TOWARDS A MEDIA ARCHITECTURE
An inquiry into the convergencies of constructed space and screen-based media

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INTRODUCTION

Visual culture is constantly evolving and in this process producing new hybrids between art, film, media, advertising, journalism, architecture, and many other spheres that are exposed to cultural and technological transformation. These hybrids sometimes call for a paradigm shift or at least challenge our culturally constituted master categories. In some cases the impact by such crossing is so profound that the new perspective causes a need for revision of previous terminology. This text will propose that a new approach to what is known as "the screen" is emerging as it adopts spatial formations and enters into public space. I shall argue that these phenomena that appear in architecture, art and domestic screens are not the result of a revolution of new technology, but rather an evolution of both existing visual media and architectural explorations that has been evolving for many years. The term "media architecture" is at once the offset, and the etymological frame for this exploration. By regarding media architecture as a convergence of media and architecture, it becomes a reversed metaphorical figure for the movement from surface to space.

When discussing new phenomena like media architecture it is possible to adopt a wide range of perspectives that may construe it as being nothing more than the result of new developments of technology. New technology has often been interpreted as a contributor to behavioral changes in society or described as the cause for such movements. This position recalls the considerations of cause and effect in regards to technology made by Raymod Williams in his famous book "Television" from 1974 (Williams, 1974). Referring to the TV as the fairly new visual medium of the time, he poses the question of whether it can really be the cause of cultural change, or is it rather the effect of changes in society.

The same type of question can be raised for the new media phenomena that may be called media architecture. Should we describe these entities by the effect they have on society or rather as an effect of society? This text will take the latter position by describing media architecture as an effect, not of society as a whole, but of the visual culture, which in this text is represented by art and architecture.

The argument is constructed in four parts. This first part serves as an introduction to the field, which will also frame the subject in a larger perspective. The second part traces to motivation behind media architecture to an understanding of architecture as a communicative medium. The third part describes the physical evolution of screen as an offset for current trends of spatial screens. And finally, the fourth part, will unite the two previous parts by analyzing current trends in media architecture through a series of "lenses" or interpretations of the field. These lenses must be regarded as perspectives that are open to further investigation and serve to prove how vast the field of media architecture may become.

Appending to these theoretical considerations, I have included a case study describing my work with developing a media facade for the Denmark Pavilion at Expo 2010 in Shanghai. This will serve to highlight some of the practical issues that designers come across when facing the task of implementing media technology in experimental new architecture. The text in this case study will constantly oscillate between descriptions of the process and the reflections that were prompted by the different steps in the process.

SCOPE

The field of media architecture has been approached from many different academic disciplines including sociology (McQuire, Jewitt, Struppek), technology studies (Manovich, Huhtamo), aesthetics (Broeckmann, Cubitt), and many more. The scope of this thesis is, on the other hand, to focus primarily on the architectural and technological foundations of media architecture and thereby establish it as a visual product of our current culture. In order to elaborate this even further, I
shall explain the scope by going over the different elements of my title and its subtitle.

Towards a media architecture. The title serves to highlight the intention of movement or change in the direction of creating a theoretical foundation for media architecture. It also indicates that the movement is incomplete and waits for further completion.

An inquiry, suggests that the method bares resemblance to an investigation or a sequential order of logic. While there is currently not a well-established consensus about the defining characteristics of media architecture, I will approach the subject with caution in order not to foreclose further elaboration. This includes adductive reasoning by posing the thesis described in the following section.

Convergencies, as the plural of convergence, suggests that this development of media does not necessarily result in a single unified multi-medium, but rather a multitude of media hybrids. This development must be understood as a tendency, or numerous tendencies, that are not predetermined by technology, but depends of our understanding of the subject and how this understanding affects the evolution of new media technologies.

Convergence has for many years been regarded as a cultural phenomenon (Jenkins, 2006) driven by a desire to surpass the technological boundaries of monolithic media platforms.

Constructed space refers to the tradition of architecture, but highlights the nature of architecture as an intentional formation of spatial form. By drawing analogy between architecture and constructed space, I wish to suggest that media architecture is not only concerned with buildings, such as houses, shopping centers and office blocks. Rather, space itself may be considered a subject for architectural investigation by its influence on our perception.

Screen-based media highlights the fact that though the field is ambiguously named "media architecture", it is constituted as a primarily visual phenomenon. It can be argued that the field of media architecture should encompass all media types, aural and visual, but the discourse at its current state has developed toward an understanding of media architecture as being visual and, most often, based on media-screen technology.

BACKGROUND

Even though screens in public space seem to be a relatively new phenomenon, they actually have a long history dating back to the late nineteenth century. According to media archeologist Erkki Huhtamo, magic lanterns were used to static images and advertisements onto public buildings turning them in to giant projection screens (Huhtamo, 2004). During the 1930s scrolling marquee signs emerged as the means to display replaceable text messages on movie theaters and road signs.

One of the first attempts to implement moving images into the facade of architectural buildings was described in the initial plans of the winning proposal for Centre George Pompidou from 1971 by Renzo Piano and Richard Rogers. The idea was to project moving images onto large projection screens that were mounted on the steel frames of the facade. Due to budget cuts and the lack of a suitable technology, the idea had to be abandoned. But the idea of large screens in urban space was soon to be realized in a completely different way. Before the world had even seen large outdoor screens, they were featured in the sci-fi movie Blade Runner from 1982 as large hovering billboards displaying commercial advertising.

In 1985 Sony presented the first large screen device that was properly suited for outdoor use. The JumboTron, as it was called, was 40 meters wide and 25 meters tall and soon became a standard fixture in stadiums all over the USA. During the 1990s similar screens were installed at Times Square, Piccadilly Circus, and other commercialized urban spaces.

One of the first media facades that was integrated into the architecture of a building is the KPN Tower in Rotterdam which was built from 1998 to 2000. Ironically, the architect was the same Renzo Piano who
proposed to implement large screens on the Centre Pompidou almost thirty years earlier. The KPN Tower features a facade with 902 green lighting squares distributed in an even grid. The low-resolution screen is capable of showing binary graphics in green monochrome color.

In September 2001 a small group of programmers borrowed an empty office building next to Alexanderplatz in Berlin. They installed a halogen lamp behind each of the 144 windows and connected the controls to a central computer. For 23 weeks the facade showed various graphics, featured interactive games, and displayed SMS messages that were sent to it. The project, that was called "Blinkenlights", soon became an iconic example of media facades and model of what could be achieved with a limited amount of pixels and the ability to interact with the screen.

Perhaps the most famous of all media facades is the BIX installation on Kunsthaus Graz in Austria. The project started in 2001 and it is possibly the first example of extensive integration between architecture and screen. The new extenuation to the old Kunsthaus was designed as an amorphous rounded mass covered in dark tinted glass. The media architects realities:united designed a media facade that consisted of 930 circular fluorescent tubes that are mounted underneath the glass skin. In daylight the lights are turned off and the lamps are hidden behind the tinted glass. But at nighttime the facade lights up and displays various graphical animations that refer to the current and upcoming exhibitions in the Kunsthaus.

The BIX installation is exemplary for several reasons. First of all because it proves that a screen is not necessarily a flat square surface, but can be curved, spatial and amorphous. Secondly, it shows how media can be an integrated part of architecture that instead of dominating the exterior can actually enhance the building and extend its communicative abilities. The limited resolution and non-rectangular screen was a conscious choice made by the designers in order to achieve a smoother integration with the building, but also limit the expressive abilities of the content. The designer Jan Edler explains:

"We had started to look at the term media facades in general and soon found out that the few media facades that exist are mainly used for commercial purposes and that the concepts behind those screens are not adequate to be used for a museum. That is why we have chosen an asymmetrical approach during the following
stages of the design. Asymmetrical approach means that we have given up certain aspects like high display resolution or color and have gained something else: a very strong expressive medium."
(Interview with Jan Edler found at www.realities-united.de)

This conscious deselection of details in the design indicates a counter-reaction to the current developments in the traditional screen industry where resolution is increasing and colors are getting more and more saturated.

Figure 2: BIX, Kunsthaus Graz (2003)

Since the BIX installation was completed in 2003, realities:united has made many other installation using the same philosophy, among others the temporary SPOTS installation (2005-07) at Potzdammer Platz in Berlin, which featured curated content provided by prominent artists like Jim Campbell, Rafael Lozano-Hemmer, Terry Gilliam, Carsten Nicolai, and many others.

An interesting phenomenon, which is not necessarily linked to the developments in media facades, is that an increasing number of media artists have in the recent years started to experiment with three-dimensional screen installations, which explores entirely new concepts of image formation. One of the most productive exponents for this tendency is the British artist collective United Visual Artists (UVA). Since 2003 they have created a large number of visual installations that are often interactive and intended for outdoor public space. "Constellation" was an installation made for Covent Garden in London, which was made from 600 LED tubes hanging from the ceiling with large intervals. Each tube contained a single row of pixels, or voxels (volumetric pixels). This made the installation into a large dynamic canopy that transformed the old market hall into a dynamic moving space. Audience could modify the expression by moving their hand on a metal plate that was placed in one end of the hall. Apart from this interactive mode, the installation was also used for as visual backdrop at a classical concert in the hall.

"Constellation" and other volumetric media installations shows that visual representation does not have to be flat or curved surfaces, but may become far more spatially expanded. The lines between the screen and the sculpture are blurring and our visual perception and representation modes are challenged to find new ways to describe and reflect on these experiences.

The trajectory of the examples mentioned here, shows that it is becoming increasingly harder to draw a clear line between traditional flat screens and spatial mediums like BIX or Constellation. They are all a part of a continuum of different spatial instantiations – varying in scale, resolution, form and expression. It raises questions of what defines a screen and when is a lamp becoming a pixel instead of just a light source. It also poses questions of how it relates to architecture and our visual culture in general.

TECHNOLOGY OR CULTURE
It has often been suggested that media architecture is an effect of new technology and that the reason why it has emerged within the last
decade is that the technology has made it possible. Especially the advancements in LED technology might have been premise for the phenomenon, as it was actually not until the end of the 1990s that LEDs were bright enough to be used for outdoor applications. But the determinism of such presumptions is not entirely coherent with the facts. Some of the first media facades, KPN Tower, Blinkenlights and BIX, did not use LED at all. Instead they used technology that could have been found teen or twenty years earlier. Media architecture is therefore not only a result of a new technology but, as I will argue, may rather originate from a shift in visual perception of both screen representations and architectural ideology.

CURRENT DISCOURSE
The community around the field of media architecture has roughly existed since 2007 where the first Media Architecture conference was held in London. Since then, the conferences on media architecture have become a reoccurring event with the Media Facades Festival in Berlin (2008) and the Media Facades Summit in Frankfurt (2010). The subjects of these conferences have mainly been focused on architecture, technology and aesthetics.

In parallel to the discourse of media architecture there has been an overlapping community around the field of "urban screens", focusing mainly on the potentials of large screens as a catalyst for the development of urban social and cultural environments. Conferences on urban screens have been held in Amsterdam (2005), Manchester (2007), Melbourne (2008), and again in Amsterdam (2009).

The many different terms describing the screen-like phenomena in our built environment has often been used in conjunction with each other and may therefore have suffered conceptual obscurity. In order to bring clarification to the subject, I shall describe some common understandings of the terms:

**Urban screens**: The use of situated video-screens in urban environments. The discourse on urban screens has been concerned with the social and cultural effect of displaying different video material in the modern city. There are many examples of urban screens around the world ranging from small in-store displays to large public screens intended a bigger crowd. The most well-know urban screens are probably those on Times Square in New York, Piccadilly Circus in London, Shibuya Square in Tokyo and so on. These screens serve as modern day billboards displaying only commercial content. But other uses of large-screens are emerging around the world, bringing non-commercial content like news, sports, entertainment and cultural events. The most predominant examples are the large-screen on Federation Square in Melbourne, the CASZUIDAS screen in Amsterdam, and the nineteen BBC Big-Screens situated around major cities in the UK. Many have claimed that the screen could have a positive effect on social and cultural environments in their location (Struppek, 2006; Jewitt et al., 2006) especially by bringing video art to the otherwise commercially dominated screens of major cities.
Media architecture: The merging of architectural forms and screen-based technology into experimental installations. This field is concerned with aesthetics and communicative potentials of new approaches to screen-technology in different scales and forms. Driving forces are mainly architects, designers and media artists, who wish to expand the visual experiments to the three-dimensional domain. There seems to be a constantly increasing number of installations that can be described as media architectural installations – ranging from small-scale art installations to large-scale integrations into building structures.

