounters and subtle dialogue to take place.

Forlizzi and Battarbee [5] developed an interaction-centred framework of user experience as it relates to the design of interactive systems. It proposes a classification of the interactions between individuals and products and the types of experiences then resulting.

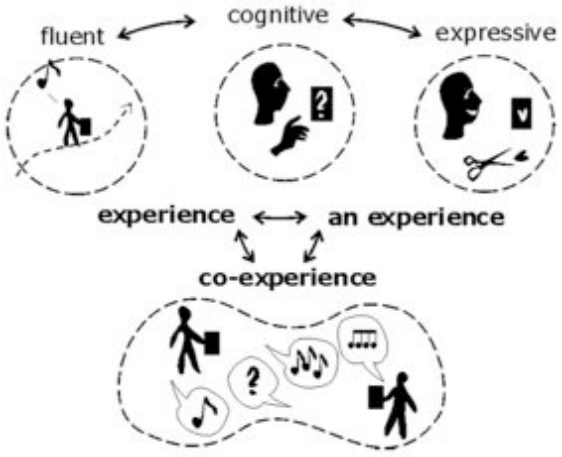


Figure 10. Battarbee's framework of user experience [5].

A *fluent* interaction happens almost without conscious thinking, built on extensive previous experience from the users. A *cognitive* interaction presents some novel aspects thus requiring an effort by the audience for making sense of it. An *expressive* interaction, in turn, is characterised by the audience adding their personal twist to the experience based on their emotional state while interacting with the installation. Experiences, on the other hand, range from nondescript (*experience*) to peculiar (*an experience*) to shared (*co-experience*).

Both performative and ubiquitous aspects of an interactive installation contribute to generate situations where seamless interplay between fluent and cognitive interactions can take place. Ubiquitous interactive environments, however, place a greater emphasis on fluent interactions, as a direct consequence of having multiple focal points scattered around the place: interacting with the environment is expected to feel highly natural. Performative settings, on the other hand, may pose cognitive challenges for the audience but also allow for more open expressive co-experiences to emerge, as was the case of groups of people making funny poses with their glowing auras when playing with *Liquid Light*.

9. FURTHER ANALYSIS

The previous sections demonstrated how the proposed framework was derived from the execution and analysis of two field studies carried out as part of the nested action research methodology we adopted. In this section, we are aiming to show the validity of the proposed framework by using it to analyse two renowned art installations: *Aarhus by Light* and *360° Room for All Colours.*

9.1 Aarhus by Light

Aarhus by Light was a large-scale interactive light installation featured in the glass facade of the Concert Hall Aarhus, facing the adjacent park. People walking in the park towards the building were presented with animated figurines of light playing in the facade. In addition, they would cross three interaction zones defined by coloured carpets (pink, blue and yellow) embedded with sensors to capture the player's movements. As they move, people's silhouettes were projected onto the glass facade and started to interact with the little light creatures.



Figure 11. Aarhus By Light [4].

Brynskov et al. [4] commented that a conscious design effort was made to minimise the display visual resemblance of the glass to a cinema or large TV screen and *integrate* it seamlessly into the

building façade. For that purpose, 180 square meters of semi-transparent LED screen were fitted to the glass forming a non-rectangular surface barely visible from the outside. On the other hand, creating an *eye-catching* and *playful* intervention on the environment was also a major value held by the design team, responding to the concert hall's goal of challenging its otherwise conservative image. To that end, the combination of the coloured carpets delimiting the interaction zones and the large building façade itself created very visible focal points where the shared focus of the audience naturally converged to – those were the spots where the action was actually happening and all people but the few playing were kept as spectators, interacting with and getting amused by the installation by passively watching the players. *Aarhus By Light* can therefore be classified as a performative interactive experience, establishing a partially exclusive playful experience with emphasis on people's egos and their willingness to suspend belief and dynamically create a live narrative by responding to the digital cues presented to them. The experience has little tangibility, since a clear distance is constantly kept between the zone where the players act and the "screen" where they can visualise the consequences of their actions. Coming back to the question of integration of the medium and content, it is clear that the Concert Hall's façade was no traditional display and the efforts to make the LED panels almost transparent had a great positive impact on the aesthetics of the installation. Nevertheless, it was still a surface, lacking additional sculptural features that would add to the meaning of the work, i.e. become part of its content. It was therefore still a "screen" and as soon as people realised so it became a major focal point for the interaction – the audience naturally shifts its gaze to it as the centre of the performance. The seamless integration between medium and the content it displayed, in this instance, seemed to add little to the actual meaning of the work, though undoubtedly enhanced its aesthetic values and, more importantly, its pervasiveness within its surrounding environment.

Table 5. Interaction goals

Parameter	Aarhus by Light	360° Room for All Colours
Type of interaction	Performative	Ubiquitous
Audience expectations	Performance, narrative	Non-interactive
Participation	Partially exclusive, honey-pot	Inclusive, collective participation
Mediation	Ego (emphasis on the self)	Empathy (emphasis on the work and its surroundings)

9.2 360° Room for All Colours

360° Room for All Colours is an installation by Danish-Icelandic artist Olafur Eliasson. It consists in a large circular room whose translucent plastic walls are backlit with fluorescent lamps continuously – but very slowly – changing colours along the RGB spectrum. The interior of the room is completely empty. Although the mechanism is not interactive, that fact is not made entirely clear to the audience and the work manages to sustain engagement due to its mesmerising dynamic pattern of changing lights. Other than the whole environment constantly changing its lighting properties, nothing else happens within the space.

The nature of the installation environment is highly ubiquitous: there are absolute no focal points; all around the space, the sensual experience is exactly the same, despite differences in the actual phase the colour switching mechanism may be at in different sections of the circular wall. The mapping of the interaction is therefore highly ambiguous, with the audience left unsure whether they have any influence on the installation's behaviour. The environment is highly tangible, with many people touching the translucent wall in an attempt to further explore the work. Furthermore, medium and content are strongly integrated: the lighting changing walls *are* the content, nothing else.

The circular configuration of the room, coupled with diffused focal points, make the experience highly inclusive: no single person holds an elevated role in this social gathering, everyone is equally empowered across the space. This, in turn, creates a high sense of empathy between the members of the audience and the environment itself, with visitors often commenting that they see the other people they are sharing the space with as integral part of the artwork's content [16].



Figure 12. 360° Room for All Colours [16].

Tables 5 and 6 summarise the application of the proposed framework to both installations base on the discussions above.

Table 6. Content strategies

Design Parameter	Aarhus by Light	360° Room for All Colours
Type of interaction	Performative	Ubiquitous
Focal point	Stage (the display)	Diffused
Mapping of feedback	1 to 1	Ambiguous
Medium integration	Fairly low: standalone	High: embedded
Tangibility	Extrinsic	Intrinsic
Situatedness	Weak	Weak

10. CONCLUSION

In this paper we analysed the impact of utilising interactive media facades in public artworks as a means for enticing and sustaining collective participation in response to contextual constraints. We deployed and studied two large installations in the public space and interpreted the results using the activity based research

framework. From the analysis of the design approaches adopted to address their very different contexts, we unveiled two separate categories of interactive public artworks eliciting experiences we referred to as *performative* and *ubiquitous interactions*. For each category, we discussed design methods that can be tuned in order to maximise the envisaged collective participation whilst adhering to the given contextual constraints.

Based on the results from the field studies we then proposed a framework whereby performative interactions can be encouraged by: 1) reducing the number of focal points; 2) devising a one-to-one mapping between input from the audience and feedback from the installation; 3) employing standalone media (e.g. clearly visible media displays playing content); 4) minimising the use of highly tangible environments (which could otherwise diffuse the focal points set for the experience), and 5) reducing the need for making the work situated, thus again increasing the importance of the single focal point as sufficient 'beacon' for the content.

Conversely, ubiquitous interactions can be encouraged by: 1) reducing or eliminating obvious focal points; 2) making the feedback from the work more diffused and ambiguous; 3) physically embedding the medium into the work; 4) making strong use of tangible experiences, haptic interfaces and materials inviting to be physically experienced through touch; and 5) aiming for a work which is highly situated, perceived as blending into the surrounding environment while at the same time augmenting it.

We compared the proposed framework with other frameworks available in the literature, notably those presented by Ludvigsen [11] as well as Forlizzi and Battarbee [5]. Finally, we validated the proposed framework by applying it to two well known art installations, *Aarhus by Light* and Olafur Eliasson's *360° Room for All Colours*.

The presented work represents yet another iteration of a broader action research cycle aiming on exploring the nuances of public interaction and the extent different media and spatial configuration can be employed to tailor individual and crowd engagement in the public space. We believe the findings from the studies presented in this paper can significantly assist the future design of customised participatory experiences in the public space with clear strategies for highlighting the interface or making it fade into the background in response to contextual constraints.

11. ACKNOWLEDGMENTS

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Urban Sound Interfaces
- Poetic Approaches to Media Architecture

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ABSTRACT
This paper draws on the theories of Michel de Certeau and Gaston Bachelard to discuss how media architecture, in the form of urban sound interfaces, can help us perceive the complexity of the spaces we inhabit, by exploring the history and the narratives of the places in which we live. In this paper, three sound works are discussed in relation to the iPod, which is considered as a more private way to explore urban environments, and as a way to control the individual perception of urban spaces.

Categories and Subject Descriptors
H.5. Information interfaces and presentation: Miscellaneous.

General Terms
Design, Experimentation, Theory.

Keywords
Urban Sound Interface, Listening, Interaction Design, Urbanity.

1. INTRODUCTION
"Haunted places are the only ones people can live in," Michel de Certeau writes, in *The Practice of Everyday Life*, in the chapter, "Walking in the City" [1, p. 108]. He continues: "this inverts the schema of the *Panopticon*". By "haunted places", de Certeau refers to places where the absent is fragmentarily dispersed in the present, where the past sleeps in the objects and in the place, both physically and symbolically, both in the actual landscape, and in people's memories and experiences of it. Haunted places are containers of knowledge – of spirits who remain silent or have been silenced, but who nonetheless hint at what is known and what may be revealed or invoked. As "local authorities" or "local legends", haunting spirits indicate "what is to be read but also what can be read" [1, p.106].

In this article, I will discuss the possibilities of media architecture for exploring haunted places and associating with local spirits. The intent is to explain how, through media technology – in this paper, solely audio technology – we encounter the spirits that haunt the places in which we live, and ask: How can we, through the use of auditory interfaces, perceive the complexity of the places we inhabit?

In the following discussion, when I speak of spirits and haunted places, I am using the poetic language of De Certeau, not expressing an actual belief in ghosts.

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2. URBAN SOUND INTERFACES
In the following sections, I will present two site-specific works by Mark Bain and Markus Kison, and a sound installation I designed with two colleagues. I will argue that, in different ways, these works deal with haunted spaces, and allow local spirits to emerge. In so doing, they pierce the surface beneath which the voices of local spirits are concealed, enabling us to hear how the history of the spaces, echoes in the present soundscape of the place.

2.1 BUG
In January 2010, a five-story building was completed in Brunnenstrasse 9, in Berlin. The house was built by B&K, Arno Brandlhuber, and was designed to house a gallery and Brandlhuber's own studio. The American artist, Mark Bain, who has worked with sound and architecture for several years, was involved in the construction process. It was his idea to turn the building into a sound installation by installing a seismic sensor system in the building's structural elements. Owing to the sensor system, the building essentially works as a resonator, and the sounds of passing traffic, wind pressure, falling rain, people walking on the stairs, and other interior noises detected by the sensors may be heard from outside the building through a plug, into which people can plug in their headphones (See figure 1.).

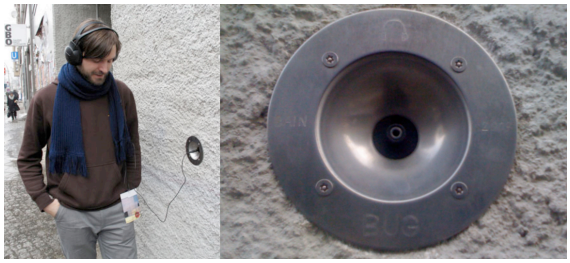


Figure 1. *BUG* by Mark Bain, Brunnenstrasse, Berlin 2010.

As a site-specific installation, *BUG* allows one to listen to the space through the resonances within the building, and to the constantly changing soundscape of Brunnenstrasse. The installation may be enjoyed as an interesting sound experience in its own right, and, as stated by Eva Kekou et al, may be listened to as "larger scale transfers of energy flowing through the city and shaking it's foundation in ways that we cannot perceive without the assistance of specialized tools" [2]. However, as implied by the title of the installation, *BUG* references the history of the divided city of Berlin during the period when Brunnenstrasse was within the zone occupied by the Soviet Union, and, as part of East Berlin, belonged to the former German Democratic Republic (GDR). "Bug" is a slang term for a covert listening device, a combination of a small radio transmitter and a microphone, used for surveillance purposes (e.g. in the context of police

investigations and espionage). As is well known today, the state security service of GDR (STATSI) was not only capable of mobilizing a huge network of informers throughout the country, which it used to monitor its own citizens, seeking out dissidents and other so-called "enemies of the state", it was also notorious for exercising its power by bugging homes. Since the collapse of GDR, the story of STASI has become public knowledge and is expressed in the context of popular culture, as in the movie *Das Leben der Anderen* ("The lives of Others") of 2006, directed by Florian Henckel von Donnersmarck.

2.2 Touched Echo

Touched Echo, by German artist Markus Kison, was a public sound installation at the Brühlsche Terrasse, in the city of Dresden in 2007 (See Fig. 2.).



Figure 2. *Touched Echo* by Markus Kison, Dresden 2007.

The installation presented the sounds of the allied bombing of Dresden on February 13th 1945, using original recordings of bombers flying over the city and exploding bombs. The sounds were hidden as vibrations in the railing running the length of the terrace. The listener had to place his/her elbows on the railing, and rest the wrists on the skull, in order to hear the sound, which then resonated through the bones of the forearm, to the cranium. The posture of the listener resembled that normally taken in order to avoid listening. This is no coincidence, but, as Kison has noted, a feature of the work, since it is a posture one can imagine the victims of the actual bombing taking, in order to shield themselves from the horrifying sounds of the aircraft and the exploding bombs.

Although quite spectacular and affectively engaging in its immediate presentation, *Touched Echo* addresses an ongoing debate regarding whether the allied bombing of Dresden was an act of war or an act of terror, a subject debated not only by historians, but that finds its way into the city's current political debates, most recently in 2010, on the 65th anniversary of the Bombing, when conflicts arose between neo-Nazi demonstrations and counter-demonstrations by local citizens and left-wing activists, a conflict that demonstrated that the city is a haunted place, and that the bombing resonates in the memory of the citizens and history of the city, as an "echo" or a voice from the past that will not die away, but keeps coming back [3].

2.3 EKKOMATEN

Ekkomaten is an interactive sound installation built for an 18th century festival that took place in Aarhus, Denmark, in March 2012. During the festival, *Ekkomaten* was placed in the city's main square (Store Torv) for three consecutive days (See figure 3.).



Figure 3. *Ekkomaten*, Store Torv, March 2012.

By physically turning the machine and pointing it in different directions, the citizens of Aarhus could locate and listen to echoes from the past embedded in an 18th century soundscape, a soundscape that was implemented in a game engine, and through a wireless sensor system connected to the machine. All the various "echoes" people could experience were site-specific stories that related to narratives and anecdotes of historical situations, persons, and events from 18th century Aarhus, and were chosen by consulting various historical sources such as the city archives, and through interviews with historians. Prior to the festival, the various stories were dramatized and (re-)enacted in the style of radio plays. For instance, people operating the machine could hear two woman arguing about which has the right to sit in the prestigious front pew of the church, and a man complaining to his friend about his daughter, who insists on her right to form her own opinions and to drink coffee! Also, a small group of people could be heard laughing at an anonymous, insulting note hanging on the chief constable's door, a note ridiculing the chief constable in coarse language. People could also listen to Mr. Drakenberg, an elderly man and something of a local legend, who, according to church records, died at the age of 145, courting a young woman at the city well, and to a sentence handed down to a man accused of adultery.

3. The PANOPTICON

Returning to the concept of haunted places and the theories of Michel de Certeau, we must acknowledge that to invoke the spirits of a place is to call them back and allow them to be heard, not just as "amusement-park-thrills" or historical information guides, but potentially as messengers of recurring conflicts or unresolved issues. This calls for attention and involvement in what the spirits have to tell us, or in what they remind us of.

As the French philosopher Gaston Bachelard mentions in his reflection on the poetics of space [4], the word "listen" can mean both "to hear" and "to obey". Haunting spirits present the same duality when they return to pay us a visit. Not only do they make themselves heard, they also call for, if not obedience, then at least for attention. We may choose to ignore them, but in the long run, we cannot prevent them from keep coming back. As such, haunted places are difficult, if not impossible, to fully ignore or master. They tend to elude control, and, as Michel de Certeau explains, it is in this sense that haunted places invert the scheme of the panopticon.

The panopticon was a model of a prison designed by Jeremy Bentham in the 18th century, in which all prisoners could be

watched from a single spot, without knowing who, if anyone was actually watching them. Michel Foucault, who has famously discussed the panopticon in his book, *Discipline and Punish*, regards the panopticon as a general disciplinary mechanism based on the idea of permanent visibility [5] (See Figure 4.).



Figure 4. A panoptic prison.

Occupying a privileged position at the center, the panopticon offers a position from which the space of the prison is observable and easily controllable. Inverting the panopticon would mean to lose control (since you no longer retain a position from which the space can be overlooked) and privacy (since you become visible and subject to the gaze and influence of others).

By referencing the panopticon, Michel de Certeau identifies two ways of perceiving a landscape – a particular space. One is through the panopticon; the second is through its inversion. While the first implies a gaze from a distance, the latter implies that you place yourself in the landscape, visible and vulnerable.

4. The ACOUSTIC PANOPTICON

I will discuss the foregoing distinction in relation to what may be the most prominent urban sound interface – the iPod – and the three sound works discussed above. In so doing, I will further elaborate on the idea behind designing *Ekkomaten*, and how the dynamics between the two different approaches of the panopticon and its inversion can inspire media architecture. It should be mentioned that the iPod is used here as an example of personal mobile audio technologies in general, and not because it has features that are unique, when it is compared to similar products.

4.1 The iPod as a panoptic interface

Following the arguments in the book, *Sound Moves – iPod culture and urban experience*, by British sociologist Michael Bull [6], it seems fair to say that iPod culture represents a subjective augmentation and configuration of private listening spaces that, in this context, I regard as a way of silencing the complexity of the space – that is, the cries of haunting spirits. The iPod works as a buffer that allows the listener to control the acoustic environment, and thereby, the way in which the space is perceived and recognized. The iPod users accomplish this by enhancing the space with music, in accordance with their mood, their dreams, their objectives, and so forth. They manage to establish a personalized sound world that is intimate and known, and which, through enhancement or simplification, becomes aestheticized.

