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Augmenting Social Environments
Real-time data in public spaces

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Songs that kept me writing

"That's the highway that goes to the building
I pick the building that I want to live in
It's over there, it's over there
My building has every convenience
It's gonna make life easy for me
It's gonna be easy to get things done"

Talking Heads, Don't Worry About The Government

"Why can't you see
That a life in art
And a life of mimicry
It's the same thing!"

Destroyer, Looter's Follies

1. ABSTRACT

Social interaction is a sustained presence in all societies throughout history; however, the methods of interaction have radically evolved in recent years, aided and augmented by both technological developments and the sense of comfort generated by these developments. In this thesis, I am exploring how embedding social data into architecture and urban environments can affect social behaviour in innately social spaces, in order to create projects that augment physical environments by incorporating digital data into public spaces.

While real-time interactive art in public spaces is a new and expanding field, effectively deploying these works requires a significant amount of prior knowledge. Due to the combination of humans, technology, the built environment, and human-computer interaction, interactive public artworks require great care and cautious design in order to provide a critical and functional takeaway. Currently, there are no formalized standards or guidelines for the execution of art works in public spaces. However, looking through the recent historical development of public spaces, architecture, computer science and interaction design can show how the theories and research projects in the various fields came together to form the basis for the existence of interactive art in public spaces. There are clear links between disparate fields of research, and instances of pre-existing theory reinterpreted for a more appropriately modern contextual use. For media artists, this collection of theory provides design principles, use cases, and point us toward the evolution possibilities of interactive art projects in the augmented spaces of modern urban landscapes.

2. INTRODUCTION

Public interactive artworks provide a crucial opportunity for media artists to recognize the shifting ideas of how urban inhabitants use their public space. Methods of social interaction, usage of public space, and how data is both created and digested are being continually re-defined and refined through technological and urban developments. This thesis will begin with building a framework for understanding how public space today is used, based off the changes and evolutions over time of public space usage. Real-time data in public spaces relies on three main components: public space, social interaction, and smart environments. These three components are studied and analyzed in detail, with attention paid to particular theories and ideas that manage to weave across the diverse fields, ideas that are continually updated and refined over decades of use and reflection. The three components were not chosen at random, or because they were the best fit; rather, they are areas that have provided an abundance of theory and research into over the twentieth century. As we will see, interactive digital art provides a natural convergence of the three, interconnecting much of the theory that wasn't initially intended to cross so many research fields.

It is my belief that artists cannot adequately design art for public space without a solid foundation of theory about how their intended spaces are actually used by people. The teachings of the Bauhaus (which are discussed in detail in Chapter 3) showed the importance of learning interdisciplinary skills that can then be applied to one specific focus; this thesis attempts the same principle for informing about public space. Chapter 3 covers the history of public space, relating to urban environments and architecture. Specifically focused on the twentieth century, the dominating principles of the century and the resultant 'legacy theory' which is still relevant today is given particular attention. Chapter 4 will show the relationship between social interaction and embodiment, and the role of phenomenology in tying together social philosophy and computer science. In Chapter 5, we look at the roots of smart environments, and the rapid development in creating spaces that can augment

daily life. Chapter 6 moves on to the Real-Time City, a term for describing the urban landscape of cities today, cities where smart environments have become augmented spaces which blend digital and physical seamlessly, often without the realization of the users of these spaces. Chapter 7 covers the pressing issues that have risen from the advent of the Real-Time City, mainly privacy and the ethics of environments that are able to track and cater to users. This thesis will then move to the practical component, showcasing the projects I have created for the thesis, how they managed to further research into public interactive art projects, and what implications for future projects can be gathered. A user-centered design perspective is used here, for two reasons. The first reason is that the theoretical portion of this thesis demonstrates a clear trend over the last century towards more user-centered design for our urban environments, computing experience, and daily life in general. Secondly, as I am originally educated as an Interaction Designer, user-centered design is what I was first taught and is almost unknowingly the centre of every design methodology for my art projects.

There is much to explore in the topic of public space, so some considerations must be made. First, most research is made from a Western viewpoint; that is, architectural and urban theory that has largely shaped the Western World throughout the twentieth Century. Furthermore, the phenomenology topics of this thesis mainly cover the branches that have gone on to become standards in computer science and Human-Computer Interaction (HCI). While many other branches of phenomenology are perhaps more apt for studying social interaction and the behaviour of people in public space, the sections which have been adapted to help illustrate HCI principles are the most relevant to this thesis. Lastly, a significant theme of this thesis is showing the interrelated theories and texts that have shaped the development of real-time interactive art in public spaces. To navigate this thesis, references to other sections of theory that support arguments or relate to artworks are given with the Section number in square brackets, such as "[Section 1]" or "[previously discussed in Section 1]".

3. A BRIEF HISTORY OF PUBLIC SPACE: FROM PRE-INDUSTRIALIZATION TO THE END OF MODERNISM

How does one define space in a city? Simple definitions such as clear divisions between easily distinguishable private (i.e., convention centres) and public spaces (i.e., parks) in the city and certain spaces designated for certain functions and purposes can be defined. But actually expressing what 'space' is in a city proves much harder. The debate over what can be labeled public space, how space is created and shaped, and how to control space has been argued and rationalized among politicians, city planners, architects, urbanists, engineers, and philosophers, alongside many other groups of people approaching the topic of space from different viewpoints. It's a fascinatingly endless dialogue with unlimited talking points. A full discourse on the history of space provides such a wealth of disparate fields of research that it quickly begins to overwhelm. This topic will thus be approached from an artistic viewpoint, with regard mainly to the twentieth century urban and architectural history of public space developments. What is important for media artists working in the public space domain is to understand the contributing factors that have shaped these modern public spaces. Learning the history allows one to see the groups that have formed what we now see as public space, and allows us to consider the future of how space can function and relate to people in cities and urban areas.

3.1 MICHEL FOUCAULT AND THE SPATIALIZED SOCIETY

> "The space in which we live, from which we are drawn out of ourselves, just where the erosion of our lives, our time, our history takes place, this space that wears us down and consumes us, is in itself heterogeneous. In other words, we do not live in a sort of vacuum, within which individuals and things can be located, or that may take on so many different fleeting colors, but in a set of relationships that define positions which cannot be equated or in any way superimposed." [Foucault, 1992]

Since the first collections of living spaces formed primitive villages, public space has existed in some ever-evolving form. This chapter focuses on public space developments in architecture and urban planning since the advent of modernism. Modernism provided a revolutionary set of principles for elements from architecture and urban planning to art and industrial design that are still routinely employed today. Modernist architecture lives on, for example, in the works of Rem Koolhaas and Massimiliano Fuksas, architects that provide an elegant mixture of functionality and expressionism in their buildings. The urban planning principles of Le Corbusier, though always very polarizing, are still debated over their relevance and applicability in modern society. Planned cities, a relic of Modernist urban design, continue to appear around the world, (i.e., the Emirates and their lengthy planned city boom). In understanding Modernism, what must first be uncovered are the events which led to the principles of modernism being so readily adapted across the western world. Forming the roots of modern society were three key change factors that swiftly pushed society forward: territory, speed, and communication. The significance of these change factors re-formed how cities were designed and controlled, as well as changing how the citizens of societies regarded and communicated with each other.

3.1.1 *Territory – changes on physical space through industrial development*

As large industrial cities formed across the western world throughout the eighteenth century, populations swelled as new citizens entered the city for work. With such a shift from country to town (rural to urban), cities expanded quickly, without the foresight to properly plan these spaces. Through this, we see a shift in political strategy throughout the newly industrialized world. Michel Foucault noted that, "In the eighteenth century one sees the development of reflection upon architecture as a function of the aims and techniques of the government of societies." [Foucault, 1982] As capitalist societies were formed, architectural space grew as the most important method of control in the city, in

terms of grouping families together, spatially separating classes, and delineating sections of the city to be thought of as public or private. While not an entirely new concept (after all, governments had largely controlled all aspects of the city for thousands of years already), what was different was the targeting of citizens instead of just buildings, facilities, and infrastructure. Considerations were made for how to adjust to life in the city (especially with large families), how to guide certain citizens towards certain areas, and generally how to live one's life and maintain a social order. While designing for citizens became the focus of political power, the results were less than ideal; early industrial cities were rampant with slums, disease and the plague spread quickly through confined urban neighbourhoods, and the outcome of having to endure these conditions tended to result in revolt or revolution amongst the citizens. However, what ultimately broke the control of government over every aspect of city life was the next big change factor: speed.

3.1.2 *Speed – the advent of railroads and increased mobility amongst all classes of society*

The speed as which a society can move was rapidly advanced by the advent of the railroad. Already understood as a foundation of the modern society, the railroad also re-shaped how humans relate to each other spatially and socially. Looking at the railroad from a social perspective is interesting; historically, the industrial aspects of the railroad tend to trump the humanist aspects. But the humanist aspects were a fortunate by-product of the industrial change. Through the railroad, urban cities were connected to rural towns, train tracks crossed borders between countries, and mass transportation became possible for citizens of all classes. Society became spatialized, and as a result the government no longer controlled all aspects of space; power was now also in the hands of the engineers, choosing the paths for railroads and creating new possibilities for interconnecting disparate spaces. Speed also has an interesting effect on the human perception of space. What would once be considered a

remote destination could now be easily and comfortably reached. It seems fair to compare the introduction of the railroad to the introduction of the internet to common society. Once again, remote place were connected, although this time there were no geographic distances to cover (at least by the user) and the time factor was compressed greatly. Imagining how eighteenth century living changed with the usage of railroads could be considered tantamount to the internet revolution. And through this speed increase comes a modification of the last change factor: communication.

3.1.3 *Communication – a revolution in social interaction, the changing concept of familiarity*

While it may seem strange to consider that the way people communicate can rapidly change, we again see parallels to the internet revolution. Through this change period, a new sense of familiarity emerged amongst people, both in the sharing of public spaces such as train cars and the ability to visit remote places quickly and often. The result was more a common experience of seeing familiar faces, more encounters with strangers, and a greater understanding of being 'worldly'. This sense of 'knowing your neighbour' took on a much different meaning, and the concept of a neighbour exploded from a street / neighbourhood level to a state /country level. Also the fact that all citizens could travel by train, as well as live in an industrialized city and be part of a neighbourhood, brought about a sort of 'human universality' that reference the ideas of Foucault yet again. With these three factors in place, society progressed throughout the nineteenth century, bringing about larger cities with less of a sense of complete government control, and more bottom-up factors at work; remote communication between common people, the ability to travel rapidly, and a democratizing of space due to the governments increasingly weakened grip on city development.

A growing trend here is less power in the state and more in the hands of commoners. Industrialization and capitalism destroyed serfdom and shifted

how society perceives each other. Through this loss of total governmental power over a city, is it fair to consider this the initial roots of user-centered design? Suddenly, through a democratizing of space, the citizens had some (limited) power. Though perhaps they weren't explicitly being considered in the debates over town planning and architecture, there was a different sense of the role of citizens in the city. The railroad enabled them to be mobile, while the top-down, government controlled city planning failed and resulted in producing slums and accelerate disease spread. With so much turbulence and unstructured standards and power control in society, the path to modernism was seemingly at a standstill, until two important documents published only two years apart would (in this thesis' viewpoint) stand as the pillars of modernist principles for both architecture and urban planning.

3.2 EBENEZER HOWARD AND THE SOCIAL CITY

Sir Ebenezer Howard's *To-Morrow: A Peaceful Path to Real Reform* [Howard, 1902] was the culmination of many gradual changes towards the idea and functionality of a city. By the end of the eighteenth century, cities were becoming modernized as the industrial revolution began to rapidly advance technologies. At the same time, railroads had begun to interconnect towns with larger cities, providing links between city and country. For perhaps the first time ever, city planning shifted from a focus on defense and military concerns to a focus on people and the health of cities, a change that cannot be understated.

The Italian Renaissance architect Filarete and his Sforzinda plan, an ideal (rational) city plan conceived in 1464, was combined with defense fortifications and provided the archetype for European city planning for hundreds of years. [Kostof, 1991] A brilliant combination of safety and livability, this modified Sforzinda was readily deployed throughout post-Renaissance Europe, gradually fading away as the importance of a walled city waned. Once walled cities (and forts in rapidly expanding eighteenth century North America) gave way to more easily and readily expandable industrial

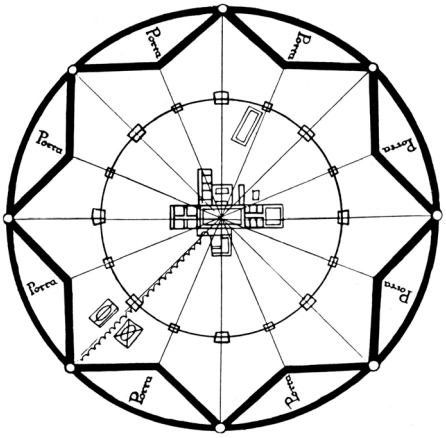

Figure 1. Filarete's Sforzinda city plan

cities, the considerations for architecture and space changed. No longer forced to consider defense first, issues of health and safety became more important after slums developed in overcrowded industrialized cities dealing with an influx of rural work seekers. With this shift in town planning strategy, the issue of how to control power in the city also shifted. As previously stated by Foucault, architecture became a powerful tool to control the city, as governments yearned to control space for political and economical benefits. Howard's "Garden City" plan, as he named it, aimed to place power in the hands of the residents; though the cities were to be completely pre-planned (with considerations for future scalability issues), the overarching message was showing how to combine town and country living and how to affect drastic and necessary change on masses of people while maintaining a high quality of living. With the Garden City, Howard sought to combine the best of town and country, combining industry and dense neighbourhoods with green space and connections to nature. Furthermore, *To-morrow* leaves us with a stunning passage: in a later section titled 'Social Cities' which discusses mostly how to link disparate sections of a larger city together, Howard discusses the notion of new cities consisting of "a society in which the social side of our nature is demanding a larger share of recognition--a society where even the very love of self leads us to insist upon a greater regard for the well-being of our fellows." [Howard, 1902] This is perhaps the first instance of city planning with a social focus, where the idea that citizens

can hold and shift the power in a town, rather than a strictly government-based, political approach to forming cities. Howard's book exists as a key first step towards the development of meaningful social public spaces, and directly along with Otto Wagner's *Modern Architecture* [Wagner, 1902], pushes towards the beginning of the modernist era.

3.3 OTTO WAGNER AND THE BIRTH OF MODERN ARCHITECTURE

> "Our conditions of life, our constructions must be expressed fully and entirely. The realism of our time must penetrate the work of art." [Wagner, 1902]

In one compact sentence lifted from his book *Modern Architecture*, Otto Wagner is able to distill the essence of his argument towards a new architectural style. 'The realism of our time' lied in new forms of buildings that reflected the pace of life, large industrialized cities, and the common people. Throughout the nineteenth century, Neoclassical architecture celebrated and re-interpreted the past, in a way not conducive to any actual progression in the field of architecture. Wagner believed firmly in purpose instead of grandiose forms and stated "we do not walk around in the costume of Louis XIV", [Wagner, 1902] a firm rebuttal to architectural styles that solely point backwards towards history. Wagner also felt that public taste in architecture had been for too long controlled by historians and politicians, who imposed buildings into the city and then convinced the public they were good and righteous works. Again, as with Howard's *To-morrow*, we see a plea towards re-shaping our cities and buildings towards a more modern and practical style, a style that actually reflects all inhabitants of the city, not just the powers that dictate control. Wagner was able to put his words into action with the construction of his Österreichische Postsparkasse building in Vienna, completed in 1906. Here, what is considered "the first truly modern interior" [Pile, 2003] brought all his ideas and demands

to fruition in a landmark building that became his Magnum opus. Interestingly enough, Wagner would be seen always as a Jugendstil architect (an Art Nouveau style which emphasized the use of highly stylized organic forms while

Figure 2. Wagner's Postsparkasse in Vienna, the catalyst for the modern era of architecture

modernizing textures in architecture), with the argument that his buildings served as a link from Neoclassicism to modernism and lacked elements of the true modernist styles. Ultimately, what is more important is his writing, which helped to condense the developments of many years of culture and social shifting into one document with a firm purpose. With these two documents, the roots of modernism were laid, and it would take just a few years for the next big leap forward, this time a change in considering space itself.

3.4 WALTER GROPIUS AND HUMANIST ARCHITECTURE

> "The fact is that around 1910 a certain space was shattered. It was the space of common sense, of knowledge (savoir), of social practice, of political power, a space thitherto enshrined in everyday discourse, just as in abstract thought, as the environment of and channel for communications … This was truly a crucial moment." [Lefebvre, 1992]

We are presented here with a bold quote from Henri Lefebvre. If we are to believe Lefebvre's statement that 1910 was the key transformative year for 'space' changing, what exactly transpired that year? While Lefebvre expands on the point (further covered in Section 4.5), the reason for choosing the year 1910 seems to be that it stands as being a generally accepted date for the large-scale adoption of modernist principles by architects and artists. However, digging a bit deeper, we can see a curious event that occurred in that year. There was no important document that year such as Howard or Wagner's modernist dissertations. Rather, a seemingly innocuous event occurred: an architect by the name of Walter Gropius began working independently, creating a private firm with his partner Adolf Meyer. Gropius, a German architect, had previously been working for the firm of Peter Behrens, a utilitarian architect who also employed Le Corbusier and Mies van der Rohe during Gropius' time there. However, Gropius didn't agree with the level of ornament and decoration Behrens used in his works, and parted ways with the firm. Gropius moved to Berlin and began his independent practice, and in 1911 secured the contract to build the Faguswerk in Andfeld an der Leine, Germany. That same year, Gropius gave a talk expressing that modern life needed new building styles that match the lifestyles of our time. He also explained that the Faguswerk and other factories should be thought of as palaces of labour, where fresh air and hygienic premises are standards, not benefits. Here we surely begin to see the outlines of a user-centered design process in architecture, if not thought of at the time as user-centered (likely since the term only came to being during the early days of Human-Computer Interaction). We can think of it as a more humanistic approach, where the workers are now thought of as the critical factor in the building, rather than the building itself.

Gropius' Faguswerk would become the embodiment of his ideas, featuring a stunning glass facade that removed the divide between outside and inside (possibly channeling Wagner's Postsparkasse with it's massive skylights which enabled natural light to illuminate the building's interior). Crucially, while the foundational "form follows function" idea of modern architecture is

clearly used here to great effect, the building itself is also beautiful; functional doesn't have to be bland. The classical era of architecture was all but dead; the new ideas and simplified, functional tastes of modernist architecture had taken hold. Gropius was at the forefront, and his influence would spread in 1919 with the formation of the Bauhaus - an institution based on modernist principles, intent on applying these principles to all facets of what can be considered art.

3.5 THE BAUHAUS AND HOLISTIC DESIGN EDUCATION

The Bauhaus was a testament to modernism, a school built with the concept to teach "design" as a principle – that is, to bring together art, architecture, graphic and industrial design, and other branches of creative expression to form what was known as "the Bauhaus style" (later the International Style). This holistic approach to teaching craft was entirely new and widely experimental. The lofty goal was realized in 1919 when Walter Gropius became founder of the school. Gropius set the foundations of the school as existing "to create a new guild of craftsmen, without the class distinctions which raise an arrogant barrier between craftsman and artist" [Gropius, 1919], and wanted to be able to train artists that could easily adapt to working in industry. Gropius had become internationally recognized throughout the 1910s for his work, and in founding the Bauhaus he was able to directly teach his principles which he had so often written and published about as well as utilizing in his works. With an official teaching of what defined the modernist style, the Bauhaus became an innovation centre, an institute designed to continually be on the cutting edge, establishing how the modernist movement should behave and evolve. This was timed perfectly with the rise of the International Style across Western Europe, as a new generation of students was being taught to follow new movements in the field of architecture.

While the tangible aspects of the Bauhaus (as well as legacy on the future of design teaching) cannot be diminished, the teachings and writings of the Bauhaus are much more culturally relevant for artists. The Bauhaus tackled the most complicated aspect of the city; the invisible. Space was a concern for

the Bauhaus - how space is felt, experienced, and how space can be designed. In this, the Bauhaus once again provided a great leap forward in the thinking of urban designers and architects, though the actual writings on theory and new concepts of space that were produced there aren't as well known. This is perhaps due to the abstract nature of trying to define and redefine the concept of space itself. It's a puzzling philosophical quest. Media artists working in public space must understand how to interpret and use space in the city, a concept that is difficult to teach. We can look to the works of Pablo Valbuena to see a clear contemporary link to the theories of the Bauhaus: clear understanding of spatial usage combined with an approach to interactive art that encapsulates design, architecture, and urbanism.

3.6 PABLO VALBUENA'S CONTEXTUAL AUGMENTATION

Pablo Valbuena's series of architectural/urban installations are incredibly sucessful because of a demonstrated understanding of the spaces used. Since 2007, Valbuena has exhibited a continual artistic idea across multiple forms of space. The theme of his work involves augmenting physical environments with geometric shapes, forms, and paths, enabling extensions and transformations of architectural and urban space. The varied spaces have been (in chronological order): private gallery spaces, a small urban park, a city hall building, and an ancient slaughterhouse turned into a private art space. Trained as an architect, Valbuena has applied this rationale to his works, resulting in highly rigid, clean visuals that truly enhance the architectural space. What emerges is a style that that is at once recognizable and trademark. Much like the International Style being built on principles and rational use of materials, Valbuena is able to apply a standard set of shapes, transitions, and patterns to show the versatility of his work. It's the principles of modernism in the interactive art world, or modernism enhanced through movement. Furthermore, Valbuena is acutely aware of how to work with the space; his *Augmented Sculpture* series, exhibited in galleries worldwide, relied on swooping angles of colour and light, giving

multiple depth and movement levels to static white blocks of sculptured form. The blocks appeared animated, quickly changing their shape and composition within the greater structure of the sculpture. This style is well adapted to gallery spaces, especially interactive art museums, where visitors often have limited patience for works and tend to move quickly from piece to piece. Valbuena provides an engaging experience in this space, using a wide range of techniques and movements to keep the piece varied.

Figure 3. Pablo Valbuena's Entramado (left) and Hague City Hall intervention(right)

Valbuena's later augmented space installations have moved more into public spaces. *Entramado* was installed in a small, intimate park and passageway in Madrid. Here, Valbuena uses lines and rectangles to outline, surround, and highlight the paths and seats in the park. Being in an isolated and quiet area, the style adapts, with slower moving lines and more subtle manipulations of the space. He focuses much more attention on the small architectural details of the park and reflects it through the augmented projections, which ultimately is much more fitting to the nature of the park than the aesthetics of the *Augmented Sculpture* series. One year after *Entramado*, Valbuena would apply his style to the Hague City Hall. Now working with a large public space (the massive building sits in a large public square which sees a lot of foot traffic), his techniques are once again shifted for the audience; the installation retains the aesthetic and flow of *Entramado*, but the surfaces and transformations are larger and more

noticeable, thus drawing attention from the people using the space simply as a transition or meeting point.

The ability of a new media artist to use multiple spaces so well is the mark of someone who can combine art and design well. One common critique of The International Style (which will be explored deeply in subsequent sections) was the coldness factor, the ability to drop similar looking buildings and design similar looking spaces all over the world with no regard for the context. Valbuena's artwork presents a particular style, but with strong attention paid to the context he is able to adapt this style and build different experiences for different audiences, across seemingly any architectural space. While such 'augmented architecture' projects are now painfully common, Valbuena has shown that understanding the history and principles of effective urban and architectural design can make a massive difference in the perception of artworks.