Media façade: The most common use of media architecture, where screen-technology is applied to the facade of a building. The approaches rage from mounting standard large-screen panels on existing buildings, to the integration of custom lighting fixtures into complex architectural surfaces. Some of the most well-known examples are the BIX installation on Kunsthauz Graz, the media facade on UNIQA Tower in Vienna, and, most recent, the luminous media installation on the recently opened Ars Electronica Center in Linz.

Figure 4: BBC Big Screen, Liverpool

ARCHITECTURE AND ITS EVOLUTION AS A VISUAL MEDIUM

Or: architecture as media

In the discourse of architecture we often encounter the notion that architecture "speaks" (Ledoux, 1852; Mayerovitch, 1996) or an understanding of architecture as "a language" (Alexander, 1978; Jencks, 1977; Summerson, 1963). Although architecture does not literally speak or is used as a spoken language, it can be argued that architecture has communicative abilities that resemble other arts of human expression. One way to think of this communication is how we "read" and interpret the functional aspects of architecture as we move through spaces and appropriate them for dwelling, working, consuming, etc. Another possible approach would be to see architecture as communicating messages towards its surroundings by means of its exterior properties.

Throughout history we have seen that the design of buildings has rapidly changed in both style and construction techniques. Arguably, appearance and construction have influenced each other in various ways, meaning that the development of new technology has influenced the style of an epoch, and that style has led to the invention of new techniques of construction.

According to Vitruvius, the classical 'Doric order' of ancient Greece developed from the mimicking of old construction characteristics of wooden temples to a new material that was not likely to perish. Stone columns and beams replaced tree trunks and rafters but retained some of their original expressive features. The bark texture of the tree trunk was translated into concave grooves in the columns, and end-beams were carved into the superjacent entablature as ornaments known as triglyphs. These basic motifs have since then been interpreted and
transformed throughout antiquity and the later the Italian renaissance. Although the structural value of columns decreased as buildings were increasingly constructed from bricks, and columns and entablature were often superimposed on buildings as ornaments. This heritage shows how shifts from one material to another can affect the style for centuries of architecture to follow. What was once a quality of construction can later turn into a style that is completely detached from its original foundations.

Conversely, new materials or construction techniques may also be seen as being produced by cultural changes or movements that set the agenda for its followers. Several notable positions have been made through history, which has helped to establish architecture as a communicative device. In the book "Surface Architecture" by David Leatherbarrow & Mohsen Mostafavi (2005), the question of style is approached, in similar way, as a division between production and representation. They argue that the production, meaning the fabrication of building materials and the construction methods applied, has through history enforced different limitations to the possibilities of architecture. As production has developed and increased the possibilities of construction, the representation has been able to explore other expressions. Especially the development of the "free facade" that is liberated from structural functions, has given architects new possibilities of exterior expression in architecture.

The term of 'architecture parlante' (speaking architecture) has been associated with French neoclassical architect Claude Nicolas Ledoux (1736-1806) as a way to describe some of his expressive architectural projects where the shape of buildings or ornaments were directly linked to the building's daily use. In an early proposal for the Saline Royale (Royal Saltworks) in the town of Chaux, Ledoux proposed to build a small village where the house of each worker were shaped to resemble an artifact associated to their trade. As an example would the house for the maker of hoops for salt casks be shaped like a round barrel (Kruft et al., 1994). Although the terminology of 'speaking architecture' was not widely articulated in discourse of architecture, the tendency towards communicative ornamentation was extensively assimilated thought the periods of neoclassicism and eclecticism in the eighteenth and nineteenth century.

FORM AND SURFACE
Two properties seem to have been central to the language of architecture within the last hundred years: the language of form and the language of the surface. These two modes of communication are not mutually exclusive, one language does not eliminate the other, instead, different emphasis has been put on form and surface as expressive characters as different ideologies have prevailed in architecture.

Form concerns the volume or the mass of a building, while surface is rather the skin, the face or, in architectural terms, the façade. The two terms are, of cause, not independent from each other, but affect or sometime dictate the expression of one another. Form will always have a surface and no surface can exist without defining some kind of form. Even the shallowest surface, like a windowpane, as it connects the edges of the frame to each other, creates a separation between inside and outside, and thereby defines the borders of a shape.

The distinction between form and surface is not always clear. A column could be described as both form and surface, and an ornamental figure is expressed through form, but does not affect the overall perception of the buildings form. Form and surface must therefore, in this context, be regarded as properties of expression, and the division between them serves the purpose of argumentation in the following sections.
"It is the pervading law of all things organic and inorganic, Of all things physical and metaphysical, Of all things human and all things super-human, Of all true manifestations of the head, Of the heart, of the soul, That the life is recognizable in its expression, That form ever follows function. This is the law" (Sullivan, 1896)

American architect Louis Sullivan coined the phrase that was later simplified to "form follows function" as early as 1896. This was to be the dictum that pervaded the Modernist thinking in the twentieth century. To the Modernist movement, form was at the core of architecture: buildings were designed from the inside out. As Le Corbusier expressed it: "Architecture is the masterly, correct and magnificent play of masses brought together in light." (Le Corbusier, 1923) His book 'Vers une Architecture' (Toward an Architecture*), published in 1923, contained a collection of essays advocating for the new architectural concepts by highlighting the aesthetics of contemporary engineering as a new role model for architecture. The book was formulated as a reminder to contemporary architects, focusing on three essential aspects: mass, surface and plan. Le Corbusier argued that the primitive geometrical forms expressed a special quality: "Our eyes are made to see forms in light; light and shade reveal these forms; cubes, cones, spheres, cylinders or pyramid are the great primary forms which light reveals to advantage; the image of these is distinct and tangible within us and without ambiguity." (op. cit., p. 29) The surface, according to Le Corbusier, should articulate the form without disrupting volumetric properties: "the task of the architect is to vitalize the surfaces which clothe these masses, but in such a way that these surfaces do not become parasitical eating up the mass and absorbing it to their own advantage" (op. cit., p. 37). Doors and windows were a necessary evil that could potentially disrupt the continuity of the surface: "... these holes are often the destruction of form: they must be made an accentuation of form". In his emphasis of form, or mass, surfaces were often left as raw untreated concrete, leading to the affiliated description: béton brut (raw concrete).

Not all Modernist architects applied same brutalistic expressions as Le Corbusier. Some used more refined materials, like steel, glass, wood and marble, while still emphasizing simplistic forms. The message was implicit in the materials that made up both form and surface of the building. Prominent architects of the period formulated manifestos to promote the new rationalism of Modern architecture. Statements like "Less is more" by Mies van der Rohe, or the manifestation of "The International Style" by Henry-Russell Hitchcock and Phillip Johnson in 1932 were extensions of the thoughts made by Le Corbusier a few years earlier.

The simplifying approach that was implemented by the Modernist architects was proclaimed as functionalism, but it was a functionalism...
that regarded accessory ornamentation as non-functional. Like Sullivan proclaimed: the form was a result of its function, and without a structural or practical function, symbolic forms were unnecessary.

A completely different approach to "form" began emerging in the 1980s. Inspired by thoughts form Jaques Derrida, the movement that called itself deconstructivism was based on ideas of fragmentation, dislocation and distortion. As an opposition to the Modernists this new approach aimed to deconstruct the simplistic language of form and instead introduce a complex and deconstructed form, which often led to an opposition between form and function. The resulting architecture looks like forms have been taken apart and assembled again in new configurations. Some of the most prominent exponents of this thinking can be found in architecture by Frank Gehry, Rem Koolhaas, Richard Meier, Zaha Hadid and Daniel Liebeskind. An often-mentioned example is Gehry's Guggenheim Museum in Bilbao, which is composed of various forms and shapes intersected with each other, creating an asymmetrical, indefinable mass. It has often been interpreted as a grounded ship or a crystalline flower, but despite these interpretations it bears no clear resemblance to any known shapes in our culture. The architecture communicates explicitly, but in ambiguous words, which make little semantic meaning.

Within the last decade we have witnessed many other experimentations in form of contemporary architecture. One of them has become known as "Blob Architecture" or "Blobitecture" which refer to the rounded, organic curves that shape the form of this type of architecture. The development of this language is made possible by the development of a technical feature in graphics software called the Non-Uniform Rational B-spline (NURB), which simplifies the task of creating smooth curves and rounded shapes. Examples of this kind of architecture is found in Kunsthau Graz in Austria, Selfridges department store in Birmingham, Jean Nouvel's Torre Agbar in Barcelona and the UK Pavilion at the World Expo in Shanghai 2010. John Kevin Waters, author of the book "Blobitecture : waveform architecture and digital design", has identified many of current trends in design and architecture as deriving from the language of the "Blob". The designs are in many cases conditions be the new possibilities of "working with virtual environments beyond the world of Platonic solids and Cartesian planes where space enfolds and objects become "soft" ..." (Waters, 2003) The movement towards blobitecture that is enabled by new technology also introduce a new perceptual paradigm in the creation process. Architecture has broken its dependence on Euclidian space and the limitations by sketching shapes on paper. It is possible that many Blob designs could not have been realized without the tools of modern technology.

**SPEAKING THROUGH SURFACE**

In the classical language of architecture, surfaces are subjected to various ornamentation that serve as communicative elements in reference to the classical orders. The ornamental figures have developed extensively through the different epochs: from the antique motifs of the renaissance to the lavish rocaille of the baroque, the ornament communicated quality and abundance. But as industrialization progressed in the nineteenth century, ornaments were subjected to mass-production and were, in some sense, devaluated as a sign of
quality. The ornaments and the classical language had lost their meaning and their architectural function.
In the beginning of the twentieth century, new thoughts began to emerge among architects who wanted to form a new approach to the surface and get rid of the obsolete ornamentation. Architect and critical thinker Adolph Loos claimed in his book "Ornament and Crime" (1908), that ornaments were the trademarks of primitive behavior and should be considered a crime per se. His opposition peaks in his statements about tattoos as an ornamentation of the body: "The modern person who tattoos himself is either a criminal or a degenerate. There are prisons in which eighty percent of the inmates have tattoos. People with tattoos not in prison are either latent criminals or degenerate aristocrats." (Loos, 1908) He further argues that earlier epochs had their own style in ornaments; the twentieth century has gone "beyond ornament" and has achieved "plain, undecorated simplicity". Like Loos, the general modernist movement worked against the explicit communicative elements of eclecticism and instead employed a functional minimalism deprived of unmotivated 'speaking' attachments.
Architectural style developed an opposition to the lavish ornamentation of earlier epochs, which had become standardized and to some extent disconnected from their antique origins. The surfaces of modernist buildings were often plane and white, which represented the simplest and most rational approach to architecture.
A text by Le Corbusier entitled "Les cinq points de l'architecture moderne" (The five points of a modern architecture, 1926) followed up on the thoughts articulated in his previous writings. The essence of this new manifesto was to utilize new materials and construction techniques to allow unrestrained design of both ground plan and facade layout. Using internal concrete columns, Le Corbusier argues that the facade would no longer be forced to communicate structural functions but could instead accentuate the form. One of the best examples of the five point implemented in Le Corbusier's work can be found in his Villa Savoye (1929).
It is reasonable to think that Le Corbusier, and the architectural modernism in general, was against the thought of architecture as communication, and that their minimalistic buildings were denying communication as an architectural feature. But on the other hand, Le Corbusier sought an aesthetic, which greatly reflected a new set of values, and communicated an opposition to eclectic architecture, which had become the a vernacular in the late nineteenth century and early twentieth century. Communication was supposed to be without ambiguity and should, most importantly, reflect the vision and ideology of a reflected architect.

During the sixties, liberal consumerism gave rise to a new "popular culture" marked by increasing amounts of advertising and new markets for leisure and entertainment. The architecture in urban environment became dominated by signage and decorations constructed to lure customers into shops, cinemas and theaters. While some saw these commercially dominated environments as a sign of a culture in moral...
declination, others embraced the opportunities and optimism inflicted by these tendencies.