When applying the concepts of Michel de Certeau, it is tempting to criticize the iPod as a way of positioning oneself in the panopticon, the privileged position from which the space is observable and controllable. Tangentially, one could ask whether the iPod user is actually the one in control, or an imprisoned, disciplined, citizen consumer of the iPod, iPhone, iMac, I-My-Self culture of modern society, but that is another discussion.

Even more critically, one could reference the German philosopher Hannah Arendt, and argue that the iPod is emblematic of the "Homo-Fabian use" of technology in the Western world. Homo Faber is often accused of creating his subjectivity or his individuality from his ability to control and master, without learning from history or nature. In *The Human Condition* [7], Hannah Arendt argues that Homo Faber is actually losing his/her individuality, as he/she fails to realize that it is among people, that is, in the social sphere, that individuality is actually created. Only by acting socially can you become a subject, so to speak. For the purposes of this paper, the point may be made that to live in a haunted place and to accept its complexity is to act socially, and to act socially you first must listen.

From a less critical position, we could argue that although the user of the iPod creates a private listening space, and uses the iPod to control the environment, it is just the latest link in a long chain of technologies that have helped us to establish disciplined spaces that are controllable and pleasant, for example the garden and the car. The use of iPods helps us to cope with the everyday, and perhaps even experience and approach the city in a more poetic and narrated way, or even serve as a strategy to oppose the already designed soundscape of the city, a soundscape that is surely haunted by stakeholders of all kinds; authorities, business, community groups, and so on. In short, the iPod becomes a way of inhabiting urban spaces and a response to the way in which other stakeholders create acoustic territories; for instance, the use of music in stores (Muzak), or the use of classical music (!) in front of public buildings to keep unwanted people like drug abusers and alcoholics away.

Whether the iPod is assessed from a critical or a less critical position, it seems to help to cope with the complexity of spaces by distancing the listener from what is already present by either withdrawing the listener from the city soundscape, or by tuning the experience of the city in accordance with a sound track of the listener's own choice. iPod-listeners choose from a play list, to create their own soundtrack to accompany their visual perception of their surroundings. Thus, listeners achieve a feeling of control, since they are able to manipulate their perception of the city in accordance with their own preferences.

4.2 Inverting the panopticon

Touched Echo, *BUG*, and *Ekkomaten* are interfaces that do not pretend to present a position from which the city may be mastered. As "inverted panopticons", they reveal layers of the city that are not immediately visible or otherwise accessible. There are no mechanisms for obtaining control or for effectively exploring and overviewing the space. Instead, they are interfaces that offer a means of acknowledging the complexity of the spaces in which they are situated, and platforms from which one may affectively engage with the space.

One idea behind *Ekkomaten* was to provide listeners with historical information about the space, by hinting at historical persons, situations, and events that took place around Store Torv in the 18th century. Nevertheless, beyond the immediate narrative of the stories, there were deeper layers of complexity for the listener to hear and reflect on, a complexity that concerns issues such as the social structure of society, social privileges, and the influence of the church. For instance, the "echo" revealing a group of citizens amusing themselves by reading an anonymous,

insulting note concerning the chief constable reveals the censorship of social criticism during the period of absolutism, and how censoring information leads to alternate forms of expression (the anonymous, insulting note), by which social criticism may be articulated. Similarly, the "echo" of the two woman arguing about the right to sit at the front of the church hints at deeper levels of the importance of the social hierarchy at that time, and the rights that were assigned to certain social classes. Also, the "echo" of the man complaining about the independence of his daughter not only reveals the recurring conflict between generations, but also indicates women's dawning self-awareness.

Returning to *BUG* and *Touched Echo*, we can observe how, in addition to addressing the recent histories of Berlin and Dresden, respectively, the two works reflect on the essential concept of listening, both as a social praxis and a strategy of power.

In *BUG*, the relation between listening and obeying in the former GDR is present in the way in which passers-by can monitor their immediate surroundings by plugging their headphones into the building. Since they can only do so from the front of the building, they immediately become visible to others, and are therefore situated somewhere between the panopticon and its inversion, as both watcher and watched. From this position, they can affectively experience what it must have felt like to be monitored, and feel the uneasiness of both being *on watch* and *watched over*. In *Das Leben der Anderen*, the protagonist is faced with the dilemma of listening and obeying, which finally forces him to react to the abuse of power brought to bear by his superiors. He no longer feels obliged to obey, and, listening to his own conscience, instead chooses to protect the very people he has been set to monitor. The complexity of listening versus making noise, of self-discipline as obedience versus listening to one's own conscience, which is thematized in *Das Leben der Anderen*, is also exhibited in *BUG*, indicating the complexity of the life that (previously) unfolded in East Berlin.

Touched Echo very directly deals with Dresden as a haunted place, forcing us to affectively perceive the horrors of the past in a position that looks like we are trying to shield ourselves from the noise. At the same time, the work forces us to question what we are actually listening to, since there are no sounds in the air. What we hear is in our head, a blend of resonances, memories, and imagination. Thus, *Touched Echo* confronts us with the ghostly nature of sound. What we hear is surely the presence of an absence [8], and therefore not necessarily to be trusted.

Regarded as media architecture, the works discussed are platforms for reflection and perceptions of the places in which we live. However, none of the works are large-scale or spectacular, as the emblematic media facades often used to depict the field of media architecture are. Instead, they qualify as miniatures, in the sense that Gaston Bachelard explains the concept in his book, *The Poetics of Space*, of 1958 [4]. According to Bachelard, a miniature is an opening into the world beyond perception, through the poetic imagination. It could be explained as a condensation of a cosmos wherein the unspeakable is spoken, silence is heard, and the invisible is visualized. I believe that, instead of working by distracting, or by posing as magic lanterns [9], the three works, considered as miniatures, offer a poetic sensibility that leads us from the empirical (the image, the light, the sound/music) into a larger world of imagination dealing with urban space and the way its past and present are interwoven and mediated.

5. CONCLUSION

This paper is premised on Michel de Certeau's statement that haunted places are the only ones in which people can live. The statement sounds paradoxical, since from an immediate point of view, one might think that haunted places must be exorcised, in order for people to live in them. However, as Jacques Derrida has argued in his historical and political analysis of Marxism [10], exorcising the specters of communism (always a historical ambition of the "powers of old Europe", and lately of the neo-liberalist movement of early 1990s) involves a totalitarian approach. In the context of this paper, it might very well seem that Michel de Certeau makes a more generalized version of this argument: To exorcise the spirits of haunted places is to be totalitarian, and people cannot live under the yoke of totalitarianism. Consequently, accepting that exorcism is not a satisfactory strategy, we have to find ways of living alongside the spirits of the haunted places in which we live, which would invert the scheme of the panopticon. In so doing, we should nevertheless remember that listening to the spirits of haunted places should not be confused with the obligation to obey them. Instead, we should find ways of discoursing on the complexity of the spaces we inhabit, and reflect on the dynamics between the panopticon and its inversion; what I hope to show is that media architecture with a poetic sensibility has a potential to do so.

6. Acknowledgment

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The Political Sensorium

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ABSTRACT
In this position paper we outline some of the key themes and background research which may help form a better understanding of the relationship between technology and political activity. The paper is written in an attempt to articulate a better understanding of the relationship between political processes, urban environments and situated technologies. The paper is written from a UK perspective, although the ideas have a broader relevance for relatively developed western democracies. To this end we analyse the political and digital divides which are present in western society focusing on local politics in Newcastle upon Tyne in the UK as a case study. Following a brief description of the problem domain we briefly give an outline of an ongoing project Viewpoint which has created a mobile voting system which we are currently deploying in various locations in Newcastle Upon Tyne.

Categories and Subject Descriptors
H.5.0 [**Information Interfaces and Presentation (e.g., HCI)**]: General

General Terms
Design.

Keywords
Politics, political engagement, architectural design, ubiquitous computing, situated displays.

1. INTRODUCTION
Democracy, as espoused by most Western countries is adapted, more or less, from the model of popular government invented in Athens c.500BC. The Athenian model creates a network of power and communication enacted through the body politic where political representatives have direct relationships to the people they serve and where the political system is performed both on the streets of the city and in designated forums for debate, speeches and decision making. This model has, however, been scaled up for heavily populated and spatially dispersed territories. The notion of true representation has, it could be argued, been lost as elected members are responsible for larger numbers and a greater diversity of people and opinions, leading to a problem of citizen distrust in the political system which manifests itself in poor and falling voter turnout in both local and national elections. We propose that a key the problems of western democracies resides in two divides:

The political divide

We know that local council elections rarely attract more than 40% of the electorate [1] and statistics for Newcastle City Council, for example, for the 2008 council elections show turnout in some boroughs of less that 26% [2]. This backs up a survey commissioned by the Electoral Commission in 2004 which showed that only 42% of people in the UK, of voting age, knew the name of their MP (compared to 52% for an equivalent poll conducted in 1992) and whilst 78% of those asked said they were interested in political issues during local elections only 51% expressed the intension of voting in the next general election [3].

The technology divide

In contrast to the decline of political participation, there has been an emergence of technologies which offer an unprecedented access to political information from a rage of online sources. E-democracy offers the promise of a new type of civic engagement from online petitions through to web based surveys, forums and 'right to reply' web sites. While heralded as generating a new type of digital democracy, these technologies are noted for their limited impact on political engagement, particularly in local politics [4] and it has been suggested that there is a relationship between the growing political divide and the effects of the technological divide [5].

2. INTRODUCTION BRIDGING THE TECHNOLOGY AND POLITICAL DIVIDES
We propose the creation of a 'Political Sensorium' to help repair the disconnections between the population and their elected representatives and to provide a bridge between the virtual and physical spaces of political discourse. We need to develop technologies and interfaces which support local political discourse and the inclusion of members of society who are otherwise excluded from aspects of the democratic process. The causal relationship between the technology and political divides is complex and multifaceted, however, our methodology follows a rationale that a primary cause of political disengagement is a perceived gap between Local Councils' day to day decision making processes and the places in which those decisions take

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effect. This gap leads to the perception of inefficiency and unaccountability in the way in which resources are allocated [6].

3. KEY CHALLENGES

Having isolated the challenge we have identified three key issues need to be tackled through the design, development and implementation of novel technologies and platforms:

- The socioeconomic groups who are least likely to engage in politics are also those that have least connection to the WWW or the skills or interest necessary to access online services offering political discourse. This leads to a 'digital divide' which further strengthens the effect of the political divide [7].
- Web based technologies are often placeless, designed to be "anytime and anywhere", and do not reflect the local condition of much political discourse and the importance of physical and informal meeting places and situations. This contrasts with studies which show that a key factor in political engagement is perceived as 'institutional proximity' [8], in other words, how close does the decision making process appear to be from the place in which the decisions have an impact.
- The mass media and many web based forums tend to favour non-deliberative types of discourse (activism and campaigning). This means that particularly contentious issues often get significant media coverage and those with a skill for activism and media engagement get the loudest voice [9]. Support for deliberative discourse is therefore a pressing issue particularly in the context of local decision and policy making [10].

4. SKETCH FOR A DESIGN PROPOSAL

Imagining that we use local council politics in the city of Newcastle upon Tyne as a test-bed for the design, implementation, deployment of technologies to support participatory budgeting we can sketch a design for the sorts of technologies and interfaces which might be applicable. Figure 1. shows a sketch scenario which explores user interactions with devices called PoliBoxes would act as ambient interactive displays presenting lo-fi information pertinent to local political issues and will be used to 'take the pulse' of the local community by feeding responses back to elected members.

The vision is for each PoliBox to become akin to a nerve ending for the body politic, allowing for constant and reflexive feedback of lo-fi political data and reaction. They would act to make political discourse a pervasive but ambient feature of various different public spaces. To this end we aim to increase community awareness of political decisions and directions through novel information graphics using aggregated data from the council and to provide mechanisms for eliciting quick responses and feedback.

The aim would be to infuse public spaces with political discourse and, in the first instance, to increase community awareness and engagement on simple issues such as whom their elected members are and the decisions they take on issues related to budget allocations. The success of such implementations could be measured in terms of 'dimensions of awareness', measuring community knowledge, community members' propensity to vote both before and after the PoliBox deployment and by measuring both the nature and amount of community engagement with the PoliBoxes themselves. To this end we propose that such an implementation would have a broader research value in tackling the problems laid out in the introduction, namely:

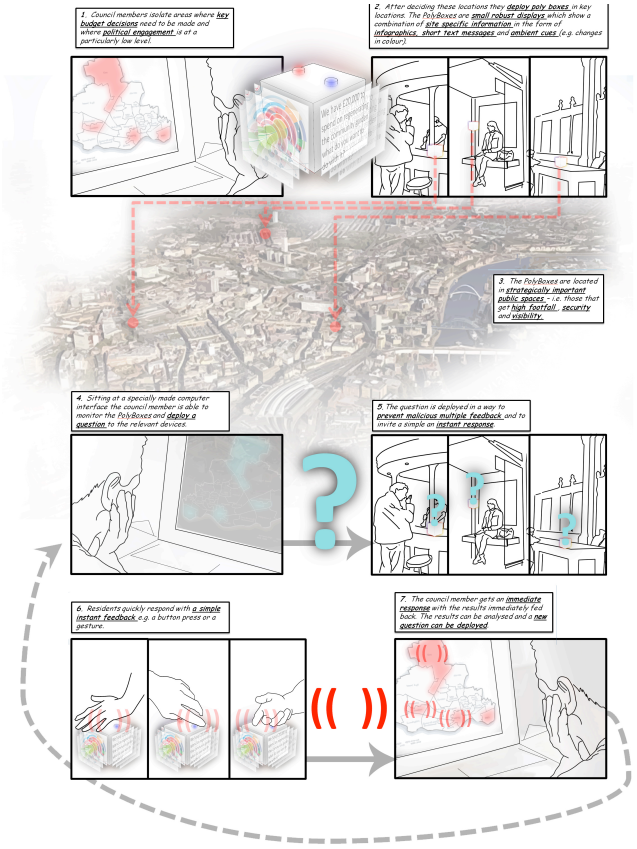


Figure 1. Interaction design scenario for the proposed PoliBoxes

- *Interaction design and the technology divide*

To help develop a new generation of situated computation devices which do not need, even basic, technological knowledge to operate but are capable of presenting political information in clear and accessible ways and allowing for simple and direct interaction methods. Furthermore, a measure of the success of the devices would be whether they are cheap, secure and robust.

- *Information architecture and institutional proximity*

By taking an architecture led approach to the proposed problem we are able to gain a sophisticated understanding of the relationship between space and place and the situated nature of social and institutional interactions. In practice this involves both a design sensibility and formal methods of analysis such as space syntax which map and analyze social and spatial conditions. As Greenfield and Sheppard state "*On one level you could say that architecture is one of the oldest situated technologies*" [12] and in the context of this proposal architecture is used as a synthesizing discipline to integrate work from Interaction Design and HCI. We aim to make contributions to emerging fields which study 'networked mobilities' [13] and the design of urban computation.

- *Technologies to support situated deliberative debate*

By drawing on literature from political science on the nature of deliberative debate and the problems of mediated communication we could also aim to support a new field of enquiry on situated technologies for the support of deliberative public discourse. To do this, the implementation would focus on using the PoliBoxes to

generate discourse on issues of local and proximate (to the PoliBoxes themselves) importance but where the topics do not attract activism and where the device itself can be used to generate a feedback loop of questions and responses (deliberative discourse).

In terms of developing novel technologies, this project would also have broad intellectual agenda in the context of a growing interest in the application of ubiquitous technologies to social and environmental challenges at an urban scale [14,15]

5. EXAMPLE DEPLOYMENT: VIEWPOINT

We have started to explore some of the issues raised in this paper through two the design deployment of two mobile coting systems under the title of Viewpoint [16] device emerged as a response to feelings of disenfranchisement encountered when working with a community in Preston, England. While attempting to engage the community in designing technologies, researchers on the EPSRC funded Bespoke project found residents were often unwilling to express their opinions and highly sceptical of the likelihood that participation would result in any tangible benefits. This is a common issue facing contemporary civic engagement: the relatively high effort required discourages participation, reinforced by a perceived lack of results.

To address this, Viewpoint was designed firstly to offer a new, lightweight method of participation, and secondly to attempt to make the outcome of the participation more visible, with the intention of encouraging further engagement. Distinctive devices were installed in three public locations around the community, where local organisations could post weekly binary choice questions. Members of the public were able to place a vote using two large buttons on the front of the device. Once the poll had closed, a response had to be posted, which would then also be visible on the Viewpoint device.

Over a two month trial, nearly 1,800 votes were placed by residents on eight different questions. Organisations who posted questions were "overwhelmed" by the number of responses, although the format of the device did present some problems. Viewpoint explored one extreme of a design space that balances quality and fidelity of data collected. While traditional consultation methods, such as focus groups or town hall meetings, can gather high fidelity data from a low quantity of participants, Viewpoint was able to capture data from a high quantity of participants, but at low fidelity. Specifically, the requirement for questions to have binary choices limited the topics that they could ask about, while the inability to follow up on answers from residents and explore their motivations limited the usefulness of the data.

Both iterations of a second generation Viewpoint device has been developed to maintain the simplicity of the original design while also allowing more flexibility. Rather than a binary choice, questions could have up to five possible responses, or allow answers to be entered on a sliding scale to indicate strength of feeling. The desired option was selected using a rotating wheel, with a button at the centre to place the vote. These devices were also smaller and lighter, allowing them to be more mobile.

Three of these second generation devices will be deployed in a residential area of Newcastle, where environmental campaigners are collecting data about modes of transport in order to lobby for pedestrianisation for small shopping street. A fourth device is planned for installation in the city's central library, where it will be used to gather feedback on the library's services. A final device is being installed in another residential area, where it is being moved around different community venues. In this final case, future questions will be sourced directly from members of the public. In several of these use cases, we see Viewpoint moving away from consultation towards activism, allowing members of the public to collect data to support their arguments and present their views to the authorities.

6. CONCLUSION

The study of Political engagement in the context of new technologies is an emerging field but, through this sketch design of a technology deployment we have attempted to illustrate the sort or project which might reframe our understanding of public space and institutional place. Such a project has the potential to make contributions to HCI and Interaction Design and broader application the evolution of democracy in the digital age. While we are informed by theory across a range of disciplines, from architecture and political science to HCI, a project of this nature cannot be conducted within the closed environments of the lab and will only make sense when deployed in locations which are politically, economically and socially challenged and challenging. The viewpoint devices offer a compelling stating point for this research and insight into an important topic for pervasive computing and architecture.

7. ACKNOWLEDGMENTS

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Media architecture – participation through the senses

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ABSTRACT
Pervasive media and interactive technologies have become inseparable not only from our everyday life but also from architecture and city spaces. However, the generic use of new technologies in the design process and material production that affects contemporary architecture, results in buildings that become mere visual objects losing their hapticity and non-visual qualities. Despite the substantial advancement in the research studies on human sensorial perception, the potential of cities to affect and co-create our sensuous experiences has diminished dramatically. The paper examines recent artistic practices that involve new media technologies focusing on their potential to create interactive environments that due to their multi-sensory qualities induce people to participate through their senses. The steadily growing interest in exploration of the role of media and interactive technologies in generating sensorial experiences establishes an important direction toward new kinds of their applications in architecture and city spaces. This work emphasizes the power of media and interactive technologies as important tools that incorporated in architecture demonstrate the ability to enrich the sensory perception of the cities.