3.7 ROBERT VENTURI AND THE BACKLASH AGAINST MODERNISM

Modern Architecture pressed on through the twentieth century, as the International Style exploded worldwide following World War II. What emerged was a sub-style known as Functionalism, with a focus on purpose, convenience, and propriety. Functionalism seemed to take the fundamentals of modernism to their logical extremes, and by the late 1960s a stagnant scene had emerged, a landscape of purely functional buildings with no flair or personality. Attempts to decorate these buildings were little more than adding small flourishes on top of the basic structure; akin to adding new cosmetic parts on a plain car after buying it. But from this plateauing of modernism would come two books that sharpened the focus of urban designers and architects, and are still today important learning tools for fields such as Architecture, Urban Planning, and Interaction Design. The two books, *Learning from Las Vegas* by Robert Venturi et al., and *A Pattern Language* by Christopher Alexander et al., pleaded not for reform but rather for a re-examination towards the current

methods employed by architects and urban planners. Both books rationalized the importance of designing for users and stressed that the user can be a useful part of the design process. For these reasons, the two books are widely used across design education to this day, and serve as proof of fruition of all the modernist theory that preceded it: theory that hinted at a user-centered design processes, but could never explicitly state the case. Quite simply, they provided platforms for learning how to study and analyze design problems, while also being influential texts in the history of modernism.

In 1966, a textual bombshell was dropped into the world of architecture: Robert Venturi's study *Complexity and Contradiction in Architecture* boldly refuted Mies van der Rohe's "less is more" principle by claiming "less is a bore" and "more is not less." [Venturi, 1966] In Venturi's mind, Functionalism had sapped the poetry from modern architecture, and the original teachings of the Bauhaus were increasingly ignored. Where the Bauhaus had put the focus on universal learning, with equal focus on art, design, urban planning, and architecture, what Venturi now saw was a total disregard for the artistic qualities of building. Throughout *Complexity and Contradiction in Architecture*, Venturi would cite Pop Art as an example of an art form that crosses boundaries and mixes different styles; this method of cross-pollination was missing by the late 1960s. While Venturi would generate a healthy amount of feedback and controversy, it was his next publication that raised the bar much higher. 1972s *Learning from Las Vegas* was an almost scathing look at the state of architecture, with a detailed dissection of the trends, problems, and possible methods for how to advance beyond this stagnant state. Venturi travelled with a group of students to deconstruct the Las Vegas strip from an urban and architectural perspective. Thus, *Learning from Las Vegas* presents itself as a strange book; it consists of essays, short notes, sketches, concept drawings, information visualization, and a variety of uncommon methods for urban analysis. What is clear from this all-encompassing research method comes through in two succinct points:

3.7.1 *Architecture should be a means of communication; what a building says is important.*

Venturi notes that the landscape of Las Vegas is reliant on symbols. Symbols dominate the landscape much more than architecture, and this is an important consideration. Ugly, plain architecture has been obscured by giant signs and designs that detract from the building. Thus the building serves the basic functional purpose, relying on symbols to make up for the lack of artistic expression in the building. Clearly the urban environments of the late 1960s lacked almost any artistic qualities; Venturi stubbornly drives this point over and over. Furthermore, these were not enjoyable, livable urban spaces that were being created. These were the type of spaces that only helped push people through as fast as possible, as the extreme functional and cold architecture provided no visual beauty, while the signs and symbols added nothing to the space itself. Otto Wagner had previously stated that construction must reflect our condition of life; was this really the condition of life being reflected in spaces devoid of any artistic, expressive elements?

3.7.2 *A duck and a decorated shed*

Venturi compares and contrasts two archetypal common building styles of the time. First is the duck, a fast-food restaurant in the shape of a giant duck. Second is what Venturi coins the decorated shed, functional box-shaped building with some elements of decoration/signs. While the duck is overly symbolic and thus hides the architecture, the decorated shed is pure function, with the symbolism tacked on. This is where the misguidance of architects is most exposed. The duck presents an attempt at expression, but removes all artistic aspects. The shed meanwhile goes purely for function, with expression as a poorly attempted afterthought. Venturi raises many valid points here; after all, architects were taught as 'total' artists for thousands of years, and buildings were expressions of their education, experience, and personality. His plea for a return

to the early modernist style of expression can be seen as a poignant and needed argument in reaction to the urban scene Venturi encountered in Las Vegas.

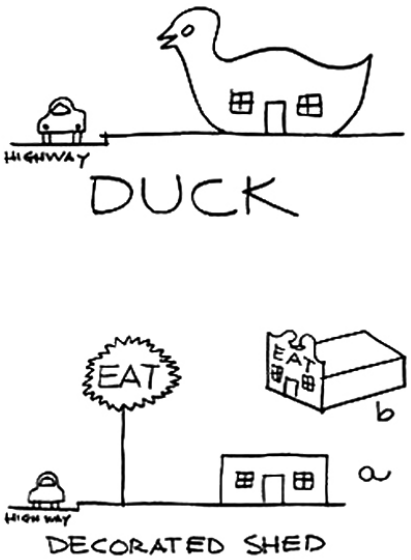

Figure 4. Venturi's comparison of the Duck and the Decorated Shed in architecture

Venturi asks architects to be more receptive with their tastes, and that the values of the common people should be expressed through architecture. This is true user-centered design, and after realizing how focused Howard, Wagner, Gropius and the early modernists were on expressing contemporary lifestyle through architecture, it's shocking to see how quickly those principles were tossed aside. We see some other trends here. Venturi challenged urbanists to produce buildings that responded to the speed and mobility of modern society. Are these not the same factors that directly contributed to Howard and Wagner's pioneering texts? Is history actually repeating itself here, or were the principles really forgotten so quickly and in need of a refresh? Or was there yet another huge leap forward in the speed and mobility of modern society that yet again urban planning and architecture had to catch up? Regardless of the answer, *Learning from Las Vegas* resulted in another shift forward in the arts, prompting

the shift towards post-modernism and a period of greater expression, dynamic form, and a stronger focus on the experience of a building.

3.8 A PATTERN LANGUAGE – USER-CENTERED URBAN PLANNING

While *Learning from Las Vegas* made many bold statements and claims about the architectural scene, Christopher Alexander's 1977 book *A Pattern Language* reshaped urban design and city planning through a much more ambitious method. With *A Pattern Language*, the Austrian-born architect attempted to catalog the built environment of the whole world, organizing them into patterns that fit into many larger categories (house, street, neighbourhood, city, etc). The goal of the book was initially outrageous: the idea that people should be the designers of their own houses, streets, and communities. After all, Alexander noted, "Most of the wonderful places of the world were not made by architects but by the people." [Alexander, 1977] Alexander also noted that users of public spaces and buildings will always know more about the structures and places than the architects who built them. Finally, after all the preceding text that asked for simplified, reformed taste that reflected (rather than just appealed to) common people, Alexander was able to give concrete explanations for why this is needed. As well, he proved that the founding concepts of modernism were still not fulfilled in society, as public space were still not being actively designed by the urban planners.

A Pattern Language presents a clever, simple structure. Each large category contains a list of patterns (i.e., the pattern of Small Public Squares is in the category of Communities and Neighbourhoods) which are then explained through an overview statement photo, rationale, and sketches. With this hybrid format of an encyclopedia/textbook/novel, it's easy to pull out and group relevant sections. Alexander was truly putting the power in hands of the common people, as sections of house patterns can be combined to form a design brief for building a house. The content choice is also interesting, as Alexander

purposely chose more post-modern design elements of buildings, a move that was widely criticized by architects. However, just as Gropius was able to spread his principles through teaching at the Bauhaus, so was Alexander able to start a shift towards post-modernism by educating the masses about new methods of construction and design. As important as the content of *A Pattern Language* is, it's perhaps more of a milestone for giving knowledge to all people, in a field traditionally thought of as a high art.

We now see an interesting chain of events. Howard and Wagner wrote the texts that defined modernism. Venturi and Alexander, meanwhile, translated and updated their theories seventy years later and in effect ended the modernist era. What transpired here? What was established through Howard and Wagner are still relevant ideas today, as with Venturi and Alexander's texts. While the modern era is over, the ideas are still very much alive and applicable to what we are in today (call it neo-modernism, post-capitalism, or the newly coined sustainism). So what was the age of modernism then? If the same theories that started it also signaled the end of it, was there anything more than decades of experimenting with urban and built structures as a tangible result? What seems to be a much better result is the written text from the era, and the relevance for artists (that is, artist in the Bauhaus definition) today. By understanding the past, we see what has worked, what came to fruition, and what ideas still remain unfulfilled in today's society. The best texts from the era work as toolkits for today. Howard and Alexander provide the rationale for user-centered urban design, while Wagner and Venturi showed how to deconstruct the state of architecture and analyze where to make improvements. As media artists, context is everything for art works, especially interactive art. Understanding an audience and how they will interact and comprehend an artist's works is crucial, and we are able to see how long and difficult of a process forming user-centered methodologies can be. With these texts to learn from and study, there are a variety of frameworks that can be employed for analyzing how to create works for public spaces. Especially with Venturi and Alexander, we can see rational, logical critiques of the state of urban landscapes. There may indeed be a time in

the future when similar books for public interactive artworks would be available; with context being the crucial factor, these are skills all media artists should have anyway.

4. SOCIAL INTERACTIONS AND EMBODIMENT: INTERTWINING HUMANS AND THE PHYSICAL ENVIRONMENT IN MEDIA AND PHENOMENOLOGY

We have seen how public space dramatically changed due to advents of technology, city planning, and architecture. But what of the people, the users and inhabiters of the space? Chapter 3 began with the question of how to define public space in a city. With this chapter, a more difficult question is posed: how does public space become a 'space'? How is it that people feel an emotion simply by entering an area? And as artists, how can we work with how people react or anticipate certain spaces and design for those moments? One can begin by understanding phenomenology, the philosophy of experiencing daily occurrences.

4.1 THE PHILOSOPHY OF EVERYDAY EXPERIENCE

Phenomenology is, at its root, a study of average living. It's an approach primarily concerned with how we perceive, experience, and act in the world around us. [Dourish, 2001] Formally founded by the German philosopher Edmund Husserl in the early twentieth century, Husserl aimed to create a branch of philosophy that objectively studied what were thereto known as subjective topics, mainly experience and perception. As these are deeply personal and from a singular viewpoint, an objective study of one's subjective thoughts was initially controversial. However, what Husserl set out to standardize was interesting. He felt that science and mathematics were too far removed and abstracted from the everyday world. He strived towards a grounded science that relied on the phenomena of experience, later claiming that experience is the source of all knowledge. Here we see a link to the ideas Christopher Alexander would write about decades later [Section 3.8], explaining that users know much more about a building than the architect. This is because they can actually experience a building, not just visualize it. So phenomenology is a philosophical

framework for self-awareness and objectifying the subjective. Husserl placed great importance on the relationship between the object of consciousness and the mental experiences of those objects. An example would be seeing a movie compared to the experience we have while we are seeing the movie. With this broadly reaching topic, Husserl's theories would be re-interpreted and questioned, spreading phenomenology across many disciplines under the notion of daily experience. Among the many philosophers who would help spread and expand Husserl's original core ideas of phenomenology would be Martin Heidegger, a student of Husserl who was intrigued by the role of engaged participation in the world.

4.2 MARTIN HEIDEGGER'S BEING-IN-THE-WORLD

Heidegger diverged from Husserl with a different take on phenomenology, one that posited that mental life and everyday experience are intertwined. Husserl had separated the mental from the physical, but Heidegger sought to show why they should be combined, labeling this Being-in-the-World (In-der-Welt-sein) [Heidegger, 1962]. He explained that his branch of phenomenology was based on understanding through experience: we understand the world based on our actions within it. Engaged participation is our central role. Heidegger also discusses the experiential aspects he coined Present-At-Hand and Ready-To-Hand [Heidegger, 1962]. He saw these two terms as the main ways we encounter the world and act through it. Let's take the example of a person using a hammer. When one is reaching towards the hammer, that object is present-at-hand: the person is aware of it as an object, and it consciously reaching to pick it up. However, once the hammer is being used for a task, it becomes ready-to-hand: an extension of the human which the operator doesn't need to remember that it is just an object. This distinction is important, and became a key Human-Computer Interaction (HCI) theory when the first computer mice began to become familiar objects to computer users (the theory was popularized in Terry Winograd and Fernando Flores 1986 publication *Understanding Computers and*

Cognition: A New Foundation for Design). This was just one branch of Husserl's original vision though. Phenomenology also spread to architecture, where architects began to consider personal, sensory architectural projects.

4.3 PHENOMENOLOGICAL ARCHITECTURE

In architecture, the idea of a personal building is at odds with the purpose of a public building. However, as the roots of phenomenology spread throughout disciplines, a group of architects in the 1970s became intrigued with the idea that experience could be used as an architectural language. In a sense, they were seeking to escape from the excess of modernism at the time, as phenomenological architects were particularly against the International Style, though from a fundamental rather than aesthetic standpoint. The clean lines and modern styles were kept, as what they rebelled against was the idea of a global architectural concept. This is important, as we will soon see Henri Lefebvre's similar critique of The International Style and modernism, and why he sees them as unsuccessful. Though phenomenological architecture was never a large-scale movement, it's important to note how wide-reaching the ideas of phenomenology were able to spread. It's also interesting to see such a strong anti-modernist movement in architecture, as the 1970s were the pivotal moments of the shift from modernism to post-modernism. Phenomenology continued to have a presence in arts and social sciences, and less than twenty years after Heidegger's Present-At-Hand and Ready-To-Hand were popularized in HCI, Paul Dourish detailed how phenomenology can be translated to the realm of computer science and user interface design theory.

4.4 WHERE THE ACTION IS - APPLIED PHENOMENOLOGY

Paul Dourish's 2004 book *Where The Action Is* can be seen as another milestone publication for translating and updating existing theory to modern times. Just as Robert Venturi and Christopher Alexander modernized and re-

examined the theories of Ebenezer Howard and Otto Wagner [Section 3.9], so too does Dourish modernize the theories of phenomenology. His idea of embodied interaction is rooted in the phenomenological basis of embodiment, the experience of interaction in the world through daily life, in a normal, immersed, unreflective matter. However, Dourish is no philosopher; rather, he is a computer scientist who sees the benefit of phenomenology as a framework for which to design better methods for HCI. Dourish also explores social computing, his concept of integrating a more social experience into the computing experience in order to bring about a sense of familiarity and understanding. Dourish sees the idea of embodiment as the underpinning for social computer, and explains embodiment as follows: "Embodied interaction is interaction with computer systems that occupy our world, a world of physical and social reality, and that exploit this fact in how they interact with us." [Dourish, 2001] This interaction, from a phenomenological perspective, will always be linked to the location in which it occurs, as Heidegger's Being-In-The-World outlined. What Dourish has given is (in the context of this paper) the first explicit link to HCI theory thus far.

What Dourish goes on to explain can read almost like a handbook of design principles for interaction; using social familiarity to enhance understanding, use real explanations instead of abstract mental models (again, a very phenomenological approach), be aware of not how the interaction works, but how the user works with the interaction. An interactive artwork must function well, but being able to provide a comfortable experience can be more rewarding to users. With *Where The Action Is*, design principles for HCI are filtered through a seemingly unlikely source, but the topics, especially social computing, are necessary modern topics to know and discuss. It's now quite clear that phenomenology has evolved and lasted through many changes, and can provide many viewpoints for studying architecture, computing, interaction and users. The principles outlined by Husserl over one hundred years ago are still as relevant as ever, and much like the trend we saw in Section 3, the best theories can be adapted to any era.

4.5 HENRI LEFEBVRE AND THE IDEA OF SPACE

This chapter began with the question of how public space turns into 'a' space. Henri Lefebvre had a deeper question — how is space produced in the first place? Not public space, not private space, but space as a both an abstract and concrete term. He questioned the very notion of how space is created and how mental, physical, and social spaces combine and effect our lives. Lefebvre paid particular attention to the intangible, arguing that it's not enough to just look at a past civilization and see the people and the building. These past civilizations had an invisible realm — their space — that no others can know or feel. This space was produced by that society, for that society only, and attempting to recreate the social space of a previous society is doomed to fail. Lefebvre explicitly uses Soviet urban planners as an example, showing that their attempted socialist space simply rehashed modernist space and was thus doomed to fail. In a way, Lefebvre gives identity to both different periods and societies of space, dividing them as unique entities that can never be replicated. Lefebvre tackled the philosophical implications of how to control space, and much like phenomenology the versatility of his theory leads it to be applicable across a broad range of disciplines, though certainly architecture and urban planning stand as the two most ready applicants. Furthermore, he birthed two ideas that have reshaped urban planning since their inception: *The Right to the City*, and *The Production of Space*.

4.6 TOWARDS THE RIGHT TO URBAN LIFE

In 1967, Lefebvre published The *Right to the City*, a sort of call to arms against what he labeled "the right to nature". [Lefebvre, 1968] Uprisings and protests against noise and general chaos of living in cities in the 1960s (also coinciding with the continued mass exodus from cities towards suburbs, which had grown worldwide exponentially since the end of World War II) had prompted a desire to be closer to nature and embrace nature in the urban city. Lefebvre soundly

refuted that, arguing that placing nature in the city contradicts what the city is for, and ruins the pleasurable feeling of retreating to nature. Instead of a right to nature, Lefebvre instead offered to use this moment as a transformation point, an embrace of the right to a new urban life, and the right to the city. The crux of Lefebvre's argument for new urban life is that while the city has been commodified (an argument which *The Production of Space* would focus on much more), the urban space itself is not actually being used by the citizens who inhabit it. Foucault's spatialized society can be seen in full effect here; the effects of changes in territory, speed, and communication have now delivered the modern city. However, Lefebvre would argue that the city shouldn't merely be used by the spatialized society. Rather, it should be appropriated, re-forming and transforming urban areas and spaces. He writes an interesting passage that the design of cities are mainly done by those who "go from grand hotel to grand hotel, or from castle to castle, commanding a fleet or a country from a yacht. They are everywhere and nowhere. That is how they fascinate people immersed into everyday life. They transcend everyday life, possess nature and leave it up to the cops to contrive culture." [Lefebvre, 1968] Lefebvre calls for the people immersed into everyday life to step up and become the users of the city [Lefebvre, 1968], to break free from daily routine and pay more attention to the space of the city they use. This is Lefebvre's right to the city, an explanation of why people should stay in modern urban areas, and how they can be changed by the inhabitants themselves through a bottom up-approach (again, taking cues from other previously covered urban theorists such as Ebenezer Howard [Section 3.2] and Christopher Alexander [Section 3.9]. *The Right to the City* is a continued ideal today, with several groups across the world (such as the aptly named American group Right to the City Alliance) pleading for urban reform reflecting the principles laid out by Lefebvre. While the idea of the right to urban life through space re-appropriation is a meaningful endeavour, Lefebvre's next work would go much deeper, pulling together nearly every topic hereto discussed: architecture, urban planning, cities, and phenomenology. This is Lefebvre's theory of *The Production of Space*, the explanation of how space

actually became a tangible commodity, and how to use and control that resultant space.

4.7 THE PRODUCTION OF SPACE - THE RELATIONSHIP BETWEEN ABSTRACT AND SOCIAL SPACES

> "By the 1920's the great philosophical systems had been left behind, and, aside from the investigations of mathematics and physics, all thinking about space and time was bound up with social practice - more precisely, with industrial practice, and with architectural and urbanistic research." [Lefebvre, 1974]

Published in 1974, *The Production of Space* revolves around spatial analysis and Lefebvre's idea that space is not simply pre-existing, but rather a continual reformation and refinement of spatial relationships. Lefebvre sees all spaces as intrinsically social, but is mainly interested in two points: how these spaces are produced, and how the social qualities of the spaces are used. Lefebvre sees many reciprocal relationships here. He first lays out social space as a sort of math equation that involves a configuration of existing space in actual time, mixed with physical objects and humans. Social space can be seen as a container for human relationships, and on a larger scale for all history. Lefebvre also sees space as an establisher of power (by those who use and appropriate it). This is a nice observation which shows how much thought is given to the citizens in the city themselves (in this case, all the thought). The balance of social power in the city favours the citizens, the main users of the space.

The global urbanization of society had some profound effects. Urbanization superseded aspects of social life that formerly relied on boundaries: boundaries between city and country, city centre and outskirt, industrial and agricultural sections, products and art works. Howard's "Garden City" plan [Section 3.2], which relied on clear boundaries between city and country, and allowed for a thriving city centre with green outskirts, as well as

divided industrial and agricultural sections, was lost in the global urbanization movement. Lefebvre here sees the outcome of this change as a shift from the production of things in space to the production of space itself. He sees this shift as a movement towards capitalism, as the mode of production maintains itself and creates more space for itself through this production of space, in a style reminiscent of a perpetual motion machine. Lefebvre also remarks that, "Urbanization is capitalism's primary extension" [Lefebvre, 1974] and that capitalism cannot be avoided in the modern city. But what started this global urbanization? Lefebvre writes that it was the work of the Bauhaus in the 1920s that helped change the perception of space and started the commoditization of it. Given the facts provided in Section 3.5 about the Bauhaus' commitment to exploring and understanding space, the link between Lefebvre and the Bauhaus seems quite obvious. The International Style gave a standardized concept of space, the idea that artists should move from creating and analyzing objects in space to analyzing the space itself. And what arose from this? A blank global canvas of possibilities, empty spaces to fill through capitalist means. No longer bound to space considerations dictated by old powers (Royalty, mainly), the new production of space was an act of pure capitalism, executed by the Bauhaus under the guise of a revolutionary action. And at the heart of the production of space is the definition of two environments: abstract space and social space.

Abstract space and social space are two constants of everyday life in the modern city. Abstract space is the intersection of knowledge and power, applicable to the controllers of social organization. Abstract space is the top-down regulator of the social space of everyday life. And what is social space, then, in this context? Social space is the everyday experience of members of society. Social space transcends all borders and regulations of abstract space. While abstract space must exist in society to provide structure and order, social space is the result of the actual usage of the space, results which can never be planned for or predicted. Lefebvre sees abstract space as the result of the capitalistic processes at work in the modern city. However, social space is the enduring change factor of people who are appropriating space in the city. It's

an endless tug-of-war. Both need each other to survive; abstract space is refined by the effects of social space, and the production of social space can only exist within an abstract space.

So what's the takeaway from *The Production of Space*? It's clear that social space is firmly in control of the people who use it, not the people who initially designed the area, despite the ever increasing commoditization of public space through capitalism and control of abstract space. Again, referring back to Chapter 3, the long and slow path towards a more user-centered design process for architecture and urban planning has been fully realized. And what does this offer to artists looking to use public space? Well, there are several lines of thought here. First, each social space is a unique byproduct of the time, place, and culture that inhabited it. Thus, the context for designing in public spaces will never be the same. While the modernist movement and The International Style created a global uniform look of buildings and spaces, the cultures who used and inhabited them are so radically different across the world that one cannot design for one 'standard' public space and simply reuse it in different contexts. This is an important consideration also for artworks. It's no longer just enough to consider the audience in a public art piece — one must also think about the space the piece will exist in, and how to properly use that space. Art works and digital information may augment public space, but public space also has the ability to augment an art work, if context is properly considered.

4.8 MARSHALL MCLUHAN'S SOCIAL MEDIA PROPHECY

The theoretical portion of this thesis is dedicated to building a framework for analyzing art projects utilizing real-time social data in public spaces. Chapter 3 of the thesis covered the architectural and urban planning historical theory needed to understand modern public spaces. Chapter 4 brings in the public itself and has thus far explored the theoretical and practical theories of social interaction and phenomenology in both social spaces and computing. The third

element in the relationship between artworks and public space is the content itself. Social data as a tool (or fuel) for art projects is still a relatively new concept, but the data is continually becoming richer, faster spreading, and easier to attain. And it's here that the ideas of Marshall McLuhan come in.