In 1966, architect Robert Venturi published "Complexity and Contradiction in Architecture" as a reaction against the "simplicity and picturesqueness" of the Modernistic movement, instead arguing that architecture should be "based on the richness and ambiguity of modern experience, including that experience which is inherent in art." Venturi was clearly influenced by the contemporary Pop Art movement, which made icons out of consumer products and embraced the hyperrealistic mechanisms of modern day society. In his attack on modernism he coined the phrase "Less is a bore" as a response to the dictum made by Mies van der Rohe many years earlier. Venturi argued that architecture should acknowledge the complexities and contradictions in society and incorporate it into the constructed spaces of our cities.

Extending this argument, Venturi along with colleagues Denise Scott Brown and Steven Izenour in 1972 published "Learning from Las Vegas – the forgotten symbolism of architectural form", a controversial attempt to re-introduce communication into architecture by means of commercial signs and billboards. The book argued that Las Vegas was an example of a city, which had pragmatically adapted to modern needs by providing symbolic complexity instead of iconic purity.

A notable part of the analysis of the Las Vegas "strip" is the identification of the two archetypes of architectural symbolism: the duck and the decorated shed. The duck is named after the Long Island Duckling, a shop shaped like a large duck, and constitutes the building that is a symbol in its form. To Venturi and his colleagues this resembled the strategies applied by the Modernist building – an iconic shape with simplistic connotations. The "decorated shed", on the other hand, was inspired by the wooden houses erected by settlers in the early days of American history. By applying various symbolic schemes to the front facade, buildings could easily gain the complexity and contradictory meaning that Venturi had also sought in his early writings. The explicit symbolism that Venturi promotes focuses on the communication itself as a medium and is less concerned with what is communicated. The quality of signs, symbols, billboards and commercials is in the complexity that is composed when they are put together. Instead of pretending not to speak, like the Modernist building, architecture should talk in many messages and languages simultaneously.

The thoughts that were derived from Venturi and his colleagues became a stepping-stone for a new movement in architecture that suddenly used the surface for vivid visual expressions. Renzo Piano and Richard Rodgers manifested one of the most expressive approaches to these new thoughts in the Centre Georges Pompidou from 1971. All tubes and piping have been put on the outside of the building and is color-coded to express their function. The building is in a sense turned “inside out” and is thereby displaying all its internal organs on the exterior.

Like modernism had declared war on earlier eclectic, symbolic-laden epochs, the next logical move was to re-introduce symbolic meaning, but with an irony that raised it above previous styles. Architectural expression in Post-Modernism came to be considered as a language spoken in two tongues.
"A Post-Modern building is … one which speaks on at least two levels at once: to other architects and a concerned minority who care about specifically architectural meanings, and to the public at large, or the local inhabitants, who care about issues concerned with comfort, traditional building and a way of life. Thus Post-Modern architecture looks hybrid and … rather like the front of a Classical Greek temple. The architects can read the implicit metaphors and subtle meanings of the column drums whereas the public can respond to the explicit metaphors and messages of the sculptors. Of course, everyone responds somewhat to both codes of meaning … and it is this discontinuity in taste cultures which creates the theoretical base and the 'dual coding' of Post-Modernism" (Jencks, 1977, p. 6, cited in Johnson, 1994)

The post-modernistic strategy of speaking on two levels simultaneously was applied in both surface and form, but was often just a shallow delusion referring the intellectual superiority of the architect.

THE SEMIOTICS OF ARCHITECTURE: FUNCTION AND SYMBOLISM

Understanding architecture as a language or a communication device implies that we can analyze its properties by established linguistic methods in order to comprehend its potentials. Umberto Eco has approached the subject of architectural communication from a structuralist point of view, describing architectural objects as systems of signs. In his article "Function and sign: the semiotics of architecture" (1986) he forms a fundamental understanding of the relations between architectural objects and their communicative abilities.

Eco begins by stating that architecture is generally not considered to be communication, as it is not constructed to communicate, but to function. This function, Eco argues, creates the basis for our conceptual thinking about an object. A cave, as he exemplifies, is not a cave because of its exact visual attributes, but because it provides the function of shelter. The architectural objects are therefore recognized by their function, but may assume various appearances. In order for us to recognize this function, the cave is interpreted as an abstract model of the phenomenon, which is visually recognizable but also provides the ability to communicate it properties to others.

To Eco, architecture represents a code, like text and spoken language, which is constituted within the specific cultural context. The signs produced within the architectural code may be interpreted by denotation, herby communicating its use, or by connotation, which translates into a symbolic meaning providing a broader understating of the denoted signs. Eco classifies these two functions into what he calls primary functions and secondary functions, while underlining that the primary functions are not necessarily the most important ones. He exemplifies by mentioning the case of a throne: the primary function is denoted as a chair for sitting, but the ornamentation connotes symbolic values like royalty, which function may be of far greater importance than its function as a device for sitting. Still, different individuals may interpret the secondary functions differently, and the primary functions may also fluctuate. A chair is not always used for sitting on. Sometimes it may be
used for other functions (e.g. standing on). Eco concludes: "... the architect should be designing for variable primary functions and open secondary functions." (Eco, 1986, p. 200)

The following figure provides an interpretation of Eco’s model of communication:

![Diagram of Eco's architectural communication model]

According to Eco, symbolic meaning in architecture is based on interpretation of the additional signs that are provided besides the function. He regards this symbolism as a style, or an ideology as he would call it, which tells something about its primary function. This understanding, though, does not account for associated symbolic signs that are unrelated to the use, or primary function, of the object, but still functions as a communicative element. Eco’s view on architectural communication is limited to the interpretation of intentional signs transmitted by an explicit sender. Both primary and secondary functions contribute to the holistic understanding of the given object.

Munro (1987) has supported this critique of Eco by pointing to the rigid differentiation between denotation and connotation, which "excludes all reference to qualitative differences between ideas signified and depends only on code structure."

**AESTHETIC AMBIGUITY**

Eco's semiotics provides a traditional understanding of architecture as communication where form, to a large extent, follows function and additional aesthetics are attributed to this form. Primary functions may not necessarily be the most important ones, according to Eco, but they are the functions that are first recognized and thereby contextualize the symbolism connoted from it.

"... rather than evoking and negating the codes, as the work of art might, and thus directing attention ultimately to itself, it (an architectural object) would have to progressively transform them, progressively deforming already known forms and functions and the functions conventionally referable to these forms. Otherwise the architectural object would become, not a functional object, but indeed a work of art: an ambiguous form, capable of being interpreted in the light of various different codes." (Eco, 1986, p. 186)

As pointed out here, Eco draws a clear destination between art and architecture. Primary functions must be univocal in reference to the architectural code in order to fulfill its function as architecture. But Eco does not exclude aesthetics from the architectural language, though. In Eco’s understanding, architecture is a code and "every code allows for an aesthetic use of its elements." (Eco, 1979, p. 13) From the theory of Roman Jakobson he infers that the message assumes an aesthetic function when it is "ambiguous and self-focusing" (op. cit., p. 262). This ambiguity he describes as "a mode of violating the rules of the code." (ibid.) But not all ambiguous messages, however, produce aesthetic effects. The message may become disrupted to an extent where interpretation becomes impossible and all meaning is lost. The aesthetic experience is introduced when ambiguity urges an interpretive effort and incites toward the discovery of an unexpected...
flexibility in the language (op. cit., p. 263) Eco hints to a definition of the aesthetic text as a violation of rules in the expression plane that involves a corresponding ambiguity in the content plane. (ibid.) It is unclear, though, how Eco defines the correspondence between the two modified planes, but it seems that the aesthetic experience occurs in the individual's ability to produce meaningful interpretations in the content plane. The violation of rules in the expression plane increases difficulty and duration of perception and the viewer thereby perceives the object as if it was seen for the first time (op. cit., p. 264). The aesthetics of ambiguity does not bring the viewer closer to an understanding of the meaning, but creates a particular perception of the object.

Conferring this to architecture, the aesthetics of ambiguity occurs when a disorder in expression (form and surface) is linked to an ambiguity in the interpreted content. In this context we may regard the content plane as Eco's primary functions and secondary functions. Remembering Eco's notion about architecture and art, we must add that the ambiguity must not disrupt the interpretation of the primary function. Expressions in forms and surfaces may depart from the architectural code and thereby produce a difficulty in perception, which forms a basis for aesthetics.

Modernists approached this kind of aesthetics by rationalizing the code of the content plane, which then resulted in an ambiguity in the expression plane. The simplistic expressions were in some ways difficult to interpret, but was always linked to an emphasis of the function.

If a violation of rules in both expression and content plane causes a disruption of meaningful interpretation within the code, the text becomes self-focusing. This challenges the code in a way that expression itself becomes a theme for consideration. Self-focusing architecture might approach this by inserting disorder in form and surface that violates certain rules in the code of secondary functions. This is often seen in Post-Modern architecture, where references to the code of classical architecture are introduced, but at the same time violates the rules of the system. Doric columns are sometimes used without a structural or symbolic function, but in order to produce ambiguity, which eventually symbolized an irony in towards the architectural code.

Although Eco does not make the connection between architecture and aesthetics himself, it may be productive in order to understand the architectural communication as aesthetics of expression. Architecture always operates within the architectural code and unless the signs produced within this code is explicit, clear and univocal, the ambiguity will refer to this code as either functional or symbolic rules.

AN EXPERIMENTAL MODEL OF EXPRESSION
The content communicated through architecture can be interpreted in different planes. Eco speak of a general code, the language of function, and a specific code, which the symbolic content communicates within. The general code may be understood as the language we refer to when denoting the primary functions of architecture. Eco sees this code as, if not natural, then at least highly conventional. The specific code describes the symbolic language that an architectural object speaks within. It defines a certain "style" or ideology, as Eco would call it, which can also be conventional, or it can express violations to this rule, thus producing ambiguity.

On a conceptual plane, the architectural sign usually falls within either the general code or the specific code. A concept of a door always denotes its function, but the way it is expressed through form and surface relates to a specific code. The ornament, on the other hand, refers to a specific code that constitutes a symbolic language for the ornament.

Intersecting the expression plane (form and surface) with the content plane (function and symbolism) can provide a model for analyzing architectural concepts and ideologies (Figure X). Venturi's "duck" is a concept of symbolism in the form, while the "decorated shed" refers to symbolism in the surface. If we look at the Modernist slogan "form follows function", it clearly constitutes a link between the shape and use, like the concepts of staircase, house and garage.
What can be argued from this model is that the different styles or ideologies of architecture are usually defined by a certain relationship between form-function, form-symbol, or symbol-surface. When an architect designs a certain form, he does it with a specific function or symbolism in mind. He may design other aspects of the form that are based on another approach to content, but a pronounced architectural ideology might be analyzed through this relationship between the expression plane and the content plane.

ARCHITECTURE AS ART AND MEDIUM
When looking at architecture as a cultural phenomenon, the communication implied by architecture may be described as a mediated communication. The content or message of this communication may be functional or symbolic, but is arguably directed towards human interpretation. Considering how architectural communication is directed towards various recipients (inhabitants, workers, visitors, audience, etc.), it seems reasonable to characterize architecture as a medium for mass communication. According to Eco there are several points, where architecture resembles the properties of a mass medium (Eco, 1986). Some of the resemblances are that: both aim at mass appeal, are psychologically persuasive, and are experienced inattentively. The reception of mass media contrasts the experience of art, which calls for "concentration, absorption, wholehearted interest in interpreting the message, interested in the intentions of the 'addresser'." (op. cit., p. 196)

This distinction between inattention and absorption resembles a similar distention between "distraction" and "concentration" made by Walter Benjamin (1935) while describing differences between architecture and art. "Architecture has always represented the prototype of a work of art the reception of which is consummated by a collectivity in a state of distraction." (op. cit., p. 233). The distracted state is, to Benjamin, a state characterized by habit to an extent where the crowd is absorbing the architecture rather than being absorbed by it – as is the case when concentrating in front of a piece of art. (op. cit., p. 232)

This perspective suggests a difference in the receptive states of art and architecture. The contemplation of art, according to Benjamin, posits an intimate relationship with the artwork. The reception of architecture has greater resemblance to cinema, which is received collectively and with the awareness of this shared experience. The nature of such receptive relationship in architecture obviously relates to its location in the public sphere, where intimacy and contemplation is impeded. Therefore, any medium located in the public domain is, to Eco and Benjamin, inevitable a mass medium.