Categories and Subject Descriptors
J.5 [**Arts and Humanities**]: *Architecture.*

General Terms
Performance, Design, Experimentation, Human Factors, Theory.

Keywords
Perception, senses, interactive, participation, media.

1. INTRODUCTION
The constant evolution and spread of new technologies that have become ubiquitous in our everyday lives, has influenced our work and life habits, as well as the modes of space use and structures of buildings and cities. The steady interdisciplinary interest in technologies and media in architecture has been followed, on the other hand, with exploration of their impact on human responses, space perception and social interactions. At the same time, the research on the significance of multi-sensory perception of space in architecture is being developed.

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Many scientists, architects and researchers underline the importance of maintaining the sensorial qualities of architecture and city environments. Juhani Pallasmaa, one of the most notable researchers in this field, states that significant architecture and, in fact, all meaningful art "directs our consciousness back to the world and towards our own sense of self and being" and lets us "experience ourselves as complete embodied and spiritual beings". Clearly embedded in phenomenological concepts of Maurice Merleau-Ponty, Pallasmaa highlights the role of the embodied perception in architecture, calling it "the art of reconciliation between ourselves and the world". This mediation, according to Pallasmaa, takes place through the senses [17].

Paradoxically, together with gaining knowledge about human senses, sensorial systems of perception and their crucial role in our lives, scientists and researchers notice deteriorating conditions of sensorial city landscapes. It was decades ago when Edward T. Hall, taking the anthropological perspective, as one of the first, wrote that American city dwellers were devoid of opportunities to actively experience both their bodies and spaces around them. In Hall's opinion city spaces are of poor visual diversity, giving no possibility to enrich the spatial sensations [8]. Nowadays, as Charles Landry claims "our perceptive capacities are shrinking because we do not sufficiently recognize or practice most of the senses. By diminishing our sensory landscape, we approach the world and its opportunities within a narrow perspective" [11]. Landry notices that paying more attention to the sensual aspects of the city spaces has a great potential to influence inhabitants' opinions and contribute to numerous real changes in the surrounding urban environment. It gradually appears that the exploration of the potential of sensual qualities of urban spaces may significantly affect the future development of the cities. In this context, it is particularly important to recognize the possible paths of development of media architecture and its power to enrich the quality of urban spaces. Is it possible that new technologies will play an important role in re-constructing sensual city landscapes and creating multi-sensory urban experiences? Based on the research concepts and examining recent artistic practices supported by new technologies one can remark their substantial role in re-creating sensorial qualities of contemporary cities.

2. VISUAL DOMINANCE IN CONTEMPORARY ARCHITECTURE AND CITIES
Contemporary cities owe their shape and condition mainly to the industrial and technological progress, which played the main role in changing urban areas to their current form and actually still has a great impact on their physical and social structures. New technologies and media products influence our perception and the qualities of the space itself. Noticeably, the visual dominance in contemporary architecture and cities seems to be prevailing. "The

current industrial mass production of visual imagery tends to alienate vision from emotional involvement and identification, and to turn imagery into a mesmerising flow without focus or participation" [17]. Due to the dominance of sight, isolated from the other sensorial domains and the integrating existential sense, architecture is threatened to lose its material existence, its hapticity and tactile intimacy. Pallasmaa observes that very often the technological development is to blame. He warns that uncritical use of digital technologies leads to extension of the visual domination, which causes the sense of distance, alienation and unreality [18]. This kind of criticism is not unique. What is interesting, Christian Moeller, an acknowledged artist experimenting with media technologies, shares a similar opinion: "The electronic city is a flood of potentially decodable signs. […] As modern display and projection techniques develop, the architectural dimension of moving images will continue to overtake the urban landscape. While this poses incredible artistic opportunities, it is also certain to bring a ridiculous and tragic media sprawl" [15].

Even though the technological development seems to have brought destructive changes considering the sensorial landscape, it equally opened new ways toward its regeneration. Remarkably, it was McLuhan who quite prophetically suggested that "by imposing unvisualisable relationships that are the results of instant speed, electric technology dethrones the visual sense and restores us to the dominion of synesthesia, and the close interinvolvement of the other senses" [13]. Analyzing the impact of technology on the aural experiences Barry Blesser and Linda-Ruth Salter emphasize today that technology influences sensory perception, spatial cognition, and social dynamics. They believe that "the industrial revolution was also a sensory awareness revolution" [2]. In their monograph on experiencing aural architecture they quote Neil Postman, who arguments that "technologies created ways in which people perceive reality, and that such ways are the key to understanding diverse forums of social and mental life" [2].

Consequently, a growing number of media artists, architects and designers use the potential of technologies to create sensual experiences or try to focus the observers' attention on the non-visual aspects of their works. They construct their own approaches toward discovering urban spaces by means of technology and human senses. "Even the most 'technical' of my projects is not about technology itself, but about people, their ability to manipulate and to be manipulated by its environment", says Christian Moeller. "Today and always, the spaces we inhabit are designable as sensation, as technology, as cognition. To explore the beauty of this condition is the first and last problem of media architecture" [15].

3. MEDIA SPACES AND SENSORIAL LANDSCAPES

Vilèm Flusser, an important media theorist of recent years, claims that "what we perceive as reality is a tiny detail from the field of possibilities surging around us, which our nervous system has realized through computation. If all reality is a computation from possibilities, then 'reality' is a 'threshold' value". Adam Somlai-Fischer, media teacher, theorist and researcher, finds it important to focus the architects' attention on this matter, particularly on the fact that "electronic media saturate our cultural environment, influencing our perceived reality" [4]. Media theorists and designers have distinguished new realities that emerged together with the pervasive technologies and "ubiquitous computing" [6]. To wit, a range of terms has been created, starting from "intelligent environments" [6], through "relational architecture" by Lozano-Hemmer, ending with "augmented space" – term invented by Lev Manovich [12]. Moreover, Daan Roosegaarde in the publication of his works defined them as 'interactive landscapes' [20], while Lucy Bullivant extracts 'responsive environments', by selecting installations which "impact is phenomenological, meaning that the body is able to directly experience its environment in a very direct and personal way" [4]. Finally, Usman Haque makes a distinction between the meaning of reactive and interactive environments.

Consequently, technology becomes an important means of both constructing and revealing the reality of the contemporary city. Research concepts and recent artistic practices disclose the substantial potential of media architecture and interactive spaces to extend human perception. Architects, artists and media designers, cooperating within various interdisciplinary groups, create installations, spaces, landscapes, that through their sensual properties contribute to the urban environment. It is achieved not only directly, through the introduction of the new sensorial stimuli as sounds or innovative genres of light, but also by the noticeable strive toward unveiling the hidden, but nevertheless existing layers of reality. For instance, the ambition of the artistic research group Sense*able* City Laboratory established by Carlo Ratti is to map invisible flows and networks, such as distribution of cell phone calls in selected cities. As a result of these investigations a dynamic digital field is identified, that transformed into graphically represented network, constitutes a starting point for artistic and architectural concepts for the particular installations [19]. These kinds of experiments gain additional importance in the context of the scientifically confirmed extensions to the list of five senses, identified by Aristotle, that includes nowadays, depending on the sources, between nine and twenty one human senses like for instance sense of balance or electroperception [11].

What is more, studies on users' active responses triggered by technologically based media and interactive installations reveal their significant role in the enhancement of the urban sensorial dimension. Frequently, artists and architects not only 'seduce' a passive observer to become an active participant by involving attention, body and senses, but also introduce new elements which contribute to sensorial city landscapes. Designing the choreography of movement through space, the constellations of unpredictable encounters, they expose visitors to experiments challenging their sense of balance, closeness, distance or relations. It allows users to discover different types of their sensory intelligence including visual-spatial, body-kinesthetic, interpersonal, intrapersonal, using the terms developed by Howard Gardner [7]. By filling the once neutral space with memories, reflections and emotions they transform the sterile urban areas into personal and social urban landscapes, which could constitute a remarkable step toward more complex strategies of urban regeneration.

Consequently, media and interactive installations are recognized as an efficient tool for provoking social interactions and their potential to transform existing configurations of public spaces is gradually recognized. Analyzing the 'media city' Scott McQuire poses the question about the capabilities of pervasive media to change the dynamics of public space, and suggests that "the experimental practices of contemporary media art can offer a useful test-bed for exploring the critical potential of relational space – the demand to actively construct social relations to others across heterogenous spatio-temporal regimes – by promoting new forms of public agency". McQuire claims that "public sociability is not natural; it needs to be learned, nurtured and practiced. […] In an era in which public space is dominated by spectacular

'brandscapes' and pacified by the distributed technology of surveillance, new forms of public interaction facilitating qualities such as collective participation and unpredictable collaboration hold increasing social importance. In this context, the role of artists using new media to construct experimental interfaces in public space can assume strategic value" [14].

The explorations suggested by McQuire are in fact, the focus of many artists, architects and designers involved in different genres of experimentations. Most of them, however, clearly unveil their intentions to create objects, landscapes and installations, conceived as imaginative interfaces between the sensorial city spaces and the user.

4. ARTISTIC EXPLORATIONS OF SENSUAL EXPERIENCES

Even though there is a number of meaningful examples of media architecture, the strongest interest is still concentrated on artistic interventions. Artistic explorations in interactivity offer a wider array of choices regarding formal solutions or the degree of public exposure, compared to the constraints associated with architectural construction. Due to their temporal character, less liability and often – nonstandard locations, the artistic explorations involve a broader group of people, offering almost unlimited range of playfulness from the application standpoint. Moreover, artistic explorations allow for "looseness in user experience, whereby users may be involved who would not ordinarily participate in an architectural setting", claim Michael Fox and Miles Kemp in their monograph on 'Interactive Architecture'. They argue that "developing interaction design on the fringes of the context of architecture also provides designers a platform with which to focus on specifics, and thoroughly isolate and test ideas. Artistic explorations open up the door to take a look at human emotion and human impulse" [6].

We can observe bold and imaginary, even sometimes willfully unrealistic attempts to investigate invisible aspects of our environment and human perception. Such projects are usually temporarily exhibited and experienced in Media Lab spaces, museums, and public spaces, very often during special media and architecture festivals, exhibitions, biennales and other events. Sometimes the successful project is being transformed and explored again for a longer period of time in the real city spaces, like in the case of one of the Daan Roosegaarde's most famous installation – Dune [20]. This public interactive landscape responds to sounds and movement of the people passing by. Filled with interactive lights and sounds 'Dune investigates nature in a futuristic relation with urban space'. Roosegaarde claims that his work is "stimulating connections and making people aware of them", if you interact with Dune "you become aware of your own body, of your relationship to other people, and to your relationship to architecture" [21].

A number of media installations concentrate on kinaesthetic perception, inviting users to co-create the experience with the movement of their bodies. Sometimes achieving that 'goal' involves more than one person, encouraging cooperation between people and fostering interactions, like it was in Body Movies project by Rafael Lozano-Hemmer [1]. To create expected shapes of shadows people had to intentionally involve their bodies and at times were induced to collaborate with other participants.

Sometimes installations engage more senses, responding to people's movement or touch with light, colour or sound. This is the case of White Noise White Light and LoRezHiFi by Höweler + Yoon Architecture as well as Audio Grove by Christian Moeller. Ben Rubin's Soundplay is a sound installation which translated a contraction of a single tight muscle and the slightest movement of any part of the body, into sound [4]. Flow by Roosegaarde, an installation in a form of a wall constructed out of hundreds of ventilators, responds with an artificial wind [20].

Beside numerous scientific inquires into the possibilities and effects of the temporal experimental artistic explorations, there are many sophisticated studies on human perception and technologically produced stimuli influencing the senses. Usman Haque shows "how the perceptions of space and objects in space are intricately affected by things we are not immediately conscious of" [4]. Bullivant describes that "Haque's projects investigate the phenomenological potential of architecture based on systems that combine hard space, such as walls, floors and ceilings, and soft space – arising from the sensuous, non-tangible elements present, such as sounds, smells, heat, colours and electromagnetic waves" [4]. In his project Haunt the artist uses humidity, temperatures, air movement and particular electromagnetic and sonic frequencies, which are associated by parapsychologists with haunted spaces, in order to create the feeling of being 'haunted'. In his other installation Scents of Space an interactive smell system opens new ways towards experiencing an olfactory environment [9].

Similarly to Haque, architects Décosterd + Rahm explore the mutable impact of environments on human metabolism, sensory states and perception. They design prototypes and demonstration spaces, very often examining modification of light, air and water control. "By bringing the physiological distortion and expression through biotechnological means, affecting temperature, humidity and light, they provoke reactions and confrontations of the body" [4]. They created such projects as Hydracafé, Melatonin Room, and Hormonorium, which influence the hormones, by, for example, producing the sensation of high attitude which causes melatonin production to drop. These installations enlarge the scope of various sensory information or consciously reveal the lack of it. As it becomes clear, the range of possibilities to influence human sensations and behaviors, due to technological development and progressing research in this field, is impressively increasing.

There are many other advanced research studies and practices exploring the influence of environmental factors and impulses, non-visible but existing; on human perception and behaviors it induces. The participation of the people involved is either relies on the process of their movement, the act of touching, hearing or is influencing their senses on the subconscious level, creating multi-sensory experiences in both cases.

While the potential of media and interactive technologies to enrich the perceptual landscape of the city is visible, there are still many issues to be searched and discussed. Lucy Bullivant stresses that "[e]volving effective responsive systems, and creating a credible interface between the work and the user, requires an awareness of many different types of user, contexts and function, as well as the phenomenological aspects of social and environmental conditions" [4]. Another question worth exploring is the mutual interconnection between artistic projects and strategies of urban regeneration, where both focus on achieving the high quality of urban landscapes.

5. CONCLUSION

There are only few architects whose buildings are filled with non-visual atmospheres and sensual values. Hitherto architecture has always been and continues to be regarded as "an art form for the

eye" [17]. Similarly, contemporary cities are evolving media cities, albeit suffering from poor and vanishing sensorial qualities. The visual domination, new technologies and industrial development change the architecture, the city, and consequently eliminate haptic, tactile, olfactory and sound elements from its environments.

After many years of abandoning the subject of sensorial design, it gradually reappears. An important role in regaining the haptic quality of architectural and urban spaces is undertaken by media technologies. They become our new means of re-appreciating the ambiance of urban landscapes, their lights and sounds, their power to gather people, to let them see themselves and become aware of different relations. As research studies reveal, the role of media technologies in enhancing the sensorial quality of the contemporary city is growing. Pallasmaa describes the importance of the echo of our steps on a paved street [17], which is almost an extinct and difficult to experience sound in the city. Even though so often we cannot hear our steps, with the new technologies we can see it, as in the case of LED-s Urban Carpet, which enlightens the panels of the interactive carpet that were stepped on [5]. Interactive technologies seem to overtake the place of many other factors creating the sensual effects in architecture.

Participating in interactions fostered by technology-based urban installations and landscapes, we are not only immersed in the reality of the experience, but also more conscious of our senses, and of our existence, and of the characteristics of the place. Nadin Heinich and Franziska Eidner in their research on 'Sensing Space' share the opinion expressed by realities:united that new media architecture "bound up with existing realities, must penetrate through them and thus make possible new, more intensive perceptions and forms of expression for the built environment. This is the true, revolutionary potential of media architecture – it needs only to become conscious of this potential" [10].

Media and technologies have a tendency to fascinate people with sometimes unreal and almost magical impressions. On the other hand, they seem to constitute a coherent component of the new kind of natural-technological urban landscape – active environment that is personal, unpredictable, changing with flows and seasons [16]. In this context media and interactive installations "could be perceived as a kind of second nature, interventions that make their entire environmental setting supernatural, like 'Alice in Technoland', to use Roosegaarde's phrase describing the effect of his installation" [3].

While artistic explorations keep interest in sensual aspects of human behaviour and confirm the potential of new media structures to create sensorial environments, many questions remain. What directions will the future development follow? Will media structures and interactive participatory installations evolve to the city scale and influence the real multisensorial urban landscape? Is the participation through the senses a solution for the unreality of the contemporary architecture, is it the future of media architecture? As it was stated in the introduction to the book of 'Interactive Architecture' by Michael Fox and Miles Kemp, "[a]dvancement will only be accomplished when interactive architectural systems are addressed not primarily or singularly, but as an integral component of a larger vision that takes advantage of today's pervasive, constantly unfolding, and far-reaching technology. It is up to architects, designers, and users to understand the foundations of the subject matter in order to extrapolate a vision of architecture to come" [6]. Is it going to be a vision filled with interactive devices creating sensorial experiences? How will they blur with natural elements like water or stone? We are about to discover in the not too distant future.

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Using Public Displays to Stimulate Passive Engagement, Active Engagement, and Discovery in Public Spaces

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ABSTRACT

In their influential book "Public space" Carr et al. describe essential human needs that public spaces fulfill: (1) passive engagement with the environment, where we observe what others are doing; (2) active engagement through intellectual challenges posed by the space, or through engagement with the people in it; and (3) excitement of novel discoveries within the space. An often underused resource in public spaces – public displays – can be used to stimulate these needs. In this paper we argue for a new research direction that explores how public displays can stimulate such essential needs in public spaces. We describe and conceptualize related processes that occur around public displays, based on in-depth observations of people interacting with a publicly fielded display application in a city center. Our conceptualization is meant to lay the foundations for designing engaging public display systems that stimulate PACD, and for supporting the analysis of existing deployments.

Categories and Subject Descriptors

H.4.3. Communications Applications; H.5.2. [User Interfaces]: User-centered design; H.5.3. [Group and Organization Interfaces]: Theory and Models;

General Terms

Design.

Keywords

Public space, public displays, community interaction, identity cognition, urban computing, urban informatics.

1. 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. Carr *et al.* [3] describe five core human needs that influence the appeal a certain public space has on us. As human beings we seek 1) *comfort*, 2) *relaxation*, 3) *passive engagement*, 4) *active engagement*, and 5) *discovery* in public space. 'Comfort' relates to our requirement for food, drink, shelter, or a place to rest. 'Relaxation' reflects our need to put our body and mind at ease, e.g., by sitting on a park bench. The two, comfort and relaxation, usually refer to physical properties of the setting, e.g., the number of food sources in the park or the quality of benches. 'Passive engagement' is similar to relaxation, yet while relaxation can be seen as drifting away and disengaging from the environment, passive engagement relaxes people by letting them observe what other people do. 'Active engagement' on the other hand represents our need for encountering intellectual and/or physical challenges in a space. An example could be conversations with both friends and strangers that are triggered by unusual features or events in a space – an effect known as "social triangulation" [41]. Finally, 'discovery' represents the desire for stimulation and delight that one experiences through new encounters. Even familiar places can lead to novel discoveries, either by people adding new values and ideas to it (like books or thoughts) or by having the place itself offer stimuli that "enable the users' interest to endure" [3].