Marshall McLuhan was frequently able to foresee and outline technological advancements within the field of media theory, including the World Wide Web (what he initially labeled the global village), and curiously enough, social data. McLuhan is best known for his quote "the medium is the message" [McLuhan, 1964], which is usually quoted as such. However, McLuhan also added "and the content is the audience" [McLuhan, 1964], almost an afterthought but also an incredibly detailing and relevant expression. McLuhan was able to see how the content in the media is not just intended for viewers; it is viewers. Media saturation established itself worldwide because it consists of human interest stories, bits of information the general public is interested in and has an emotion towards; it is the audience. The medium is the message shows how the medium that delivers the message will influence how the message can be received. In the internet age, the message is delivered instantly through a worldwide medium. With social data, the content is truly the audience, as social data is created by people, small bits of personal information that are instantly broadcast worldwide. Through smartphones and laptops, the content is interpreted differently by each receiver. Internet users control the intake of their media, but they contextualize the media to their particular world view, finely choosing what news updates they wish to receive, while placing precedence on certain sources. Much as McLuhan predicted the global village of the World Wide Web, it seems he also foresaw the dissemination of media, the de-regulation of content and its distribution to a truly global audience. When using social data in art projects, considerations of audience must be made: is the data relevant to the people in this context? Is this the right public space for this data? One successful, fairly broad approach to an artistic intervention of social data, for example, is Jens Wunderling's *Default to*

Public series, which takes the simple concept of spreading Twitter posts and uses several novel distribution methods.

4.9 DEFAULT TO PUBLIC AND TWITTER-BASED ARTWORKS

Jens Wunderling's *Default to Public* [Wunderling, 2008] series deals with social data consumption both in the real world and cyberspace. Specifically, the focus is on making digital data physical in the city. *Default to Public: tweetleak* is a monolithic box that randomly selects geo-located Twitter posts in its current city, notifies the author that their Tweet has been stolen, and prints the tweet as a sticker, leaving piles of them on top of its box for the public to take away. *Default to Public: tweetscreen* meanwhile selects Twitter posts and projects them in a storefront window, also notifying the author that their tweet is currently

Figure 5. Jens Wunderling's tweetleak (left) and tweetscreen (right)

being broadcast. While the projects are rather simple in concept, the execution is well done and the issues raised are interesting. Wunderling gave a talk at Ars Electronica 2009 about the *Default to Public* series, and a debate about the ethics of publishing this content arose. Wunderling noted that the tweets are already public in cyberspace, where they actually stand a better chance of being read than if they were solely in physical space. Furthermore, in Default to Public the tweets are either printed or broadcast only once; they are not repeated and the names are not stored. Therefore, it's actually much less private online, where

there is a permanent, traceable link of not just the one tweet, but all by each author. However, there is still an unusual feeling about putting digital data in physical space that is seen as being more public than if it were just to be online. It's no different from someone going onto Twitter and reading the streaming feed, which lists all new Twitter posts, providing hundreds per minute that anyone can read. Why then, does actually making a physical copy of one seem so unethical, and what are the implications for future social data-based art projects? Is using social data in artworks really an invasion of privacy, especially when the author of the piece has no control over whose data will be used?

The artistic appeal of using Twitter for artworks lies in the limitless amount of real-time social data. This data can be used in a wide variety of ways, providing very versatile data sets for artistic usage. Kitchen Budapest's *Where is your art?* [Marton, 2009] project continually scans Twitter for posts containing the word art. When a Tweet is found, it is read out loud through a small robot. The installation consists of several robots in a small group, continually broadcasting all the Twitter posts about art. Sometimes it feels as if they are speaking to each other; other times it's just mindless chatter. By focusing on a single topic, *Where is your art?* connects a particular community of Twitter users to the physical space their Tweets are broadcast in. This isolation of content is a powerful tool for demonstrating the vast amounts of various content being generated constantly online.

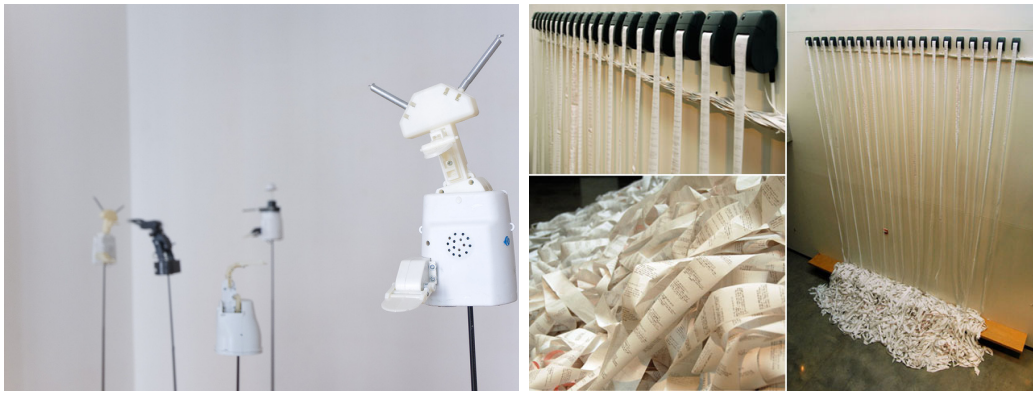

Figure 6. Kitchen Budapest's Where is your art? (left) and Christopher Baker's Murmur Study #1 (right)

On the other end of the spectrum, Christopher Baker and Kitchen Budapest's *Murmur Study #1* [Baker, 2009] aims for the large-scale, by continually printing as many Twitter posts and Facebook status updates as possible. *Murmur Study #1* is a complete information overload, with thirty thermal printers creating massive paper trails of social data that focus on small emotional keywords such as 'argh', 'ahh' and 'grrr'. The data seems meaningless, nothing more than collected human thoughts on nothing in particular. What value can be gained from these printouts? *Murmur Study #1* does two things very successfully. First, it explicitly demonstrates the speed and scale of social data creation online, presenting this to viewers in a tangible way. Second, it proves just how difficult it is to filter the data for rich results. These two points are key for enhancing the public reaction and understanding of interactive art projects in public spaces, and in this sense the project is successful. However, the data leaves us ultimately with no emotional connection to the content — it is completely random and unfiltered, leaving us with no idea of the people behind the social data.

With the issues related to privacy online ever-increasing, it seems society is in the midst of a transition period, one where we are still a bit unsure of how to deal with the rapid change in how we communicate and interact. Privacy is seemingly the biggest issue, but ownership of data and how to integrate this data into public space are also large topics. With all this in mind, a greater understanding of what brought the digital aspects of art in public space to where it stands today is needed. Tracing the history back, interactive artworks in public spaces is still a quite new idea, as the last thirty years of computing history has mainly focused on the more technical and HCI aspects: ubiquitous computing, reactive environments, and augmented space mainly. And while interactive artworks in public spaces make use of the years of research done investigating the more technical and theoretical aspects, it's important to know this history as well.

5. ENVIRONMENTS THAT THINK: UBIQUITOUS COMPUTING AND AUGMENTED PUBLIC SPACE

Chapters 3 and 4 have defined the first two elements in public interactive art requirements: public space and the inhabitants and users of the space. Chapter three will focus on the computer, the driving force that brings such projects to life. Bringing computing to the level of producing interactive art was a path littered with technological milestones. Throughout the 1960s, the idea of virtual reality (a term coined by Myron Krueger) began to be explored, with Ivan Sutherland's *Sword of Damocles* Head-Mounted Display (HMD) being the first [Sutherland, 1968]. This HMD, first tested in 1966, provided an early user-tracking interface based on the user's current gaze fixation, and opened up a new channel of HCI possibilities. The HMD encouraged new forms of user interfaces and began to change how people thought of computers; no longer simply machines to be fed tasks, they could now be devices that actively responded to the users input. The experiments and usage of the *Sword of Damocles* were nonetheless purely for technical purposes and advances in HCI. However, in 1969, computer scientist (though better known as computer artist) Myron Krueger would produce a project called GlowFlow [Kruger, 1969] that can be seen as the true starting point for interactive art.

5.1 MYRON KRUEGER AND THE BEGINNINGS OF INTERACTIVE ART

GlowFlow is a reactive environment that responds both visually and audibly to visitors. The light and sound are choreographed and respond to pressure sensors in the floor being activated. But while it was reactive, the interaction was largely one-dimensional; the user make inputs, the computer makes outputs. Krueger proceeded with experiments in audio and visual interaction, culminating in *Videoplace* [Kruger, 1975]. *Videoplace*'s initial implementation captured several users in different rooms and allowed interaction between their

tracked silhouettes based on a number of pre-programmed recognized gestures. In a response to all the virtual reality (VR) systems that were being developed involving cumbersome gloves and goggles, Krueger had created an interactive tracking system that relied solely on the user's body. It worked extremely well, and was unprecedented in both the art and computing world. These two worlds, suddenly, were combining. Krueger had created a new art form, and summed up his fascination and interest in this new field as such: "Interactive art is a potentially rich medium in its own right. Since it is new, interactivity should be the focus of the work, rather than a peripheral concern." [Krueger, 1991]

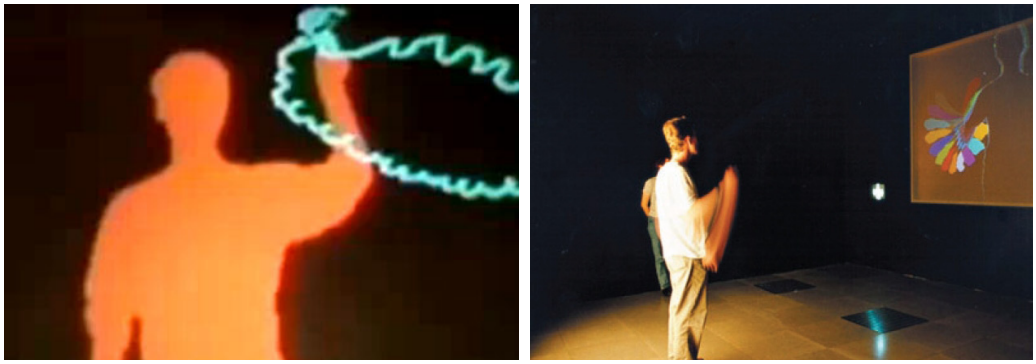

Figure 7. Myron Kruger's Glowflow (left) and Videoplace (right)

Krueger created many variations of *Videoplace*, allowing manipulations of virtual objects and animals. Krueger's seemingly endless exploration with this new technology was justified with his statement that, "We must fully explore these aspects of our inventions, because the next generation of technology will speak to us, understand us, and perceive our behavior. It will enter every home and office and intercede between us and much of the information and experience we receive" [Krueger, 1977] Krueger saw the need to eliminate VR systems, as they never fully allowed users to disconnect from the machine. Without this, full engagement could not occur, as users would always be aware they were 'wearing' the technology. In a VR system, the goggles and gloves always remained Present-At-Hand (Heidegger's phenomenology term from Section 4.2, adopted for Computer Science use); the technology and apparatus was never advanced enough to allow full scale Ready-To-Hand (Heidegger again, Section 4.2)

immersion. In a tracking system as developed by Kruger however, the user's focus remains on their own feedback shown via projection or screen; the technology allowing this to occur is never intrusive nor unnatural. The camera tracking system is still today (for better or worse) an essential component of interactive art installations, with such successful archetypes as David Rokeby's *Very Nervous System* [Rokeby, 1986] or Art+Com's *De-Viewer* [Art+Com, 1992]. Krueger's last quote, however, forecast a leap forward not from a technological standpoint, but a theoretical. In 1988, Mark Weiser, chief technology officer at Xerox PARC, would refocus the goals of all artists and computer scientists with his explanation of a new age for society: the age of ubiquitous computing.

5.2 MARK WEISER - UBIQUITOUS COMPUTING AND THE SOCIAL COMPUTING FUTURE

"The most profound technologies are those that disappear" [Weiser, 1991]

What we have seen so far in the development of public spaces, architecture and social interactions typically involve large leaps forward after periods of culmination. Many of these such moments described so far involve a key date, instance, or event which changed the entire path of an art, theory, or culture. In the case of Mark Weiser's ubiquitous computing theory, however, the leap forward is a bit different. When Weiser's *The Computer for the 21st Century* was published in 1991, the world of computing was a rising worldwide industry, permeating such diverse domains as education, art, business, and automobiles. In short, the computer had achieved a rapid world dominance, with seemingly endless possibilities. The devices had shrunk and become 'personal,' allowing people to see these machines as something more than just a mechanical box. Mark Weiser's greatest ability was being able to rationally see the near future. Whereas Ebenezer Howard [Section 3.2] or Edmund Husserl [Section 4.1] were visionaries in their penchant for thought, Weiser more falls along the lines of Marshall McLuhan; he had a sort of gift for rationally outlining the

evolution of his field of interest. In contrast to McLuhan [Section 4.8] however, Weiser's visions were easier to consider. As a computer scientist, Weiser presented a very utopian, feasible explanation of the factors that will lead to Ubiquitous Computing. McLuhan's meanwhile, a theorist with the intangible idea of the Global Village, an electronica network connecting every citizen on the earth, was certainly hard to imagine in a time when only a relatively small number of cottage-sized computers existed in the world and could only be afforded by universities and global companies. What Weiser described was far easier to agree with due to the nature of what he described; computers had entered households and were rapidly shrinking in size and increasing in power. And while ubiquitous computing may have been a bit far-fetched at the time, it would quickly become a reality.

The core idea of ubiquitous computing (ubicomp) is simple. Computers would continue to proliferate our lives, spreading to more and more regions of the home, office, public space, and everywhere in between. Eventually, these machines would all communicate with each other, forming a global network of interconnected devices capable of transmitting and sharing data. This forms the most interesting aspect of Weiser's paper from an artistic viewpoint; he spends much of the paper talking around the technology, rather than about it directly. Intead, he focuses on the positives for HCI and daily life as a result of the rise of ubicomp. As we saw with Myron Krueger, much research and development in computing was formed with a user-centered focus; that is, how can an emerging technology have benefits for the public? Weiser makes two key points here for media artists. The first is his admission that it's not valuable that the computers become invisible. This he sees more as a natural progression based on advancements in technology. What Weiser makes a point of is the value of interacting with the invisible machines, and the benefits of being in a networked environment. He even goes as far as saying that carrying a super laptop is still the equivalent of having just one great book — whereas a machine connected worldwide to all other devices can be seen as having an entire library. Furthermore, Weiser seems to anticipate the rise of the social aspect of

computing, noting that, "By pushing computers into the background, embodied virtuality will make individuals more aware of the people on the other ends of their computer links." [Weiser, 1991] He cites Heidegger's Ready-to-Hand [Section 4.2] as an example of how humans can forget about an object once they are sufficiently comfortable with it. Weiser sees no reason why computers can't follow that same path.

This social aspect of ubicomp indeed became a reality. But Weiser also made a flat-out wrong statement in his outline of the future of social computing. While he (maybe) unknowingly explains how McLuhan's Global Village idea will quickly become a viable reality, Weiser curiously states the opposite of McLuhan's "the content is the audience" [McLuhan, 1964] idea. Weiser says, "Sociologically, ubiquitous computing may mean the decline of the computer addict. Computer access will penetrate all groups in society. Most important, ubiquitous computers will help overcome the problem of information overload." [Weiser, 1991] This is a strong point of interest for looking at how social data has really come to function presently. What Weiser sees is the network of devices being able to reduce cognitive load, while connecting people with people rather than people with machine. But Weiser was only considering the Global Village, and not the Internet itself. The internet provides an endless supply of content and information, and through the increases in social data online the information is continually flowing faster and faster. Ubicomp has actually increased information overload, as the amount of devices people own and operate increases the methods and possibilities to consume and create data. And while ubicomp has enabled humans to interact with other people as much as they do with machines, it also opens the door to being able to interact with dozens of friends simultaneously. Multitasking is almost a given for anyone using a computer for work, as it's nearly impossible in the social computing age to simply focus on one task with no digital interruptions. Apart from this however, Weiser shows incredibly accurate predictions in what ubicomp will bring; a variety of gadgets with different shapes, sizes, and interfaces that can all connect globally to each other. A network on always connected humans

operating these devices. And most importantly, the idea that computers will simply fade into daily life without any problems; that they would so rapidly become so normal and average that we are able to see them as social devices, as interfaces to connect globally, to create content and have it instantly connected to this global network of devices. Weiser was so accurate in some predictions and ideas that in reading *The Computer for the 21st Century* its content seems almost obvious, and therein lies the strength of his vision.

5.3 CALM INTERACTIVE ART

At the root of *The Computer for the 21st Century* are engineer and computer science based ideas. However, the lasting legacy of Weiser's idea is the hope it gave to disparate groups of people. Much like the Bauhaus revolution and subsequent flourish of The International Style, ubicomp would become a focus point for creatives: interactive artists, industrial designers, architects and engineers saw the potential in Weiser's words. For interactive art, the focus was on hiding the technology. Still unable to improve on Krueger's tracking system, more immersive experiences were sought after, relying on more hidden technology to provide greater immediate and tacit feedback. Myron Krueger continued to experiment, calling his explorations in smart environments artificial reality. And other projects picked up on a key term Weiser outlined in a later paper, what he described as calm technology. Weiser started by saying, "We believe that calm technology may be the most important design problem of the twenty-first century." [Weiser, 1995] What Weiser was trying to do here was continue his quest towards reducing cognitive load and information overload through ubicomp. He saw calm technology as being able to hide in the background and reappear as we see fit. And the example he gives is Natalie Jeremijenko's *Live Wire* [Jeremijenko, 1995], a simple project that perhaps best illustrates this concept.

Live Wire was installed in the very Xerox PARC headquarters Weiser worked in. A single wire hanging from the ceiling, *Live Wire* was connected to the office-wide network, receiving a signal every time a bit of information passed over the network. This bit triggered a small motor which caused the wire to twitch. Obviously, there was rarely ever a single bit flowing through the ethernet cable, so *Live Wire* was usually an active jerking wire. Weiser described it as fun and useful, and this usefulness seems to stem from the fact that *Live Wire* was indeed discreetly providing information: it visually (and audibly if it was moving enough) provided ambient feedback on the state of network traffic. *Live Wire* is one of the key early interactive art projects relying on a kind of social data; it is, after all, powered by the people who use the network. It is a non-intrusive installation that serves a simple purpose, but is so effective in what it sets out to do that it becomes much more than a passive piece of art. Perhaps Weiser says it best: " Its output is so beautifully integrated with human information processing that one does not even need to be looking at it or near it to take advantage of its peripheral clues" [Weiser, 1995] Weiser furthermore goes to explain that an art project such as *Live Wire* can take the information overload of analyzing network traffic and reduce it to a calm representation. He sees this as a method to conquer and contain information overload, and provide this crucial social interaction he hopes the ubicomp world can provide. While Weiser's ultimate goal of a more social world through computing has indeed come to fruition, another concept from *The Computer for the 21st Century* would be explored in depth much earlier: the idea of ubicomp providing smart environments for daily life.

5.4 THE REACTIVE ROOM AND THE ROOTS OF AUGMENTED SPACE

In 1995, computer scientist Jeremy Cooperstock released a paper summarizing his group research to date in a project called the *Reactive Room*. The paper, *Evolution of a Reactive Environment* was data-driven, outlining the concept of

this smart environment, a meeting room that can handle a range of meeting styles and media required for such meetings. Cooperstock explained the testing to date, the iterations in the design and functionality of the room, and the ultimate goals of the project. However, two years later, Cooperstock would publish *Reactive Environments*, a paper that reflected on the last two years of

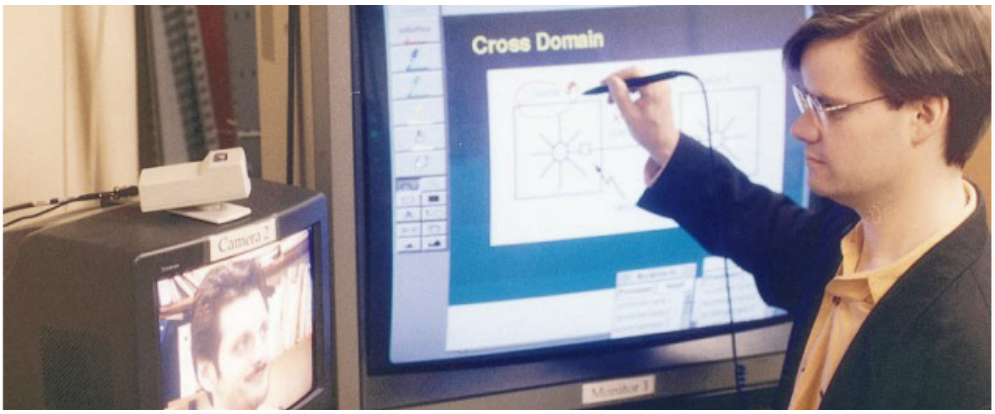

Figure 8. Teleprescence and digital whiteboards in Jeremy Cooperstock's Reactive Room

further experimentation on the *Reactive Room*. In this paper Cooperstock dove deep into the HCI principles supporting the project, and more of the theoretical aspects of smart environments. Cooperstock did nothing less than illustrate how quickly the concepts of ubicomp had become a reality. His motivation for making ubicomp a reality comes from a common problem in computing. "We have been stuck in our ways of thinking about computers. All of our interaction with the technology is through the highly limited channel of communication provided by the user interface and takes place purely at the level of the machine. As a result, we cannot 'walk up and use' the technology, but must be trained in its operation." [Cooperstock, 1997] Cooperstock notes that, in his opinion, the full potential of the computer cannot be realized in its current form; it must be invisible to the user in order to achieve its maximum effect. Whether he means invisible in a Ready-to-Hand definition or actually hidden from the view of the user, we aren't sure, but the Reactive Room itself seems to favour this notion of invisible technology: the design principles listed by Cooperstock are invisibility, manual override, and feedback. These carefully detailed principles provide the

foundation for what future smart environments (and interfaces) would come to possess: a sense of the machine knowing what to do next, but with commands executed by a human and providing immediate feedback on all actions.

Reactive Room seems like a project limited only by the technology available at the time. We can see the impact of Weiser's ubicomp principles: while it didn't cause a revolution per se for computing, the idea of ubicomp refocused the aim of computer scientists. Whereas Otto Wagner's *Modern Architecture* [Section 3.3] was a call to modernize the global living style, what Weiser did was less demanding. Rather than exclaim "this must be the future for computing," his argument comes across more as "it seems that computing will eventually reach this point." And with *Reactive Room*, we see that although the technology is still really in its infancy, the theory supporting the research is absolutely ahead of its time. It was an entirely user-centered design process, as Weiser and his group of researchers were the active testers, able to experience in practice what they had considered theoretically. Cooperstock notes that the research results are a bit subjective as a result, but nonetheless illustrates that *Reactive Room* satisfied the design principles, breaking away from the traditional idea of a keyboard and mouse based, Present-at-Hand computer interaction. The paper ends with the hope that this research would help fuel alternate projects that simplify the complex barriers to interacting with computers. This hope would be quickly satisfied just one year later, with Michael H. Coen extending the idea of what a smart environment can be.