As I have argued, architecture may assume many different approaches to communication of both functional and symbolic value, and it does so by various expressions. The strategy for such communicative endeavors often lies in the ideology applied, which may emphasize form, surface, or both as implicitly functional or explicitly symbolic features.
It may also be argued that architecture and artworks have similar potentials to express aesthetic ambiguity. Violations to the rules of the architectural code can induce new interpretations in the meaning and thereby produce poetic encounters with architecture.

THE SCREEN AND ITS PHYSICAL EVOLUTION

Or: media as architecture

Decades of cinema, television and personal computers have constructed the phenomenon of "the screen" as a culturally established entity. Although the different instantiations of the screen bares very little variations in physicality and technology, we no longer question the basic properties that define it. The screen has seamlessly taken over the legacy of representation from the painting, with its flat, rectangular surface and its picture frame as the boundary. The smooth transition has made us unaware of the constructed preconditions that have followed along with it. In this chapter I shall examine these assumptions that have formed contemporary understanding of the screen and how it is still shaping the way we think of its uses and potentials today.

DECONSTRUCTING THE SCREEN

In order to form an offset for discussion, I find it necessary to establish a hypothesis about our current understanding of the screen. There is no clear definition of what constitutes the screen, although several attempts have been made to formulate it. Lev Manovich has defined what he calls the "classical screen" as representing "the existence of another virtual space, another three-dimensional world enclosed by a frame and situated inside our normal space." (Manovich, 2001). He further describes the properties of the classical screen as "a flat, rectangular surface [...] intended for frontal viewing" and it "acts as a window into another space." (ibid.)
Shape
The classical screen and its properties constitute a system of representation that has dominated our culture for centuries. The legacy of the flat rectangular surface for frontal viewing incorporates the same visual constraints as were applied to cinema, photography and, before that, the painted canvas. It is reasonable to ask why the flat rectangle has become the conventional image format as opposed to other shapes, and so little effort has been put into contesting this convention. Is it due to practical concerns that no one has come up with an alternative solution? Is it plausible to think that, if our culture had constituted, e.g. the concave circle, as the predominant shape for representation, that a material or technology would have been invented to support this format?

Frame
One of the most distinctive features of the media screen is its rectangular shaped surface, encased by a border that frames and accentuate the boundary between the screen and its surroundings. This feature is not only present in contemporary media screens, but dates back to the wood board paintings of the Middle Ages. The frame acts as a separator, but also a mediator between the image and its context. It often contrasts the painted canvas in color, but also raises itself from the surface and thereby marks an entering into the surrounding space.

Time
The early moving image devices – first embodied by the cinema and later the television – added a temporal dimension to representation, in fact making them three-dimensional representation devices, although not in the conventional sense. The fourth dimension, as we may call it, was in fact introduced into the screen medium long before the third.

Reception
The screen must be considered a primarily visual medium. According to Marshall McLuhan, all media (and technologies in general) are extensions of bodily functions, and by that fact enhancing our human abilities (McLuhan, 1964). For example, the telephone is an extension of hearing, as it extends the spatial range of our ears by means of technology. In the same way, it is possible to regard the screen as an extension of vision in the way we look at and beyond the screen. McLuhan controversially argues that each of these extensions to man introduces a numbness into our ability to act as human beings. While amplifying one sense by technological extension, the body reacts by impairing the other senses an eventually causes self-amputation (op. cit.). Similar reaction has been identified by Jonathan Crary as a “suspension of perception” that has been introduced by shifts in human attention, which originated in the second half of the nineteenth century. Crary argues that the way we intently perceive impressions like sound and images causes an exclusion of our immediate environment and thereby allowing us to focus our attention towards the subject. This also goes for modern media like the television screen (Crary, 2001).

As argued, screens have a long history both as image representation and as medium of light. The conventional understanding of the screen, where the image is being projected onto a surface goes back to techniques of the magic lantern or even the camera obscura that was invented over two thousand years ago. This historical investigation has been called “Screenology” by Erkki Huhtamo who argues that public screens of today constitute “a different mode of spectatorship” than the dominant immersive separation of vision and body that characterize the cinema experience (Huhtamo, 2008).

CONSTRUCTING REPRESENTATION: THE VIRTUAL IMAGE
It has often been suggested that the linear perspective was the first successful attempt to recreate reality as representation. The renaissance painters were the first to appropriate this technique by rationalizing the visual perception and translating them into a set of rules that made the illusion of perspective possible. Several renaissance painters made great efforts to describe the techniques to achieve linear perspective. Among those are Albrecht Dürer, Leon Batista Alberti and Leonardo da Vinci. The linear perspective was conceived as a
representational scheme based to scientific approaches to visual projection. The central technique was the introduction of the vanishing point, which determined the proportional scaling of content and thereby created the illusion of depth. This often resulted in symmetrical compositions where depth was achieved by scaling of characters according to the converging lines of the perspective.

The linear perspective was based of the perception of a singular immobilized eye. Many of the texts on linear perspective describes how the painter needed to keep one eye closed and his head still at the exact same position when observing his subject. The two-dimensional representation is created by projecting light rays aimed at a single point onto a flat surface thereby eliminating the possibility of real depth and movement around the depicted motif. Manovich has described the problem in following way:

"... the first screen apparatus, Alberti’s perspectival window, which, according to many interpreters of linear perspective, presents the world as seen by a singular eye – static, unblinking, and fixated. As described by Norman Bryson, perspective "followed the logic of the Gaze rather than the Glance, thus producing a visual take that was eternalized, reduced to one ‘point of view’ and disembodied."

(Manovich, 2001)

The disembodiment represents an amputation of the normal bodily function – reducing the viewer to a single eye – deprived of mobility and ability to change of perspective. The audience all see the image through the same set of optics and the possibility of interpretations are reduced by that effect.

The monocular representation has been challenged on several accounts through history, though, in early history by the stereoscope and later by 3D glasses and head-mounted displays. All of these have relied on binocular representation by projecting two different images into each eye and thereby still producing a virtual representation of the subject.

Like the linear perspective expresses a desire to mimic or represent reality on a two-dimensional surface, the virtual reality phenomenon dominant in the 1990s expressed a similar desire to reach even further: into the third dimension. Although much research was put into the field the attempts for mimesis were never really successful. Virtual reality in a way represents the peak of human desire to achieve perfect representation, and its lack of success shows that this is not likely to happen. The medium will most likely never be transparent.

This "myth of transparency" is a part of a greater "problem of representation" or what the Post-Modernists called the "crisis of representation" to underline the constructed nature of representation in itself. We are increasingly exposed to media which claims to be "even more real" – screens becoming larger, higher definition, and now also including ability to use 3D glasses in the home cinema. This all contributes to a higher sense of immersion and suspension of disbelief. Many influential thinkers have criticized the immersive experience. Walter Benjamin referred to the cinema experience as "reception in a state of distraction" pointing to the disengagement of criticism and reflection, which contrasts the contemplation and absorption in the experience of art. Guy Debord has criticized the spectacles of modern society with a special emphasis on the dominance of media and its ability to separate and isolate individuals.
THE LOW-RESOLUTION SCREEN

A pixel is the smallest visual part of a digital screen. It represents a single dot in a matrix, which in its whole make up the image surface. This type of image representation depends on the visual perception of the eye and its ability to create connected shapes by principles of proximity or closeness. What is perceived as an array of square pixels becomes connected shapes, figures or letters in the perception of the creative eye, as Arnheim describes it (1974). Each pixel is usually produced by a light source, which in them self can be said to be “a medium without a message” (McLuhan, 1964). The pixels constitute semiotic signs, and do not carry any meaning in itself (other than what can be attributed to the cultural symbolism of colors), but form new signs by their juxtaposition and the following semantic interpretation.

The deconstruction of images into pixels can be compared to the mosaics of ancient Roman Empire, which employed small colored tiles of various materials to construct images on walls, ceilings and floors. The pixelation patterns were not always square, but shaped to follow the contours of the depicted elements, which enabled the mosaics to draw shapes that did not follow a square grid. The mosaics served as decoration, ornamentation, symbolic imagery, and as a protective coating of floors and walls.

Another evidence of pixelation in the history of visual representation can be found in the pointillist paintings. Artists like Paul Signac, Camille Pissarro and, most notably, George Seurat pioneered the technique of applying small dots of paint, which blended into grained figures when viewed at a distance. Signac has provided the term divisionism as an alternate description to pointillism that instead of points only highlights the separation of brush strokes on the canvas. Seurat, on the other hand, preferred to call the technique chromo-luminarism, which articulated an interest in expressing the surface as both color and light. This notion of painting with points of light was picked up by Marshall McLuhan and interpreted as an entirely new mode of representation and perception, which drew the viewer inside the picture:

"by utilizing the Newtonian analysis of the fragmentation of light, he (Seurat) came to the technique of divisionism, whereby each dot of paint becomes the equivalent of an actual light source, a sun, as it were. This device reversed the traditional perspective by making the viewer the vanishing point." (McLuhan, 1968, p. 22)
The effect of an image created by light shining through the surface, instead of on the surface, represents to McLuhan a reversal of perspective, which makes the viewer immersed in representation. To McLuhan, this marks an anticipation of electronic media, which, many years after Seurat, became the prevailing source of visual representation.

With the invention of the digital screen there was a need to create a uniform pattern of pixels to ensure versatility to different graphical content. Early computer screens had very low resolution, as well as limited number of colors, which resulted in very crude graphics that were often difficult to interpret. The limited number of signs (pixels) produced by these screens preserved a sense of ambiguity in the expression, which posed challenges to the creative eye. As users became accustomed to the pixelated signs, the visual elements in a sense became icons of a conceptual understanding of their function. As technology has developed screens with increasing number of pixels, we have now reached a point where most visual representations are displayed in high definition, which causes less ambiguity in the visual perception. The difference between high and low resolution can be compared to the distinction between hot and cold media by McLuhan:

"A hot medium is one that extends one single sense in "high definition." High definition is the state of being well filled with data. A photograph is, visually, "high definition." A cartoon is "low definition," simply because very little visual information is provided. ... hot media do not leave so much to be filled in or completed by the audience. Hot media are, therefore, low in participation, and cool media are high in participation or completion by the audience." (McLuhan, 1964, pp. 24-25)

Hot media, in other words, induces a mode of perception, which is less engaged with interpretation. This bares a striking resemblance to Benjamin's description of "reception in a mode of distraction", referring to the habitual perception of many modern representation devices, among others the cinema. This reception mode contrasts the concentration, which often occurs in the contemplation of art. Seeing the low-resolution screen as a cool medium, it may therefore hold a potential for aesthetic exploration by its ambiguity and, presumed, higher level of engagement in visual interpretation.

American artist Jim Campbell has produced several works that displays low-resolution video by the use of individual light sources mounted on a plane surface. In his "Fifth Avenue series" (2001) he employs a gradual blurring of the high-pitched pixel, which points to the perceptual sense making of pixel-images. He describes the works as:

"A matrix of 32 x 24 (768) pixels made out of red LEDs displays a pedestrian and auto traffic scene in NY from an off-street perspective. There is a sheet of diffusing plexiglas angled in front of the grid. As the pedestrians move from left to right the figures gradually go from a discrete representation to a continuous one (or metaphorically from a digital representation to an analog one)." (Text from www.jimcampbell.tv)
The description reveals the common conception of the pixel matrix: its decent from the digital domain. The uniform distribution of dots has become a visual language in itself, which instantly connotes a lot of meaning. Campbell's work points to this convention and literally blurs the borders between digital and analog representation. In the crude graphics we are faced with signs that are "open" and less iconic in appearance.

METAPHORS FOR REPRESENTATION: THE WINDOW AND THE MIRROR

"Let me tell you what I do when I am painting. First of all, on the surface on which I am going to paint, I draw a rectangle of whatever size I want, which I regard as an open window through which the subject to be painted is seen; and I decide how large I wish the human figures in the painting to be." (Alberti, 1435)

Alberti's famous window from "De pictura" (On Painting) was conceived in the early renaissance in 1435 and has become the prevailing metaphor for both paintings and any other type of two-dimensional representation. It serves as an insight into how the linear perspective is constricted as a framed view upon the world, as it is still today. The albertian window, as it has been named, has often been used as a tool to criticize visual representation as a myth of transparency, especially during modernism. Dadaist artist Marcel Duchamp's "Fresh Window" (1920) depicts a reverse albertian window: it is closed and its glass in painted black. It does not look out onto the world, but instead it refuses access to it. The "Fresh window" becomes, like the original window, just a surface, unpretentious and without perspective.