One of the proliferating resources in urban spaces – public displays – can be used to enrich the environment and stimulate human needs. The significant price drops in large LCD panels have led to a massive expansion of digital public displays in public spaces, yet their predominant use as simple slide presenter or video player has seen dwindling "eyeballs" and led to *display blindness* [10], [26] – an effect describing the fact that viewers ignore much, if not most, of such animated advertising. However, public displays could be running applications that nourish passive engagement, active engagement, and discovery (abbreviated PACD from now on), i.e., human needs in urban spaces. This way they would make a more stimulating participant within the urban environment, one tailored for its users [20], [21], [22].

As comfort and relaxation usually refer to physical properties of the space, we decided to focus our investigation on using public display to stimulate passive engagement, active engagement, and discovery. In order to understand how public displays could foster PACD, we built FunSquare [19] and deployed it on an existing city-wide public display installation in the city of Oulu, Finland, a city with over 140'000 inhabitants. We then observed the interaction of more than 50 passers-by with FunSquare in two distinct city locations over two days, and interviewed 37 of them in order

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to better understand their behavior. Based on these findings we developed a model that describes the spatial and relational processes involving passive engagement, active engagement, and discovery. We call this the PACD model.

The contribution of this paper is thus twofold:

- We provide inspiration for a novel line of investigation in public display research by advocating the use of public displays for stimulating passive engagement, active engagement, and discovery (PACD). PACD displays would be oriented towards human needs in public space (as defined by Carr et al. [3]). This would make them a stimulating participant within the urban environment, which in turn would lead to more appealing public spaces. Note that in the context of public displays, Carr et al.'s concept of "engagement" thus also includes engagement with the environment in general, and in particular with interactive public displays.
- We describe and conceptualize processes that constitute passive engagement, active engagement, and discovery with the help of public displays – the PACD model. The model is based on our own observations of people engaging with and around FunSquare over two days at two locations in a city center. The conceptualization can help designers in creating public display applications that nurture PACD. It can also be used for the analysis of existing deployments in order to describe if and how they stimulate PACD.

We will begin by analyzing related work on public displays in urban/public spaces. We then describe the FunSquare application, the study setting, and our data collection process. After that we summarize our observations and describe the processes that surround PACD displays. We then present a conceptualization of the processes and describe phases in coordination and engagement for PACD. After contrasting our conceptualization with current engagement models, we discuss implications for design and development of public display applications that stimulate PACD. Finally we present concluding remarks.

2. RELATED WORK

There have been a large number of in-the-wild studies on public displays in urban/public settings. While some of the work in this area has focused on describing the underlying *technical architecture* of public display systems [7], [29], a large body of research has described how public displays can be used for *community purposes* [1], [17], [18], [31], [37] and *civic engagement* [9], [13], [34]. Researchers have also investigated the potential of public displays for supporting *social interaction* [25], [32], [33], [36], and more specifically their connection with Goffman's theory [8] on how people socialize in public spaces [14], [18].

At a finer level of granularity, prior work has also looked at *engagement with public displays* [4], [5], [11], [16], [28], [30], [38]. Work in this area looked at how people *notice interactivity* of a display [28]; how to map *interaction techniques* onto very large public screens, e.g., media facades [5]; at the interplay between the *cultural, physical, content-related, and social aspects* of engagement [4]; at designing for *walk-up-and-use of displays* [11], [16], [30]; and at public display *game design* [6], [38].

Last but not least, researchers have developed *coordination and engagement models* of user behavior around public displays. They go from theoretical [39] and ideal [6] to empirical [2], [24], and focus on: *advertising*, i.e., providing advertisers a measure of how successful their content/application is [24]; behavior that leads to *overcoming social embarrassment* when interacting with public displays in public spaces [2]; display *content appropriation* depending on users vicinity to it [39]; and *ideal user coordination* around public displays leading to engagement with it [6].

Our work lies mostly at the intersection of public display engagement and coordination models, yet offers a novel focus (human needs in public space). More specifically we investigate the possibility of public displays to enrich public spaces according to Carr et al.'s notion of human needs in public spaces, i.e., passive engagement, active engagement, and discovery. After we present our conceptualization below, we will also contrast it with existing models.

3. FUNSQUARE ARCHITECTURE

FunSquare [19] is a public display application that creates self-generative content. Self-generative content is made by matching dynamic information sensed *within* the display environment, e.g., the number of people in the space or the current wind speed, with static information from *without* the display environment, e.g., the population of Pitcairn Islands or the speed of a dragon-fly. Some examples are illustrated below.

- The population of Pitcairn Island (50) is only five times more than the average number of people around the display today (10).
- The speed of a dragonfly (97 km/h) is more than 4 times the current wind speed in the city (23 km/h).
- The number of manufactured mobile phones every second (27) is almost the same as the average number of visible Bluetooth devices today (26).

By having information that describes the environment combined with information coming from outside the setting, we were aiming to create an interesting and provocative 'fun fact' that would provide an intellectual challenge in the environment. This challenge would invite people to engage actively with the environment through the display, potentially sparking the effect of social triangulation, i.e., spontaneous interaction with others [41].



Figure 1 - An example of a dynamically created "fun fact"

FunSquare screenshot is shown in Figure 1. Fun facts are presented with an opening statement 'Did you know that…' shown in the upper left hand corner of the screen. Next to a fun fact, four buttons allow passers-by to 1) request a new fun fact ('+' button); 2) give feedback on a fun fact ('thumb up' and 'thumb down' buttons); or 3) to leave a comment ('comment' button). Each fun fact is displayed for thirty seconds with the remaining time indicated by a timer in the bottom right hand corner. In the upper right hand corner there is a QR code that allows users to download a fun fact

onto their smart phone in order to "bookmark it" and/or share it with others.

We want to note that in our previous publication [19] we described the system architecture that creates self-generative content in more details as well as user experience with it in two contexts, i.e., in the context where information is simply presented in a screen-saver fashion as in Figure 1, and in the context of a game where users have to match the two pieces of information. On the other hand, in this paper we go broader, i.e., outside system architecture and user experience with content itself, and focus on coordination and engagement for PACD, i.e., passive engagement, active engagement, and discovery.

4. DATA COLLECTION

We deployed FunSquare on two large (57") interactive public displays in Oulu, Finalnd, to observe and gain an understanding of the social dynamics surrounding public displays that focus on stimulating PACD.

As location plays a crucial role in evaluating any application on public displays [27], we identified several candidate locations for testing FunSquare in downtown Oulu before the deployment. From these, we chose two venues that we deemed as the most promising: the central market square and the main library (cf. Figure 2). These are pivotal locations in downtown Oulu, where people often come to spend their spare time and relax, thus being more open for spontaneous encounters, which FunSquare aims to cultivate. More importantly, the displays at the two locations had already been equipped with interactive public displays for more than two years, thus eliminating the novelty bias that would inevitably occur when deploying new large public displays. All information in the FunSquare's content was available in English and Finnish language. A button in the UI showing the other language's national flag allowed switching between the two.

One of our goals was to observe the potential of large public displays for PACD 'in the wild', i.e., in public spaces that accommodate a diverse range of people. The display in the market square is situated next to a statue representing an important cultural asset of Oulu, thus attracting a variety of people ranging from locals to tourists. Similarly, the main library features, among others, a free reading hall, public computers, audio books for children, auditoriums, cafeteria, etc., thus attracting a diverse audience as well. In the library, the display is located next to the only staircase leading to the upper floor and therefore has the potential to catch the attention of a number of visitors. We believe that these two locations were a good match for FunSquare and its intended use – both socially and spatially.



Figure 2 - From left: Interactive public displays installed in a central market square and in a main library (Oulu, Finland).

FunSquare was evaluated on two consecutive days at the above-mentioned locations, i.e., the market square and the main library. Evaluation was conducted right after FunSquare was deployed. A longer deployment, i.e., more than two days, or alternatively multiple short ones, were not possible because public display system in Oulu runs commercial digital signage (advertisement) that creates revenue for their maintenance. This created a two-days-only constraint when FunSquare could be deployed.

During the observation we took notes and photos, and performed walk-up interviews in order to collect qualitative feedback. At least two researchers were present in both locations at all times. Observations were performed unobtrusively from "hideouts" (e.g., a nearby café on the market square or a visitor sofa in the library) in order to avoid any Hawthorne effect [15], a common issue in this type of user tests where users modify their behavior in response to the fact that they know they are being monitored. After people had "used" FunSquare and were leaving the vicinity of a display, one researcher approached them to ask for a brief semi-structured interview, which focused on assessing the experience with the FunSquare application. Additionally, we also tried to eavesdrop on discussions around the display and paid particular attention to the spontaneous reactions occurring around FunSquare and its use. No video or audio recordings were used for these observations.

5. FINDINGS

During our 18+ hours of observations, roughly 130 people read at least one fact. In the following, we will link our findings to the individual interviews using codes referring to the individual interview transcripts. The first letter indicates the location (L-library/T-market), the second the type of observation (I-interview/C-eavesdropped comment), followed by a consecutive number.

People read facts alone, in pairs, or in bigger groups, usually families (cf. Figure 3). Most of the interviewed people described the facts as 'nice', 'funny', and/or 'interesting' (LI1, LI2, LC1, LI3, LI6, LI7, LI9, LI12-18, TI3-5, TI8). Some people thought of the fun facts as 'unnecessary information' or 'information snippets' (LI3, LI7) while others thought of them as questions (LI9, TI2, TI9). After reading a number of facts for the first time, some people came back to read more, e.g., LI12:

> LI12: '*If my parking meter would not run out of money I would not leave these premises the whole day*.'



Figure 3 - Interactions: single, pairs, or groups

People stated they 'learned something new' (LI1) and said it was 'fun to play while waiting' for family members or friends (LI3, LI5, LI12, LI14, LI16). Some people said that they would share the newly gained information with people they know, e.g., family members, friends, and/or acquaintances (LI1, LI3, LI5, LI6, LI7, LI9, LI11, LI17, TI3, TI9). Some people went even further and explicitly said that this type of information would be very useful in schools (LI7, LI9, LI12, LI13, LI15).

5.1 Passive Engagement

We noticed that some people interacted only briefly with the display: some people read one fun fact and immediately left (42), some were reading the facts while engaged in other activities such as talking on a cell phone (3), while others were more comfortable

with reading the fun facts from a distance (7). We call these brief reading sessions *read'n'go interactions*, as most of them were short and involved reading only a single fun fact: once the display changed to the next fact, people moved on as well. In several cases, people simply *observed* from afar others interacting with the display. Because these observations were relatively short as well, we group both read'n'go interaction and observations into what we call *glimpse interactions.*

While some people read one fact and left the display premises, others *stop-read*. By 'stop-read' we mean that they were on their way to pass a display, but once the facts caught their attention they slowed down and stopped to read (cf. Figure 4). This was most prominently observed at the library due to the display's location, i.e., on the ground floor next to the only staircase leading to the upper floors (cf. Figure 2 right). Some people would only slow down to read a fact, some would actually stop next to the display to finish reading, while others would even come back to read one or more facts after initially deciding to take the stairs. Overall we observed almost the same percentage of stop-reads at the library (33/99) as at the market square (6/20). One interesting thing to note is that we also had 2 instances where people who did neither speak Finnish nor English, yet still stopped to check out the application.



Figure 4 - 'Stop-read' at a) library b) market square

In some cases people touched the display out of curiosity to see what happens (7), engaging in a couple of button presses. We call these short interaction sessions *curiosity interactions.* Similarly to stop-reads, people were on their way to pass a display when they disengaged from the activity and engaged with the display. Because of this, we group curiosity interactions and stop-reads into what we call *immersive interaction.*

5.2 Active Engagement

In several cases we observed people reading two or more fun facts consecutively (10). The reading sessions were significantly longer than for both glimpse and immersive interaction and we call them *active reading.* In some cases (12) people started interacting with the display after reading one or several facts. Since these sessions involved interaction after reading we call them *read'n'interact*. In cases where we were able to interview such users they described the content as 'interesting' or 'of one's interest' (LI1, LI7, LI14), 'funny' (LI3, LI15, LI16), or 'puzzling' (LI10), which we believe were the reasons for longer reading sessions. In one particular case where we were able to eavesdrop on the conversation after a longer reading session we discovered that it did start social interaction between family members.

> LC2: '*It's not true that all muffins cost 2 Euros!*' [Mom commenting to her daughter on a fun-fact "The number of people in front of a display (2) is the same as an average price of a muffin in Euros (2)"]

There were also some cases where the displayed content started social interaction (*social triangulation*) due to the need for extra explanation of the information presented (LI10, TI7, TI9) or interest in the topic (LI12). In one particular case (TI7) the session was not characterized as active reading but the content itself sparked the conversation. In other cases people were delighted with the presented content and were laughing (LI18, TI8, TI9), while in others they were intrigued with it and discussed it with people in their vicinity (LC2).

> LI10: '*How can you put together two facts that have nothing to do with each other?*'
>
> TI7: [came back to the interviewer to ask]'*Is this really true? Are these facts real?*'

In several cases we observed that people stopped to read a fact while others were engaged with the display, thus creating the opportunity for the effect of triangulation. One such instance occurring between strangers is shown in Figure 5.



Figure 5 - The effect of 'triangulation' between strangers

Although we observed more situations where single people were reading facts (102 singles, 34 pairs and groups), people in pairs and bigger groups were more likely to interact with the display (26/34) than single people (15/102). In some cases people approached the display and started interacting with it immediately without engaging in reading first (32 sessions, 51 people). We call this type of behavior *direct interaction*. Children were most likely to start interacting with the display (18) as well as families (6 families, 19 people). The colorful design and animated buttons seemed to be appealing to children, especially the pulsing '+' button, which children tried to jump-reach. However it seems that they interacted with it without any particular goal: they would touch all buttons, they would try to 'move' the images, or select text, i.e., they touched everywhere in search for a reaction. Kids enjoyed interacting with FunSquare and saw it as a 'gaming machine' (LC4, cf. Figure 6).

> LC1 [2 boys and a girl, after interacting with FunSquare]: '*That thing was quite fun!*'

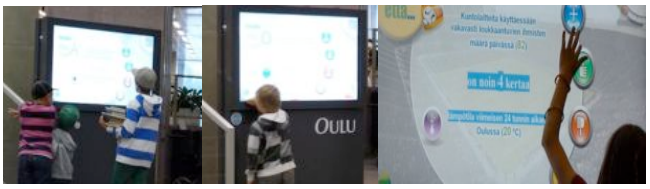


Figure 6 - Gaming machine

In cases where children were accompanied by their parents their interactions would create a 'honey pot' effect, i.e., they would lure their parents in (Figure 7a). Some kids simply approached the display (LI4, LI11), some asked their parents to read the facts for them (LI16), while others 'dragged' the parents to interact with the application. There were also cases where parents approached the display, which in turn prompted their kids to ask questions about the display. The 'honey pot' effect was also observed between strangers, i.e., if there was interaction in front of a display it would 'lure' others to interact with the display (Figure 7b).

We observed both groups of 2-3 people (5 groups/11 people) and individuals (7) interacting with a display. In several cases direct

interaction with a display sparked social interaction between children (LC1), friends/couples (LI18, TI9), and family members (TI8). There were also cases where the mix of direct interaction and displayed content prolonged social interaction (TI8, LI12).



Figure 7 - Honey pot: a) family b) strangers

5.3 Discovery

The interviews revealed that people did appreciate the intellectual challenge posed by the display. They either liked the content on a specific topic (LI1, LI5, LI6, LI7, LI9, LI12, LI13, LI14, TI9), the locality of it (LI5, LI9, LI14, LI15, TI1, TI2, TI3, TI8, TI9), or the obscure connection between the two pieces of information that comprise a 'fun fact' (LI7, LI11, LI15). Some people said that they would share some of the 'newly learned information' with people they know, e.g., family members, friends, and/or acquaintances (LI1, LI3, LI5, LI6, LI7, LI9, LI11, LI17, TI3, TI9) thus promoting the *challenge* from the environment. While some people stated that they would like to share the new information with friends and family, some went even further and explicitly said that this type of information would be very useful in learning environments, i.e., schools (LI7, LI9, LI12, LI13, LI15) where intellectual challenge plays a key role in the learning process.

When people were actively engaged with the display they also started discovery. We observed two things that people were interested in discovering: 1) content and 2) application information. The two strongest examples for content discovery were LI5 and LI12. LI5 browsed through 20+ facts. When asked about the content she said that *she was actually browsing to find the content that matches her topic of interest*. She also wanted to find out more of a local content. Similarly, after the initial interaction with the content LI12 returned to interact with FunSquare because he was 'absolutely fascinated' with the application's content. People were also trying to learn more about the application when they were actively engaged with the display. They were either eager to uncover application's purpose (LI6, LI10, TI6, TI9) or its features (curious interactions, kids engaged in direct interaction with the display, LI17, LI18, LC4, TI2, LC1, TI3, TI4). For example, LI6 understood how to interact with the application and appreciated content that matched his interest. However during the interview he was mainly asking questions about the *purpose* of the application. He also noted that his interactions were geared towards *discovering* what the application does. On the other hand, TI2 was 'pushing buttons to see what will happen', i.e., he was interested in *discovering* application *features*. Similarly LI18 interacted with the application although they characterized it as 'useless'. They pressed the 'thumbs up' and 'thumbs down' buttons in order to uncover the available variety of funny pop-ups.

6. CONCEPTUALIZATION

We conceptualize the observed behavior of coordinating around and engaging with public displays according to Carr et al.'s human needs, i.e., passive engagement, active engagement, and discovery. This conceptualization represents a first step towards developing a more concrete model, similar to those reported in [2], [6], [24], ultimately augmenting theory of stimulating human needs through public displays.

Overall, we observed people interacting with the display in two zones (cf.): the 1) *passive engagement zone* and the 2) *active engagement zone*.

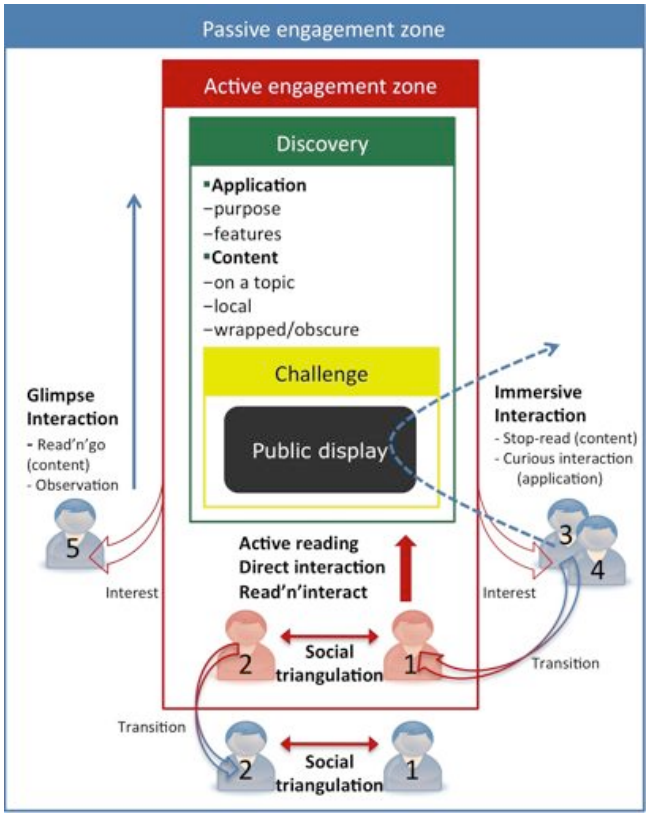


Figure 8 – Conceptualization: engagement zones and activities around a display. Several transitions between both zones and activities are possible.