5.5 MOVING TOWARDS INTELLIGENT PUBLIC SPACES

"Interaction may become personal even in a public space" [Coen, 1998]

Intelligent environment research projects exploded in the late 90's, fueled by the developments of Mark Weiser and Jeremy Cooperstock. Projects such as Aaron Bobick's *KidsRoom* [Bobick, 1999], an interactive playspace for children, and Georgia Tech's *Classroom 2000* [Abowd, 1999], which provides a visual

record of the learning experience, helped push computing into all areas of daily life. However, Michael H. Coen took the ideas of the smart environment and

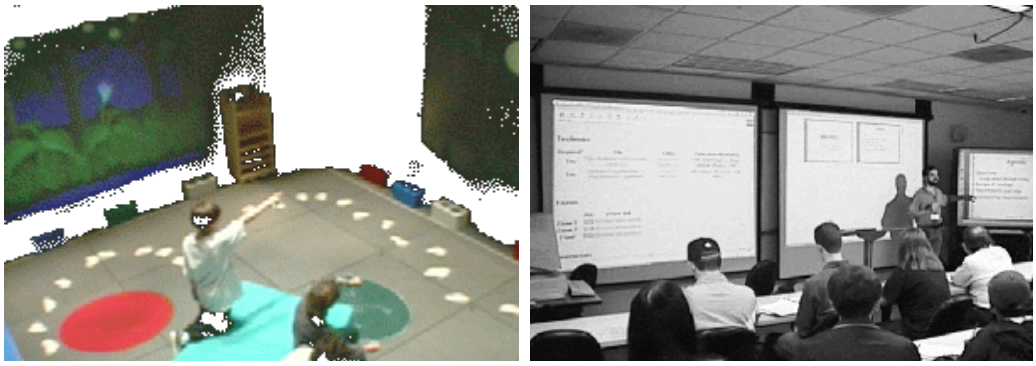

Figure 9. Two early intelligent environments in action: KidsRoom (left) and Classroom 2000 (right)

considered a more natural approach to thinking about the design principles. What Coen set out to do was "enable unencumbered interaction with non-augmented, non-computational objects … without requiring that people attach high-tech gadgetry to their bodies" [Coen, 1998]. In the *Reactive Room* papers, Cooperstock had relied on gadgets and devices to perform many features, including early tablet-like devices that participants kept attached to their belts. Coen, however, aimed for a bit more sophistication in his approach. He rationalized that a single camera can capture much more valuable data than groups of sensors would. While sensors can be used to track where people in the room are sitting, what richer data is being missed in this approach? Small subtle details such as how people are sitting, their facial expression, and who they are currently looking at are the factors that can transform a smart environment into an immersive responsive environment. The real difference between Cooperstock and Coen's approach is in the problems they attempt to solve. Cooperstock wants computers to disappear into the background and help simplify cognitive load. He sees the age of ubicomp already upon us, and is anticipating how we can best interact with this technology. Coen, meanwhile, wants computing in the physical world as a method of supporting non-computational activity. His viewpoint is that computing should be brought out into public space, and used to enhance the daily interactions between people. It's almost two separate

studies: people interacting with computers in a more natural way, versus people interacting with people, in technologically augmented spaces.

Coen's experiment revolves around building *Intelligent Environments* (IEs). In IEs, people should communicate with the technology the same way they communicate with people. Context, gestures, and tone are important considerations for Coen here. He argues that not enough smart environments take advantage of artificial intelligence systems, giving the example again of using simple sensors to 'track' the participants in the room. He also states (provocatively) that IEs are not examples of ubicomp; this is due to the nature of how Coen sees an intelligent environment. It's not full of distributed devices actively collecting info and interacting with participants; rather, it's one central artificial intelligence (AI) system that passively monitors the entire area. It's a much lighter infrastructure which Coen sees as the key to adapting into public space. The IEs Coen describes involve an array of cameras to create a 3d map of the room; this map can then pinpoint individuals and track their actions. This allows for the tracking of subtle actions such as pointing, a natural action that Cooperstock's approach simply doesn't allow for. There's a curious similarity here to Myron Krueger's pioneering interactive art works. Krueger saw the problems with VR systems, the entirely unnatural feel of having to wear bulky apparatus and expect an immersive experience. Krueger's tracking systems were an expression of his rebellion against the dominating VR research projects of the time. In the same vein, Coen sees Cooperstock's approach as heavy-handed, overloading too many analog objects with digital sensors, and forcing users to interact with these systems through hand-held devices. His IEs are a more natural evolution of the smart environment.

The work of Coen helped inch smart environments closer to the general public domain, but these smart environments for the most part remained contained to a room, a private space for a certain group of individuals. It wasn't until Lev Manovich coined the term 'augmented space' that we see the

culmination of all previously discussed theory merge and shift society into the age we live in now: the age of augmented public space.

5.6 LEV MANOVICH AND THE REALIZATION OF AUGMENTED SPACE

> "It is quite possible that this decade of the 2000s will turn out to be about the physical – that is, physical space filled with electronic and visual information." [Manovich, 2002]

In 2002, new media theorist Lev Manovich published a remarkable paper. *The Poetics of Augmented Space* [Manovich, 2002] is a realization of the present and an anticipation of the future, tying together many branches of artistic and computational research. He was able to foresee the convergence of so many different technological fields that would come to form the augmented space landscape we all live in today. Manovich started with a casual summary of what led him to this realization. "The 1990s were about the virtual" [Manovich, 2002] he opened the paper with, outlining the dominance of the World Wide Web and the virtual worlds that people inhabited online. However, by the early 2000s, the internet was expanding to portable devices, and these portable devices were becoming more powerful and smaller. Data was moving into the public. At the same time, surveillance of public spaces was also increasing, exponentially increasing the amount of real-time data being created and raising questions of privacy and ethics. Manovich sees all this as the creation of a digital layer of data that overlays the physical layer of the city, as what he calls augmented space. It's such a revolutionary shift in daily life and the public space of the city that Manovich goes on to reason that throughout time, all architects, artists, and engineers were working on how to augment space, how to place data

into physical space. It would be a rather outlandish thought if it weren't so well thought out.

Augmented space can be seen as a container for the emerging technologies of the past decades that preceded its definition. Manovich lists a variety of these technologies that contribute to augmented space; ubiquitous computing, smart environments, and public screens are among the variety. While Cooperstock and Coen were moving in different directions with their smart environment research, it seems that they were simply pushing towards discoveries in how to augment space. In fact, much of the prior research in this thesis can be seen as explorations towards augmenting public spaces. Manovich uses Robert Venturi (previously discussed in Section 3.7) as an example of how architects should be inherently concerned with how to augment space. During the 1990s, Venturi proposed that architecture could be used as a communication tool in the information age, emitting electronic information from its surfaces. Referencing Medieval architecture with its use of sculpture and painting to tell stories, Venturi showed that the current age of information is a chance for architecture to "return to its traditional definition as information surface" [Venturi, 2002] Augmented space can here almost be seen as a sensible backlash against the over-virtualization of the 90's. It's an important shift back to physical space, and the realization that the virtual world the 90's brought us can and should be integrated with the pre-existing physical world. Manovich pays particular attention to architecture in *The Poetics of Augmented Space*. He uses architecture as a frame for his big three questions about augmented space:

- What about the phenomenological experience of being in a new augmented space?
- What about its cultural applications?
- What about its poetics and aesthetics?

[Manovich, 2002]

Augmented space presents challenges to architecture, the biggest challenge being that the abstract space it inhabits will no longer be static. The social space will always change, of course, but the data layer on top of these spaces is continually changing, shifting, and updating in real time. In the 1970s, Christopher Alexander told that inhabitants of the building will always know more about the building than the architects thanks to their daily experience. [Section 3.8] Here, a similar statement emerges, with Manovich indicating that the public will not just always know more about the space, they are the space (again, the content is the audience [Section 4.8]). For architects, this is an important realization, as a building can now be an augmented building, an information screen that serves as a beacon of data in the urban landscape. And how can all these spaces be combined? The contextual space of a building must now contend with the social and data space, the culture of both the public and the virtual public who inhabit that space. Manovich also sees a particular challenge for artists, as the public expectation is that in the digital age, all things are becoming interactive and responsive, while art moves from the canvas to the physical, three-dimensional world. The classic 'white cube' art gallery is no longer good enough, nor can it contain the new media possibilities brought on by augmented space. New media artists must go public, using the data layer to express their artistic intentions. Manovich sees an opportunity for artists to be the groundbreakers, no longer waiting for corporations and military to make breakthroughs that trickle down eventually for the artists to use. With the convergence of so many technological avenues, there is a wide realm of new opportunities in experimenting with data, devices, and most of all, wide-scale interaction with the public.

Manovich ends with saying that augmented space now needs its own poetics, rules, politics, guiding principles. Some of the issues inherent in augmented space include surveillance, security, and dealing with increasing information overload. We are still very much in this phase of defining rules for hybrid public space. What is interesting is that as more data and devices that use this space, more rules are being formed by the social space. Lefebvre

originally defined the abstract space as defining the use of the social space. [Section 4.7] However, this has seemingly become a closed loop, with both spaces defining each other continually; the functionality and usage of the space is simply shifting itself too rapidly in an augmented space environment.

The introduction of the computer into the physical world pushed concepts and theories quickly into concrete research projects. As in the previous chapters, it took a visionary (in this case Lev Manovich) to reflect on the decades of innovation and see the next great leap forward for society. Manovich's refuting of VR environments draws parallels to Robert Venturi's critique and plea for abandonment of Modernism [Section 3.7], and the resultant shifts that followed their publications can also be viewed similarly. That the computer was able to so rapidly change thousands of years of urban and architectural order is truly remarkable. Yet the pace of change in the technology sector should have predicted this. As a result, computer science projects began spilling over into the architecture and urban design domains, creating new guidelines, principles, and research fields. The outcome of this would push towards the next stage in the history of civilization: the real-time city.

6. THE REAL-TIME CITY: EXTENDING ARCHITECTURE, URBAN INFORMATICS, AND SOCIAL COMPUTING

In his definition of augmented space, Lev Manovich explained that the space needs its own standards and order defined. While Manovich was able to give a name to this emerging convergence of UbiComp, real-time data, and smart environments, he avoided the issues of governance. This seems mostly due to the nature of the paper itself, but perhaps it was a strategy taken from Christopher Alexander's theory of the users knowing more about the building than the architect. [discussed in Section 3.8] Manovich saw the creation of augmented space, but he desired to leave the formation of its structure to the researchers and theorists who would work in the context of augmented environments. In 2004, Malcolm McCullough, an architect and information designer, looked at the new opportunities afforded by augmented space in his book *Digital Ground*.

6.1 DIGITAL GROUND - CONVERGING DIGITAL AND PHYSICAL ENVIRONMENTS

> "Much as a river needs banks unless it is to spread aimlessly like a swamp, the flow of information needs meaningful contexts." [McCullough, 2004]

In McCullough's eyes, pervasive computing (a term he uses in place of ubicomp) has indeed done what Manovich outlined, a shift from creating virtual worlds to embedding digital data in the physical world. The concept of 'digital ground' centers on the importance of context and environmental knowing. So, while environments may be omniscient, the truly important factor is the context in which they operate, how the data is handled and delivered, and how people interact with the environment in general. Its at this point in which we see a rise in the importance of interaction design. A term coined by Bill Moggride and Bill Verplank in the 1980s, interaction design has grown to a separate branch of design specifically focused on user-centered, contextually rich design.

Digital Ground was perhaps the first publication to directly state the importance of applying interaction design principles to the physical environment (or augmented space). Projects such as Cooperstock's *Reactive Room* [Section 5.4] were careful to consider design principles for the project. However, the

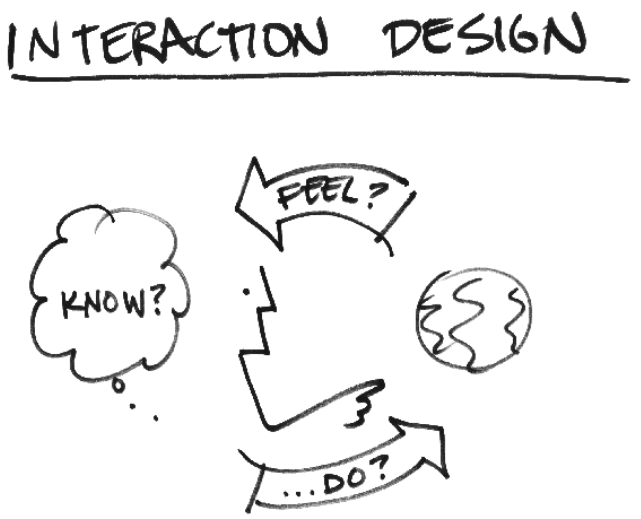

Figure 10. Bill Verplank's tasks for effective interaction design: answer how people feel, how they act, and how the understand.

results and feedback seem to be on how well the system performed, rather than how receptive and useful the interface was to the users. Furthermore, Cooperstock admitted the users were mainly made up of his research team, thus further limiting how they could really judge the intuitive nature of the room. In *Digital Ground*, meanwhile, McCullough recognizes the importance of interaction design, especially in a public space setting where the user group cannot be anticipated. He sees the role of interaction design changing around this time as well. Whereas the history of interaction design was centered on interfaces and industrial design, its applicability has now adapted to public space and architecture as screens move from traditional displays to urban interfaces and public screens. McCullough's digital ground concept involves three key factors, all of which are interrelated and will undergo significant adaptation and transformation in this new environment. These three factors are interaction design, architecture, and public space.

6.1.1 *Interaction Design: beyond the screen*

The inclusion of interaction design as a principle of digital ground is important. As well as shaping and designing the content that will fill these new augmented spaces, interaction designers must be responsible for the contextual design. The content is the audience, [Section 4.8] and the interaction designer must recognize that the audience will be different in every situation. The key point for interaction designers is understanding that the interface is no longer confined to screen based; changing from a screen-based interface to an 'extended screen' such as a building facade or other reactive surface changes the methods of interaction and reception for the public. McCullough also references embodiment, using it here as a keyword for evaluating the quality of interactions possible. As a designer for digital ground, graphic design is perhaps less of a concern than the interaction methods. There's not yet any defined standards for interacting with public interfaces; we still lack a *Pattern Language* [Section 3.8] for augmented space. What interaction designers can do is anticipate how the public will react to and use these augmented spaces. Issues such as where and how to show digital content and how to interact with that content (or the entire building, in the case of a facade) are paramount design problems for this rapidly growing field. McCullough states a need for a new class of interaction designers, a group that designs for the context of pervasive computing, with an innate understanding of both how augmented space can help architecture, and how users can be expected to interact in and with these spaces.

6.1.2 *Architecture: from static to dynamic*

In augmented environments, architecture is no longer static in the traditional sense, as digital interventions result in a dynamic room / building / public space. Of course, buildings and ways of creating buildings cannot change so fast. "Flow is of course an essential goal of interaction design, and fixity is an essential goal of architecture." [McCullough, 2004] McCullough sees the role

of interaction design as being able to not ignore physical buildings in place of digital data, but rather to extend them. Thus, architecture must allow itself to be fluid, with sensors, devices and displays enhancing the traditional role of the building and turning it into an information hub. Interactivity with architecture should be a cultural challenge, not a technological concern, and embedding a building with contextually appropriate digital data can augment not just the role and presence of the building but the surrounding space as well. McCullough is careful to avoid what 'data' these buildings should contain: whether for news, social means, way-finding, or any other. Instead, he provides the idea that when dynamic architecture is thoughtfully designed and useful, the content will find a way of presenting itself in the context it finds itself.

6.1.3 *Public Space: a canvas for interaction*

Digital Ground enables more power and functionality to public spaces. If these spaces can be real-time data hubs, they become places people want to visit and stay. McCullough writes about public spaces as a sort of blank slate for new explorations into interaction. The internet and our devices have ruined the traditional notions of space; you no longer need visit a space to see it. The experience of visiting a space for an event can now simply be watched remotely without ever leaving your comfort zone. While seemingly technology has removed many aspects of spatial exploration and discovery, what McCullough points toward is the experience of a space, and the identification of knowing certain spaces in cities. These are factors that no technology can replace yet. This thesis started with the question of how one defines space in a city; how one experiences that space is another seemingly impossible question. Regardless, McCullough points to public space as the experimentation ground for interaction design and an area for new methods of helping users identify and 'feel' a space.

Combining these three fields creates a new field that we are still struggling to define properly. Terms such as 'experience architecture' and

'environmental knowing' can help contextualize design scenarios for these augmented spaces, but they also take on a variety of meaning and scenarios. As architecture, urban spaces, and interaction design merge it becomes harder to imagine one clear term that explains this convergence. Furthermore, as the fields become less-traditional (or perhaps part of a new tradition), the roles of the creators become blurred as well. An architect is no longer just an architect, as McCullough notes that the building is no longer static but rather subject to influence from both the interaction designer and the general public. The interaction designer, however, must also be aware of the architectural design principles of the building and use this context to inform their design. What we see here is a trend back to the ideas of the Bauhaus, this idea that art can be taught as an overarching theme, and used to teach architecture and graphic design through the frame of understanding art. It isn't enough for an interaction designer to simply understand good HCI principles for user interface design, because it's not clear anymore where a user interface begins and ends. And as artists, this same care must be taken; it isn't enough to create an interactive system that responds to users. There have been interactive public art projects since at least the 1970s, when *Two-Way-Demo*, [Sharp, 1977] a telematic art project from Willoughby Sharp et al. enabled a live video feed connecting the two coasts of the United States, creating a country-spanning video conference. There was actually no human-computer interaction though, and a cross-country video chat is a routine computer function today. Today, interfaces and art projects are much more complicated, requiring more user input and consideration of how to use the project. It's a very careful balancing act to provide a mix of design, artistic vision, and urban context to a project, but there are many examples already of projects incorporating the principles of *Digital Ground*.

6.2 GUERILLA SPACE AUGMENTING

The Graffiti Research Lab's *Interactive Architecture* [Graffiti Research Lab, 2006] project is a guerilla experiment that subverts the traditional functionality of a building by extending the façade. By tracking a laser pen as an input device on a projected surface, any structure can become an interface. However, *Interactive Architecture* seeks to go one level further. Due to the computer vision aspect of the project, the surface can become editable, and the elements of the building can act as interactive objects. The facade of the building can be 'drawn' on with the laser pen, with architectural elements such as windows/door frames and edges become dynamic points that act differently than the flat surface when drawn on. Another mode which turns the laser pen into a giant cursor displays different behaviour when 'rolling over' lit up windows than when the pen hovers on a darkened window. There is a nice interplay between traditional and non-traditional user interface elements. A laser pen and a building acts as the least traditional interface imaginable, yet the interaction methods and behavioural feedback are what a user would expect when using a standard desktop setup. The role of the building is extended to create a dynamic urban interface, but the resultant interaction methods are very familiar. *Interactive Architecture* is successful due to the underlying concept: a temporary reconfiguration of a building's functionality. With just a projector, laptop and laser pen, any building can instantly become a surface, yet the results can also disappear without a trace instantly. This fluidity and ability to be moved quickly gives *Interactive Architecture* a temporal presence in the city, and is a playful example of augmenting urban environments.

Figure 11. Augmenting the urban landscape: Interactive Architecture from the Graffiti Research Lab (left) and Chris O'Shea's Hand From Aobve (right)

6.3 HAND FROM ABOVE - PLAYFUL INTERVENTIONS

Chris O'Shea's *Hand From Above* [O'Shea, 2009] is a public space intervention. In a transition space (a place people go through, rather than go to) along a busy shopping corridor in Liverpool, a large screen shows live video footage of the people walking through the space. A giant hand occasionally appears on-screen, picking people up and removing them from the space, tickling or pulling on them. *Hand From Above* is a playful distraction in the space, a small disruption of a typical urban transition area. By shifting the functionality of the space, it instantly becomes a place where people will stop and spend a bit of time, instead of being just another empty space only used as a walkthrough path. But does the installation really make the space better, or extend the functionality? Not exactly, but what it provides is a temporary new destination for people in the city to visit. It's a memorable meeting point and an opening for increased social interaction. At the same time though, it's a purely playful project, not improving the informational or 'smart' qualities of the environment. So are these types of projects meaningful as an augmented space? It depends what the intent of the space transformation is. Playfulness is an important factor in daily life, and art projects that provide this sense of curiousness often leave the strongest impression in the participants minds. The randomness of the installation enables

the space to become a gathering space, and if only temporary, it succeeds as a playful artistic augmentation of the environment.

6.4 HYPOSURFACE - FORECASTING A FUTURE OF INTERACTIVE ARCHITECTURE

Mark Goulthorpe's *Aegis Hyposurface*, [Goulthorpe, 1999] first realized in 2003, is a responsive architectural façade. The façade is composed of close to nine hundred metal plates that are pneumatically controlled, enabling the ability to continually alter the function and appearance of its surface. The result is a piece of architecture that can react to movement, sound, and light. *Hyposurface* can also be programmed to display text or create images on the surface, through the subtle manipulation of the hundreds of facets. There have been many demos and exhibits of *Hyposurface*, but it has yet to leap to a fully realized, production ready system. What implications can we draw from *Hyposurface* thus far? Seeing

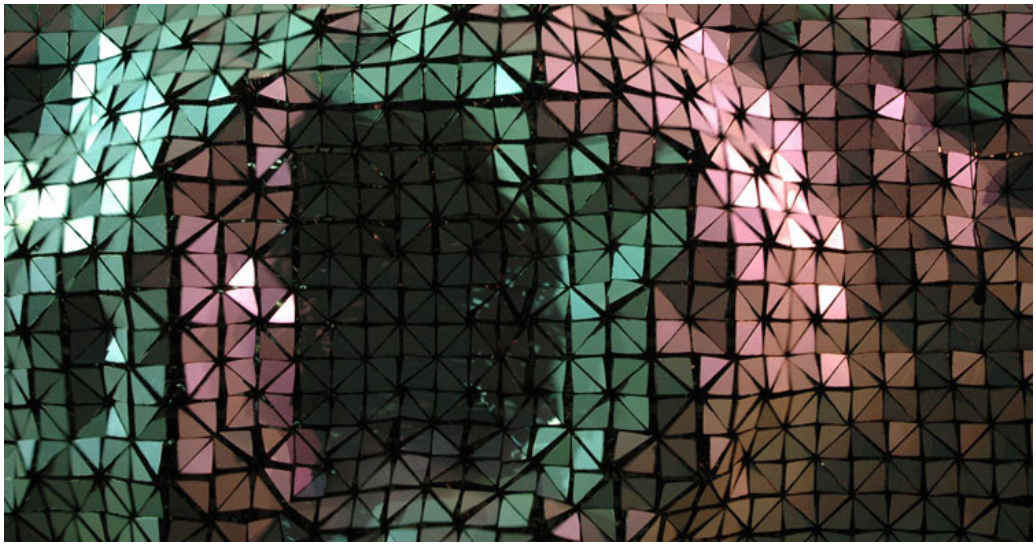

Figure 12, The Aegis Hyposurface and its undulating, dynamic surface.

the responsive façade in action is at once impressive and a bit unnerving. We are not yet used to seeing a static object of such size be able to either move or interact with people in real-time. The scale of the transformations gives a certain

power to *Hyposurface*, and herein lies the problem. From the documentation available, the main functionality of *Hyposurface* is purely cosmetic. This likely stems from the fact that it was born out of an architectural competition for a piece of interactive art for a theater lobby. While the fact that it is interactive as well as responsive is promising in the scope of *Digital Ground*, the interaction doesn't offer anything truly engaging for the participant. In the context of a city, would *Hyposurface* be useful? Or is it more suited as an interactive kinetic surface, existing for amusement purposes only? There is potential for *Hyposurface* to be a subtle interface in the city, one that shows ambient information through non-traditional methods. City data could be visualized in a variety of methods, from creating graphs of real-time information on the surface to visualizing the activity level occurring within the building it's a part of. So while *Hyposurface* is promising from a technological level, what we see is an unfortunate lack of consideration for the social and human aspects of the project. It's these same problems that form the basis of Anne Galloway's research, problems of continuing to look at computing from a purely machine-based perspective despite continually referencing the human side of computing.