Anne Friedberg, who has made an extensive contribution to the understanding of the screen as a window, has metaphorically traced the role of the screen as a virtual window back to its origins. She draws several parallels between the virtual transparency of the screen and the spatial transparency in architecture provided by glass, windows, and openings. The screen is not only a physical object, which is placed in space, but causes perceptual transformations of the surrounding space and vice versa. These transformations can be seen in her description of the role of spectatorship: "The screen functions as an architectonic element, opening the materiality of built space into virtual apertures in an 'architecture of spectatorship'." (Friedberg, 2006) The act of spectating then becomes the link between material and immaterial space. The trajectory of Friedbergs argumentation relies heavily on Alberti's window metaphor, which becomes the legitimacy for connecting the screen to architecture. Many scholars have criticized such references to Alberti's window, arguing that the metaphor relies on a misinterpretation of the original text. Joseph Masheck has pointed to the fact that Alberti instructs the painter to draw a rectangle on the canvas, which he must "regard as an open window" instead of regarding the canvas itself the open window (Masheck, 1991). This goes to show how metaphors often become vessels for philosophical exploration.

The dominance of the screen has also inspired critical thinker Paul Virilio to draw metaphorical to the window. The television screen, he argues, has become the new preferred access to the outside. It has become the "third window".

"The first window is the door, the door-window necessary for access to and thus for the reality of the home, since we could not conceptualize a house without some means of access... The
window as such – the second window – appeared fairly late, in the sites of monastic cults, before becoming popular among the rural homes and only then, and especially, in the palace and the homes of bourgeoisie... The third window is a recent invention: the television screen, a removable and portable window that opens onto the false day of speed of light emissions. The television is an introverted window, one which no longer opens onto adjoining space but instead faces beyond the perceptible horizon." (Virilio, 1984, p. 79)

By using the window as a metaphor for the television screen, Virilio attacks the subject in a twofold manner. He both underlines the dominant position that screen has gained in modern homes and at the same time he criticizes the false image this new windows presents. The third window extends the visual abilities of its audience and connects the architectural context to different random spaces by representation. The vision has become global by the use of the new window.

In contrast to the window metaphor it has often been suggested that the screen may in some cases be perceived, as it’s opposite: the mirror. Psychoanalytic film theorists inspired by Lacan’s "mirror stage" theory, such as Christian Metz and Jean-Louis Baudry, look at the film screen as a mirror through which the spectator can identify himself or herself with a hero figure as an omnipotent ego (Metz, 1982). The mirror metaphor is in this case constituted by the immersiveness produced by the cinema experience and refers to the psychological identification process that the viewer undertakes during this experience. Instead of transporting attention away from the viewer situation, as the window might do, the mirror sees the perception of the screen as a process directed back at the audience.

Jay David Bolter and Diane Gromala have described similar reflective potentials in their book "Windows and Mirrors" (2003). In a critique of interface design they attack the so-called "myth of transparency" as a misled understanding that mediation can occur in a natural form without translation. Designers should, instead of trying to make the computer screen transparent, accept the impossibility of this task and embrace the potentials of its opposite. By accepting that the computer screen cannot rely on "natural" modes of interpretation, Bolter and Gromala argues that the computer instead holds unique possibilities to create new types of interfaces that makes the user reflect on his interactions with the screen. This invokes the "mirror" metaphor, which to them becomes a new aesthetic ideal for the screen.

ESCAPING THE SURFACE

In spite of the predominant flat, rectangular shape of both paintings and media screens, there have been attempts of transgressing the border and escaping the surface. An early account of this tendency may be seen in the tromp l’oeil paintings of the baroque period, where artists created illusions by merging the border into the painting itself. Painted ceilings seemed to open into a blue sky or illusionistic windows were painted onto walls – hereby fooling the eye of the beholder (as the term suggests). The technique has been widely used throughout history to create optical illusions, but also serves to prove how modern vision has been cultivated to such a degree, that frame acts as a undisputed marker between real and virtual space.

The pursuit of realism through illusion became especially pronounced during romanticism, where new types of illusionistic devices like the cyclorama, the phantasmagoria and the stereoscope were invented. As the photography gained status as an exact reproduction of reality, painters were forced to find new ways of representation that surpassed the possibilities of single point perspective.

Perhaps "Escaping Criticism" (1874) by Pere Borrell del Caso is a meta-image of the crisis that struck the art-world, when critics became aware of the representational schism that was on its way. The boy portrayed virtually climbs out of the painting. The painted frame on the canvas is such a conventional visual element, that the viewer is fooled to believe that the boy is outside the surface. The example serves to highlight both the inherent crisis of representation in painting, but also a desire to escape the flat surface of the canvas, the screen, and in general, the surface.
The surface has throughout history been a problematic character that artists have tried to challenge in many ways. American art critic Clement Greenberg has characterized the Modernist painting as the recognition that canvas is inevitably flat and the Modernist expression has evolved by exploring that fact. From the coarse paint strokes of impressionism, the separated dots of pointillism, the flat geometries of cubism, to finally the abstract expressionism that stopped painting recognizable figures and instead saw the canvas as a surface to be transformed with tactile textures visible marks of the painting action. The pinnacle of this trajectory was, according to Greenberg, marked by the "drip paintings" by Jackson Pollock.

"... in several of his huge 'sprinkled' canvases of 1950 – One and Lavender Mist – as well as in Number One (1948), he has literally pulverized value contrasts in a vaporous dust of interfused lights and darks in which every suggestion of sculptural effect was obliterated." (Greenberg, 1961, p. 228)

The virtual depth, the so called sculptural effect which is the offspring of linear perspective, was in abstract expressionist paintings replaced with a tactile surface with a shallow, but real, depth. Painting was in a sense converging towards the sculpture, not as an effect, but as a spatial visual phenomenon. This tendency had actually started many years earlier when cubist painters developed the collage painting, which later led to the development of the assemblage. Concurrent with these explorations, installation art was emerging as a completely new category that transformed entire rooms into artworks in both a sculptural a conceptual manner (Bishop, 2005).

As far as the surface goes, flat painting was ongoing massive experimentation during the Avant-garde movement in the early and mid twentieth century. The previously separated master categories were blurring and the assemblage became one of the main characters in this transformation. Among the reformists were American artist Robert Rauschenberg who merged painting and sculpture in works he called "combines", which usually meant mounting objects onto painted canvases and sometimes even continuing the painting onto the mounted objects. In "Pilgrim" (1950) he placed a wooden chair in front of a painted canvas, thereby extending the canvas to the room and visually connecting surface to the surrounding space.

Pop-artist Jasper Johns had another approach to the departure from flat-surface paintings. In "Three Flags" (1958) he used not one, but three canvases superimposed upon each other in decreasing size. Each of them depicts the same motif: the iconic American flag. This triple exposure of the image somewhat resembles the double-mirror effect that occurs when placing tow mirrors in parallel to each other. Not only does the painting extend itself into the viewer’s space, it also imitates the illusion that the viewer is standing inside the painted space.

Although the experimental approaches performed by Modernists and pop-artists challenged the paradigmatic surface in several ways, they all
worked within traditional static materials such as canvas, paint and objet trouvé (found objects). It was not until the late sixties before new media, in terms of sound an moving images, entered the art scene. But the video screens were flat an lacked a materiality to decompose and manipulate. Norman Bryson has articulated it as follows:

"Though the screen is able to present a scenographic depth, it is obviously unlike the Albertian or Renaissance window: its surface never vanishes before the imaginary depths behind it, it never truly opens into depth. But the screen does not behave like the modernist painting, ether. It cannot foreground the materiality of the surface (of pigments on canvas) since it has no materiality to speak of, other than the play of shifting light." (Bryson, 1999, quoted in Manovich, 2001, p. 95)

Many video installations of the sixties and seventies incorporated the television set as a sculptural figure in the artworks. Korean-born artist Nam June Paik took video art a step further by creating installations of multiple television sets that made up a sculptural form while displaying flickering images on the screens. Paik’s installations manipulated the conception of the screen as a singular centralized medium of representation and instead made the viewer aware of the screens as spatio-temporal figures. Many of these compositions appeared as kaleidoscopic instruments presenting visual infernos that transformed the surrounding gallery space into a part of the installation. A crucial point in the multiplication of screens in Paik’s installations is that instead of looking through the television screen he makes the viewer look at the screen. This part is where the screen is transformed from surface to form. The many screens become a mosaic that is constantly changing and creating new constellations of colors. Unable to concentrate on more than one screen at a time, the viewer is forced to shift attention from a single screen to the entire installation.

THE SCREEN AS ARCHITECTURE

As we study the screen as a culturally constituted phenomenon, it becomes apparent that the problems associated to the screen do not only concern the content of the medium. Not only does the screen evoke perceptual changes to its spatial context, but the physicality of the screen itself may be subject to variations in form and expression. Screens become flexible, expandable, modular and extendable. As screens are exposed to transformations and occupy increasingly more of our physical space, we are going to need new perspectives on visual media that goes beyond the surface. Although Alberti’s window metaphor may rely on misinterpretations, it still represents the prevailing perceptual mode of looking through instead of at the screen.

Like architecture, the visual properties of screen are dependent on both surface and form. Traditionally, the screen has been described only in terms of its surface, meaning the content and how it is presented. Media theory has generally been concerned with the messages produced through the representational surface and not how these
messages are presented – the form. The formal properties of the screen are aspects like: size, scale, shape, color, texture, material, etc. These are all properties that concern architecture and may be subjects to transformations according to the communication strategy applied.

When viewed in a cultural historical context, the screen has a long history that has manifested itself through various mediums. It could be argued that the historical trajectory constitutes a screen culture. As discussed, this culture has performed many attempts to escape the conventional boundaries of representation and is transforming the modes of representation. The screen is not only a transparent window; it is also an opaque surface, and a reflecting mirror.

TOWARDS A MEDIA ARCHITECTURE

Media architecture has already established itself as a practical phenomenon in a variety of permanent or temporary installations. But the field still lacks an ontology and a theoretical discourse to support it. The community has on many occasions discussed the potentials and challenges of media architecture, but only little effort has been put into discussing what media architecture actually is and how we define it. This is, of course, no easy task and there may not be a simple univocal answer. Instead we may perceive it through a number of different perspectives that each highlights different qualities. The following chapter is an attempt to identify some of the most significant aspects of media architecture that I have come across through my participation in the media architecture conferences and through reviewing various literatures on the subject. The intention is to describe these aspects through a variety of "lenses" that each interprets media architecture as metaphors for something else.

MEDIA ARCHITECTURE AS SCREEN

As various examples have shown, the screen is not just a screen. Or, at least, it is not what we traditionally mean when referring to the screen. Screens come in various shapes and sizes and inherit its representational mode from television, cinema, and even painting. The screen is constructed as a visual paradigm with certain assumptions and modes of perception that dictates a certain reception of the medium. But these parameters may be challenged, and have been so, through the history of both art and technology. By experimenting with properties like depth, shape and resolution, we are experiencing new visual and spatial transformations that may alter our current understanding of the screen and its possibilities. The flat surface screen dictates a certain mode of perception, which regards the image as a virtual space that the viewer can look into. By
creating awareness of the architecture of the screen, we may be able to shift the perspective from looking through the screen to looking at the screen and thereby being able to focus on the consequences it may have for our immediate environment. It may be argued that media architecture concerns all types of screens, as it applies a certain sensitivity towards the physical and contextual aspects of the screen. Looking at the various instantiations of the conceptual "screen" we can construct a continuum of the physical evolution of the screen (Figure 19). The small private screens of the TV and the computer are the lowest ranking subjects in terms of physicality. The reception of such screens usually occurs in a small social space in a very privatized situation. The larger cinema screen and the recent phenomenon of urban screens are instead directed toward a larger crowd were reception happens collectively. These screens are often facing a large room or open space that accommodates the crowd, but also forms a physical boundary of the screen space. The third category is the media facade that makes the screen itself into a spatial enclosure. The media facade defines the mass of the building but is also directed toward the urban context that it faces. Depending on its media architecture, the media facade may assume various spatial formations that determine its physicality in the continuum. The last category is the media art installation, which becomes truly three-dimensional. Installations like "Constellation" by United Visual Artists makes the medium into a spatial phenomenon and, in a sense, also makes the space into a medium.