In the *passive engagement zone* (roughly in the area 2–3 meters from the display) people observed what others were doing in front of a display (observations) or they had short interactions with it (read'n'go), i.e., they had very brief *glimpse interactions* after which they left the display location shortly. Other had more *immersive interactions* in this zone, where they interrupted their current activity and directed their attention to the display. During our observations, activities in the passive engagement zone did not spark any prolonged interaction with the display, i.e., *active engagement* with the environment. For this reason they can be seen as *passive engagement with the environment*.

In the *active engagement zone* (roughly between an arm length and 2 meters from the display) users were engaged in a longer and more focused interaction, either through *active reading* (where they would read more than one fact, which resulted in a longer interaction), *read'n'interact* (where they read on or more facts prior interacting with the display), or *direct interaction* (where they actively interacted with the sparse display user interface). Since these activities involved longer engagement with the display they can be seen as *active engagement with the environment*.

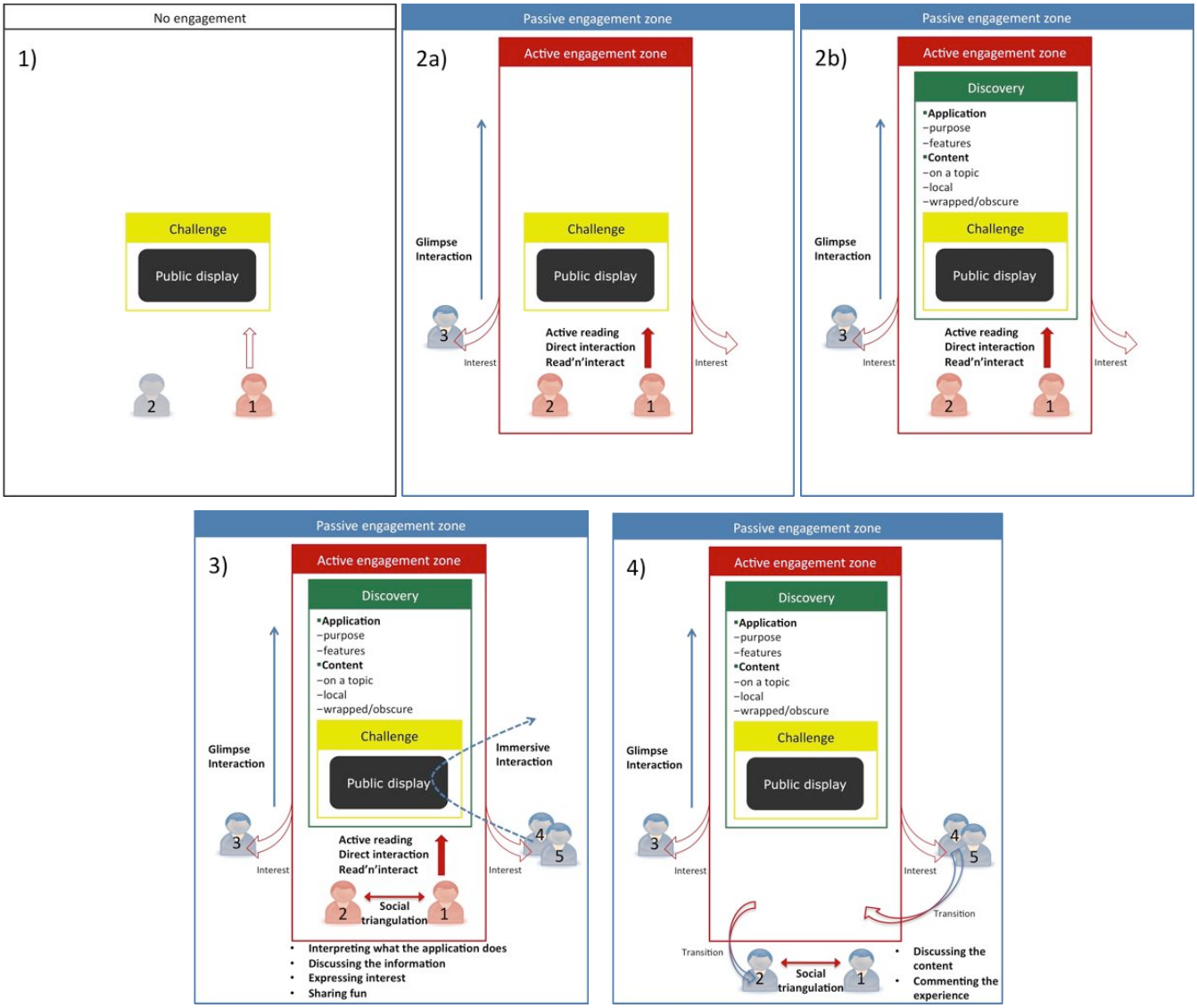


Figure 9 – Observed stages in engagement and coordination for discovery, passive and active engagement. Steps 1-4 describe how a user begins interacting with the display and consequently draws in both people in the active engagement zone and passers-by in the passive engagement zone. Eventually, the initial users leave the display and other users move in from the passive engagement zone.

People would transfer from one activity to another. We observed two instances of these transitions between the *immersive interaction* to *active reading* and one from *immersive interaction* to *direct interaction*.

In several cases we observed social triangulation, i.e., social interaction occurring within the active engagement zone (LI16, LI18, TI5, TI8, TI9). In cases when we were able to eavesdrop on the conversation the conversation was started because people were interpreting the application (TI9). Unfortunately in other cases we were not able to understand the conversation. However from the interviews we could also understand that people would like to discuss the information because they were puzzled by the content and would like to get more explanation (LI10, TI7, TI8), or they would like to express their interest in/towards the content (LI12). In several cases we also observed that people were sharing fun (LI18, TI8, TI9), i.e., they were connecting socially through laughter. In some cases people continued their social interaction *after* they finished active engagement with the display. In those cases they either commented on their experience (LC1) or they discussed the content (LC2).

In addition to the two zones, our conceptualization comprises form the following elements (cf. Figure 9, moving from the image center outwards): 1) an *intellectual challenge* that sparks interest for interaction with the public display, 2) the *discovery* process that allows one to discover the application and its content, 3) *active engagement* activities leading towards discovery, i.e., active reading, direct interaction, and read'n'interact, 4) *passive engagement* in the form of glimpse and immersive interactions, and 5) *transition* between the zones (indicated by arrows). Figure 9 illustrates how public displays stimulate PACD in public spaces. At the outset there is no engagement and person 1 in the display vicinity notices the display (cf. step 1). In the second step this person starts an active interaction with it, either through direct interaction, active reading, or read'n'interact. As soon as person 1 starts interacting with the display, a nearby person 2 follows, which in turn raises interest in the passive engagement zone and triggers a

glimpse interaction by person 3, e.g., read'n'go (step 2a). Meanwhile, persons 1 and 2 engage in *discovery* (step 2b). Discovery can lead to spontaneous social interaction, i.e., social triangulation in the active engagement zone (step 3). Other passers-by (persons 4 and 5) disengage from their current activity and engage in immersive interaction, e.g., curious interaction (also step 3). Eventually, these passers-by then transition into the active engagement zone after it is vacated and in turn start an active engagement with the display (step 4), while those who left the active engagement zone continue their social interaction This exact series of transitions was observed in two instances.

7. COMPARISON

As pointed out in the related work section, a range of public display interaction models have been presented before, which similarly describe the coordination and interaction with public displays. Finke et al. [6] describe ideal user behavior leading to active engagement with a display. They differentiate between three types of users, i.e., actors - people who are engaged with a display, spectators – people who observe what actors are doing, and bystanders – people who are aware of the display installation.

In comparison with our conceptualization, actors would be users interacting in the active engagement zone, while spectators would be users engaged in the passive engagement zone in the form of immersive interaction. Bystanders can be seen as users engaged in glimpse interaction. As authors themselves note, their model is ideal and misses understanding of transition between different user roles. We complement their model by describing how engagement around the display leads to users transiting from the passive engagement zone to the active engagement zone.

The most similar model to our conceptualization is one of Vogel and Balakrishnan [39], which describes different *information appropriation zones* within a display's vicinity, in which display should react to people's presence and change/appropriate its content. Their model consists of 4 such zones: 1) *ambient display* in which the display should show a range of categorized content that would signal available information on a display, 2) *implicit interaction* where the display should notice the user's presence and should signal that it 'knows' that a user is in the vicinity 3) *subtle interaction* where user-relevant information should be displayed, and 4) *personal interaction* where the user would interact with the presented information directly through touch.

Our conceptualization can be connected with Vogel and Balakrishnan's model: in some cases of immersive interaction that transitioned to active reading, the interaction went from the 'ambient phase', i.e., noticing the display, to 'implicit interaction', i.e., observing the information – stop-read. In some instances, it would further transition to 'subtle interaction' – active reading. In cases where the transition was from active reading to direct interaction, the interaction changed from 'subtle' to 'personal'.

Brignull and Rogers model [2] describes social coordination around public displays with respect to the flow of public interaction around it. Their model uses three phases: 1) *peripheral awareness activity*, which is similar to Vogel and Balakrishnan's 'ambient display' in that people are somewhere else in the space and are not aware of display content; 2) *focal awareness activity*, in which people are closer to the display and are engaged in other activities like eating, drinking, or talking next to a display; and 3) *direct interaction activity*, in which a person is interacting with a display directly. There are several similarities as well as differences between our conceptualization and Brignull and Roger's model. The 'focal awareness activity' is similar to glimpse interaction in a sense that people paid attention to a display, while 'direct interaction activity' is similar to direct interaction. However there are also several differences between the two models. While Brignull and Roger's 'focal awareness activity' is similar to our glimpse interactions, we also observed focal awareness during *immersive interactions*. Both interactions happen in what we call the *passive zone* – a space that did not spark social triangulation in our observations. Our *active engagement zone*, i.e., the zone where people are engaged with a display and where there was potential for social triangulation, in turn is covered by both Brignull and Roger's focal awareness and direct interaction activities. These differences between the two models may have been caused by the different settings in which the observations were taken: Brignull and Rogers created their model based on two highly social events, while our observations covered a public space. Also, different interaction techniques where used (keyboard and touch screen).

The model that explains coordination in front of public displays with most details is the "audience funnel" of Michelis and Müller [24]. The model describes the interaction flow in front of one or several consecutive displays and has 6 phases: 1) *passing by*, i.e., simply passing by a display and not seeing the display, 2) *viewing and reacting*, i.e., very short glancing at a display 3) *subtle interaction*, i.e., user movement with an intention to trigger display reaction 4) *direct interaction*, i.e., interacting with a display directly through gestures, 5) *multiple interaction*, i.e., moving and interacting with more than one display, and 6) *follow-up action*, i.e., actions that followed after the interaction was done, e.g., taking photos of a display. The 'viewing and reacting' phase is similar to *glimpse interaction*, while 'direct interaction' is similar to *direct interaction* in our conceptualization. There are several differences between the audience funnel and the conceptualization. Firstly, the audience funnel was intended as a basis to calculate conversion rates between the different stages, hence e.g., providing advertisers a measure of how successful their content/application is, rather than to model for PACD. Secondly, the model only considers single users, whereas our conceptualization allows multiple users to be moved into the focus. Thirdly, the audience funnel is a rather linear framework that does not allow modeling the user as he/she moves back and forth through different phases. Note, that as in the case of Brignull and Rogers, differences between the PACD and Michelis and Müller's model may come from a different use context, which focuses on *economic aspects rather than on PACD*.

8. DISCUSSION

As stated in the introduction, people appreciate challenges in public spaces, whether they would be physical or intellectual [3]. Public display applications can provide for this need and stimulate people intellectually. In the case of FunSquare, this stimulus was coming from information on 1) people's topic of interest, 2) content that reflected the locality, or 3) slightly obscure information. While we explicitly solicited local content of interest during the development of FunSquare, in order to make the facts resonate better with passers-by, such information could also be collected automatically, e.g., by acquiring user profile of people in the space (e.g., Facebook profile [35]), or by displaying search queries of people that are near the display [12]. Content that reflects the locality could be pulled from the web by using the display's GPS coordinates and crawling the web on the information that is relevant for the particular place. On the other hand it could also be sensed within the environment, e.g., through a crowd sensor. In the FunSquare case some of the information was pulled from the web, e.g., local weather, while some was sensed, e.g. through a

Bluetooth sensor. "Obscure information" in FunSquare was embedded in the *connection* between the two pieces of information. As commented by L17 it provided *explanation* for the 'big things' by 'combining static information, like big number and distances, with real world data'. This type of explanation can be also found on the web, e.g., Wolfram FunFacts (see http://twitter.com/#!/WolframFunFacts), or through self-generative content [19].

Another requirement public display applications could stimulate in public spaces is *discovery*. People are interested in uncovering a public display application's features or purpose. This would mean that in certain cases stating what an application does might diminish its ability to support discovery. Letting people uncover on their own what the application is about could be done gradually, e.g., by providing textual clues. However, too much explanation might lower the need for social interaction between people. In order to further support discovery of an application its purpose could be changing as well. For example a simple public display application that shows topical information could be turned into a trivia quiz game. Besides uncovering the application's purpose, people were also willing to discover the application's features. People wanted to see feedback to their actions. The discovery of applications features can be something that is changed quickly, e.g., changing the pop up location and text message, or something that requires more time, e.g., implementing a novel functionality that allows one to 'rate' the content.

People also enjoyed discovering application content. Content discovery was supported in FunSquare by having information randomly presented: one would have to browse and wait until he/she reaches the content of interest. However people expressed interest towards certain groups of content, i.e., 1) towards the content that reflects their topic of interest, 2) towards the content that reflects the locality, or 3) towards wrapped/obscure content. Grouping content into categories might increase one's willingness for discovery. However it might also diminish it since people would be able to get the content of their preference directly and might not access some of it serendipitously.

Activities that lead to discovery, i.e., active reading, direct interaction, and read'n'interact, were *active engagement with the environment*, another human need in public space. People engaged with the display alone, in pair, or in bigger groups. In some cases when there was more than one person in the active engagement zone, the display sparked *social triangulation*, i.e., spontaneous interaction. People were trying to interpret what the application does collaboratively, or they were discussing the information, expressing interest in it, or simply enjoyed the content together. These spontaneous interactions were sparked through *discovery* and could be amplified by designing public display applications that stimulate this need.

Activities in the active engagement zone sparked interest of people who were outside of it, i.e., it sparked *passive engagement with the environment*, another need we seek in public spaces. People observed what was happening around the display or glanced at it. In some cases activities in front of a display were so interesting to others that they disengaged from the activities they were performing and engaged with the activities happening in front of a display, i.e., they were *immersed* into activities in the active engagement zone. The more people were in the active engagement zone, the more attention the display got, thus increasing chances for social triangulation. We believe that in public spaces where people linger for some time, such as a bus stop, a more pronounced 'honey pot' effect would take place. The particular idea of placing displays at bus stops in order to spark interaction has also been investigated by Yahoo!'s 'Bus Stop Derby' (see www.busstopderby.com/) where players can play a quiz game. So far, unfortunately, there have been no reports on their current deployment.

9. CONCLUSION

Public spaces cater to some important human needs, namely 1) passive engagement with the environment, 2) active engagement, and 3) discovery (PACD) [3]. Passive engagement allows people to relax by observing environments features or what others do. Active engagement nurtures our need for intellectual stimulus by providing a challenge in the environment, potentially leading to spontaneous social interactions (social triangulation) through special features that act as a catalyst. And discovery of new features in a place supports our need for acquiring new experiences.

In this paper we take the public space perspective and investigate how public displays can enrich them by stimulating PACD, thus 'weaving themselves into the fabric of everyday life' [40]. In order to test the potential of this idea we have designed, developed, and deployed FunSquare, a public display application that aims at stimulating PACD by showing locally scoped 'fun facts' in a screen-saver fashion. FunSquare was deployed and evaluated over two days at two locations in Oulu, Finland.

Based on an in-depth analysis of our observations of over 50 interactions and interviews with 37 users, we conceptualized PACD-related interactions in front of public displays, both spatially and temporally. By dividing the space into passive and active engagement zones, and identifying different interaction phases both with the display application and with other users, the conceptualization can help with both the development and the analysis of public display applications that try to support PACD [23].

10. ACKNOWLEDGMENTS

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Experiencing Participatory and Communicative Urban Lighting through LightStories

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ABSTRACT

This paper presents the results of a real-world adaptive urban lighting demo conducted in a pedestrian street in the centre of a city in Northern Finland. The main objectives were to explore methods of enabling the inhabitants of the city to participate in the design of public urban lighting, as well as interaction and communication through urban lighting. This article discusses the participants' experiences of participation and their attitudes towards adaptive and interactive lighting. The case project – *LightStories* (Valotarina) – applied a web-based design tool which offered our participants the possibility to devise one-hour long lighting designs, displayed along a pedestrian oriented street. Additionally, users could write a narrative or a message associated with their lighting design, published on the website and the public UBI touch screens. This article describes both our participants' experiences of participation and how *LightStories* (LS) was used as an ambient media in urban space.

Categories and Subject Descriptors

J.5 [**Computer Applications**]: Arts and Humanities–*Architecture.*

General Terms

Design, Experimentation, Human Factors.

Keywords

Participation, adaptive urban lighting, evaluation, LightStories.

1. INTRODUCTION

Our urban and architectural spaces are being filled with digital media, delivering new opportunities for communication in the city. Often this communication occurs in the form of light: for example, as displays, intelligent lighting fixtures, and media façades. In practice, however, urban communication via light remains usually one-directional, commercial and private. Nonetheless, interactive technologies are enabling new uses of the urban space as a forum for its citizens, as is already the case in numerous art projects and temporary installations. Thus, the design of urban lighting can be viewed as a form of interaction design.

1.1 Lighting as a part of the urban experience

During the dark period of the day, artificial lighting affects our experience of urban environments in various ways. Lighting is necessary for visibility, orientation, safety and the feeling of security for the users of urban spaces. This functional aspect of public lighting is regulated by many national and international norms and guidelines. [22] However, since a few decades agp. lighting design has been understood as a more multi-faceted task, including social, cultural, political, architectural, aesthetic, communicative, commercial, ecological and economical viewpoints. [22, 5, 24, 20] Lighting is an essential part of the atmosphere and aesthetics of the urban environment at night, and it can have a positive effect on a city's image and identity. Considering the former aspect, successful lighting helps to promote the area and attracts visitors, which creates active and rich city life, as well as provides commercial value. Regarding the latter aspect, lighting can also have a positive effect on the inhabitants of the city, by enhancing the identity of their area [4, 22].