6.5 EVERYDAY AUGMENTED LIFE

> " Just as context shapes Ubicomp, so too ubiquitous computing shapes contexts of interaction." [Galloway, 2003]

Anne Galloway's thoughts on Ubicomp provide the sort of grounding necessary to visualize how an augmented space may look. Whereas Malcolm McCullough discusses the high-level theory of interaction possibilities, Galloway instead focuses on the more phenomenological aspects; specifically, what benefits augmented environments provide for daily life. She questions why social and cultural concerns tend to be in the background of ubiquitous computing planning and design. It's a valid question, given that Mark Weiser's original focus with ubicomp [Section 5.2] was more on the social and cultural

implications than the technological. When reading this paper, some of the issues which are now at the forefront of the augmented space arguments stand out, issues such as persuasive systems and privacy. A large concern about what here is called 'information infrastructures' is their ability to shift modes; from periphery to centre, from listening to responding. Galloway is skeptical of the ability of computing to truly be context-aware, noting that it relies on two types of information: physical location and user identity. This information requires extensive amounts of data acquisition and processing, another factor in the privacy argument. However, Galloway's attention to the routine experience of daily life is the most fascinating here. She describes that walking in public spaces is a very personal act, no matter what the purpose. This personal act allows the individual to experience space on their own terms. With ubicomp, however, there is an outside influence from the technology that ruins this intimate relationship between person and space. Although the idea may be augmented space, is it necessarily augmented for the better?

An augmented city can be one that does not allow for getting lost. It may provide contextual data to people when they enter a certain space or cross an invisible threshold. This would be heralded as a technological success, and certainly the technology today already exists. But is it culturally better for a person? When one is effectively inhibited from experiencing the space at their own whim, what has the technology actually done aside from limiting the person? Furthermore, there is a tendency among humans to put far too much trust in technology. Our opinions can be easily swayed by something we read online. We trust unseen databases with all our personal information, and broadcast our random thoughts for the whole world to see, allowing timeless access to this data. In the context of the augmented city, why would the same thing not happen here? It's far too easy for public space to be commercialized, and digital maps could easily choose to give priority display towards certain business. For way-finding, paths could be purposely routed past particular stores and buildings. Galloway fears that, "Without accounting for these possibilities, the design of ubiquitous technologies may set us on paths for which we are

not socially and culturally prepared, and at the same time limit chances for creativity, serendipity and innovation." [Galloway, 2003] The same technological changes that give people more power in their everyday life can be the same changes that actually take away power, choice, and most importantly, freedom. These counterpoints are important to consider. As artists, there's often not enough questioning of art works, and unfortunately self-expression can be an all too common fallback justification. In the case of public art, much more consideration should be given to the purpose of a given project and how to tailor the content and context to the audience.

Galloway's concerns are a necessary contrast to McCullough's aspirations. Whereas McCullough points towards the need for an evolution of interaction designers to pay more attention to augmented space computing, Galloway is careful to remind that the envisioned usage scenarios won't necessarily improve living conditions just because of the addition of technology. Clearly, there is much testing and experimentation to be done in the area of daily use cases for augmented space, and theory and scenarios alone can't provide the optimal solutions.

6.6 MARCUS FOTH AND THE NEW URBAN INTERACTIONS

> "Urban environments in the network society are characterised by fast-paced technological change and a swarming social behaviour of its inhabitants" - [Foth, 2008]

It has been well documented that there will eventually be a shift to true augmented spaces and the realization of ubicomp. Again, like Modernism or any great shift in human history, these precise moments of change are hard to pinpoint. As the theory is always speculative and, well, theoretical, it allows for these such lacks of black and white definition. Most writing about augmented spaces thus far is largely looking at existing research and referencing the standards of augmented space theory, without taking such a firm stance on

where we actually stand in regard to a complete augmented world. Instead, works such as Mark Weiser's *The Computer for the 21st Century* [Section 5.2] or Lev Manovich's *The Poetics of Augmented Space* [Section 5.6] papers are shown as points of attitude and theory transition, but a practical equivalent tends not to be discussed. Marcus Foth, however, looks at this issue from a different viewpoint. He doesn't explicitly say that we've entered the age of augmented life, but rather stresses that its time we abandon tags such as 'cyberspace' and states of being online and offline. Instead, what is needed is a casual label of everyday life, what he defines as a complex hybrid nature of urban spaces [Foth, 2008]. Foth looks at public spaces as social catalysts, as places where dynamism is an inherent feature. Rather than the now-standard reasoning of public space as an augmented space, we are given another view: the public space acts as a physical bridge for the social interactions that start online. Foth also shows that the traditional idea of a public space has changed as well; no longer confined to well-known recognizable areas and key points in neighbourhoods, the advent of mobile technologies (especially SMS) has brought about a more impromptu and casual level of meeting points spread out around the city. This democratization seems a natural extension of Ebenezer Howard's reasoning towards more bottom-up control and natural evolution of public spaces. [Section 3.2] Continuing from this mindset, Foth lays out his three areas of contribution that can lead to more in-depth studies of urban public spaces, those being:

6.6.1 *People – contextual space usage*

Not necessarily a user-centered design approach, but rather the urban sociology and the development of communities is what's essential here to Foth. There's an important distinction here from other augmented space theories and that is Foth's approach of looking not at the people using the space, but rather the background and characteristics of the people using the space. As important as it is for an artist to recognize one's audience, it's also useful to analyze the history and traits of the viewers in each context.

6.6.2 *Place – The design and planning of architecture and urban areas.*

Foth has a particular interest in how these spaces are adapting to the technological interventions, rather than the technology having to adapt to the space. He notes the rise of 'swarming social spaces', places such as cafés which may suddenly become a physical hot spot after being digitally chosen as a meeting point.

6.6.3 *Technology – enhancing human interaction*

Again focusing on the people, Foth repeatedly asks what kind of technology might be most useful and how to affect the greatest change in social interaction amongst community members. Foth notes that augmented space has already provided innovation in architectural construction, as well as future-proofing buildings by anticipating new technologies which may one day be integrated in the building.

Community is a central theme here, and mostly in the physical sense. As the digital communities mix with the traditional, a term such as neighbourhood or village must be updated, either a social network or what Foth calls an urban tribe. But it's this combination which is so intriguing. These urban tribes don't appear readily in public space; it may be a group of people standing separately in a space, but connected digitally into private clusters. The public spaces they inhabit become what has been labeled the "third place" (Oldenburg, 2001), a transitory space where crowds can gather and disperse. While this temporary nature may seem unnatural, when the urban tribe is connected digitally being together in a single physical place becomes less and less important.

Is ubicomp still a relevant term here? Or has the original ideas moved and transformed so much that a new title must be given? Foth uses a pre-existing term, urban informatics, as his main umbrella that covers all these ideas. Foth defines urban informatics as "the study, design, and practice of urban

experiences across different urban contexts that are created by new opportunities of real-time, ubiquitous technology and the augmentation that mediates the physical and digital layers of people networks and urban infrastructures." [Foth, 2009] Modern urban public spaces enable us to transition between the visible and invisible infrastructure around us. We continually move through the physical layer while interacting with the digital layer. And the city is becoming alive, not just figuratively but technologically. Urban informatics is the realization of half a century of bubbling technology that has promised to move computing away from the screen and towards integration in daily life.

After so much theory revolving around smart environments (tracing back to Sutherland's earliest VR experiments discussed in Section 5.1), the smart environment has truly succeeded due to its seamless integration in all cities worldwide. Once again, this integration was put into motion through top-down infrastructure. Early technologies that monitored water, electricity, and traffic patterns began to peel back the layers of the city, revealing the rich unseen data. However, as we have seen continually over time, and as yet another example of Lefebvre's theories [Section 4.5], the abstract controlled space was once again disrupted by the social space. With mobile devices being tracked throughout the city, the once rigid traffic patterns suddenly began to adapt as participants were turned into dense swarms of mobile objects throughout the city, influencing the structure and order of the space. The scope of change possible through urban informatics is seemingly endless. We are just now beginning to dig through the rich datasets of the city and comprehend just how much we have to work with. This ever-growing mass of raw data provides so much opportunity for designers, urban planners, architects, and media artists. We may be in the age of ubicomp, but the age of urban informatics seems like a much more appropriate title.

Just as with the evolution of smart environments, the real-time city has quickly evolved and morphed through its many early iterations. What's truly different here is the influence of art projects, rather than research projects. As the line between interactive art and computer science continue to blur, art

projects have been able to test human behaviour in public spaces and provide rich data for analysis. The original theory from Mark Weiser and Lev Manovich that defined these new spaces has also been quickly augmented and modified, updated to reflect the ever-changing physical spaces themselves. And as the real-time city asserts itself worldwide, a rich playground for art exploration is given to media artists. As the spaces become smarter, more and more data and infrastructure becomes readily availably for artistic intervention. However, as exciting it is to be given a world full of smart environments, we must pay special attention to the new problems and issues that arise in these spaces. Privacy and ethics of smart technology use have become important issues; as artists, we can take the new opportunities provided in these spaces and experiment to both enrich the environments culturally and explore the concerns of the people who inhabit them.

7. PRIVACY AND ETHICS: SPACES THAT FORGET, CITIES THAT THINKS, THE BLUR BETWEEN DIGITAL AND PHYSICAL SPACES

Marcus Foth has claimed we are now living in the age of urban informatics [Section 6.6], and I am inclined to agree for several reasons. First, the real-time city is a given in daily urban life, and theory and ideas that would have seemed radical even ten years ago are now rational, reflective issues. As a result, the hopes and optimistic dreams of the previous generation of computer scientists and designers have largely become reality. Unfortunately, optimism alone cannot foreshadow how real-time urban environments behave and integrate into the public space landscape.

With the advent of so much data, information exchange, and contextual user targeting in public space, issues have arisen that were initially given less thought in the early stages of smart environments. The main issue is privacy and its associated issues: the ability of a space to remember, the awareness of a space, how to actively control one's privacy in a public space. Ubiquitous computing has given way to pervasive computing, which is quickly leading to invasive computing. This issue wasn't so much ignored in the early stages of smart environments. Rather, it simply wasn't considered to begin with. In a smart environment, one can enter a room and have the room instantly configured to their standard preferences (temperature, brightness, etc.). What was always missing in these earlier scenarios were scenarios where a person was simply passing through the room or didn't want anything in the room to change upon entering. Michael Coen's richly interactive environments [Section 5.5] failed to consider how they could function at a reduced level; would we always want every single work meeting to be monitored, with a system that analyzed every move we made? The potential for technological breakthrough overshadowed the human aspects of these environments. Again, it's a reflection for media artists; always striving to incorporate the latest technology in a piece can often limit the

value users will get out of a piece, by failing to consider whether the technology should really outweigh the interaction possibilities.

Privacy in interactive art projects is a whole other topic altogether, as most projects rely on some form of recorded input or data collection for interaction, and are increasingly using real-time crowd sourced data. Professor Dana Cuff sees this combination of HCI considerations and privacy concerns as a looming issue for modern society.

7.1 DANA CUFF ON THE IMMANENT DOMAIN

> "These new levels of information, security, conservation, and access are balanced by heightened possibilities of intrusion, tracking, classification, and exclusion." [Cuff, 2003]

Cuff's reasoning is a perfect example of what would sound like a fleeting idea years ago, but is now a reality: the digital and urban environments we inhabit are so well integrated that it's becoming increasingly more difficult to actually distinguish them. Her 'immanent domain' is the merging together of these two spaces, resulting in not a new landscape, but rather a shifted one. And with this, a set of issues rise. Cuff lists four issues, each of which is worthy of further dissection.

7.1.1 *The physical environment is given life.*

We can now think of public spaces as living, not in the sense that they are 'lively' but that they are places that actually live. They are data hubs, places of great and rapid information exchange both digitally and physically. This digital layer placed on the physical space enacts a quality of receptiveness and awareness. The space has the ability to control and direct the inhabitants through digital means, a true shift in how we consider the role of public space.

7.1.2 *The idea of what is visible has transformed.*

As discussed in the previous chapter, digital ground can reveal the previously invisible infrastructure of the city. Paradoxically, the technology enabling this is itself invisible to us. So while we can learn and understand more about the city through real-time usage, it arrives to our devices invisibly, with little to no concern of how it actually did. We see more the physical structure of the city through the digital lens.

7.1.3 *The line between public and private is blurring more and more.*

This is a trend we have anticipated since the *Reactive Room* [Section 5.4]. In a private environment technological surveillance seemed fine, but with smart urban spaces, we can question which spaces are still private, and where the border between public and private space really is.

7.1.4 *Public life is changing due to increased surveillance.*

Surveillance is perhaps the biggest issue due to it's far-reaching fear potential. It's an issue that receives the most attention, with an overwhelming negative stigma associated with it. Cuff notes the habit of information technology to be subverted and used in opposite methods of its original intent. This is something which is more fearful for the general public (not knowing who actually has footage of them) and has great potential for designers and artists (access to seemingly unlimited data records of how people use space)

Cuff also uses the term 'cyburg' to detail an environment of spatially embodied computing. It's the opposite of cyberspace, a nice term that encapsulates the ideas Malcolm McCullough explained in *Digital Ground* [Section 6.1]. The cyburg contains technology which is at once everywhere and nowhere. This pervasive technology is intelligent, which leads to another problem. Cuff reminds us that the greater the technology, the greater the

failure, which helps fuel the surveillance debate. Further, these intelligent systems operate spatially and rely on spatial computing; yet they are invisible. How can we determine an urban space is intelligent simply by looking at it? If the system is invisible, and is generally accessed through a device, we can no longer physically tell a smart space from a regular non-digital space. It's a strange thought to process, as the technology becomes increasingly invisible as it becomes more powerful. Will we reach a time when it's simply assumed that all urban spaces are smart? Will we accept the continual feeling of being watched, tracked, and guided through spaces by a network of invisible computers? Can we reclaim some form of privacy in a public space? Cuff seems to say no. Interestingly enough, it's noted that the cell phone (and all smart gadgets, really) have allowed for a new type of space formation. With communication devices, people can now be intimate amongst strangers. Private spaces can be created in public space, a network of very closed small intimate spaces existing in the sphere of pervasive public space. And in these new hybrid environments, "The architects goal must be to embed civility in a pervasively computerized public realm." [Cuff, 2003] We can only dream of what Henri Lefebvre would have to say about these new hybrid spaces.

7.2 THE SUBVERSION OF SPATIAL COMPUTING

Cuff wrote of the tendency of technology to be subverted. Rapidly changing technology is increasingly more complex to control and regulate, proven by the endless battle against digital piracy and copyright ownership problems with digital content. In other cases, the technology can simply be borrowed temporarily, such as art projects powered by external data sources. A clever usage of this possibility is demonstrated in the works of MediaShed, a public "free-media" space in England. MediaShed helps spread awareness of how to capture CCTV footage, often available by finding the IP address of the CCTV camera and subsequently accessing the non-password protected database of recorded video. It's called *video sniffin'* [MediaShed, 2006], and MediaShed promotes a

sort of free broadcasting system, relying on the existing infrastructure to do the work for them. Using signal sniffers that detect naerby cameras, a sort of urban cinematography can be pre-planned. MediaShed has helped produce music videos and parkour (free running) videos, all with a combination of 'found' footage and original sound. It's unclear what to call MediaShed's approach. Is it a democratization of spatial computing? Is it fair use? Or is it tampering with State infrastructure? And what can we draw from these projects as guides to further public art projects? Clearly, media artists have great opportunities to invisibly 'borrow' existing infrastructure, an idea that would be unheard of before the age of smart environments. As with the Graffiti Research Lab's *Interactive Architecture* [Section 6.2] project, the infrastructure of the city is easy to re-appropriate and use for our personal means. As more and more public data is made visible online, artists can increasingly access this data and use it to power art projects. It's a reciprocal process, as the art projects help to spread awareness of the visualized data by making viewers aware of its existence.

Figure 13. Re-mediating CCTV footage: MediaShed's video sniffin' (left) and Manu Luksch's Faceless (right)

Other artists take different approaches towards using CCTV footage. Manu Luksch's *Faceless* [Luksch, 2007] video uses CCTV footage freely accessible under the UK Data Protection Act. Under this law, people are freely entitled to the CCTV footage in which they appear in, given that they can provide the time and place where they were recorded. With this, Luksch creates a narrative from the footage, which is distributed with all recorded faces except her own covered. *Faceless* uses this convention as an opportunity to build the narrative,

telling a story of a faceless society, and a woman who reclaims her human face, leading to a re-discovery of the power of the face. James Coupe, meanwhile, uses CCTV as his personal automated director in his *(re)collector* [Coupe, 2007] project. Installing a series of CCTV cameras around Cambridge, Coupe sought to automatically re-create Michelangelo Antonioni's film Blow-Up scene for scene. Custom software analyzed the original scenes of the film and automatically shot similar 'cinematic behaviour' sequences throughout the city. Coupe notes that, "As new footage is captured by the cameras, it replaces and juxtaposes the existing narrative sequences. The story mutates, becoming retold each day, altering the context of people's actions." [Coupe, 2007] While CCTV is by nature intrusive and unethical, what are the ethics of using the footage to power art projects? Is it a reclamation of power in public space? And what are the implications for using real-time data for art projects when that data can easily be manipulated to produce false data? The projects tend to avoid the ethical question of recycling captured footage in favour of democratizing the access to the footage. It's an approach that is successful, but avoids the bigger topic of using CCTV footage in the first place.

7.3 SENTIENT CITIES AND THEIR AFFORDANCES

> "It is a world where we not only think of cities but cities think of us, where the environment reflexively monitors our behaviour." [Crang and Graham, 2007]

Through urban informatics, environments are radically transforming. While architects and designers can play a large role in the shaping and evolution of these spaces, it is also valuable to consider other fields that have both an interest and a role to play in the usage of augmented environments. Industries in particular can be relied on to be involved in augmented spaces; with these new spaces comes new forms of capitalism. As artists, these fields can be studied in order to predict the near-future changes and new technologies available for use.

In an augmented environment, it is especially useful for artists as much of the research and development focuses on improving infrastructure and equipment. These additions can then be leveraged by media artists for their own works. Mike Crang and Stephen Graham see these new 'sentient cities' as a playground for research and development, offering three main areas of innovation. Innovations are looked at through the filter of surveillance and feasibility, providing very well explored and outlined near-future scenarios for artists.

7.3.1 *The retail market and customized consumer worlds*

The implications for retail and consumer goods in augmented space are obvious. Since its inception, augmented space has revolved around targeting, tracking, and learning about users in spaces. The domain of retail is thus a natural candidate for being involved in such a space. The concepts around targeted consumerism have been previously covered by Malcolm McCullough and Jane Galloway, with writings about customized advertising and automatic product suggestion. In a few short years, however, technological advents have led to Crang and Graham seeing a change in how consumers can be targeted through their devices. The main difference is a change from simply showing data to processing data though accessing device history data. This results in new possibilities such as geo-specific ads (for items only relevant to the current location) and determining what individual consumers will purchase next. In this way, retail is "projecting the interactive model of cyberspace back into physical space. The metaphor of cyberspace has, in other words, come full circle" [Andrejevic, 2003]. However, Crang and Graham raise an interesting question: if this has been a topic so long and frequently discussed, why hasn't it happened yet? Issues of privacy seem to trump the idea of augmented retail, but more importantly, a shift to device-based targeting likely leaves a majority of consumers out of the loop. The effect can directly translate to lost sales and eroded consumer confidence, seemingly the major barrier thus far. There are implications for media artists as well, as clearly we are not yet able to transition

into a society that interacts with these proposed environments. There is still too much relying on the early adopters of technology and not enough design for less technically oriented people. On the other hand, we are able to see some areas where smart spaces will become smarter, relying on the user's devices to process for us and allow for less infrastructure on the artist's side.

7.3.2 *The military – improving surveillance methods*

Crang and Graham highlight some military projects for tracking people in cities. The overarching theme is that of perspective changing. No longer relying on overhead satellite tracking and conventional surveillance, the US military is actively developing sensors that monitor from the ground level, tracking and scanning network devices in the city. With the public infrastructure already in place, it's a more common-sense approach, given that it's much less time consuming to filter data than it is to filter surveillance footage. Here there is a nice trend that finally points towards a leap forward in media art, curiously. As the military has realized, it's no longer most important to track the user. Rather, tracking the data provides a richer set of information. All the shifts that have led to augmented space are breaking away from camera tracking of people, and instead point towards using geo-located devices and sensors that automatically pinpoint one's location. Seeing the actual person is no longer a primary concern when you can simply track their device in the city. Interestingly, Crang and Graham point out a statement from Malcolm McCullough, that these richer data sources actually make it harder to pinpoint and track people. While there is richer data, there is much more non-essential or irrelevant data acting as static in the filtering process. This too has repercussions for designers and artists working in smart environments, as the richer data sets won't always provide more useful information.

7.3.3 *Re-enchanting environments through artistic interventions*

Crang and Graham state that, "Amid these commercial and military dreams there are increasingly widespread calls – and this is our third area -- to try to realize and reclaim the potentials of augmented spaces through art and activism." [Crang and Graham, 2007] They note trends in augmented space media art, projects that can seek to make the environment more transparent, democratically and digitally re-design the space, and allow new engagements with the space through shifting pre-conceived dynamics. They note the power of community and transferring authorship to the individual, key methods that allow greater engagement with urban spaces. While this sub-section almost reads as a design guide for augmented space art projects, it's important to note the trends of these art projects. They tend to use the existing technology and create new endeavors, which in turn pushes the research and commercial aspects of the art projects, enabling further new technologies which can then be leveraged once again by the artists. A fascinating relationship which is seemingly ever-evolving and co-dependent, Crang and Graham are able to stress the importance of continued artistic interventions in public space.

Crang and Graham discuss an interesting new concept, one that seems to encapsulate the advances in smart environments. They note a tendency for emerging public space technologies to no longer process data in real-time. Rather, these new devices and sensors rely on anticipatory processing, done in advance of people entering a space. Is real-time no longer fast enough? Or is this the next leap forward in artificial intelligence? With the ability to track and access devices, environments can predict when people will enter the space and pre-configure the space for their particular habits. If we look at Crang and Graham's three innovation areas of retail, military, and art, it's clear all three can benefit from these advances. However, each technological breakthrough results in a slightly more invasive environment, and we again see technology taking precedent over user concerns. Would we adjust to these tailored urban spaces that seem to know all of our daily life habits? Or can there be a common

ground between technological advancement and user-centered design? There are certainly some interesting theories being discussed, particularly the ethics of forgetting ideas of Martin Dodge and Rob Kitchin.

7.4 THE NEED FOR AN ETHICS OF FORGETTING

> "Forgetting is not a weakness or a fallibility, but is an emancipatory process that will free life-logging from burdensome and pernicious disciplinary effects" [Dodge and Kitchin, 2005]

How can we curb the inherent problems of surveillance and privacy invasion in public space? Martin Dodge and Rob Kitchin believe that if devices can 'think' like humans, then they should also forget naturally over time as we do. The level of surveillance we undergo today goes well beyond CCTV in public spaces. Dodge and Kitchin unpleasantly remind us that our travel is constantly monitored, whether through radar cameras on roads to the extensive tracking of the airport system. In our work lives, phones and computers are continually monitored for 'performance'. When we buy products, loyalty cards for stores and credit/bank cards create permanent records of every transaction. However, this is still seen as traditional external/public surveillance methods. What is more interesting is what here is termed 'sousveillance,' the internal counterpart to external surveillance. Rather than capturing everyone, sousveillance focuses on one person at a time. Dodge and Kitchin see the formulation of Life-logs [Dodge and Kitchin, 2005], a new style of life recording (the next step after writing and the printing press) that will digitally capture all aspects of daily life.