The traditional screen is created for a specific optimal viewing distance with very small variations. The seats in front of cinema screen goes from four to fifty meters, of cause depending on the size of the theater. The normal television is best seen from a distance between two to five meters. The computer screen is typically a half to one meter from your eyes. And your telephone screen is in most cases under fifty centimeters from your head. These distances give the optimal viewing experience in regards to the resolution of the screen and the readability of the content.

When screens are implemented into architecture, the viewing distance may be exposed to even greater variations than traditional screens. The viewer may be up close or he may be hundreds of meters away. This fact addresses issues concerning scale, content and the speed of changes in the content.

New visual representations are not only a concern for our conceptual understanding of the screen. It becomes a practical challenge for the designers who provide content for these new types of media. The limitations that are imposed may force designers to develop new visual languages and perhaps even new tools to create and visualize it.

**MEDIA ARCHITECTURE AS ARCHITECTURE**

A starting point for the following perspective is the realization that "architecture communicates". Although different strategies have been applied to this communication through history, the composition and visual character of architecture has always been able to express certain immaterial qualities. This makes architecture practice of both function and symbolism, while shaping materials into form and surface.

**PHYSICAL EVOLUTION OF THE SCREEN**

<table>
<thead>
<tr>
<th>Metaphor</th>
<th>Presence</th>
<th>Perception</th>
<th>Reception</th>
<th>Field of study</th>
</tr>
</thead>
<tbody>
<tr>
<td>window</td>
<td>wall</td>
<td>skin</td>
<td>situated</td>
<td>media studies</td>
</tr>
<tr>
<td>pervasive</td>
<td>located</td>
<td>reflective</td>
<td>public</td>
<td>sociology</td>
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<tr>
<td>distracted</td>
<td>immersed</td>
<td>ambiguous</td>
<td>architecture</td>
<td>art</td>
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*Figure 19: Physical evolution of the screen*
It is natural to think that media architecture is a "style" or an ideology that is having its golden age in these years and will eventually subside when it goes out of fashion or new ideologies take over. On the other hand, media architecture is not tied to a specific material or expression as many other movements have been. Media may be implemented in various materials, resolutions and forms. Similar to terms like "glass architecture" or "concrete architecture", the term media architecture defines how expression is achieved, but not what is expressed. Media architecture regards architecture as a medium and the matter of style is then a question of content. Dynamic expressions may be achieved through light, but other materials may also be thought of as a mediator. Several unrealized concepts have been made by designers WHITEvoid and realities:united that incorporate reflective materials or colored curtains and panels that mechanically change the expression of the architecture.

At the Swiss Expo 2002 on Lake Neuchatel, American architects Diller Scofidio + Renfo had created a pavilion consisting in its primary expression of mist. The “Blur Building”, as it was called, consisted of thin steel frames that supported a network of tubes, hoses, and nozzles, providing a constant flow of water that vaporized around it. This entire structure was placed near the shore of the lake, and visitors were able to enter by following a narrow walkway. Blur Building was, of course, a highly experimental project, but shows how architects strive for new ways to break to previous code and how immateriality may be implemented in many ways and materials. The cloud surrounding the building could in some ways be compared to a medium in its dynamic character and constantly changing expression. The architects have even made this comparison in their own description of the project:

“Blur is an anti-spectacle. Contrary to immersive environments that strive for high-definition visual fidelity with ever-greater technical virtuosity, Blur is decidedly low-definition: there is nothing to see but our dependence on vision itself.”
(dillerscofidio.com/blur.html)

This statement shows that the architects perceive the Blur building as low-definition medium that directs attention towards the viewer’s own perception. Like the cool medium described by McLuhan (1964), it provides very little information, thereby leaving much to be filled in by interpretation.

MEDIA ARCHITECTURE AS VIRTUAL ARCHITECTURE
When architecture adopts symbolic expressions it adds qualities that are not tied to traditional architectural function, but may instead be described as immaterial qualities. Ilka and Andreas Ruby have suggested that media architecture may even be described as the illusion of a virtual architecture in public space. An example could be the many "fake" facades in Berlin, which are merely large, printed posters applied to scaffolding. In some locations, these scaffoldings serve as replacements for real architecture,
making the construction into a "decorated void" – or perhaps a media façade (in the sense that media is not real). This would indeed be the most extreme approach to "surface over form" where the building is reduced to representation and is detached from any spatial function other than that of the surface. (Ruby et al., 2005)

If media architecture points towards a virtualization of space, it also resembles what Virilio describes as a dematerialization of architecture. Going from real to virtual implies going from material to immaterial. When dynamic images replace static structures, space becomes a property of information – fluctuating and immaterial. According to Virilio, this process was initiated even before the dynamic screen entered the public space.

"In some way, you can read the importance given today to glass and transparency as a metaphor of the disappearance of matter. It anticipated the media buildings in some Asian cities with facades entirely made of screens. In a certain sense, the screen became the last wall. No wall out of stone, but of screens showing images. The actual boundary is the screen." (Virilio & Ruby, 1993)

When the screen becomes a wall, as suggested by Virilio, the boundaries of space are no longer defined by matter but of information. But this tendency is no novelty. Our current society is already overlaid with layers of information that constitutes virtual spaces and creates boundaries that may shift from one place to another. Information space is a space of flows, as Castells (2004) has pointed out, which constantly intersect with the space of places, but in various configurations. Therefore, as Castells argues, must "architecture of all kinds" be "called to the rescue in order to recreate symbolic meaning in the metropolitan region, making places in the space of flows." (op. cit., p. 59). It is possible that media architecture may one of these kinds of architecture that can translate information space into actual places and thereby create meaningful experiences.

MEDIA ARCHITECTURE AS RELATIONAL ARCHITECTURE
Mexican media-artist Rafael Lozano-Hemmer has described some of his early installations as "relational architecture" defining it as:

"... the technological actualization of buildings and public spaces with alien memory. Relational architecture disorganizes the master narratives of a building by adding and subtracting audiovisual elements to affect it, effect it and recontextualize it. Relational buildings have audience-activated hyperlinks to predetermined spatio-temporal settings that may include other buildings, other political or aesthetic contexts, other histories, or other physics." (Lozano-Hemmer, 1999)

Although Lozano-Hemmer's installations are often based on projections of virtual images on existing buildings, he rejects an analogy between relational architecture a virtual architecture. While virtual architecture strives for simulation, realism and illusion, relational architecture, on the other hand, amplifies the spatio-temporal manipulations. Lozano-Hemmer's relational architecture could easily be interpreted as media architecture applied by augmentation of existing space, but not all media architecture fits his description of relational architecture. According to his definition, the content shifts dynamically by the involvement of an audience, suggesting a degree of interactivity with the architecture.

The term "relational" is often attributed to the phrase "relational aesthetics" coined by Nicolas Bourriaud in his book by the same name (1998). Bourriaud defines relational aesthetics as a "theory consisting in judging artworks on the basis of the inter-human relations which they represent, produce or prompt" (Bourriaud, 1998, p. 112) The artworks that exemplifies this kind of aesthetics are created from "a set of artistic practices which take as their theoretical and practical point of departure the whole of human relations and their social context, rather than an independent and private space." (op. cit., p. 113). This would make relational architecture a practice of facilitating shared experiences and intersubjective encounters defining, or defined by, a spatial context.
Relational architecture may result in what Scott McQuire (2008) calls "relational space", which may be interpreted as a space formed by social encounters in the public realm. The relational concept of intersubjectivity can be traced back to influential thinker Edmund Husserl who described its phenomenology. Husserl relates intersubjectivity to "acts of empathy" between subjects interacting (Husserl, 1973).

Relational architecture can provide a social perspective to media architecture in the sense of describing the reception as a shared experience instead of an individual act. Architecture in general has a strong focus on social aspects and media architecture may provide tools to enhance these aspects further.

MEDIA ARCHITECTURE AS TRANSFORMATIONS OF PUBLIC SPACE

Many influential scholars and thinkers have reflected on the influence media has on public space, other pointing to the negative consequences that may follow from it. People like Jürgen Habermas, Richard Sennet and David Harvey have all suggested that public space is undergoing transformations that "privatize" our engagement in public life, and that mass media has a role in this process. Others like Paul Virilio, Marshall McLuhan and the Situationist movement with Guy Debord has more explicitly connected the decline of public life to the developments of new media technology.

The arguments often point towards the lack of control and participation in media, which makes it authoritarian and non-democratic. The media as controlled by capitalist interests and does not serve the needs of the individual citizen. Another issue is the private modes of reception that are dictated by modern media. The use of cell phones and laptop computers removes our attention from our immediate environment and makes the urban life less a matter of public social relations. Commercial advertising imposes authoritarian messages on the public space that allows no room for discussion or expressions of opposite opinions. Relating this discourse to media architecture, there is surely a risk that increased use of screen media in public space may support this disengagement in public life. If the phenomenon does not attain a sense of legitimacy in the public opinion, it could result in a collective opposition. Media architecture must therefore legitimize itself by some sort of relevance to the public. This could be achieved in many ways, for instance by participation, by providing public service or by artistic expression.

American artist Jenny Holzer performed a series of interventions on public space in the late 1970s called "Truisms" where she leased time-slots on commercial electrical billboards around USA, Times Square among others, and used them for provocative statements like: "Private property created crime" and "Money creates taste". The reason why she chose the electrical billboards, as her medium is possibly that this...
medium was only used for commercial advertising at the time. This ironic framing of her statements made them even more powerful. What "Truisms" suggest is that electric media holds a dominating position in public space, which is usually not accessible to the common citizen. When Holzer's political statements appeared on the public screens, people immediately became aware of issues regarding the politics of public space.

The various issues that are raised by both Holzer and literary thinkers somehow all relates back to the question of who owns public space. Or maybe the question would be posed more adequately by asking who controls public space. Virilio compares the facades of the city to an interface that allows access to different functions:

"In fact, since the originary enclosures, the concept of boundary has undergone numerous changes as regards both the facade and the neighborhood it fronts. From the palisade to the screen, by way of ramparts, the boundary-surface has recorded innumerable perceptible and imperceptible transformations, of which the latest is probably that of the interface. Once again, we have to approach the question of access to the city in a new manner. For example, does the metropolis possess its own facade? At which moment does the city show its face?" (Virilio, 1984, p. 12)

In December 2006 the city of São Paulo decided to ban all outdoor advertising and thereby stripping the city of billboards, banners and electronic signs. The Clean City Law was a decision to clean the city in regards to water, sound, air, and most controversially: visual pollution. The decision shows an extreme case of how the politics of public space can lead to legislations on the visual expressions in public space. Media architecture could also be subjects to such political considerations of ownership and pollution of the visual environment". 
CONCLUSION: THE FUTURE OF MEDIA ARCHITECTURE

As the different perspectives on media architecture unfolds it only gets more clear that the issues related to this subject originates from various traditions including art, philosophy, sociology, media theory, and architecture. But often it appears that one field alone cannot cover the range of implications deduced from these issues. Media architecture calls for a truly interdisciplinary discourse.

One of the first steps that must be made, is to establish an ontology that attempts to place the phenomenon into a cultural causal relation. This would imply that media architecture has evolved out of existing cultural phenomena and that these can be identified as supporters of this development.

A possible perspective on the origin of media architecture is to describe it as an evolution of ideas and practices that converges from both architecture and screen culture. When we speak of convergence in media, it traditionally implies that the different media forms will eventually merge into a multi-medium that can perform all requirements that media can provide. Seeing media architecture as convergence does not necessarily indicate the same type of merging, but rather describes the phenomenon as a result in a series of undercurrents that to some extent can be ascribed to shifts or developments in both architecture and screen culture.

The practice of architecture has in recent years turned toward the use of new tools, which provides alternatives the Cartesian plan and Platonic solid, and instead moved the conception of space into the realm on non-Euclidean geometry. Concurrently there has been a development in art where artists have made various attempts to break with the linear perspective and the paradigmatic surface of the canvas – a development that can be characterized as shift from looking through to looking at the image.