Since the introduction of electric lighting in urban areas, walking around at night for its own sake, or *noctambulisme*, has been popular entertainment for city inhabitants, and has lately been developing into 'nocturnal tourism' in Europe. This phenomenon spurred the production of illuminated billboards, which became iconic symbols of urban centres. [2, 20] The use of light as media in the city has spread ever since and found new forms. As with all new technology, there is a danger that decorative lights and dynamic lighting are used to outshine everything else, especially for marketing purposes. There is a risk that public space will be further privatised as a result of this process. Consequently, the integrated design of lighting in urban spaces is necessary [16]. New cultural and social approaches concerning the content and users of illuminated media are also necessary, as are new forms of participation. This need was our starting point for the LS project.

1.2 Adaptive urban lighting as an expressive ambient display

Ambient displays use "the entire physical environment as an interface to digital information," as described by Wisneski et al. [29], who also envisioned that "the architectural space we inhabit will be a new form of interface between humans and online digital information". Consequently, information is embedded into the built environment, and it "manifests itself as subtle changes in form, movement, sound, color, smell, temperature, or light." [29]. LS is an urban ambient display which uses urban infrastructure to display information in an urban space through the colour, intensity, and movement of light without adding to the cognitive load in the form of intrusive visual noise of the inhabitants of the city.

The amount of information displayed digitally in urban environments has increased dramatically over the past few years. However, many of these systems are meant for commercial purposes, [12] delivering a deluge of advertisements on passers-

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by without engaging them in any meaningful way. Despite this, ambient displays offer an infinite amount of possible variations to augment the physical environment, and these have been explored in many research and design projects [25, 28, 17]. Notably, in the case of Urban Pixels, [25] individual but interconnected lights are seen as forming a larger whole, an ambient display that is embedded into the built environment. This principle is shared by LS, which, however, takes a more radical approach and does not add anything to the environment, but turns existing elements of urban lighting into an ambient display. Urban Pixels also invited people to communicate and play with the expressive potential of lights, both through actual changes of positioning of the physical light objects and by digital information throught SMS messages. Additionally, the expressive use of light and colour as means of visual communication and self-expression, facilitated by a control-table [17] or smart-phone application [28], have been presented and studied, for example, in the context of media façade installations. In the case of LS, we were interested in exploring the potential of a web-based design tool for enabling visually rich and versatile expression through colour and light embedding personal content as artistic communication. The aim was to give the participant the power to really design themselves and a good sense of control – "perceived control" with the ability to predict the outcome of a particular design choice accurately.[2]

1.3 Participatory Design as a Concept

The ideological roots of participatory design (PD) in the field of HCI can be found in the efforts to democratise work practices in the Nordic countries in the 1970's. [11, 7] As new technologies and information systems were introduced into the workplace, participation was seen as central for the successful design of computing systems. More recently, in what is known as the third paradigm of HCI, computing is no longer thought of as something that is restricted to the workplace, or to any specific place or device for that matter. The subsequent introduction of different locales and heterogeneous user groups provides new opportunities and challenges for employing PD methods in interactive systems, a theme which was explored also in LS.

In urban design and planning, participation emerged as an opposing force to the *rational-comprehensive planning theory*, the aim of which was to acquire as much objective knowledge as possible. As such, it placed importance on expert knowledge, leaving no room for participation or multiple viewpoints. This mode of thinking was critised early on in the 20th century, (e.g Paul Davidoff [10, 19]). Importantly, the ideas of Jürgen Habermas [13] offered a framework for a planning theory which focused on communication and consensus-building between stakeholders. This *communicative planning theory* was later amended by Foucauldian planning theorists [14, 19]. Lately, the notion of crowdsourcing has also been used in the context of urban design and planning [e.g. 6] Coined by Jeff Howe [15], crowdsourcing "represents the act of a company or institution taking a function once performed by employees and outsourcing it to an undefined (and generally large) network of people in the form of an open call." Brabham [6] argues that on that on the Web, "where anonymity for users is available and where body language, identity politics, and interpersonal power dynamics are absent or changed, we can begin to ameliorate the several pitfalls of public participation" in urban design. LS, then, can be seen as representative of this kind of urban design participation, where participation is web-based and an element of crowdsourcing was present.

Citizen participation was one of the salient ideas behind LS from its inception, and it can be seen both as a co-design project as well as a participatory art project. In contemporary art, the will to employ participation stems from the desire (1) to activate and empower audiences, (2) to cede a part of the authorship in pursuit of a more egalitarian form of art and (3) to address the perceived crisis in community [3]. Muller and Loke [18] have also stated that there is a phenomenological emphasis on these participatory art projects which places importance on participants' experiences. LS was especially interested in what could be learned from our participants' experiences as co-designers.

In the existing multidisciplinary literature on PD, participation is usually seen as having two guiding rationales or arguments: an *ethical-political* argument and a *pragmatic* argument. According to the former view, participation enables the empowerment and activation of those who are in weaker positions of power within organisations or communities. From the latter point of view, participation can be seen as a tool to harness the latent knowledge of those affected, broadening the base of available knowledge to its largest possible size. Both of these elements emerged as important themes in the conception, building, operation and evaluation of LS.

1.4 The LightStories project

In the *LightStories* (LS) case project, lighting was approached as an experiential, interactive, social and communicative element of a public urban space. More specifically, then, the underlying goal was not utilitarian, but meant to enrich the urban experience through digital means, as discussed, e.g., by Yvonne Rogers [27]. Accordingly, the information displayed was not factual, but communicative and expressive. The main concept of LS was to appropriate a part of the existing lighting on a pedestrian-oriented street as a forum for personal narratives, messages and greetings. Through this playful idea of street lighting as social media, people were invited to participate in the lighting design of a public street using our online design tool. Anyone with internet access could create their own design for the existing street lights, which are equipped with RGB LED stripes, and write a story that would be associated with the lighting design by displaying it on the website and on the public UBI touch screens in the city centre. Each participant booked a suitable time for their story and created a lighting design by choosing and modifying different static and dynamic effects and colours.



Figure 1. Pakkahuoneenkatu street in Oulu with a user-generated lighting design.

Real-time video of the street was also displayed to illustrate the current story on the website. The LED stripes provided athmospheric lighting, but the functional part of the street lighting, provided through indirect metal halide lamp luminaires, could not be controlled. The LS project was designed and implemented during the autumn and winter season of 2011-2012. The design tool was in use and the LightStories were displayed in the Pakkahuoneenkatu street in the city centre of Oulu (pop. approx. 140 000), Finland, in February 2012.

The research aims of the LS demo were threefold: 1) On the level of *Design Process* the aim was to gain understanding of the design process of participatory and interactive lighting solution in an urban environment, and of the methods and tools necessary for the process. For this purpose, a pilot version of a PD tool was developed and tested in the wild. Additionally, the aim was to explore ways to employ algorithm aided design methods in the process. 2) On the level of *Participant Experience* the aim was to research how our participants experienced the PD process and the interactive urban lighting setting. Our objective was also to get feedback from the users of the design tool. 3) On the level of *Adaptive Lighting System* our challenge was to design and build an interactive and communicative lighting system, which allows the inhabitants of the city to participate in the design of public lighting, employing existing street lighting infrastructure.

The results of the LS demo have been discussed from the points of view of participatory lighting design process, tool development and piloting, algorithm aided design, as well as adaptive lighting system, in an earlier paper [21]. The paper at hand, then, focuses primarily on the specific insights and knowledge gained from the LS demo through our various evaluation methods with an emphasis on the themes of participation and communication, which were central to LS. Firstly, we will discuss our findings relating to our participants' attitudes towards adaptive and interactive urban lighting, and how participation was experienced by our participants, for example, is participation seen as necessary, and in what ways would our interviewees like to participate? Secondly, we will reflect on how participation and communication occurred and how these were achieved in this type of a process, and what kind of communication case LS created as an ambient media in urban space. Thirdly, we will discuss the sustainability and possible uses of the LS concept, the central feature of which was the participant communication through visual and verbal means.

2. METHODS AND MATERIALS

LS was in operation in February 2012, during a period of 25 days. Within that time, 105 user-generated dynamic lighting designs were displayed in the pedestrian-oriented street. The participants of LS were requested to fill an online questionnaire, in which the respondents were asked to answer a short set of multiple choice and open-ended questions relating to the experience of participating in lighting design, and basic demographic details about the users were collected. Volunteer participants were also invited for further theme interviews. Altogether, we interviewed seven participants and three accompanying friends. Two of the interviews were group interviews as we aimed to create some fruitful discussion about urban lighting in general between our interviewees. The semi-structured theme interview consisted of three sections and lasted from 1-2½ hours. In the first section we asked the participants about their attitudes towards urban lighting in general, adaptive and interactive urban lighting, and PD. In the second part we asked about their experience of participating in the LS demo. The last section consisted of questions relating to the user experience of the LS design tool. Participants' wishes and development ideas concerning LS were also collected.

All in all, the research material produced and collected in the LS case project included documentation of the design and implementation process; video documentations of the user created lighting designs; detailed data of the lighting designs and the associated narratives saved to the database; questionnaire results from 83 users (11 entries from members of the research group were removed); and videotaped interviews of seven participants and three accompanying friends. The following methods were used in the analysis of the research material: reflection of the case design process; statistical analyses of the participant's lighting designs; story texts and questionnaire data; and qualitative analyses of interview material and questionnaire answers. In qualitative data analyses the videotaped interview material was observed and analysed with the transcriptions collaboratively among the research group members. The emerging topics were discussed and documented accordingly. Results from different methods were reflected against each other. All interviews were conducted in Finnish, however, for the purposes of this article, relevant portions of the transcriptions have been translated into English.

3. ADAPTIVE AND INTERACTIVE URBAN LIGHTING: ATTITUDES AND IDEAS

Most of our interviewees portrayed a rather rich and varied understanding of the concept of urban lighting. Besides street lights and commercial lighting, the illumination of buildings and trees, signal lighting and seasonal lighting were brought up. Two of the interviewees defined the term as including all the lights that are present in the city.

The objective of urban lighting was seen as creating a safe and pleasant environment, the latter usually expressed as "aesthetics" or "a good atmosphere". By safety, they meant both being able to move around safely and having the feeling of security. Urban lighting was regarded as a way of showing people in the winter something that they cannot see in the summer. This aspect of northern seasons was present in many of our interviewees' answers, and the role of lighting in making the environment pleasant and beautiful was seen as important, *"after all, we really live in a country where there's very little light available for half the year"* (architectural student, male, 20-29). In addition, good urban lighting attracts people to use urban spaces (architectural student, female, 20-29). Or, as one of our interviewees put it: "*Good urban lighting, what would that be like… Urban, so that it would reflect the urban-ness of the city."* (social worker, male, 20-29).

Besides considering lighting as a static, unchanging component of urban environment, the interviewees were asked to imagine what urban lighting as a dynamic and adaptive element of urban spaces could be. The idea of dynamic urban lighting, which would respond to changes in environmental conditions or the presence of people, was regarded as positive by those interviewees who had a background in design or engineering, and they all presented ideas of how lighting could react and how users could interact with it. Several interviewees saw the benefits of adaptive lighting from the perspective of energy and cost savings. They imagined that

artificial lighting levels could adapt to their environment by dimming the light according to daylight levels, snow-covered surfaces, and the activity level of urban spaces. For one interviewee (publishing field, female, 30-39) the idea of changing light levels was unfamiliar, and she was suspicious of whether it could be possible at all for safety reasons. Light which changes according to the presence of people in the street was not seen as an entirely positive thing: *"it could be quite tiresome to live along a street like that, where the lights are flickering all the time."* (biologist, male, 40-49) On the other hand, brightening and dimming the street lights according to traffic levels was seen as a way of reducing light pollution in adjacent residential buildings during the night (UI designer, female, 30-39).

Additionally, lighting adaptations to natural seasons and calendar events were seen as having potential value in making the urban environment more pleasant and beautiful, for example by creating 'urban autumn foliage' with warm coloured lights, and a festive atmosphere over the holiday season. However, the use of this kind of lighting should be limited to important public areas. (biologist, male, 40-49)

Interaction with lighting was regarded as positive by the interviewees, although initially the idea seemed foreign to some of them. A pedestrian street was considered a good site for interaction with lighting. Artistic projects, such as LS, were seen as good venues for interaction. However, more direct interaction was also requested by one our participants (male, social worker, 30-39), who wanted to operate the lights in real time via a public screen. Others also mentioned this in a more indirect manner, such as both of the two architecture students, who wanted to influence the intensity and colour of lighting through touching the luminaires directly. Other ideas presented by the interviewees were "light graffitis" (nurse/geography, female, 30-39) and the ability to "highlight" things in the city for visiting tourists (UI designer, female, 30-39).

4. EXPERIENCING PARTICIPATION THROUGH LIGHTSTORIES

4.1 Participant profiles

Our system received questionnaire responses from 83 users (11 entries made by the research group members were removed). Additionally, 23 participants had made a LightStory without submitting the questionnaire. According to the results, LS was equally interesting for both female and male (54,2% and 45,8% respectively) participants. A majority of the respondents represented the age groups 20-29 years (39,8%), 30-39 (21,7%) and 40-49 (19,3%) (Figure 2).

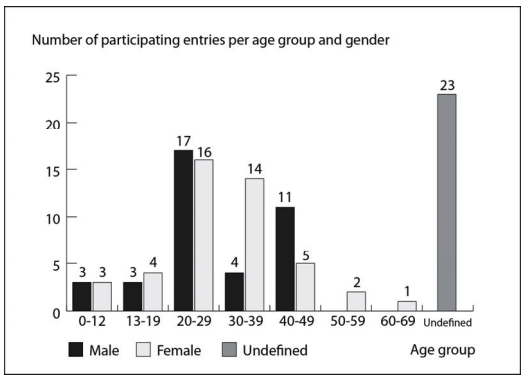


Figure 2. Number of design entries per age group and gender

Concerning their education level, a third of the respondents (32,5%) had completed their A-level equivalents and another third (36,1%) had a Master's degree or a Doctorate. 18,1% of the respondents had a Bachelor's degree, and 10,8% had passed elementary or middle school. Most of the participants were either from the city of Oulu (71,1%) or from the Oulu region (8,4%). However, the project had garnered interest also from other areas in Finland (16,7% of participants) and even abroad (3,6% of participants). More than half of the participants (57,8%) had lived in the city of Oulu for over 5 years, however, a fifth (22,9%) had never lived in Oulu.

4.2 Experiencing participation

At first, participating in LS and the concept of being able to design urban lighting seemed quite confusing for two of our interviewed volunteers. They expressed having doubted how it could even be possible to do so, and whether they had the abilities required. (retired healthcare administrator, female, 60-69; publishing field, female, 30-39) An architectural student (female, 20-29) mentioned that at first she was suspicious about whether there was any proper participation involved, and whether there would only be limited choices available without any real possibility to make a truly original design. However, besides these initial doubts, there was a keen interest to find out what all of this was about and how did it work.

Interviewees described the idea of LS as interesting and innovative. Moreover, it was seen as fun way to involve the citizens in urban lighting and in the design of their own environment. The respondents to our questionnaire reported that participating was easy (although sometimes challenging at first), inspiring, interesting, fun, or exciting. Only six people out of 83 commented negatively and said that they felt that participating through LS was complicated, boring, or did not meet their expectations.

Two out of seven interviewees had made on-site visits to see their own lighting design. When asked about what it looked like, one interviewee said he was pleasantly surprised as the colors were brighter than he had expected (electrical engineer, male, 20-29). Others had forgotten, were too busy, or the weather was too cold or stormy for an on-site visit. Most of the interviewees, however, had read other participants' texts on the website, or watched the street through the web camera.

How did the participation change the experience of that particular urban space, then? It can be safely assumed that all participants were obliged to think about the designated street space from the point of view of someone who is designing. Overall, those participants who had noticed a change in their outlook of the street in question reported positive changes. For instance, one interviewee (female architecture student, 20-29) felt that the street was now more pleasant to be in. Another (male electrical engineer 20-29) felt that his general outlook towards the area was now more positive because of participation. A third (social worker, male, 20-29) reported that he now thought of the lights every time he passed the area, which made that part of the city more interesting. Others did not think that participating in LS had changed their experience of the street in question, as they had not been familiar with the particular street beforehand. For these people, LS nonetheless brought the area into their awareness.

Overall, participation was seen as something novel, enjoyable and interesting. For example, several participants were eager to know whether LS would continue next winter, and asked if similar

things had been done elsewhere. Participation was seen as being most meaningful when it concerned the participants' own daily environment, such as their residential areas or a site of importance in their city (the pedestrian centre of Oulu was suggested).

4.3 What motivated our participants?

According to our interviewees, the various motivations to participate in LS seemed to be (1) the pure pleasure of playing with light and colour, (2) the pleasure of writing and publishing a story (3) the curiosity to find out how they can make a LightStory, (4) sending a message to their fellow citizens, (5) to enhance the space visually (6) the possibility to have an influence on their environment.

Two of the interviewees, both with design backgrounds (UI designer, female, 30-39; architectural student, female, 20-29), mentioned that they were mostly interested in playing and experimenting with light and colour. However, one male interviewee (social worker, 20-29) and an elderly woman (retired healthcare administrator, 60-69) described themselves as people who enjoy writing, and the stories or messages related to the lights were important to them.

Having an effect on one's own environment was found motivating: *"That I can actually have an effect on my living environment, that's really interesting and fun."* (Social worker, male, 20-29). Similarly, the electrical engineer (male, 20-29) was proud to be able to control the environment: "*I can say that I've had an influence on that […]and that [the street] is mine for an hour."* (electrical engineer, male, 20-29).

4.4 The necessity of participation

Bearing in mind that most of our interviewees had already expressed some interest in participation indirectly through making a LightStory, it was not surprising that most of them expressed a generally positive attitude towards citizen participation in the design of urban lighting. Only one participant (biologist, male, 40-49) had a mostly negative view of participation in the design of urban lighting, stating: *"that kind of stuff should be left to the professionals.*"

Those that were most enthused about participation in lighting design saw it as a natural extension of their citizenship. In other words, LS was not merely *imposed* on the inhabitants of the city; rather they were instrumental as individuals in how LS finally manifested itself visually on the street level, a finding which corresponds with our earlier discussion about the theoretical roots of PD. One participant also thought that participation was important so that different age groups could be better represented in design. Another (a non-participant) even saw participation as having an educational, or a consciousness-raising element (business economics, female, 20-29): *"Having the chance to participate, I think it makes people think about these things more."* However, many of those who expressed a positive attitude also had some hesitations towards participation in the design of urban lighting. Without exception, those who expressed doubt also said that they had trouble imagining how citizen participation could really be achieved in practice. Some also had a slightly cynical view of organised participation, as they could not believe that the citizens' opinions would be taken into consideration in earnest by the powers that be.