In modern life and especially in the real-time city, an automatic sousveillance is self-produced throughout our lives. Our own devices, coupled with pervasive computing devices we encounter daily (appliances, gym equipment) augment this data, recording the many thoughtless actions and decisions we make daily. Furthermore, self-conscious creation forms our social data Life-log, while photos and videos of us enhance this highly detailed data

trail. The biggest problem facing total sousveillance thus far is the distribution of data. Our smart devices are not yet all capable of talking to each other, and much of the data from our non-communicate devices are still unattainable. However, there is a branch of pervasive computing that aims to become interlinked and invisible in this data collection process, and once every second of your digital and physical lives are being captured you will no longer notice. Much as we no longer actively notice the influence of our devices in our lives, soon we may not actively notice that we are continually adding to our Life-log. The hope is that all social memories can be archived, with no filtering or Off button. It's quite a frightening thought. Furthermore, through GPS and cell-phone access, these social memories can be tagged to locations, providing all the data necessary to maintain a continually accessible, contextual memory. Life-logs will be a hybrid of written, spatial, and tangible media. The implications for these life-logs are potentially terrifying, to be blunt, and there are many ethical and technological obstacles to overcome. Life-logs seem by their nature counter-intuitive to the ideas of phenomenology [previously discussed in Section 4.1]. Phenomenology is a philosophy of being, of experience. It equates consciousness with daily experience. Life-logs ruin this feeling, as the purpose of a Life-log is to be able to contextually review events in your life. How differently will people act in both public and private spaces, if they are aware that everything is being digitally stored, precise enough that the exact details of any event can be recalled?

Dodge and Kitchin offer a logical solution to this terrifying idea. They see the opportunity of technology to naturally forget events, and position this not as a technology failure, but rather an opportunity. What is crucial is that the forgetting must occur the same way a human brain forgets. Single journeys/adventures/days should fade small pieces over time, as parts with less technological involvement can be forgotten first. They even go as far as to suggest using facial recognition and remove the memories where the user is not actively in the video footage. The digital recording should become more of a memory. Small informational details can be delated, timestamps can be

removed, and certain photos can be removed. Dodge and Kitchin argue that this method allows for human fallibility to remain in daily life, a key part of natural experience in both public and private spaces.

Forgetful technology holds special implications for artists. Mainly, it changes the way in which people could regard a public space. Currently, a public space that tracks inhabitants through CCTV and sensors is likely monitoring for crime and tracking traffic flows. However, add the element of forgetting to an augmented environment and suddenly the environment becomes not a recorder, but rather a viewer. The spaces no longer survey everything; rather, they experience the actions of the inhabitants. How would public perception of interactive art projects change if it was assumed their actions wouldn't be permanently recorded? If real-time data was accessed and then deleted immediately after, how would people change their attitudes towards having their data in public? The ethics of forgetting promises to be a topical issue for years to come; the technology is very much in progress, art works haven't begun to explore the possibilities of digitally forgetting, and public perception of surveillance needs a big shift if Life-logs are to become commonplace.

8. THEORETICAL INFLUENCES AND METHODOLOGY

The first part of this thesis has built a framework for understanding the history and evolution of public space, social interaction, and smart environments. This collection of knowledge can be seen as a guideline for understanding the development of how people use public space, and how to tailor art projects for use in these spaces. With a particular focus on the advances in HCI in the field of spatial computing, we can track how people expect smart environments to function, and how these spaces are being used today. We can therefore also attempt to predict future evolutions of public space usage and interactive art integrating real-time data in the city. For this thesis, I have created four projects to serve as experiments in interactive art for public space fueled by real-time data. Both the theoretical and practical aspects of the projects have been largely informed by the theory covered in this thesis. As all projects created for this thesis are interactive art works, a strong user-centered focus was maintained during the theoretical, design, testing, and implementation phases of the projects. Particular interaction design standards such as Fitts' Law and Hick's Law played a large role in the eventual interaction methods and interfaces for projects. Fitts' Law is a model for movement, showing that the time required to move to a target area is a function of both the size of the target and the distance to it. Hick's Law is a model for choosing, proving that a person will take longer to make a decision based on the number of available possible choices.

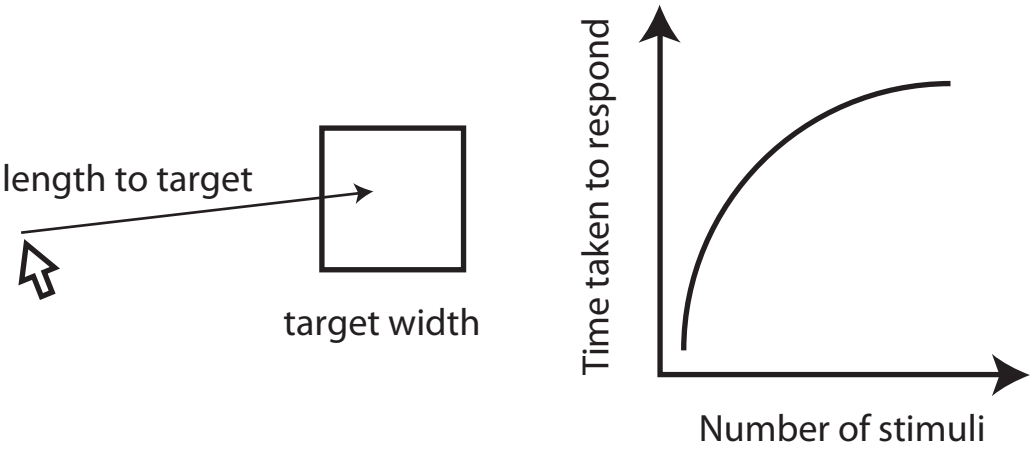

Figure 14.
The interaction design principles of Fitts' Law (left) and Hick's Law (right)

For interfaces, the strategy was to always provide large, easy to reach targets, clustered together if multiple targets were required. For interaction, a minimal amount of methods were provided, enabling intuitive access to the art projects through simplified interaction. However, for most projects, the interaction wasn't the key factor. What was most important was how the projects fit the context of their installations.

Urban and architectural projects require a careful consideration of not just how people will use them, but how the pieces integrate into the overall space. For this, the ideas of Robert Venturi and Christopher Alexander were paramount. With Venturi's *Learning From Las Vegas* urban viewpoint [Section 3.7], it becomes possible to deconstruct a public landscape, identifying the main components and functional structures. More importantly, Venturi gives a basis for actively studying public spaces and quickly realizing the components of the space: how inhabitants move through them, how different symbolism affects behaviour in the space, and how to spot the differing factors in the overall behaviour of the space. Christopher Alexander's *A Pattern Language* [Section 3.8], meanwhile, provides a reference for understanding the elements of public space. Pragmatically ordered by size (i.e., building elements, street elements, city elements), the book gives both the knowledge of how to judge the success of a public space, as well as contextual photo and drawn references to explain each element. These two books were essential for the urban aspects of the completed interactive art projects. *Newsleak* [Chapter 11], a project developed for this thesis, was especially influenced by Venturi and Alexander, as the search for established urban transition points in cities were heavily researched with Pattern Language and spatial deconstruction principles. Malcolm McCullough's *Digital Ground* [Section 6.1], meanwhile, was the inspirational starting point for *Fluid Data* [Chapter 10], as it became the first attempt at combining real-time computing into architecture. Specifically important was the concept of extending the screen into physical space, and seeking to abandon the screen altogether in favour of using the built environment as urban displays.

The completed art projects for this project are attempts at understanding the state of interactive art in public spaces. Paul Dourish and his phenomenological approach to HCI remained a constant in the user-centered design aspects of each project. Dourish's theory [Section 4.4] is particularly suited to public art projects, as users have a greater chance of unexpectedly (or unknowingly) encountering a project in their daily routine. Chris O'Shea's *Hand From Above* [Section 6.3] is a prime example of this, a focus on accidental user discovery. Heidegger's Being-in-the-World [Section 4.2] is also an important consideration, as it allows for design that considers the average everydayness of being in an urban space. If we remember that people in urban spaces aren't actively seeking art works or urban informatics, we can design less invasive, more passive experiences. Marcus Foth's real-time city theory [Section 6.6] was an influence by explaining the required properties for urban informatics possibilities in cities. By realizing where design interventions are both appropriate and useful, the projects for this thesis presented useful outcomes, providing real-time data that helped to blend digital and physical environments. Lastly, the ethical considerations of Martin Dodge and Rob Kitchin [Section 7.4] helped with the actual selection of what data to use for the thesis projects. Especially valuable was their idea that "Memory should always be complemented by forgetting." [Dodge and Kitchin, 2005] This directly informed the somewhat mercurial aspects of the thesis projects, as the real-time data used to power the projects was always fleeting; it was simply passed from online into the physical space, disappearing both physically and digitally after. Dodge and Kitchin's ideas also led to conversations with many users of the projects, collecting valuable feedback about how the content was received and the feeling of accessing 'private' data in public spaces without the original authors awareness.

8.1 DESIGN METHODOLOGY: SUBTLETY IN INTERACTIVE ART

These projects span a variety of interaction methods, data sources, and exhibition methods but there is a common methodology behind all. This methodology can be termed as "design subtlety" — that is, a methodology that seeks to apply subtlety to the user interface, the interaction, and the technology of each projects. A few guiding principles are shared by all projects:

8.1.1 *Data-Sourced, not Data-Driven*

This was a key factor in the early explorations of real-time data visualization. Data-Driven has a tendency to sound heavy, and this approach relies on collecting large data sets for analysis and summarizing. I chose to migrate towards Data-Sourced projects, focusing on single pieces of data at a time, rather than show a staggering collage of data that is difficult to navigate and understand. While it may be interesting to show how many thousands of Tweets are appearing on Twitter every second, I find it more valuable to pull small sets of Tweets and actually be able to read them. Malcolm McCullough states that "as information becomes more and more abundant, clear views trough it becomes less and less possible" [McCullough, 2004] Each project thus takes this statement into account as a design guide, isolating small bits of data to present to the user, resulting in a more simplistic and understandable approach.

8.1.2 *Content Dissipation*

My main stimulus to work with real-time data is the chance to make visible the physically invisible conversations, news, and information that continually flow online. Bringing this into the real world enables people to connect with the online sphere from public space. Each project provides a broadcast of digital information into the physical world, bridging the gap between the two through the interface of art. The design viewpoint is that each project should allow

digital content to flow into public spaces; using this metaphor of data flow, allowing the content to be revealed to users of each project is key.

8.1.3 *Simplistic Interface*

To share this real-time content with any and all viewers of each project, an elegant interface is required. Elegance is a difficult accomplishment in interactive interfaces; it requires a blend of functionality, beauty, and intuitiveness. The interactive projects I have created rely on subtle design elements; a single button to push or an interface controlled with the wave of an arm, for example. This simplicity allows for both accidental and extended use: accidental in the discovery of how the interface works, and then extended by providing an interaction method that is quick, responsive, and easily understood.

8.1.4 *Minimal Infrastructure*

As our personal devices become increasingly smaller and wireless, art projects too must become less technically visible. The design principle of subtlety involves appropriate use of technology and making sure as little as possible is actually visible to participants. Again, as one principle was content dissipation, the content itself must be the visible highlight; the technology should simply serve as the means of delivery for it. Some projects in particular were designed to recede into the background, acting as a passive art installation in an urban environment. This allows for a greater sense of user interaction by 'discovering' the piece, enabling curiosity through interaction.

8.1.5 *Non-Invasive and Non-Intensive*

As issues of privacy and ethics surround the age of augmented space, art projects should be receptive to these issues as well. An approach of subtlety works well in this situation. The art projects, acting as passive interfaces in public spaces, are

non-invasive to people walking past them. Rather, they continue to function as autonomous art pieces. Interacting with a project is also minimal, which avoids drawing attention to the users who may not initially understand what they are seeing. This is a big concern; in a gallery space, people are happy to interact and experiment with projects because the context is clear. In public space, however, encountering something in which it's unclear the function, outcome, and purpose results in much less engaged interaction. Designing art projects which respect this human tendency will result in a better experience for both designer and user.

The approach of "design subtlety" has thus far worked well for public interactive art. Participants were sometimes talked to after interacting (or refusing to interact) with a project, in order to learn what was most and least successful about the implementation of the project. This approach continue to be employed in future projects, and the methodology can continue to evolve based on changes and emerging trends in both public space usage and interactive art.

9. GLIFIC

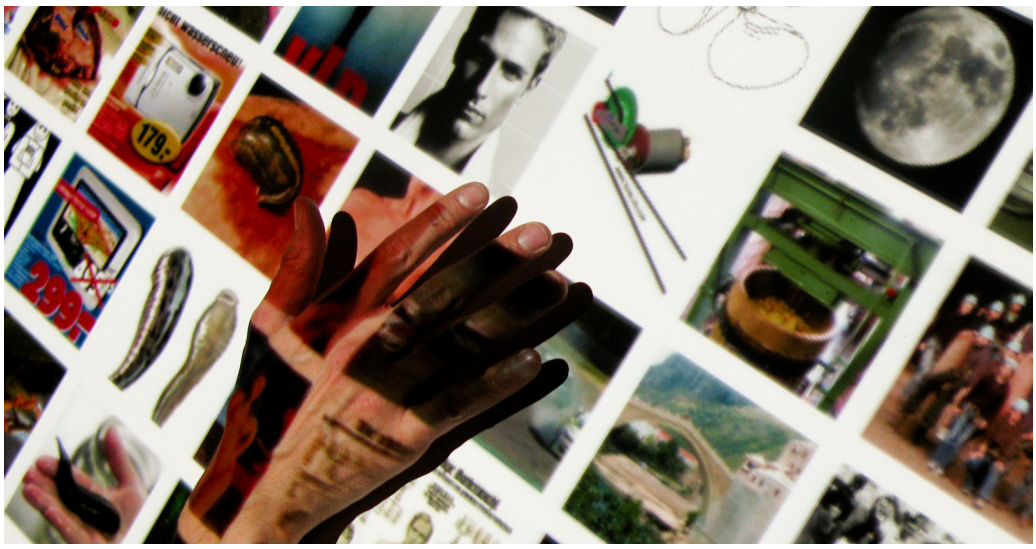

Figure 15.
Glific, original press photo

9.1 OVERVIEW

Glific was this thesis' first exploration into real-time social data. The concept of *Glific* is a reversal of contemporary trends in web-based media, whereby the concept of tagging media is transformed back onto itself. Rather than tagging images, video, and content with words like Flickr, Delicious, and other social bookmarking sites, we' a dozen words, we seek to tag one word with a dozen images. This reverse tagging provides insight to the global tag cloud, showing the wide variety of tags the public will put on photos. Using social data to fuel *Glific* was initially a small detail. Over time, however, this would become a deeper interest and ultimately drive the creation of this thesis.

9.2 CONCEPTUAL DEVELOPMENT

The concept of story telling has been completely re-written by the Internet. Publication no longer refers to the written word, as publication is now dynamic, instant, and certainly not static. Collaborative and remote working possibilities

enable stories to be written in real-time by multiple authors. *Glific* looked to explore the effects of both how story telling has changed online, and how we can use the vast amounts of digital data online to re-shape the traditional idea of text. *Glific* uses images as tags which replace words in stories. We rebuild the narratives, news and events by replacing the words in the texts. In an installation, users can explore different texts and the images that make them up. Narratives, news and current events are broken down into a picture form, each picture representing one word of the story. By using tagged photos from online, we are able to see how the subjective qualities of social data affects the art piece. Replacing a word such as 'enemy' proves to be difficult, as ten photos, all tagged with 'enemy' from ten different people, offer variations on what each person perceives an enemy to be.

9.3 TECHNICAL DEVELOPMENT

For collecting all the images needed for *Glific*, we first assembled a series of texts: well-known speeches, famous newspaper articles, and excerpts from classic books. Every word was then combined into a massive list, and we filtered out words that would fail to produce an appropriately tagged image (and, it, the, etc). With this filtered word list, we automatically searched Flickr for the ten most 'relevant' photos for each tag. We say 'relevant' because Flickr employs their own algorithms for determining photo relevancy. The photos were then retrieved to build the dynamic database that would power *Glific*.

The installation was a projection of the text onto a table, where the mixture of photos and text provided a mixed media narrative. By waving their hand over a photo, the photo would change, allowing users to see the different representations of a single word as decided upon by the online world. The interface contained just two 'buttons' activated by hovering one's hand over. One button moved to the next story; the other removed all pictures and displayed the normal text, leaving the viewers to see what the pictures were truly representing.

Glific was programmed in OpenFrameworks, and used an OpenCV tracking system for interaction. The interaction was simple and passive, while at the same time enabling multiple users to explore the collected photos simultaneously.

9.4 INSTALLATIONS

Glific was installed at the SantralIstanbul gallery for its Uncharted exhibition and in Linz for Ars Electronica 2009. What we found was that in many cases it was too hard to piece a story together; the tagging was too abstract or irrelevant for many photos. By using as many words as possible, it left too much guess work to figure out the text being presented. Users were much more satisfied with simply viewing the thousands of photos by waving their hands - the simplified interaction seemingly compensated for the fuzzy data. Glific was a success in terms of an interactive installation, and while it was possible to understand the fragmented stories, the collected data simply wasn't rich enough. As a first encounter with social data, it quickly became clear how much filtering and consideration must be given for large data sets. Relying on the digital communities to self-organize their photos wasn't very successful, an important finding for further endeavours in handling social data.

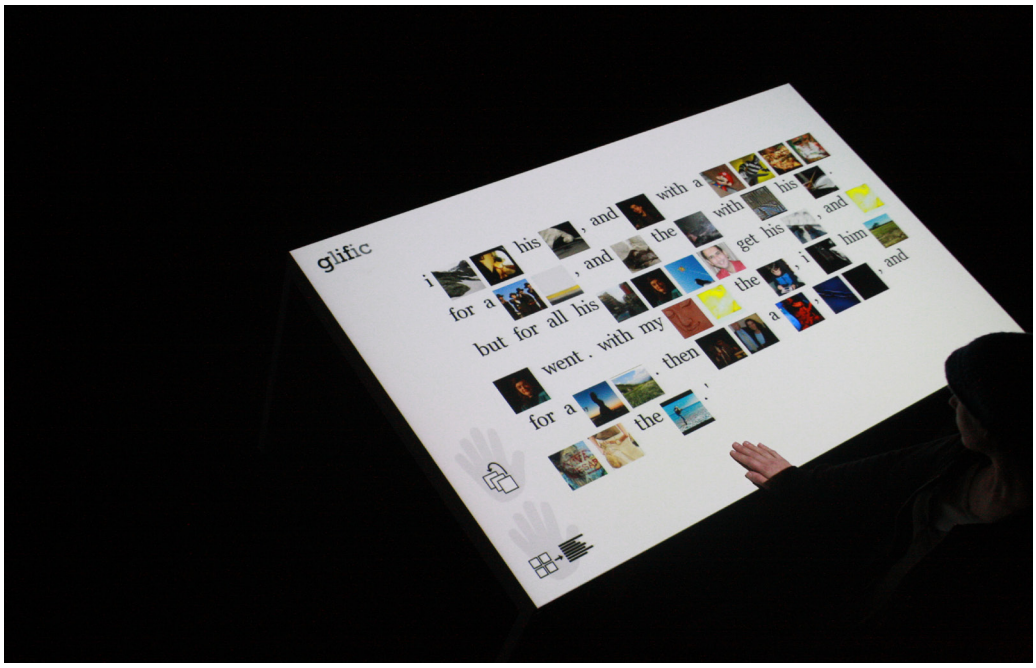

Figure 16. Glific installed at SantralIstanbul, March 2009

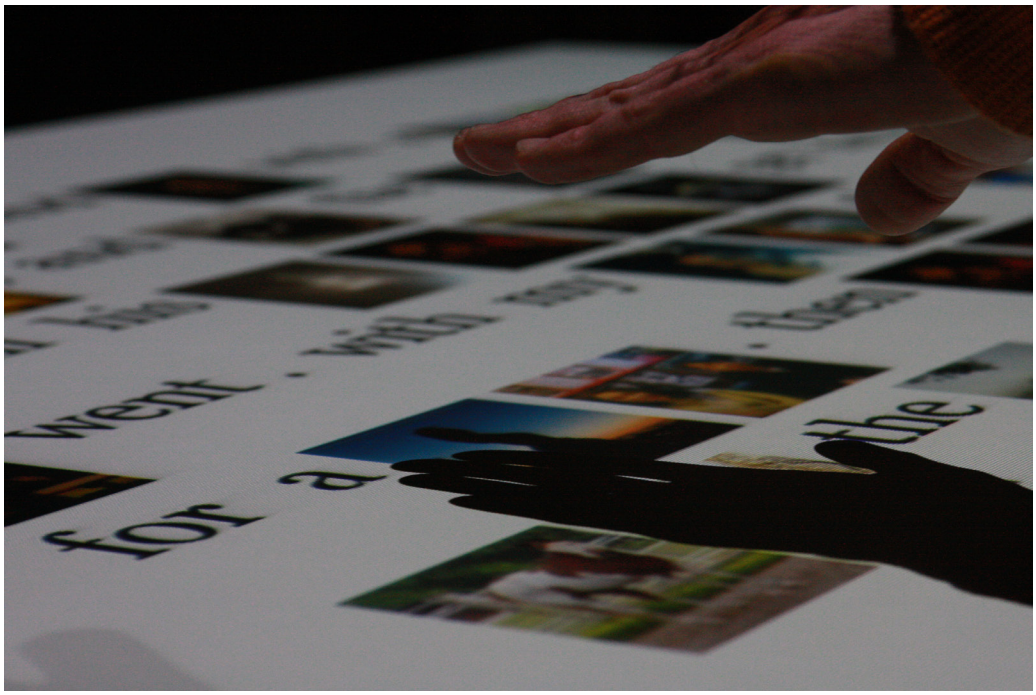

Figure 17. Gesturally interacting with the Glific interface

Figure 18.
Multiple user interaction at SantralIstanbul

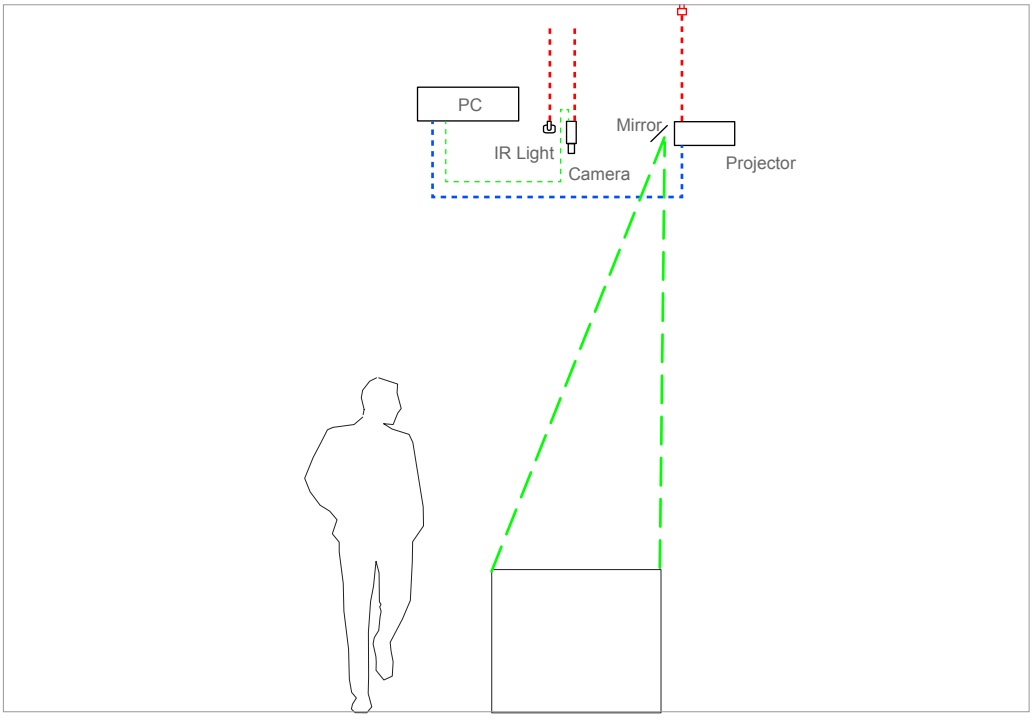

Figure 19.
Glific tech diagram for exhibition setup

10. FLUID DATA

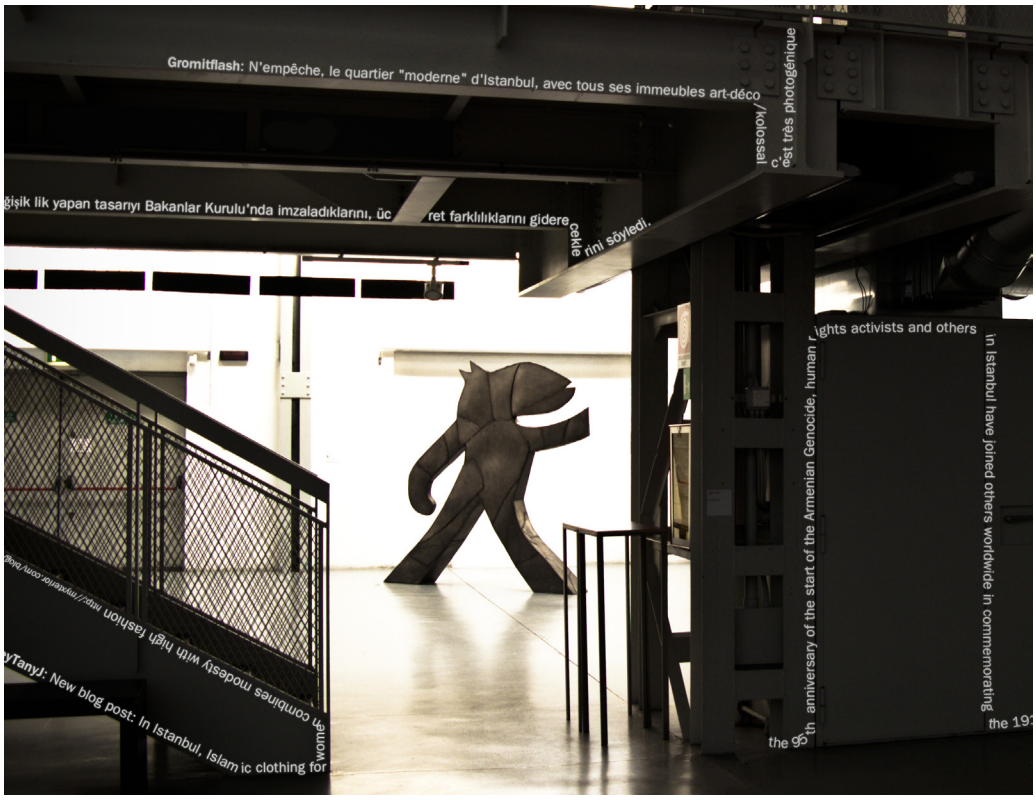

Figure 20.
Fluid Data press photo

10.1 OVERVIEW

Fluid Data is a dynamic urban interface that combines social data with architecture. This project intends to make visible the large sets of data that are never seen by the general public, by bringing locally sourced data into physical public spaces. When *Fluid Data* is installed and running, real-time Twitter posts (both about the city and by residents of the city where the project is) and news stories about the city will gently flow throughout the architecture of the installation space. This seemingly endless flow continually retrieves new data, showing viewers just how much data about their city is being created in real-time. Intending to highlight elements of architecture, the data will follow paths

both in and out of a room, appearing in the space via the internet, flowing along the architecture, then disappearing again, back into the social data sphere.