The field of media architecture has in its numerous instantiations established itself as a new and experimenting approach to technology. It is, in many ways, a violation of the specific codes of architecture that expresses a signs of ambiguity towards its surroundings. The future of media architecture relies of whether architects and designers can keep finding new ways of violating the rule and challenge our perception. This may even mean challenging media architecture’s own rules.
The following pages contain descriptions and reflections on a project that was conducted in the period from autumn 2009 to May 2010. The project concerns planning and designing a media facade for the Denmark Pavilion for the Shanghai Expo 2010. My role in this project has been as a project coordinator and the main visual designer for the content. The purpose of this work has been to provide an insight into the practical challenges related to the design of media architecture and at the same time providing the possibility to let the experience from the work influence my theoretical reflections on the subject. The reason for including it in this master's thesis is to provide documentation for my work, while demonstrating that the application of media architecture causes both theoretical and practical challenges that may affect each other mutually.

A BRIEF HISTORY OF WORLD'S FAIRS

The history of world expositions dates back to 1851, where the first international world's fair were held in The Crystal Palace in Hyde Park, London. Under the title "Great exhibition of the works of Industry of All Nations", the fair was initiated by Prince Albert to be an international exhibition of manufactured products. The fair was inaugurated on the 1st of May by Queen Victoria in the newly erected Crystal Palace – a marvel of industrial engineering with its slender iron construction and thousands of glass panes. The building housed 14,000 exhibitors from 25 countries, which exhibited the novel advances in industrial manufacturing. The exhibition was aimed at inventors, engineers and craftsmen, but also sparked an interest among the general public. During the five-month period of it's running it received six million visitors from both England and abroad.

After the first world's fair, the event became a recurrent phenomenon that appeared in varying major cities every two-to-five-years, primarily driven by French initiative. Especially the Universal Exposition in Paris 1889 has become world famous by making the Eiffel Tower its trademark. Usually the fairs lasted about three-to-six-months. In 1928 an alliance of 31 countries gathered to form the Bureau International des Expositions (BIE), which would organize the formal regulations regarding future fairs.

In the early years of the world's fairs, the aim was to exhibit technological inventions and advancements to the general public. The idea was, of cause, to generate attention towards these developments in order to inspire the public of the host country and to gain new knowledge of the current state of industrial progress. This notion of being beneficial to both the host nation and the participating nations has been the driving force behind the world's fairs throughout history. The motivation is therefore not tied to instant economical revenue, but rather the added cultural awareness and potential incomes by a later increase in export and tourism. Much like the Olympic Games. This economic model may be seen as an early example of experience economy (Pine & Gilmore, 1999), as it relies on the immaterial value of experience to generate future profit for the participating nations.

After the Second World War, focus began to shift towards the exchange of cultural values of the participating countries instead of industrial production. During the sixties word fairs were increasingly associated with the appellation of "an exposition" – later to become known as "Expo" in short.

At present day, the BIE holds 157 members which form a governing body that establish the formal regulations, such as the selection of host nations, frequency of Expos and the regulatory framework that ensures a fair and equal treatment of all participating nations. The BIE also help organize the theme associated with each Expo. As stated on the BIE's official website "The Theme Makes the Expo". It further states: "A successful Expo must have as its foundation a theme whose treatment
is a priority for the whole of the international community. This indicates a high emphasis on global responsibility and a commitment to global issues that may benefit all nations. Since the formation of BIE there has existed a distinction between registered (or universal) expositions and recognized (or specialized) expositions, the major difference being the size and thematic scope of the event. At registered expositions, the participating nations are encouraged to build their own pavilions, and hereby giving a greater opportunity of branding the notation through architectural expression.

ARCHITECTURE AND EXPOSITIONS
All throughout the history of Expos, architecture has played a major role as an “avant-garde” of contemporary architectural achievements. Quite a few original expo buildings have been preserved due to their popularity and iconic status for the host nation. Among these are The Crystal Palace (London, 1851) (which perished in a fire in 1936), The Eiffel Tower (Paris, 1889), Grand Palais (Paris, 1900), Atomium (Bruxelles, 1958), The Space Needle (Seattle, 1962), New York State Pavilion (New York, 1964), Habitat 67 (Montreal, 1967), United States Pavilion "Biosphere" (Montreal, 1967), and many others.

Expositions have often been criticized for its rather superficial approach to both exhibitions and architecture. Umberto Eco has written "A Theory of Expositions" in 1967 where he forms a semiotical critique of expositions based on his experience of the 1967 Expo in Montreal. Eco begins by asking the central question of there still is relevance for expositions today, and whether there will be relevance for its continuation in the future. Considering that the text is more than forty years old, this question seems somewhat ironic. He continues to analyze the different approaches to architecture that different nations have applied to their pavilions while making a critique of the connection between symbolism, function, and the meaningfulness in experience that results from this. The argument is that the architecture of expositions does not comply with the traditional architectural code where symbolism is subsidiary to functions. Exposition architecture puts its main emphasis on the communication of symbols and often looses its connection with meaning in the process.

"In an exposition, architecture proves to be message first, then utility; meaning first, then stimulus. To conclude: in an exposition we show not the objects but the exposition itself. The basic ideology of an exposition is that the packaging is more important than the product, meaning that the building and objects in it should communicate the value of a culture, the image of a civilization."

(Eco, 1967, p. 299)

Eco here draws attention to the national symbolism that is incorporated into the nation pavilions, often referred to as "nation branding". He concludes by providing three possibilities for expositions of the future. The first is an exposition of open symbolic objects that provides a sense of ambiguity similar to the experience of art. This will yield a number of different interpretations and increase the freedom and creativity of the recipient of the message (op. cit., p. 303). The second possibility is the exposition as an educational instrument, a teaching device, as Eco
describes it. The exposition in Montreal displayed many different attempts to teaching its audience, some more successful than others. It is central to this possibility that the teaching reached its audience at an aesthetic or emotional level in order to convey its message. The final possibility for a future exposition is to regard it as "an enormous laboratory, not to be criticized for its immediate results, but for its bequest of suggestions and ideas for architecture and design" (op. cit., p. 306).

As a somewhat bewildering conclusion, Eco returns to this experimental and stimulating value as the real justification of future of expositions, while still questioning its usefulness. Although Eco’s text is more than forty years old, the central questions may still apply. Does expositions still function as a laboratory for experiments that points the direction for the future?

SHANGHAI EXPO 2010

The theme of the Shanghai Expo 2010 is "Better City, Better Life", hereby focusing on improving urban life on an international scale. This notion is elaborated by the BIE to advocate the concept of the "City of Harmony" as a goal for future cities around the world. To approach the question of harmony, the Shanghai Expo will focus on five different perspectives: culture, economy, science and technology, and rural-urban interactions. These five perspectives are further elaborated through five sub-themes: Cultural Diversity, Economic Prosperity, Scientific Innovation, Communities, and Rural-Urban Interactions. All together the themes and sub-themes are used for exhibitions in so-called theme-pavilions, but also serves as an inspiration and a focus for the national pavilions throughout.

By putting substantial emphasis on both the main theme and the sub-themes, the Shanghai Expo aims to contribute to resolving global issues of urbanization and sustainability in urban development. The various national pavilions are encouraged to adopt their individual interpretations of the subject and thereby producing a wider articulation of the urban solutions.

THE DENMARK PAVILION 2010

The commission for the Danish pavilion at Expo 2010 was appointed to Danish architects BIG in a joint venture with construction engineers Arup and exhibition consultants 2+1. The team won the competition in September 2008, featuring a double-spiral building revolving around a pool of water with the famous Danish sculpture The Little Mermaid in the center.

The overall theme and title of the pavilion is "Welfairytales" – a verbal composition of welfare and fairytales – and is intended to propagate the results of the Danish welfare model through tales of how we live, what we love and where we are going (www.expo2010.dk).
The spiraling building acts as a three hundred meter long exhibition area, featuring photos, video projections, a shop, two bars and a bicycle lane that runs along the entire exhibition area. The outer facade of the pavilion is perforated with almost four thousand holes in various sizes and configurations. These holes act as both an expressive surface that gives the building a texturized visual character, but also serves the purpose of allowing sunlight and air into the interior of the building. Because of the double-looped structure of the building, the facade is almost three hundred meters long and can at be viewed, at some angles, as two bands above each other. The exceptional shape of the building poses a lot of challenges to the construction of the building, and has had a vast impact on the design of the other parts of the building.

The layout of the holes reflect the statics of the building, meaning that the facade is a part of the load-bearing structure, and holes are made only where the statics and the inner construction allows them to be displaced from the structure. The angled halftone pattern of holes in varying sizes is made on the basis of a calculated map of the overall building statics. In that process, the stresses on the building become an architectural expression that also communicates the inner structure and layout of the building.

In a sense, the logics of the facade can be seen in parallel to some of the principles of the architecture of ancient antiquity, where structural elements are articulated and amplified as a part of the facade expression. But instead of arcs and columns, the facade expression on the Danish pavilion is based on digital models and calculations that are transferred to the construction process. The visual impact may not be as clear as in ancient times, but it is an indication that structural principles still has a role in the design of architectural surfaces.

THE CAVI FACADE

The collaboration between CAVI and BIG took its point of departure in a research project entitled Media Facades, started in 2007 at Aarhus University. The research project was financed by the Danish Agency for Science, Technology and Innovation and included co-funding from the project-partners: architects BIG, lighting manufactures Martin Professional and graphic animators Wall of Pixels. Through a two-year period, starting in October 2007, the aim was to explore new concepts for media facades that investigate aspects such as visual and spatial qualities, interactivity, and the impacts on urban and social life in public space.

The design team involved in the research project has consisted of project leader Rune Nielsen (MA Arch., PhD) and myself. Grad student Rasmus Enø Pedersen, who has worked on process analysis, has assisted in documenting the progress of the project. A handful of other researchers, programmers and technical staff at Aarhus University have
contributed during the various other cases. Half way into the Expo case, Morten Lervig (head of CAVI) joined the design team and took over the role of case leader from Rune Nielsen.

Previous cases developed in the Media Facades project include: Aarhus by Light – a playful-interactive media facade on Concert Hall Aarhus in collaboration with Martin Professional and Wall of Pixels. House of Industry – proposal for a dynamic facade as a part of competition material in collaboration with architects 3XN. ColorScan – a responsive lighting installation for the entrance of Skanderborg festival in collaboration with Martin Professional. Climate on the Wall – an interactive facade-projection on "Riddehuset" in Aarhus created for the climate exhibition CO2030 arranged by the municipality of Aarhus. Dokken – a proposal for an experience-oriented exhibition at the new Danish Maritime Museum in Elsinore as a part of competition material in collaboration with BIG.

At the time where CAVI entered the EXPO-project, the design of the pavilion and its facade was almost fixed and the tight schedule did not allow for any modifications. The idea of illuminating the four thousand holes in the facade seemed like a clear-cut case for a media facade that would articulate the expressive pattern of the facade during the evening hours of the Expo. Therefore, the CAVI-team (Rune Nielsen and Tobias Ebsen) suggested adding lighting fixtures into the cavity wall above each tube going through the facade. The tube would then have to be made from a semi-translucent material that would make each hole appear as an illuminated tube-shaped pixel on a media wall. This meant that the lighting fixtures would be hidden, hence becoming a part of the building. At once the tubes would serve a double function: as an open window in the daytime, allowing sunlight and fresh air to enter the building, and at nighttime they would serve as illuminators, outlining the shape of the building and acting as mediating layer between inside and outside. By turning the facade into a media wall, the facade itself would, by metaphorical reference, become a window constructed by the windows of the building.

Transformation of the existing tubes in the facade into pixels would produce a low-resolution screen, with an extremely wide aspect ratio and an angled pixel-grid. The tube-shape of each pixel meant that pixels would be less visible when viewed from the front than when viewed at an angle. Because of the spiraling building structure, the screen would appear not only circular, but also double circular, exposing two parts of the facade on top of each other, when viewed from certain perspectives. These spatial qualities appealed to us by providing alternative perspectives on the shaping of visual content on an architectural form. By using the pre-existing architectural features of the pavilion, we would be able to gather first-hand experience in integrating media technology as an architectural material. It furthermore provided a possibility of gaining knowledge from the process of developing a large-scale installation that would persist for a longer period of time.
MEETING THE ARCHITECTS
At the first meeting with BIG it became clear to us, that they had a very distinct vision for the design of the pavilion. The design was build around a very strict minimalistic strategy, including smooth surfaces, hidden installations, and a narrow color-scheme consisting primarily of white, only with a few details in black and red.