Our interviewees, then, for the most part saw participation as democratic and empowering; it had a positive effect on them and their fellow citizens. They did not express any strong opinion about whether or not they themselves had any special knowledge that would have been useful to design professionals, and no one expressed any distrust in the professionals' abilities either. However, participating in a design task, which is an immersive activity, nevertheless made it possible for these participants to commit to LS and spend a considerable amount of time thinking about what kind of a lighting design they would like to see in their city. For the research group, this meant that deeper, more reflective responses could be elicited from our interviewees.

5. LIGHTSTORIES AS COMMUNICATION

In this section we will discuss LS as a medium, reflecting on it from the perspective of how the project was designed to enable communication, how the communication was realised as user generated dynamic lighting designs and textual narratives, and how the users experienced communicating. Additionally, we will discuss how the user generated LightStories corresponded with certain times of the day, calendar events and topical issues. Questions of publicity and censorship will also be discussed.

5.1 Context and time

The number of stories created and the amount of visits on the website seemed to be connected with the visibility of the project in the local and national media. LS appeared twice in the local newspaper, and there were six radio broadcasts related to it (three on local and three on national radio). Additionally, a report from the street was shown four times on television, of which three were on national television. These reports were also published on the website of the national broadcasting company YLE, accompanied by a video clip. LS was also promoted through mailing lists, Facebook, and posters and flyers distributed in the city centre.

The three days on which people designed the largest number of LightStories were, or followed, the days on which the LS website had appeared in the media, either in print, on radio or on television. These are visible as three disctinctive peaks in Figure 3. The first peak occurred when the website was launched and was prominently displayed in a local newspaper and on the radio that morning. LightStories began to be displayed two days after (Feb 5). Television broadcasts of LS were on February 7, 8, 13 and 27. Besides the media-induced peaks, the service received approximately 2-3 entries per day, a small but steady use. These peaks were apparently not related to the dates on which the stories were displayed, except for February 14, which was both after the TV broadcast and Valentine's Day (Figure 4). Due to a technical error, there were no design entries on February 15. More LightStories were displayed during the first half of the test period than on the second half, which may partly be due to waning interest, but is partly related to the fact that there were less bookable hours available in the second half of the month due to the increasing amount of daylight and daylight saving time. The stories made by the research team were removed from the figures describing the use of the service.

The LS design tool was used relatively evenly during the day after 11am (except for slight peaks at 5pm and at 8pm), and the usage dropped at night after 10pm, as shown in Figure 5. The slight peak shown at 11pm might be partly due to the fact that the design system locked the next night for editing at noon. If a user wanted to have a LightStory presented on the same day, they had to submit it before noon. The display times for a LightStory between midnight and 6am were used only 0-2 times each (Figure 6), which could indicate that there is not a great need for this kind of service during the night.

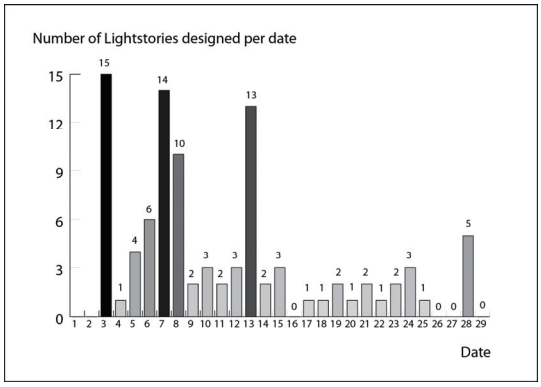


Figure 3. Number of LightStories designed per date

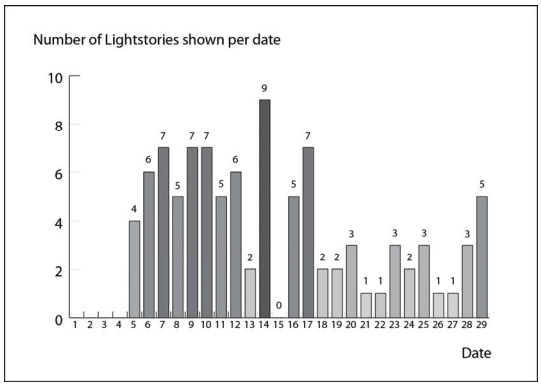


Figure 4. Number of LightStories displayed per date

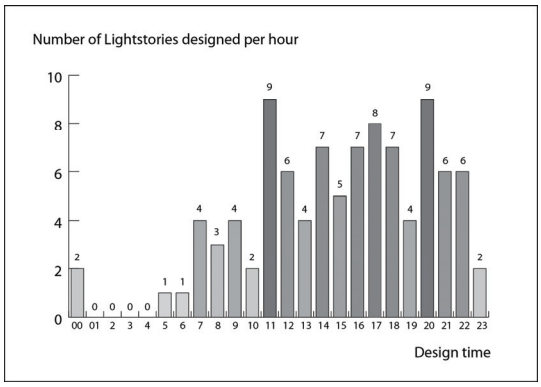


Figure 5. Number of LightStories designed per hour

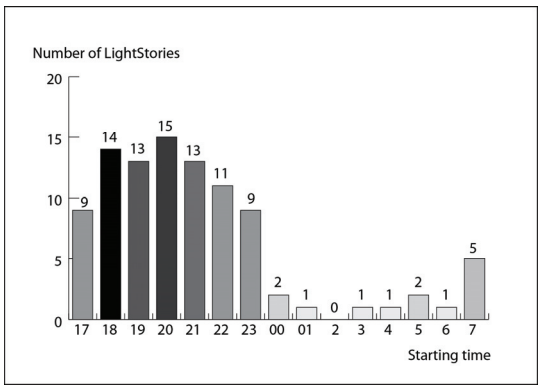


Figure 6. Number of LightStories according to starting time

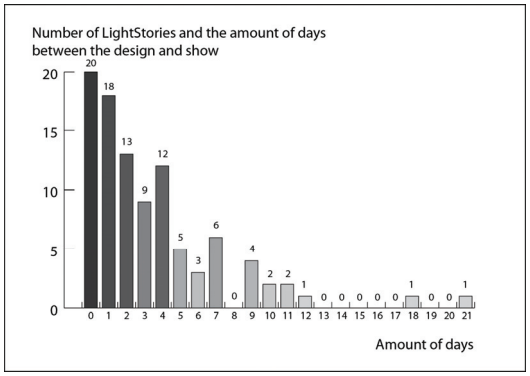


Figure 7. Number of LightStories and the number of days between the design and its display on the street

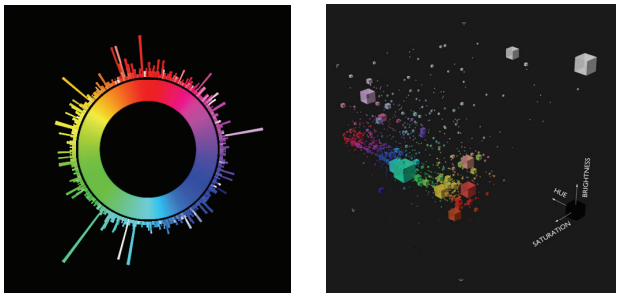
The stories were designed most often to be shown on the same or the next day, suggesting the need for a quick response and short delay between design and display (Figure 7). The majority of the stories were meant to be shown within a week of their design. There were only a few individual entries scheduled for a longer interval. A part of these designs commemorated a significant future date, such as the day when the participant was going to move to a new city, or the start of the study holiday for students preparing for their A-level equivalent exams.

5.2 Use of colour and dynamics

The LS online design tool was intended to offer users the possibility to make varied designs, and to communicate expressively with dynamic and colourful light. A web-based design tool was chosen as the interaction medium, as the research group saw it as giving the users the most accurate and versatile means for co-design. One central problem in the design of the tool was how to strike a balance between the amount of design choices that were offered to users, and how uncomplicated and simple the user experience should be. Making the tool as easy-to-use as possible has the risk of limiting the users' freedom of choice, thus discouraging also their design aspirations. A PD tool in our case was not meant for professionals but for everybody, and it should attract and encourage people to participate.

Our online PD tool was built around the concept of a *timeline*, which is used in many control device manufacturers' design programs. Users compile their lighting schemes from different kinds of partially pre-determined light events, both static and dynamic, which they can modify to their own preferences.The creative options that a LS user could have were carefully designed considering the tool designer's responsibility to prevent any possible harm to pedestrians or neighboring buildings caused by ill-devised lighting schemes. The choices concerning the speed of change within the dynamic effects were tested to ensure that possible traffic and medical problems were avoided.

However, the LS web design tool offered a complete range of 16 million colours for the design of LS. The colour picker included a selection tool for the brightness and saturation values of a particular colour, and a colour wheel for the hue. The entire hue range is very well represented in the colours that have been selected for the stories, which would indicate that the possibility to freely select colours is important. The used colours, then, were a rather good representation of the whole and continuous colour spectrum (Figure 8 a).



Figures 8 a, b. The colours used in participants' LightStories.

The brightness and saturation on the colour picker was set by default to be fully saturated and in the middle of the brightness value. Possible influence by the default value can be seen in Figure 8b, as the majority of the colours are located at the most saturated end of the spectrum; however, the intentional use of bright colours was also brought up by several participants in the interviews. There is a significant amount of less saturated colours too, meaning that the brightness and saturation selection tool has been used extensively. Overall, lighter colours have been used more often than darker tones.

Figure 8b shows the full range of colours in the three dimensional HSV-colour space (Hue, Saturation, Value), with the size of the cube representing the number of times a single colour was used. White and black appeared more than any other choice of colour. Their abundance can be explained to a great extent by the use of the 'Flicker' effect, where black and white were used by default among the selected three colours to create the desired effect. The large amount of black is also due to errors by incompatible browsers, where colours were not correctly saved. Consequently, black and white are truncated to 22 instances, since this was the maximum number the most popular colour (turqoise) was used.

According to our user feedback, communicating with colours had been seen as very important and also rewarding by the interviewees, as well as essential in expressing symbolic meanings and feelings. Colours were thought to be useful for expressing, e.g., political opinions, calendar events (national day, Valentine's day, Christmas, Easter) and support for sports teams. Participants wanted to imitate the look of the northern lights, growing grass, and snow storms, just to mention some examples. One participant (biologist, male, 40-49) had made a tribute to his recently departed mother. For him, participating in LS was part of his grieving process. Another one (publishing field, female, 30-39) wanted to express the joy of moving to a new city, to Oulu.

Experimenting and playing with colours and light was also mentioned as a positive thing: "*It took some time 'cause I changed them around, I didn't get to the end result right away[…] it was nice to design and savour those colours before deciding on an end result*." (publishing field, female, 30-39) A biologist (male, 40-49) commented that because street lighting usually is monochromatic, colours can create more interest. "*I love colours anyway, so it's an important thing.*" Interviewees mentioned intentions, such as to make a design "*as colourful as possible*" (publishing field, female, aged 30-39), to have colours "*as bright as possible and clashing with each other*" (electrical engineer, male, 20-29). The need to bring vivid colours into the cityscape seems to be closely related to the cold and dark period of the year (February), as also one of the interviewees stated, he wanted *"to bring those springtime colours into this greyness*." (social worker, male, 20-29).

Besides colours, the dynamics, which could be created from customisable pre-determined effect templates, were seen as an important and interesting means of expression. One participant spoke of "*the dynamics, how to make it come live*." (biologist, male, 40-49), another stated that she "*certainly altered the pace, too […] so that it was kind of slowly flowing forward […] and at some point it was changing a little faster.*" (publishing field, female, 20-29). Displaying calmness (slow) or being energetic (fast) were among the more popular ways to use dynamics. Those effects which could be characterized as the most dynamic ones – namely "Flicker" and "Movement" – were the most commonly used. Moreover, of the three tempo alternatives, "Quick" was very clearly used more than "Moderate" and "Slow". This might indicate that users really wanted to have as big an impact as possible on the urban space, a sentiment that was also stated by some interviewees (e.g. electrical engineer, male, 20-29).

Additionally, users were able to determine the length of individual events in their lighting designs. Events of shorter lengths were more popular among the users than longer length ones (Figure 9). Some of our users also wished to have the ability to make even shorter light events than the defined minimum (5 minutes). This would add the expressive potential of the design tool. Moreover, one interviewee thought that there should be an option to make lighting designs which are shorter than one hour – for example, 10 minutes would be a more suitable length for the story to be watched as a whole on the street.

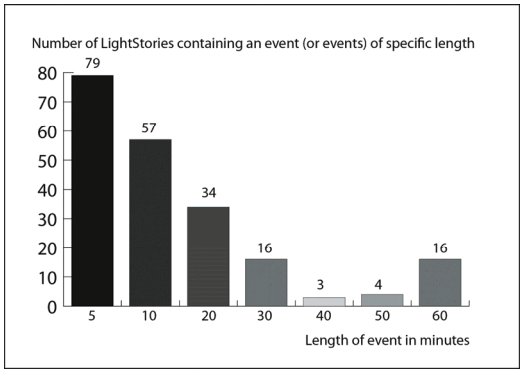


Figure 9. Number of LighStories containing (an) event(s) of specific length

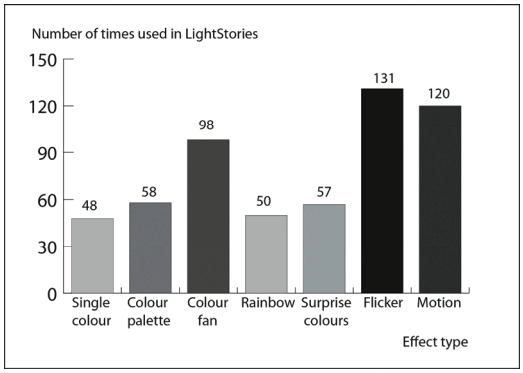


Figure 10. Use of effects in LightStories (number of incidents)

The interviewees' answers indicate that the offered amount of choice was sufficient; for most of them, it was difficult to invent anything else they would have wanted to do. They felt that they really had the possibility to design for themselves, not just to

select from ready-made options. Also the data from user-generated designs suggested that all the effect templates were necessary, as they were all used (Figure 10).

Regardless of the wide array of design choices, the tool was considered generally to be easy to use. However, the design task had been difficult for the elderly user (retired healthcare administrator, 60-69). Surprisingly, also one design professional (UI designer, female, 30-39) considered the design of lighting as quite difficult, because of the many choices, and also the unlimited colour options. She suggested that there could be two options: a more versatile tool for the more experienced users, and a very simple one for basic users. One explanation for her reaction might be that she was approaching the task in a very professional manner, which also set the standards high for her process and results, whereas most of the users, being laypersons, saw the task in a more leisurely way.

We also asked in the questionnaire about how participants would describe the experience of making a LightStory. 67.1% of the respondents described it with positive adjectives ("easy" 31.6%, "fun", "nice", "inspiring", etc.), 17.7 % mentioned something positive, but suggested improvements, 7.6 % were unable to form an opinion, and 7.6 % of the answers were negative, or indicated that the respondent had experienced difficulties.

5.3 Narratives

To accompany the lighting designs on the street, the users had written texts which could be read on the landing page of the LS website at the time the lighting design was presented in the street. All the stories were displayed also on the calendar page and on the public UBI touch screens. During February, 90 texts were saved to the server (11 by members of the research group). Additionally, 15 lighting designs were saved without the text due of a system error. These texts varied from short greetings, narratives or descriptions to longer stories.

Greetings often marked dates, such as Valentine's Day, birthdays, anniversaries, or were just meant to bring joy to some close person or to all the people of Oulu. Stories described, for example, a memorable situation in the writer's personal history (e.g. the birth of a younger sister, memories of a summer holiday in Oulu in the 1950's, a story of two swans which the writer had taken care of throughout one winter), a topical theme (election day, the birth of Princess Estelle of Sweden), or simply the writer's current state of mind. The last example could easily be likened to a status update in social media. LS was not used to inform of events or for advertising, except for our own invitation to participate, which was the very first LightStory displayed.

5.4 The interplay of light and text

The narrative element was intended to help participants without previous design experience to start designing dynamic lighting. In the interviews, attitudes towards the narrative part varied: some participants found it very inspiring, an important part of the process, and also useful as aiding the design. For example, in the questionnaire, one respondent compared telling the story with light to making a narrative with music, a process which was familiar to him. A couple of our interviewees suggested that writing should be done in parallel with making the lighting design, so that each light event composed could be linked with the corresponding part of the written story. This could also be used in the presentation phase of the lighting design as some kind of a manuscript of events in parallel with the lighting. However, as previously noted, for some of the participants, the play with light and colours was the primary part, and writing something that would be published on the website was seen as unimportant, or as even an unpleasant necessity. However, the minimum length for the story was one character, so the decision about how much to write was left to the user. Consequently, the verbal and visual tools complemented each other as was intended, attracting people with different strengths and abitilies, and enabling users to express themselves accordingly.

All in all, the rich collection of varying lighting designs and texts is a compelling demonstration of the enthusiasm and inspiration the participants experienced. The documented material, then, offers many possibilities for a full content analysis, which is not in the scope of this article.

5.5 Publicity and Censorship

Participation in LS required a willingness to make one's designs and messages public. Attitudes to this publicity varied widely. One participant (architecture student, female, 20-29) expressed some discomfort about the task of writing a story or a message. Despite this generally disdainful attitude towards publicising her own words, this participant had a very clear message (encouraging people to vote in the presidential elections) in her LightStory, which had also informed the choice of colours in the lighting design (her candidate).

At the other end of the spectrum we find the participant (male, 40-49) who wrote arguably the most personal narrative, a tribute to his mother who had recently passed away. Despite the intensely private subject matter, he was eager to express his feelings, as long as he remained anonymous. The act of expressing these feelings implied that the mode of participation was seen as secure and trustworthy enough, and at no point did the interviewee express any doubt about this. Another participant (male, social worker, 30-39), had given a good amount of thought to the publicity his narrative would receive. However, rather than repelling him, the publicity of the story had sparked a desire in him to encourage people to participate in LS and to care about the urban environment, and that ultimately he *"got this urge to get that message out there"*. Overall, almost all of our interviewees were very much aware of that the narratives would be displayed publicly, and most of them wanted to use their LightStory as a platform to tell other citizens something that was important for them. In this respect, LS truly was an urban social medium.

As such, the question of *moderating* the content was considered carefully by our research team before the launch of LS. It was decided that the narratives would be checked afterwards daily. Albeit a somewhat risky choice, this proved to be the right one for LS. No messages were removed from the website, as most were overwhelmingly positive in their tone, and even those that were considered somewhat borderline were merely slightly incoherent. Some of our participants also considered moderating important and potentially problematic, especially by participants who were designers. Concerns that the quality of lighting should not be negatively affected were expressed by layperson participants.

During the final analysis of our evaluation materials we became convinced that the inherently creative nature of LS repelled those who only wanted to wreak havoc. In order to vandalise the system, an ordinary user would have had to create a lighting design, write a message and fill out our user survey. This ensured that the system was not a particularly worthwhile target for disruptive use (notwithstanding more technologically advanced

forms of vandalism). Systems which require creativity and more immersive participation, then, are at least potentially more robust against simple leisurely vandalism.

6. Development work: challenges and ideas

In this final section, we will reflect on the key challenges and ideas for further development work concerning participatory lighting design and installations, which the LS case has taught us.