10.2 CONCEPTUAL DEVELOPMENT

Fluid Data is this thesis' initial experiment involving social data in architecture. The main methodology behind *Fluid Data* was an adaptation of Mark Weiser's idea of calm technology [Section 5.3], thought of in this context as subtle technology. The focus is on using the architecture as a pathway for the data to flow along, which lets the data passively display as an augmentation to the architecture. Through this method, the architecture of the installation space is turned into a non-intrusive urban screen. The resultant data that is displayed acts as a realization of Marshall McLuhan's "the content is the audience" [McLuhan, 1964] statement, previously discussed in Section 4.8. By using entirely user-generated content, the flowing text shows the talking points and discussions that are occuring online, and reflect (or possibly contrast) the mood of the physical city. Through only using data generated in the city *Fluid Data* is installed in, visitors can see their city's online social landscape. We can see how each city uses Twitter and how they disseminate information and content online.

This project was directly influenced by Malcolm McCullough's *Digital Ground* [Section 6.1] — the idea of combining real-time computing into architecture led to the visual style of the project. Aiming to turn any piece of architecture into an urban screen directly influenced the programming of the project and led to the development of a flexible system that allows *Fluid Data* to be easily adaptable to any architectural installation.

10.3 TECHNICAL DEVELOPMENT

Fluid Data was programmed entirely in VVVV (http://www.vvvv.org). The graphical nature of VVVV and it's unique ability to 'spread' data sets made it

particularly useful for this project. The concept of *Fluid Data* came before any opportunity to install it, thus leading to the creation of a system that allowed for use in any architectural environment. The data is obtained through Google News and Twitter via RSS feeds that are continually refreshed and imported. VVVV parses the feeds into individual data blocks, filtering out posts only containing URLs or small replies to other Twitter users. This initially led to a small conundrum. All the data collected is important for analyzing how different cities use Twitter. Tweets that only contain URLs or two word replies to another user on Twitter help to truly see the role of Twitter in the city. However, for an urban screen display, simply showing Twitter usernames and then a URL doesn't help the inhabitants see the online sphere; there's no context for understanding what is being shown. Thus, by filtering such posts, what was left were what could be considered 'average' Twitter posts: URLs posted with full descriptions of the linked content, user's random personal thoughts, and Twitter conversations between multiple users.

Once the data was filtered, VVVV put the text strings onto the pre-made paths and animated them to slowly scroll along a projected architectural path. The paths were made by photographing the public space and drawing the lines to be used. This drawing was then imported into VVVV, where each line was made into a path which text could be placed on to flow along. While this enabled some flexibility, the greater flexibility came from implementing the ability to control each path: the scale of the path and the angle. Individual points along the line could also be manipulated, allowing for pixel-perfect projections into the space. This system allowed Fluid Data to be completely re-configured for a new architectural environment in a matter of hours.

10.4 INSTALLATIONS

Fluid Data was installed twice, in two very different environments. The first, for the Amber 09 Festival in Istanbul, was situated in a neglected century old royal house. The project ran in a transition space between living space and a private

indoor basketball court. Taking advantage of this space (which all visitors had to pass through to see the main exhibition hall), data was projected along four elements of the room: along a door frame, around a mirror, in a sink, and down the sink pipe into the wall. The result was exactly as intended: some visitors completely missed the subtle flowing data, while others stopped to watch and read what was currently displayed. One participant actually used the sink to wash his hands, only stopping when text suddenly began to flow around the top of the sink. Several viewers were casually asked their opinions about the work, with the general consensus being that it was a novel approach to displaying and dealing with this massive stream of data. On multiple occasions, however, some questioned the critical aspect of the project, and felt that the data should have been filtered to prove a point, such as showing how people are using Twitter to communicate. One idea was to show only conversations, and have these real-time conversations flow through the gallery space.

Fluid Data was installed in the Kasa Galeri in Istanbul for a private exhibition. In this space, a door arch connecting two of the three gallery rooms was used. Again, viewers were asked for feedback, and most were positive, with one viewer explicitly stating that she enjoyed seeing a glimpse of online space while she was away from her computer. As an initial endeavor into artistically translating the ideas of *Digital Ground*, this project was invaluable for providing opportunities to create urban public displays powered by real-time data.

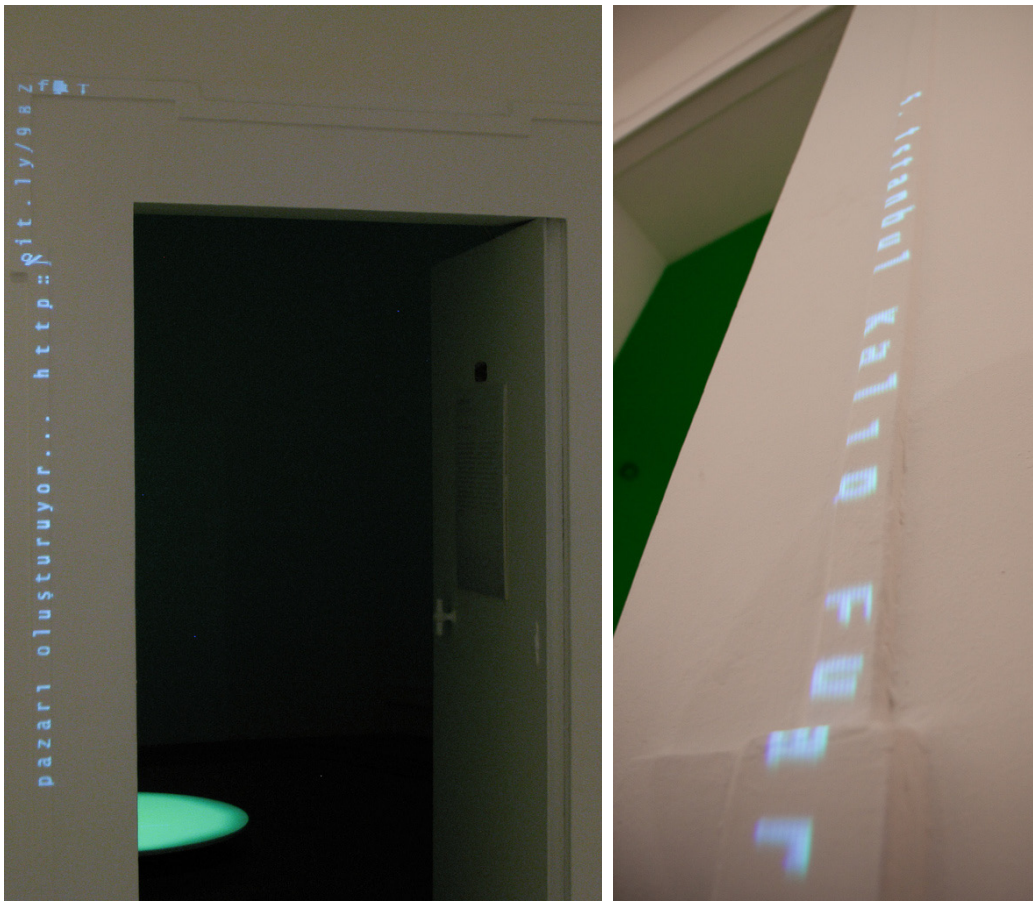

Figure 21.
Fluid Data in Kasa Galeri, Istanbul

Figure 22.
Fluid Data during the Amber 09 Festival

Figure 23.
Fluid Data in the built environment, Amber 09 Festival

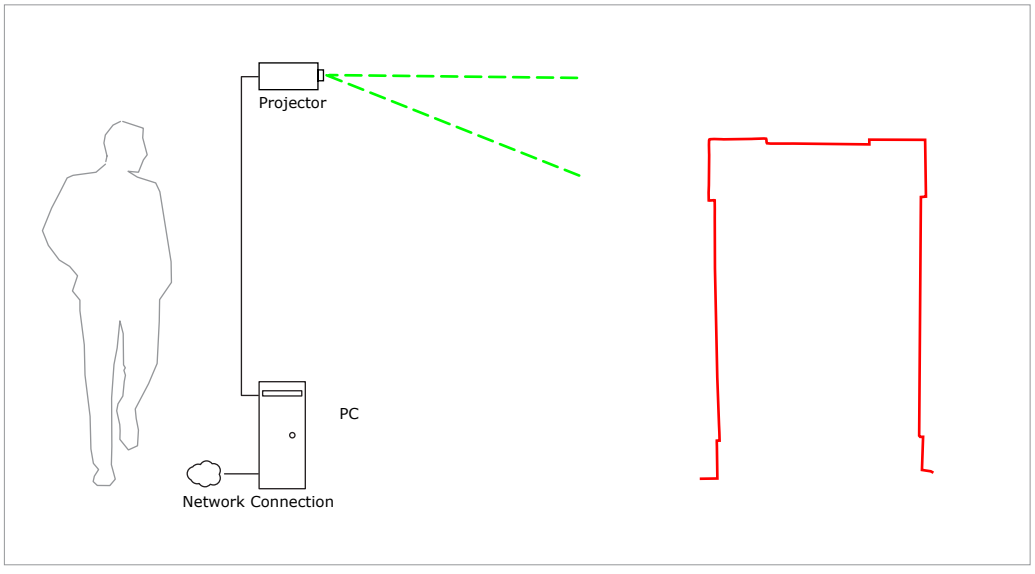

Figure 24.
Fluid Data tech diagram (left) and a vector architectural path that the data would flow along (right)

11. NEWSLEAK

Figure 25.
Newsleak press photo

11.1 OVERVIEW

Newsleak is the project for this thesis which combined urban informatics, social data, architecture, and public space. *Newsleak* is an experiment in urban interventions, a tangible method of integrating the digital and physical worlds in real-time. A Newsleak is a news publication — a motivated functional hybrid of real and digital cultures and media, a physical interface in the transitional spaces of daily urban life. Press a button on a pink box in the urban environment to instantly receive a printed summary of the latest news from around the world, news from your current location, news of internet cultures, events, trends and social media. *Newsleak*'s aim is to cultivate a functional exchange between the real space and the virtual space. As any other print media publication, *Newsleak* has a target audience, a distinct style and type of content, and specific intervals and methods of distribution. Most publications are fundamentally focused on the target audience and the target audience is defined by the content and distribution.

Newsleak in its installation form is a single button, reminiscent of a mouse click, on a housing mounted to existing street poles. The housing contains hardware connected to the internet and software constantly generating a new publication of the most recent information from around the world every

30 seconds. When the button is pressed the publication is instantly printed from a thermal receipt printer.

11.2 CONCEPTUAL DEVELOPMENT

Our main aims for *Newsleak* were the following;

- 1st Aim *Newsleak* is a functional publication for the target audience.
- 2nd Aim *Newsleak* effectively represents both cyberspace and real space and they are perceivable in the publication.
- 3rd Aim The publication is seen as a functional alternative to traditional print news and free tabloids.

Our target audience ranges from those who seldom use the internet and are unaware of the cultures or services on the internet, to those who are often connected to the internet and engage in social media of some kind. The target audience is a mirror of the content we provide and functions to overlap the borders of the real and virtual spaces. Think of how the content of a credible newspaper is structured — world, politics, business and sport. Not every section will be relevant to every reader, but every reader accepts that the sections are relevant to their broader environment and culture. As Markus Foth proved in his outline of urban informatics [Section 6.6], our everyday life is existing more and more in virtual spaces. As our physical and digital lives begin to collide and interweave, the more we should reflect and report about it: the more, 'we' should pertain to people and cultures from both spaces.

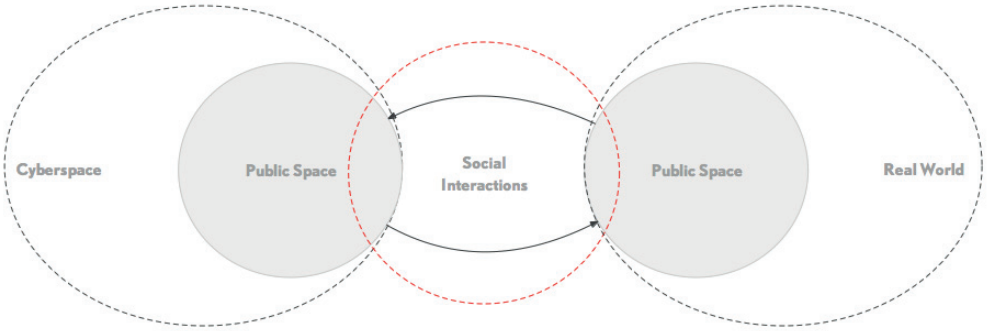

Figure 26. A visualization of our daily life interactions, and the overlap between digital and physical spaces (design Mahir M. Yavuz)

Our lives currently exist in the following physical and digital spheres: in the real world, public space in the real world, public space in cyberspace, and cyberspace. In the space between real public and cyber public, a variety of social interactions occur that shape and change our daily life. *Newsleak* is targeted to fit in this area.

A main conceptual concern was the categorization of *Newsleak*. *Newsleak* is not an art project. This was important for our own internal focus, to maintain a user-centered design strategy for creating *Newsleak*. It does not belong in a gallery or an exhibition. It exists solely in public space for use by people in transition spaces, urban junctions, and daily social passage spaces. In these spaces, *Newsleak* interacts with the user both directly and indirectly. This could also be seen as physically and digitally. The green button on the front of the *Newsleak* box is the physical interaction; with one press, the publication instantly prints out of the box. The interaction is simple and functions as one expects a typical button to. The second interaction, which is more indirect and largely unseen by users, is digital and occurs via a webcam in the side of the *Newsleak* box (side pic). The camera takes a photo every 30 seconds and there is a chance the person receiving the publication will see themselves walking towards the box. The camera is quite hidden in the side of the box, allowing discreet street shots to provide visual memories of the street for a very specific period of time.

11.3 TECHNICAL DEVELOPMENT

In a user-centered design process, determining the user is often the first step. However, we did not specify a target audience for *Newsleak*. Rather, we focused on the urban context for the project, specifying target locations and areas where Newsleak should be installed. In Budapest, we conducted ethnographic research on a variety of urban areas, looking for the spots that combine the right mix of transition opportunities (areas for transferring between public transit, large traffic intersections, public squares) and urban affordances. This method, known as design ethnography, involves urban study as well as "spending time

with people in their daily lives. It's not good enough to just keep producing technology with no notion of whether it's going to be useful to consumers." [Bell, 2001] We kept this in mind for *Newsleak*, paying attention to how people use the space. We searched for spaces with an ideal mix of areas to stop and rest, as well as paths to quickly pass through. Christopher Alexander [Section 3.8] calls these areas activity nodes, while outlining how to create transition spaces in the city:

> "To create these concentrations of people in a community, facilities must be grouped densely round very small public squares which can function as nodes - with all pedestrian movement in the community organized to pass through these nodes." [Alexander, 1977]

Thus, *Newsleak* comes with no instructions or flyer explaining its use; rather, the design must be clear enough that the narrative explains itself. We must pique peoples' interest enough that they will press the button; when a printout appears the concept explains itself, as we saw many times when *Newsleak* was installed in urban areas. This 'eureka' moment provides both the user with an understanding of the project and the function of the device, as well as feedback on us the creators of the success of the design. Technically, the *Newsleak* box is entirely self contained. A netbook with a WiFi connection runs a series of Python scripts that collect, collate, structure, save and output the data. Every 30 seconds, the data sources are refreshed and checked for existing duplication, ensuring we only take the newest digital content available. A camera mounted on the side of the Newsleak box takes a photo of the urban space as well. When the green button is pressed, the netbook sends the newest publication to be printed through a thermal printer. *Newsleak* is powered by two batteries cells, and is completely self-contained once installed in a public space.

11.4 INFORMATION STRUCTURE

The concept behind *Newsleak* replicated itself through its content: a transition from traditional static news sources into digital real-time news and information sources. A *Newsleak* begins in real space with the city: date, time and temperature of the place where it is accessed. We move through traditional news sources with Google News Global, and Google News localized to the city in both English and the language of the country *Newsleak* is in. We then show local concert listings and a photograph of the local physical space taken from the *Newsleak* box. We then move into local cyberspace with Twitter posts sent from the city *Newsleak* is installed in, and Twitter posts containing the city name. This is followed by statistics about continental internet news traffic. *Newsleak* then moves entirely into global cyberspace. A popular picture from Flickr, Google search trends, Unix epoch time and the global traffic and usage of the internet finishes the publication. (See Figure 28 for a detailed view)

11.5 INSTALLATIONS

As a public installation, we intended *Newsleak* to be left for use unmonitored. This shaped the technical development. Newsleak employs a simple but necessary control factor; a restricted print period. While unnoticed by the user, it is a crucial factor for us. Initially every press of the green button provided a print-out; people tended to press the button three or four times quite quickly, causing printer jams. Looking at tacit feedback tactics, we understand that, "The tacit knowledge that many physical situations afford plays an important role in expert behavior. We draw attention to the importance of tacit knowledge because computerization can, often accidentally, inhibit it." [Klemmer et al., 2006] Thus, We restricted the printout by having the machine 'sleep' for five-seconds after pressing the button. This enables the user to press the button many times but still only receive one printout. The instant printing of the *Newsleak* compensates for the limited print period; the user must wait for the print to

finish (three to six seconds), tear it off, and read it. In groups, people tend to gather around one print out, not immediately rushing to print their own copies; this allows us the affordance of restricting print functionality.

Newsleak was initially installed in Budapest, across four very different transitional space. The first space was a pedestrian space with many restaurants and cafés. Second, we chose a walking path between two main squares of central Budapest, a space in which large volumes of foot traffic moved through. For the third space, we moved to the main public transit connection point in Budapest, where a large, sprawling public square exists. Lastly, we installed *Newsleak* at a large tram station with multiple transit connections. All locations were studied beforehand, using the ideas of *A Pattern Language* [Section 3.8] and *Learning From Las Vegas* [Section 3.7] to decode the elements of the space and realize the differing urban functionality of each. After multiple rounds of testing, what we discovered that the culture of a city is as important of a concern as the narrative aspect of the project. In Budapest, citizens tended to be much more reserved about pressing a green button on a pink box on the street. After our first round of testing in which it was almost impossible to have someone press the button, we had to add large text that stated "News with the press of a button" on the front of the box. With this, more people were attracted to the box, but most were still reluctant to press the button. We asked several people what they thought of the box, with the most common answer being "it doesn't interest me" or "is this actually working?"

Newsleak was next installed in Istanbul. This presented a variety of challenges, mainly that the foot traffic is much heavier than Budapest. As a result, the pace of the city is much faster and chaotic, and people move through the city much faster. In Budapest, *Newsleak* drew plenty of attention from people stopping to look at it. In Istanbul, it largely went unnoticed. When it was noticed, it was for a variety of reasons: one man simply pressed the button while walking by, stopping a few metres later after looking back to see a publication being printed out. In another case, a man used it to lean his elbow on while having a casual conversation with a street vendor. In Istanbul, *Newsleak*

seemed to blend too much into the urban fabric; it was simply unnoticed by the majority. We can thus see how much the urban fabric of a city can influence the artistic intervention possibilities.

After testing *Newsleak* in a variety of urban spaces, we saw that most people simply don't expect a free distribution in public space, much less a fully functional machine that provides real-time news. Perhaps in a more tech-savvy urban environment (Silicon Valley / Bay Area, Tokyo or London for example) the reaction would be completely different, but for now we are providing a service that is not currently readily available or adapted as a social norm. This was interesting, as using urban spaces less suited to urban interactive displays was actually more useful for research purposes. How can we begin to adapt these spaces in the context of urban informatics? What are the implications for citizens who don't anticipate or even know of the changes that urban informatics will bring to public space? *Newsleak* was also exhibited in the Social Bits [Chapter 12] Kasa Galeri exhibition, and people could receive a *Newsleak* publication during the opening. We found people to be much more open to pressing the button in the gallery space than on the street. Why the difference? We feel it's because of the level of engagement. *Newsleak* in public space requires someone to willingly press a green button on a box they've never seen before. In a private gallery space, people were walking around with *Newsleak* publications and the documentation video was playing, removing any unfamiliarity towards the project. Simply pressing the button was not a problem for visitors due to the private nature of the event and the ability to stop and study the Newsleak box in a completely different context. Designing interactive pieces for the context of augmented public space remains an ongoing challenge.

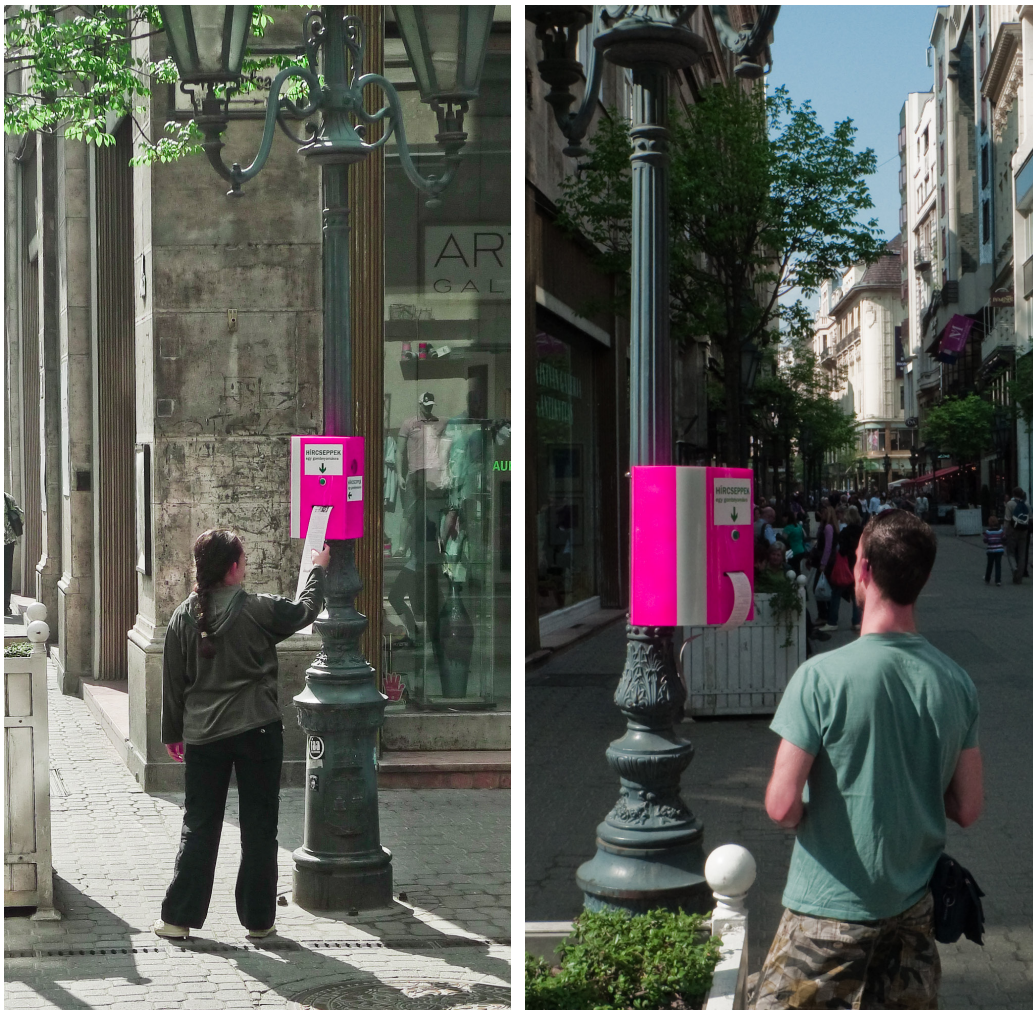

Figure 27. Newsleak publications being printed in Budapest, April 2010

Figure 27. Newsleak at a transit transfer point in Budapest

Figure 28. A sample Newsleak publication (in two pi, pulling content centralized to London, England

NewsLeak

A Hybrid Media Publication

London, England

2010-05-13 15:04:27
12ÄC

Dutch boy who survived Libyan air crash 'stable'

"A Dutch boy who is the sole survivor of a plane crash at Tripoli airport in Libya that killed 103 people is said to be in a stable condition after surgery."

Deadline looms for Thai Red Shirts

"The leader of Thai anti-government protesters has urged supporters to surround any armoured vehicles that converge outside their demonstration site in Bangkok, to prevent them from dispersing Red Shirt protesters."

Turkey's Pact With Russia Will Give It Nuclear Plant

"ISTANBUL - Turkey and Russia signed 17 agreements on Wednesday to enhance cooperation in energy and other fields, including pacts to build Turkey's first nuclear power plant and furthering plans for an oil pipeline from the Black Sea to..."

David Cameron coalition team in first cabinet meeting

"David Cameron's cabinet got "straight down to business" at their first meeting, as the prime minister finalises his coalition government."

500 euro note - why criminals love it so

"In some countries they're known as "Bin Ladens" - the banknote everybody knows exists but few, other than criminals, ever see."

Tax rises likely under coalition government, says Institute for Fiscal Studies

"The coalition agreement has left the door open for Äsignificant net tax increasesÅ, most probably in VAT, the Institute for Fiscal Studies has warned."

Upcoming concerts in London

2010-05-13 00:16:01 Revolver - Pure Groove
2010-05-13 05:11:01 Duke Special - Shaw Theatre
2010-05-13 06:14:01 Third Eye Blind - Shepherds Bush Empire
2010-05-13 08:42:01 Red Drapes - Proud Galleries
2010-05-13 10:30:01 Joan Armatrading - Fairfield Halls

Where you are

London on Twitter

Ketishia V. at 13 May 2010 12:03:18 wrote:
@vvanouska eek just saw this tweet! Whereabouts are you? I hoop in London from time to time, we should totally go for lunch or something!

wizard1953 at 13 May 2010 12:03:18 wrote:
Gordon Brown has no plans to quit politics: Agent|London, May 13 (PTI) Former British Prime Minister Gordon .. http://oohja.com/xd2tN

David Chadderton at 13 May 2010 12:03:18 wrote:
RT @exitthelemming: Are they mad? It's one of our few profitable industries. UK theatre got Ç54m in subsidy in 2008; it paid back Ç75m in VAT just in London.

London on Twitter

Veronica A. at 13 May 2010 12:02:56 wrote:
Oklahoma Tornado 2010 - Tornado Safety http://bit.ly/cPudJw

Siobhan O'Dwyer at 13 May 2010 12:02:56 wrote:
IÉve had it up to here *points here* with some people. http://tumblr.com/xyw9uaiwy

Disgracebook at 13 May 2010 12:02:56 wrote:
RT @CraigMurrayOrg: Western Collusion in Assassination: Robert Fisk's impeccable Arab sources strongly suspect, with good evidence, th... http://bit.ly/bLRufB

The amount of Europeans currently reading news online is...

+65% above average levels

Popular photo from Flickr

P7128556 by Eleni ▫ on Flickr

Google search trends

(1) you cut (Score: 570.00)
(2) maurice strong (Score: 391.00)
(3) how old is bon jovi (Score: 52.00)
(4) eminem not afraid video (Score: 50.00)
(5) alchemist (Score: 47.00)

The Internet

1273752267.38 Unix time
Global internet traffic is currently 18% above average levels

NewsLeak

A Hybrid Media Publication

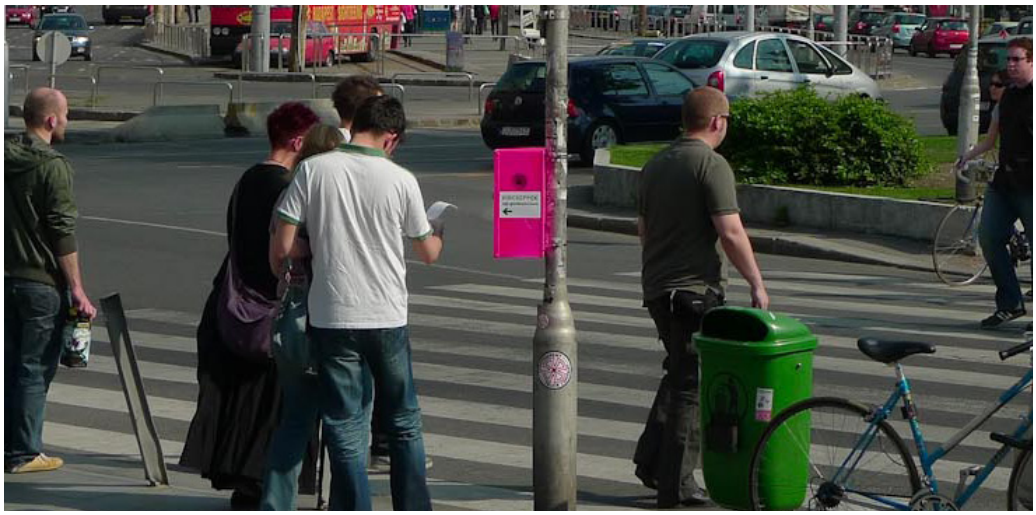

Figure 29. Newsleak installed on a pole at a busy pedestrian crossing in Budapest

Figure 30. A Newsleak being read in Istanbul, May 2010

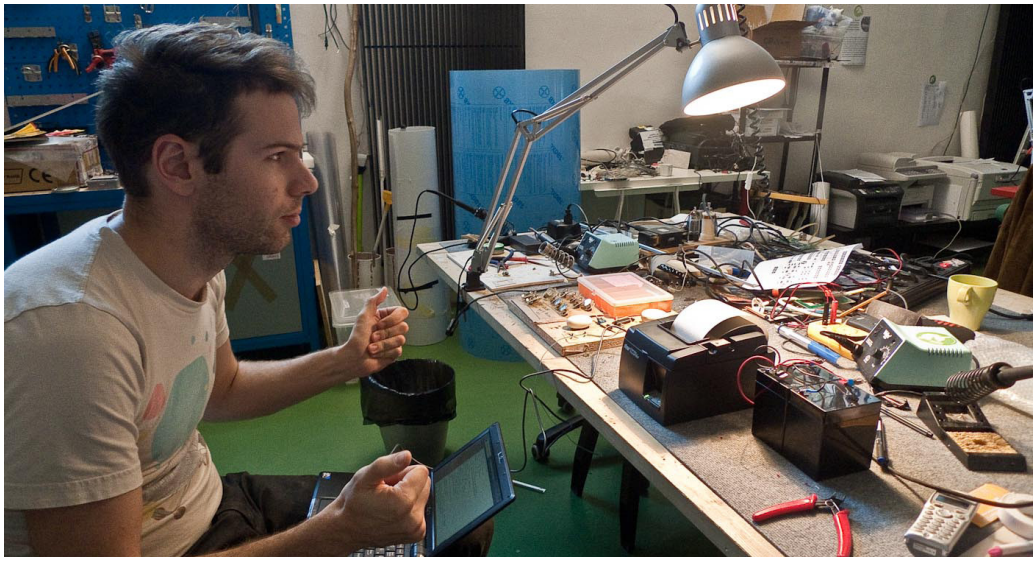

Figure 31. Newsleak disassembled: the Netbook, sending output to the battery-powered thermal printer

Figure 32. Newsleak installed on Istiklal, the main street of Istanbul

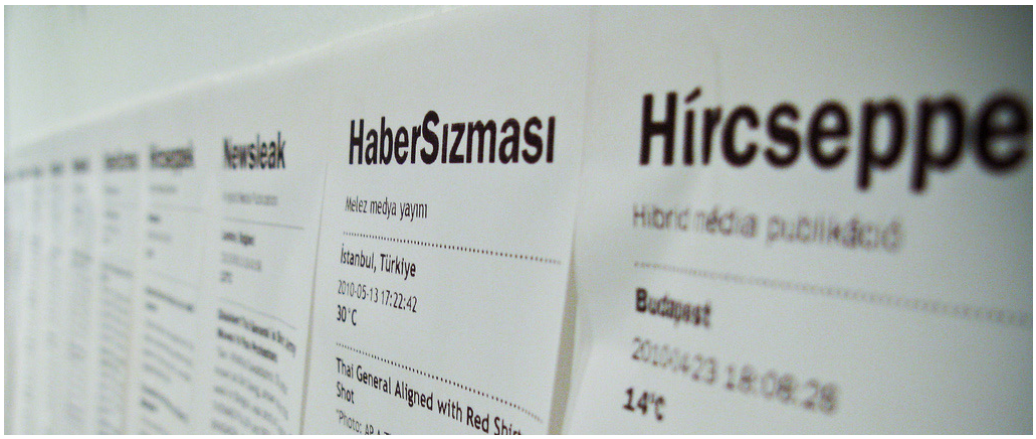

Figure 33. Newsleak in three languages (from left): English, Turkish, Hungarian

Figure 34. A collection of Newsleak publications in the Kasa Galeri, Istanbul in May 2010

12. SOCIAL BITS

12.1 OVERVIEW

Social Bits is a research group based in Linz, Austria focusing on the artistic output of social interactions in real world locations; specifically in urban environments, public spaces and unique architectural complexes. Social Bits are traces of small information generated through the daily lives of people. We generate 'bits' as pieces of our physical and digital presence through social media and sensor information. By using these bits as a metaphor, Social Bits enables us to imagine the new expressions and experience architecture activated by social energy. Social interaction is a sustained presence in all societies throughout history; however, the methods of interaction have radically evolved in recent years, aided and augmented by both technological developments and the sense of comfort generated by these developments. Our research studies and analyzes the collective information cloud created by humans worldwide, as well as introducing new mediums, materials and platforms to present the artistic results we discover. Social Bits is interested not solely in the social data itself. Rather, it is the means of producing the data, and how it can be reflected back on society that interests us. The process of turning a human thought into digital information, then in turn putting the information in a physical context is what is intriguing.

12.2 MANIFESTO

Day by day, life in cities is changing and being affected by the information coming from virtual platforms. The information we create in virtual worlds merges into real life and becomes a part of the daily life activities in cities. The source of our information, the technology to share information, and the potential media to display the information converge into a new field that can be referred as Urban Information Interfaces. In *Digital Ground* [Section 6.1],

Malcolm McCullough discusses the "paradigm shift from building virtual worlds toward embedding information technology into the ambient social complexities of the physical world." [McCullough, 2004] The modern cities we inhabit are like nerve networks. They are as much formed of interactions among the cells (inhabitants) as they are about their physical nature and architecture. Life in cities is built on these interactions and it is an endless progression. The methods of interactions change, renew or evolve, but the underlying sociality endures. We create many bits of information during these chaotic interactions, information which is largely invisible to us. These bits can be seen as similar to the shadows of the people in the city. They cannot exist without the citizens; however, they are different from the people themselves. They contain some pieces of meta-information that are interrelated to the citizens, interactions and the city itself.

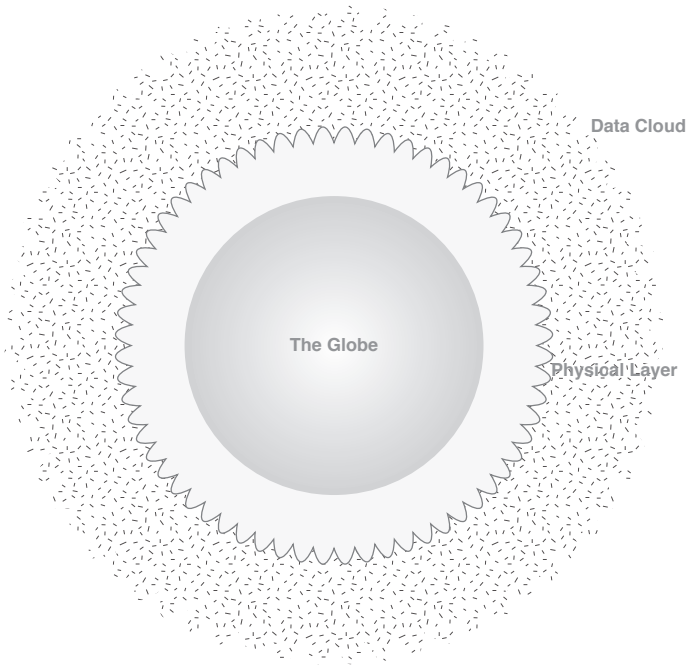

Figure 35. The invisible data cloud that augments the physical layer in modern cities (design Mahir M Yavuz)

These meta-information clusters are clouds that cover the entire spectrum of the city, and they continually move, scale and transform. Today, we create the source information for these clouds on online platforms. We share our thoughts

and experiences via social networks. This trackable information we create in virtual worlds merges into real life and becomes a part of our daily city life activities. Social Bits aims to track the invisible information in shadows and explore the data clouds in the city. It researches on possible avenues of output and display for the information in the cityscape via media art. In exhibitions, the inhabitants of the city and the visitors of the gallery become part of the cloud and contribute to the formation of the works.

Research Questions (thus far)

- Is it possible to talk about a feedback loop that may occur between virtual platforms and psychical urban life in the future?
- What would happen if we let virtual information shape our environment and architecture?
- How would this feedback affect the speed and qualities of communication and the dynamics of our society?
- Can we develop an architecture of experience for being able to construct the new augmented experiences in daily urban life?
- What are the implications for less technologically savvy cultures?

12.3 CONTRASTING PHYSICAL AND DIGITAL SPACES

Social Bits exists as a platform for experiments with social data. For our 2010 exhibition in Istanbul, Social Bits installed six projects in the Kasa Galeri in Istanbul. One of these projects, *Collective Data Maps*, is a series of Istanbul city maps printed and prepared for exhibition visitors. We provided two identical maps; one with a large heart symbol on the map, the other with a broken heart. A tray of miniature cloud pins were provided, in a variety of sizes, and no further instruction was given. A box of pins with various sized 'clouds' were attached to the end. Visitors to the exhibition left their trace via the pins; a surprising amount of broken heart pins appeared on areas related to traffic and

highways. For the heart map, parks and recreation areas received not only the most pins, but also the biggest ones, showing the most liked places in Istanbul.

After one month, the two maps were densely packed with data, and some interesting trends emerged. First, the Dislike map was much sparser than the Like map, and generally filled with smaller sized cloud pins. The largest pins almost always went on the Like map. Furthermore, the Dislike map had a tendency to have clusters of disliked places; we also saw visitors during the opening studying which places had been Disliked, and then adding on to one of them. For Liked, however, the results were truly spread throughout the city

Figure 36. Collective Data Maps in the Kasa Galeri, Istanbul, May 2010

evenly, showing a greater variety in citizen's favourite locations. What intrigues us is the analogue approach to *Collective Data Maps*. There is a greater sense of humanness in these physical maps. Perhaps it's the feeling of being in a public space that makes people less eager to show negative feelings towards something. What does this say overall about public perception to artworks? It seems there is a correlation between the level of participation users will put in, and the level of openness required by visitors. *Collective Data Maps* however requires not just more engagement, but relies on crowd-sourced emotion, making it a much more personal act to interact with. Public openness to participation remains the greatest design challenge for public interactive art, and the direct relationship between the level of engagement and reluctance to participate provides a

formidable barrier to the next generation of data-rich art projects in urban spaces.

12.4. FUTURE ENDEAVOURS

We see this metaphor of Social Bits as becoming frequently more applicable to daily life situations. We are distributing our lives virtually, by sending these bits of feelings and experiences online through our daily experience. Phenomenology [Section 4.1] in its relation to HCI is more relevant than ever, as urban inhabitants seamlessly blend their Being-In-The-World with their Present-At-Hand [Heidegger, in Section 4.2] devices. As urban spaces become further augmented, the artistic opportunities will flourish, thanks to increases in infrastructure and sensor technology. The role of Social Bits will be to artistically shape these environments, enabling all inhabitants to experience augmented space, and enrich the daily experience of being in smart environments. Artistic exploration remains a vital and necessary component of research in augmented spaces, and through this Social Bits metaphor we feel well equipped to thoughtfully explore the new augmented urban landscape.

13. CONCLUSIONS

The projects for this thesis made a broad attempt at exploring and understanding the role of interactive art in public spaces. Through the use of social data, a new data source for understanding both the city and the digital social sphere has been probed and tested in-situ. Participants were frequently asked for their opinions on pieces, mainly concerning the value of the data and the appropriateness of showing this data in public space. Though no concrete conclusions can be made, several traits which made themselves clear in many instances provide feedback for the projects and show the design opportunities possible for further research into interactive art in public spaces. It is this author's hope that future projects will begin to build guides and lexicons for designing public interactive art. Integrating art, design, architecture, and urban spaces requires much consideration; having some standards to help guide the conceptual development of a project would be invaluable.

13.1 USER-CENTERED CONTEXTUAL DESIGN AS A BRIDGE FOR UNDERSTANDING INTERACTIVE ART

We cannot simply place art works in the public and expect all to use, understand, and appreciate it. In public spaces, it becomes particularly difficult as the audience cannot be easily understood. In-depth urban analysis and pattern language study provides feedback for the context of the urban environment. Studying public space and how the inhabitants use the space is the key to a successful art installation in that context. Subtle hints such as the general walking speed of the city, inhabitants' use of urban elements such as benches and ledges, and the what public spaces are used for provide subtle feedback for how space is used and can thus be designed for. An urban intervention is successful if it is able to blend into the existing fabric; art pieces cannot expect to radically shift the entire context of a public space. Furthermore, successful urban interfaces rely on the simplistic. While this is likely to

eventually evolve as they become more commonplace, we must accept that the public is not yet accustomed to interacting directly with urban spaces; giving simple methods of interaction is the best method we can currently employ.

13.2 LESS DATA, NOT MORE

A main goal of art projects in augmented urban space should be to connect the worlds of digital and physical. For this to be effective, passers-by must be able to understand the piece and want to interact with and experience it. Working with real-time social data has proven to be an effective method of demonstrating the amount of content creation and dialogue occurring constantly in the online space. However, the desire to show off just how much is happening online is a dangerous method. In the projects completed for this thesis, what intrigued people most of all was individually produced social data: personal thoughts, photos, and snippets of online conversations. Looking at this, we see that isolating small sets of data is a useful tool for giving a personal, emotional connection to the text pulled from the online space. This sense of seeing a stranger's life has a certain curiosity, and giving participants small personalized views into the online world is much more beneficial than overwhelming them with mass amounts of content.

13.3 RESPECT THE PHYSICAL SPACE

A successful interactive piece should disappear into its urban context. Natural methods of interaction and minimal visible infrastructure allow people to unexpectedly encounter interactive pieces. This passive method of presenting artworks allows a greater sense of curiosity towards the project and allows the user to intuitively explore the work.

13.4 PROVIDE RELATABLE DATA

In a public setting, the data should be relevant to the context. Connecting physical and digital spaces should help to show the similarities between the two spaces, and thus further inform the interweaving of the two spaces in daily life. Displaying and selecting content that is relevant, understandable, and relatable gives a sense of familiarity and helps to give an identity to this online world and it's ever-flowing data stream.

13.5 DIGITAL DEFINES THE PHYSICAL

As more and more of our lives exist online, large shifts are being made that push all content to the digital domain. Our books and newspapers are all digitally distributed. Journalism has been democratized through blogging, and Twitter further decentralizes the spread of information. As we begin to receive our news updates on our devices and through urban displays, we can begin to see the digital world shaping the physical. Future architecture and urban spaces must be smart environments to continue and enhance this information flow. There are great opportunities to use real-time data within art projects to influence and shape the development of these spaces.

Overall, the trends towards integrating real-time data into public spaces for artistic interventions is promising. While certain facets are still largely being explored (especially the data itself, and the infrastructure to both capture and display it), a greater acceptance of augmented spaces can be clearly seen in urban spaces worldwide. As artists, we must continue to work with the ever evolving spaces, both physical and digital. As with the dissipation of ubiquitous computing [Section 5.2] we will eventually reach a point where we no longer differentiate between our digital and physical existences; it will simply be augmented life. We already live our lives in the two separate worlds, whether it be communicating, shopping, learning, or almost any other aspect of daily life. We will soon no longer actively consider doing something on-line or off-line,

we will simply go about our daily augmented experience with no thought given. The artistic opportunities in this new space will continue to grow; for now, we can continue to experiment with combining the two spaces in our daily urban life.

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