6.1 Communication in the street and online

Our project expands the idea of social media by bringing it into the urban scenery, and by imagining what else could it be than comments and pictures on a two-dimensional screen. In this pilot version of LS, the communication with light and text was more or less one-way communication. Even though self-expression in a public forum was important in itself for the participants, the system could be developed further by adding the possibility for two-way communication between the participants in the street and on the web, e.g. with a commenting feature, "like" buttons or even by the possibility of responding to a LightStory with a LightStory. This latter kind of internal referencing would have been possible in the current system in principle, but incidents of such use did not occur. The delay in communication due to the time booking system might have prevented this.

The texts were accessible on the site through the public wireless PanOULU network, via personal mobile devices, and with a laptop one could even compose a LightStory in one of the many adjacent cafés or restaurants. We will explore the potential ways to bring this option to people's attention in the future, e.g. with QR-codes attached onto the light poles.

6.2 Method, medium and context of participation

As previously stated, co-design enabled the research team to engage the participants more deeply, and similarly, our interviewees saw it as a good way for them to participate. Moreover, rather than limiting, the design tool's set of customisable pre-designed effects was seen as a good starting point for participation. The internet was overwhelmingly favoured as a medium of participation. Ideas revolving around online tools included the possibility to design and preview LightStories in real time on the internet, the ability to report unsatisfactory lighting conditions on the City website, and a service where citizens could take pictures with their camera phones and send them to city officials. Ideas for more direct interaction with lighting were also presented, e.g. controlling lighting via a public touch screen or smartphone in real-time, or even by touching the luminaires themselves. Some participants also wished to play with other types of light, such as projectors, and to influence *what* is being lit. Some also wished to be able to cast light on different kinds of objects, such as walls, architecturally interesting buildings, and snow. A larger implementation of LS, which would span the whole of the pedestrian centre of the city, was also requested by some participants. Many hoped for a continuation of LS, especially at Christmas. The choice of site also appeared as an important factor in the success of a participatory lighting system. Some participants had hoped for an even more prominent and central location, but others reported an increased positive awareness of the previously uninteresting locale. The system, then, can be used to improve low-profile or disused areas; however, a more prominent site can attract more users.

6.3 Sustainability of participation

As LS was well received by our participants and it also captured the interest of the media, it is an interesting question whether a similar system would be feasible in the long run. It must be noted, however, that LS was not intended as a year-round system. This was partly due to special northern circumstances, and to the restrictions of the research project, but also partly because LS was intended to play a slightly different role in the city. By involving participants deeply in a co-design process, LS was suitable for educational and awareness-raising purposes, as well as for research purposes. As such, LS fulfilled its intended task well.

As the street lights are maintained by the electricity company, the added maintenance task would be to ensure the smooth running of the LS website design tool. The real challenges, then, for the continued operation of LS would relate to developing the content and mode of participation, as LS is currently best suited for events and shorter periods of time. The added possibility to use multiple platforms, especially the various mobile operating systems, would be a priority. Similarly, more independent, intelligent and responsive real-time interaction might be necessary to lower the threshold of participation in long-term use. Even though an 'empty canvas' was preferred in this short-term demo, the system might create its own designs when it is not being used to maintain people's interest and a lively, attractive cityscape. Furthermore, as media attention cannot last for an extended period of time, participants might be sent a message to encourage them to invite their friends to participate. Additionally, QR-codes, public touch screens and posters could be used to inform passers-by to use LS.

However, a continually available system, with added ease of use and a subsequently lower level of engagement, would likely produce a different kind of experience for its users. Interesting research questions would include: How would this affect the sense of control that LS participants feel? Would usage fade away with dwindling media attention, or would misuse eventually become a problem? Or would some kind of a culture of usage develop over time? Another interesting way forward would be to use LS as the event-based medium that it is. How would people from different demographics, such as school children or convicts, use the design tool and what stories would they tell if given the chance?

7. CONCLUSIONS

LS explored the process of utilising a part of the existing lighting on a pedestrian-oriented street as a forum for personal narratives, messages and greetings through an online PD tool. The LS concept of engaging participants through the possibility of visual and textual expression – the design of dynamic lighting and the writing of texts – was found successful, our main findings being:

(1) From a research point of view, LS provided our research team a means of engaging people in a more meaningful way, thus eliciting more thoughtful responses from our interviewees and questionnaire respondents. The method is applicable in other participatory projects, which aim to collect people's profound attitudes and ideas for, e.g., developing public environments.

(2) The combination of both a visual and a textual task managed to inspire participants with different abilities to participate and communicate. The interplay between light and text can be developed further both in the design of the tool and in the presentation of LightStories in the street.

(3) The participants valued the many design possibilities the LS design tool offered. The tool with a set of customisable pre-

designed effects was found to be a good starting point for participation, as it aided the design process. Our participants used the design tool in creative and versatile ways.

(4) LS proved to be robust against vandalism, quite possibly because it required a high level of engagement and creativity from its users.

The prolonged sustainability of LS could be ensured by the continual development of the system and the modes of interaction. The use of LS could be developed in collaboration with different demographic groups. On the other hand, as our evaluation of the interview and use data shows, the piloted concept for participation and communication through expressive means was seen as empowering, meaningful and inspiring. As such, it should be employed for different purposes in further projects.

8. ACKNOWLEDGMENTS

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Developing a Neighbourhood Locative Media Toolkit

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ABSTRACT
We describe the development of a toolkit using locative media and Internet of Things (IoT) technologies as an approach to enabling neighbourhoods to engage with their local built and social environment. We address how the local community informed the concept, development and presentation of the projects through a series of public consultation workshops and events where neighbourhood residents were invited to trial the projects. The paper describes and documents work in progress.

Categories and Subject Descriptors
H.5.2 [**User Interfaces],** H.5.3 **[Group and Organization Interfaces]**

General Terms
Design, Experimentation, Human Factors.

Keywords
Neighbourhood, locative, toolkit, engagement, place, workshop

1. INTRODUCTION
Digital tools invite people to interact with urban space through in-situ and embedded experiences with digital media. When interactions are situated within the context of existing social knowledge and processes this can create a deeper understanding of place [1]. Traces of past activity and inhabitation, which are by their nature immaterial, can be made tangible through these digital media. A key aspect of such media is that they explore and adopt the narrative format and nonlinear frameworks to capture and reveal stories about the city. For example projects such as 34 North 118 West [2], Urban Tapestries [3, 4], Comob [5] and 1831 Riot! [6] draw on everyday social histories and mobile practices to create new relationships between people and places. These works enable new forms of shared interactions in public spaces through ad-hoc encounters and participation in event-based interaction [7].

The key aspects of such projects; the fact that social narratives can be embedded in place, and the opportunities for sharing experiences can have benefits for processes such as planning in place-based communities [8]. Digital tools invite community members to experience urban space in new ways, both through enabling them to interactively engage with design decisions and processes and also through literally enabling people to view virtual exploration of proposed designs. Public participation has been recognised as an essential part of the planning process and many studies have been carried out to evaluate what tools are available and how effective they are. The majority of the studies focus on the use of visual presentation and communication using a range of advanced computer software such as Geographical Information Systems (GIS). However the main issue with the use of GIS is that it is generally viewed in a situation remote from the environment in which it is captured. The increase in the use of mobile and ubiquitous technologies (mobile phones, GPS etc.) can help to address such problems. Recent developments in the use of ubiquitous technologies can enable a move away from the screen into in-situ decision-making that can happen over time and that can have significant benefits for understanding. As suggested, many projects have developed GIS mapping and visualisations of landscapes, however, little research has been carried out on mobile and ubiquitous technologies within the urban environment. These have the potential to capture more person-centred and everyday experiences of the built environment in neighbourhoods, including aspects such as recording emotion and enabling sharing of information. As such they offer a valuable method for citizen participation in complex urban issues [9].

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This paper outlines an approach that investigates the use of ubiquitous media (such as tablet PC's running interactive mapping software, IoT QR codes and GPS platforms) within a neighbourhood as a toolkit for participation and engagement. These projects were situated in Devonport, a neighbourhood of Plymouth, UK with a long and complicated history of urban change, where physical divides, historical changes, social policies and natural boundaries have created a rather incoherent and fragmented urban fabric and organization. The aims of the project are for a whole range of types of mapping, intervention and dialogue such as:

- Mapping change in the environment
- Making sense and characterising the built environment in their neighbourhood as a shared process
- Allowing for a gathering and making sense of opinions in the place.
- Recording and capturing responses and comments on what others have said or done or thought.
- Giving the possibility for people to make decisions about characteristics, change or development in the built environment in-situ.
- Capturing the existing view of the place.

The paper outlines the early stages of the engagement process where we completed two workshops in the neighbourhood. We outline the development of the toolkit and the process we undertook to gain support or 'buy-in' for the approach within the neighbourhood. We discuss the initial outcomes of a workshop

with schoolchildren from the community and how they interacted with the toolkit. Finally we review implications for this approach for engagement in neighbourhood planning processes.

2. PARTICIPATION

2.1 Technology Narratives

Willis et al define an approach that employs 'technology narratives'; where rather than focusing on one platform, device or application (app) instead there is an interweaving and co-production that also changes over the course of a particular activity and over time. In this way 'the technology may suggest a fixed outcome or goal, but actually it simply creates a point in space to which people weave their own practice of the use of technology' [7]. This allows for individuals and groups to construct their own technology narrative around an 'activity' rather than insisting on a common outcome [10]. The narrative as a format creates a way of making the personal, hard-learned information of one person or group accessible to another person or group. Therefore we focused on developing a toolkit comprised of a range of IoT and Augmented Reality (AR) technologies, as well as GPS-based platforms such as geocaching.

2.2 Barriers to Participation

The primary barrier to participation is that it is hard to mobilize and appreciate the local community's reading, interpretation and inner-knowledge of place. This is exacerbated in more deprived communities, where locals are not used to having a voice, so that locals simply do not understand why they are being asked to engage, and why their opinion matters. The 'why me?' question is an oft-encountered barrier to engagement, as neighbourhood members seek to define their role, especially if they do perceive a problem or issue that requires their voice to be heard. In order for the technologies to be successful and sustainable, locals and stakeholder groups need to take ownership of the tools and have a sense of being part of the overall process. However, in the use of location-based content there are many barriers to participation at an everyday level, which include practical issues such as:

- People simply do not have internet-enabled, location sensitive smartphones. If they do they don't have a common platform (iPhone/Android/Windows/RIM).
- People are not familiar with downloading and using apps.
- There is a poor network/GPS signal in the place where you want to access information.
- Communicating instructions and background about a project over a mobile interface are difficult to make entirely self-explanatory.

3. DEVELOPING A TOOLKIT

In this project we did not develop a single app or platform. Instead we took a technology narrative approach based around the idea of a toolkit. This does not present a technological 'solution' but a process through which a palette of location-based technologies can be adapted and moulded to suit a neighbourhood's needs. This allows for people to engage with the process through choice; they decide which format/mode of participation suits them and work with this. This can be based on factors such as areas of interest, familiarity with technology or whether they want to interact independently or with a group. This was also about sharing access to the platform and changing formats before, during and after the activity. Therefore the toolkit offers a series of options, out of which participants can build their own narrative. These include a mobile format (app), a web-based/game format (the integration with an existing web platform), an embedded format (QR Codes embedded in place) and a sharing format (iPad with all four options together with a camera). Each of these options were designed and developed by an interdisciplinary group of architecture and digital arts students from the University of Plymouth.

3.1 Mobile – App

The app was developed to enable the discovery of familiar places in the neighbourhood but through self-navigation. Entitled 'that way' it consists of a compass that points towards one of a series of 24 destinations in the neighbourhood. The compass needle is split, so that one needle points to the destination, whilst the other stays fixed pointing to a key destination (in this case the Devonport Guildhall or Town Hall whose location is known to all local residents) (Figure 1.). It enables locals to navigate to places in Devonport, not through showing them the way, but through taking routes through lesser known streets and areas, and thus enabling people to explore the area anew.



Figure 1. 'that way' app.

3.2 GPS based Web Platform and Game

We decided to work with an existing web-based platform in order to try to engage with people who were already interacting with places via GPS. We created a series of geocaches and located them at significant locations in the neighbourhood. Instructions in the logbook and in the online description asked geocachers to take a picture at the site and upload it to the geocache library. This was linked to a game that can be played at workshop events. Inside each geocache cards with numbers were concealed. For the game teams set out to find as many geocaches as possible before the other teams, gathering the highest scoring card in each cache as they go. The team to return to the start-point with the highest scoring cards is the winner.



Figure 2. Log from visitor to 'Redrow' cache.

The valuable aspect of the geocaching game is that it enabled engagement with wider members of the public through an existing established platform. Very quickly the geocaches gathered logs which documented personal histories of the cache locations (e.g.

see Figure 2). It also brought strangers to the location who discovered a new place

3.3 Embedded - QR Codes

At a series of locations within the community QR codes with a story platform were fixed in place. These codes link to a platform where audio stories recorded with locals can be heard, comments can be made and new stories can be recorded. This aspect of the toolkit was about creating a way for locals to make sense of everyday social histories linked to key places in the neighbourhood and to create an opportunity to share them (Figure 3).



Figure 3. QR code at the Devonport Column.

3.4 Sharing and Exchanging Knowledge - Tablet

As a format for working with a group and sharing and exchanging comments and ideas a tablet such as the iPad provides an easy-to-work with platform. The iPad becomes the focus of a small group who can either interact with the app, download information about the geocache locations or access further information. Importantly the camera enables the group to document their investigations during a workshop, and then review and discuss them at the end.

4. WORKSHOPS

4.1 Getting Stakeholders on Board

For the initial workshop we developed a prototype version of the toolkit and showcased it to the local community at an open event in Devonport Guildhall in February 2012.



Figure 4. Plymouth City Council Neighbourhood Officer discussing the prototypes.

This was hosted by RiO (Real Ideas Organisation), a social enterprise company based in the neighbourhood, who acted as the local 'champion' for the project. At this event we had conversations with a number of stakeholder groups about developing the student projects into working applications to be used in the community as an exploration tool (Figure 4.). These included local representatives from the city council, school teachers and community groups.

4.2 Working with a Local School

As an outcome of the initial Workshop we were asked to develop a workshop for students from Seymour House in Devonport, a pupil referral unit for children excluded from the traditional school system. They have a range of issues, ranging from autism, to severe (ADHD) or psychological problems. A key issue was that these students have difficulties with maintaining concentration, particularly for longer periods of time, and do not respond well to traditional ways of giving instructions or guides. None of them had access or experience of smartphones, although all had mobile phones. There were also issues of anonymity and responsibility, since the students were both underage and in local authority care.

The teachers asked to work with the toolkit because it suggested ways of learning about the local environment that was non-classroom based and did not involve traditional teaching formats. The primary focus of the workshop was on the app and geocache game with a slight variation where pieces of a QR puzzle were hidden across the caches. The students carried iPads with them to document their actions. Since all the students needed adult supervision the workshop was split into teams, with each team having one member of teaching staff, University staff, staff from RIO and one student. Each team had to collect puzzle pieces from each of the geocaches as well as filling out the logbook and they used the 'that way' app to navigate to the cache locations (Figure 5).

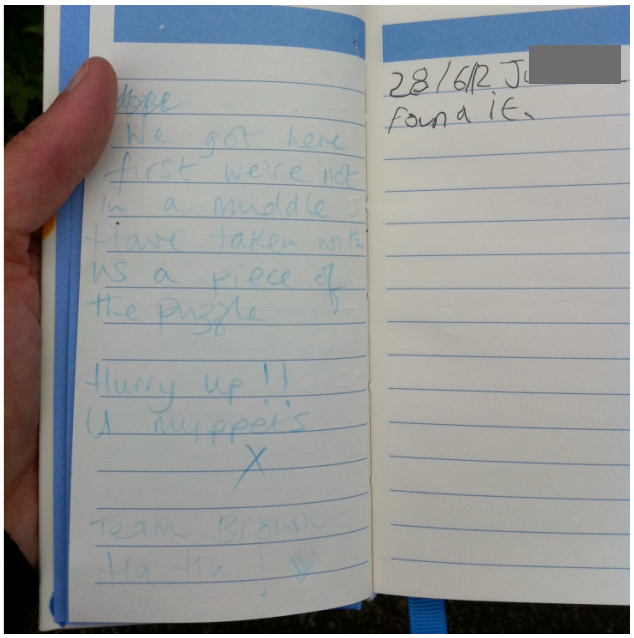


Figure 5. 'L' The logbook for one cache, with the different teams' entries '*We got here first were not in a muddle. Have taken with us a piece of the puzzle. Hurry up muppets. Team Brown.' 'J': 'found it'*

During the game there were many opportunities for sharing stories about Devonport and talking about change that had happened in the neighbourhood. This became an opportunity for incidental learning and shared social experience. At the end of the workshop

each student talked through the photos they had taken during the game and what they had found (Figure 6.).



Figure 6. 'J', 'S', 'W' and 'K' take a photo to mark the 'find'

Below is a transcript of the conversation in one team during the last stage of finding one cache. The cache is located in the only shopping street in the neighbourhood, which has seen a lot of change over the years. The team comprised of 'J' the student, 'W' a teaching assistant who also grew up in the neighbourhood, 'K' from RIO a local social enterprise working with the school and 'S' from the University.

K: Can you see how far up we have to go?
J: (looking at phone to guess distance to cache) Yes
W: Are you seeing it on the phone are you watching it on the phone?
K: We've got a bit further.
J: Yes.
K: Yes, we've got a bit further, its look like it.
J; My friend's dad's shop is up here. I think it is, it's still up here innnit?
W: Yes it's called 'World'.
J: Yeah I've been in there, I know his dad.
W: I tell you which one has been a long time, the locksmiths. Now, that supermarket has always been a supermarket. Not always been a Co-op though. It was just a Post Office first. Err. I can't remember. A Lyptons. Lyptons. That's it.
K: How are we doing?
J: Well, we're nearly there.
K: (reads out the geocache clue) Here's the clue- 'it's next the wall behind the bush'.
J: it's here.

In this activity 'J', who is high on the autistic spectrum, held the phone and was given the role of deciding where to go and guiding the other team members. She was also prompted to recount her own memories of connections with the place, where she talks about the shop owner she knows. 'W' brings in an account that shows just how much the street has changed over the last ten years, with one key shop having changed names a number of times. It shows the way that knowledge about the place is shared through the conversation and how the search for the cache enabled a way of negotiating a shared awareness of place.

5. SUMMARY

The toolkit approach has enabled us to engage in a small way with a local neighbourhood and provide a platform for locals to share their knowledge and understanding of the place. Locative media have potential to create opportunities for such engagement, but they also present challenges to participation that a toolkit approach on its own cannot address. Creating a medium term framework for locals to capture and make sense of their local neighbourhood's value and characteristics in order to think about the future is still a long way off, but we have taken some first steps to exploring a route which may enable such an approach. Particularly in the context of the UK Localism debate and the focus on neighbourhood plans, we suggest that prioritising the narrative over the technology platform during the design process helps communities relate to, understand, and talk about their locality in new ways and that this may help them to take part in such processes.

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