At the starting point, BIG did not want the facade to add any additional narratives to the building, and the facade should be illuminated only in white light. Furthermore, they were against the idea of people interacting with the facade, as they feared it would become a "toy" for the audience and remove attention from the building itself. The architects envisioned the facade-light as primarily having the function of illuminating the existing properties of the building.

At first, these constraints seemed to us like a very harsh limitation to our work, which almost made us give up on the project. In previous projects we had not been constrained in such an early stage in the process, and limitations had often appeared in form of technical possibilities. Through discussing with BIG, we became aware that their concerns were directed towards the general impression of the building as a whole, and not to let the facade disrupt this continuity. Realizing this aesthetic approach, we decided to take on the challenge of developing an interesting lighting concept under these conditions.

DEVELOPING A CONCEPT
Developing on the constraints given by the architects, we took a point of departure in the notion that the facade would serve a double function, as both visual expression and as a light source for the interior of the building. Our thoughts soon began to turn around the notion of responsiveness in respect to the illumination of the facade. By using light-sensors, we would be able to dim the facade-light in response the changing lighting conditions.

THE ADAPTIVE LIGHTING CONCEPT
The first idea was to mount light-sensors near every hole in the facade and thereby making every lighting fixture respond to the light or darkness at the given position on the facade. The resulting expression would hereby reflect the inverse light level, adding another layer of information to the facade. Shadows cast on the facade by clouds or other obstacles would then make the facade illuminate in patterns or entire sections, creating self-generating and ever-changing content for the medium.

The functional logic behind this concept would be in line with the logic behind the layout of holes in the facade. The audience would be able to affect the illumination by casting shadows on the facade and form luminous patterns as a result of these interactions. The concept provided a simple poetic solution with complex expressive impacts on the building.

Reflection: The notion of adaptive facades as a way of making dynamic expressions is not new, though. At the 1967 World’s Fair in Montreal, the United States pavilion featured a 62-meter high geodesic dome designed by architect Richard Buckminster-Fuller. The unique geodesic form was constructed from identical triangles that were fitted with acrylic panes to create a weather-resistant interior. Some of the triangular cells had automatically retractable blinds in order to control the temperature inside the "glass-house" dome. These blinds would then open or close, creating changing patterns on the facade throughout the day. Unfortunately, the automation system was faulty and had to be disabled shortly after the opening.

Another noticeable example would be Jean Nouvel's Institut du Monde Arabe in Paris, completed in 1987. For the outer facade panels, Nouvel designed a wall of 240 quadratic panels, each featuring 21 motor-controlled irises that would both control the amount of sunlight entering the building and form a ornamented surface in style with Arabic tradition. These blinds were independently controlled by light measurements and would therefore change in various patterns throughout the day. As with the Buckminster-Fuller dome, these
mechanisms has unfortunately been disabled due to flaws in the electronics.

SCALING IT DOWN
Having circled around the concept of adaptive illumination of the facade for a while, we slowly began to realize the complexity of such an installation. No standard product existed to connect the thousands of sensors to a digital hub, so we would have to custom-make a massive amount of parts in order to complete the concept. We also realized that due to the angle of the sun, people would not be able to cast shadows on the facade, so the amount of sensors seemed somewhat "overkill" for the rather limited expressive abilities we would be able to achieve.

Coming to terms with these realizations, we decided to scale the installation down to sixteen light-sensors placed a regular intervals along the facade. From the measurements we would be able to determine which part of the building was in the shade and which was in direct sunlight. We would then be able to dim the light where the facade would be in direct sunlight, and only illuminate the part of the facade where the building were in shade of itself or other buildings close by.

EXPLORING THE DESIGN
A major downside to this new solution was that the limited amount of sensors would not generate the detailed patterns that we had envisioned in our original solution. We therefore started to explore what kind of design and possible video content would fit the facade of the pavilion. In order to do so we would first of all need to establish a communication strategy for the visual design and secondly, we would have to find a way of testing our designs before the building was actually built.

THE DESIGN MANIFESTO
In order to narrow down the possibilities, we decided to write a manifesto that would define our opportunities of expression. This was meant as both a limitation and an inspiration for the rest of the process. It would at the same time function as a thread in our work and a visual communication strategy.

The manifesto took its point of departure in the wishes already expressed by the architects and the design scheme that was laid out for the exhibition material. Elaborating from that, we formed these initial guidelines:

- **Medium.** The facade light is not a screen and should be regarded as a part of the architecture.
- **Architecture.** The lighting design should underline the architecture and not constitute a visual takeover.
- **Form.** The visual expression should be created with sensitivity towards the layout of lighting fixtures and the pattern they form on the facade.
- **Speed.** All movements and changes in light must be slow.
- **Adaptive.** Light levels are adjusted according to sunlight measurements.
- **Colors.** The overall color-scheme primarily consists of white or shades of gray, with some details in ether black or red.
- **Visual content.** The visual content should build on already existing visual features of the pavilion.

The purpose of this manifesto was to articulate some of the common understandings existing among the team, and further to establish a strict set of rules to ensure that the ideas among the team members progressed in the same direction. Manifestos have on many previous accounts been used in the field of design to mark out a commitment, an aspiration or a direction of development. In our case it was important more as process and a method for us designers to negotiate and agree on central points in the design.

The agreed resolution was to keep the lighting design fairly low-key – or "ambient" as we often formulated it – in order to blend in with the architecture. This meant slow movements, limited colors and an adaptive behavior in regards to daylight.
VISUALIZATION TOOLS

We shape our tools and thereafter our tools shape us.
(Marshall McLuhan, 1964)

An essential step towards creating lighting designs was the development of visualization tools. The complex shape of the building and the unusual layout of pixels made it impossible to use existing software tools. Therefore the design team needed ways to create truthful simulation of how the lighting patterns would look on the building. After weeks of development, the team came up with two different approaches that would each cover different needs in the process.

First of all, programmers developed a 3D virtual model of the tubes in the pavilion based on CAD-drawings from the architects. In this model designers would be able change the colors of every tube in real-time, while being able to turn the model around and view it from different angles. This was a simple and lightweight tool that was easy to run as a visualizer while designing content. Similar visualizers existed on the market, but none of them were able to represent the lighting fixtures as tubes, nor were they able to place the tubes in double spiral shape. This is yet another indication that producers of media technology has still not realized the spatial potentials of media architecture.

The second tool was a physical scale model in 1:100, on which we were able to project the holes onto using three video projectors. Using virtual 3D technology, the model was able show the holes as they would illuminate on the pavilion, as well as simulate the daylight and shadows cast by the sun. This tool was based on technology recently developed by CAVI in order to match physical objects with their 3D virtual counterpart and thereby add visual content at exact locations on the object.

The physicality of the projection-model proved to be a valuable visualizer for conversation among the design team, but also made it easy to explain our ideas to the architects when presenting our work. As the main projector was mounted in the ceiling, designers were able to walk around the table on which the model were placed and share...
conversations on the design. A downside to the projection model was that we were not able to recreate the visual perception of tubes in the facade. The resolution of the projectors we had was not high enough to draw a small stroked circle for each of the tubes in the facade. In fact, no projectors existed that would be able to draw that level of detail without being put too close to the model. The compromise was to project filled circles with a slightly larger radius onto the model. While realizing this unfortunate limitation, we still found the model useful as a visualization tool, but reminded ourselves to constantly use it in conjunction with the 3D virtual model.

The development of visualization tools only stressed the fact that the building was too complex to represent in two-dimensional environment. These tools represented two very different approaches to visualization that each had their strengths and limitations. This underlines the need for new tools that support the development of media architecture in ways that realize the spatial nature of this phenomenon.

FROM SCREEN TO BUILDING

In constructing the facade lights as a media facade, we first needed to consider how to translate imagery in the computer into individual lights, or pixels, in the facade. As is the case for many media facades, the surface can be conceptually unfolded in CAD software to from a flat surface and thereby be understood as a two-dimensional structure. In that way we were able to produce images for the facade in two dimensions instead of three, which would simplify the process greatly.

This "spatial-downgrade" was necessary in order to reduce the complexity of designing for the three-dimensional facade, but at the same time made the task of designing less connected to the spatial qualities of the building. Although it provided a lot of advantages, we also lost the ability to design for the building in all three dimensions. By considering the spiraling facade as a flat image, we were no longer designing for space, but for a surface – in fact reducing facade architecture to an image. The loss of spatiality is, unlike Virilio's "Lost Dimension", not produced in the urban environment, but is introduced at conceptual stage in the planning process.

The step is a condition of fact that computers perceive the world as being two-dimensional on a basic epistemological level, whether it being text, images, graphics, user interfaces and even 3D graphics are eventually projected onto a two dimensional screen in order to represent it to the user. In our case, it was the lack of proper tools to design content for a 3D medium that was the rationale for moving the design process into two dimensions.
When unfolding the facade of the pavilion, it produced a 300-meter long and 12-meter high structure, with a wavy shape due to the spiraling form of the building. This means an aspect ratio of 25:1, which is 225 times wider than what we normally define as "widescreen".

MAPPING THE PIXELS
With the two-dimensional facade rendering at hand, we were then able to work out the ways we would translate from digital imagery to lights in the facade. The main challenge here was to decide whether to perceive the screen as being shaped by the building or the building being wrapped in a screen. In other words: should the inputted images be projected horizontally on the building or warped to follow the shape and contours of the spiraling facade.

Figure 30: the façade (a), horizontal mapping (b), and warped mapping (c)

After discussing the issues with our programmers, we ended up implementing both translations in an application called the "Input Handler". This input handler would function as a translator between the content we designed and the data signals that were sent out to the lighting fixtures in the facade.

By scaling down the drawing of the facade, we were able to produce a list of coordinates, known as a pixel-map, where colors would be sampled from the input image. Because the holes in the facade were aligned in an angled grid formation, the coordinates would be situated at decimal pixel positions, requiring that colors were sampled as a weighted average of several pixels – a process called sub-pixel sampling. This sampling method was necessary to ensure smooth lines without aliasing-effect.

The programmers at CAVI produced three different pixels-maps in order to have the greatest amount flexibility when designing for the facade. The first represented the horizontal mapping of the content, which would be required in order to create content with horizontal lines or movements from the ground to the top of the building. The second mapping was the warped translation of the image onto the facade that would enable us to design content that could follow the contours of the building. As the third and last, we added a "direct" mapping technique, that mapped each hole in the facade to a pixel on the input image. This direct mapping were provided to allow us to design content that targeted individual pixels instead of sub-pixel samplings.

After completing the mappings for the input handler, we were then able to produce images, videos and animations in a wide, but narrow, format and test it on our two visualization tools.

DESIGNING CONTENT
The process of designing content for the Expo pavilion can be described in three stages: expansion, reduction and finalization. In the first stage, the aim was to expand the window of possibilities by bringing every idea to the table and preferably test it out on the visualization tools. This initial stage lasted a few weeks and included a workshop with professional animators from our research-project partners Wall of Pixels. After this uncritical expansion process came a phase of selecting the best ideas and visual features to proceed with. This greatly reduced the number of possibilities. The final stage of the design process was played out on-site in Shanghai, when designs were tested and modified in accordance to the actual building.
STAGE 1: EXPANSION
This early part of the process was about collecting and testing as many ideas as possible. The underlying basis was still the points from the manifesto, but we allowed ourselves to become more liberal towards these points and use them as an inspiration rather than a limitation. The point about the "visual content" served as a starting point as we began exploring the existing visual vocabulary.

Shortly after commencing the design process, we decided on conducting a workshop to allow uncritical expansion of the design material at hand. The participators were mostly designers at CAVI, but we also invited two animators from Wall of Pixels to join us and contribute with their animations skills. The idea was to let everyone work on their individual graphics, animations or videos, and then, at the end of the day, collect it all and test it on the visualization tools.

The workshop lasted for a whole workday, and was initiated with a short presentation of the pavilion, the facade and our design values extracted from the manifesto. The manifesto itself was not presented, as we feared it would restrain the expansion process. Instead we encouraged participators to, use Danish culture, Chinese culture, Denmark-China relations, Shanghai, or the visual features connected to the pavilion concept as an inspiration for the work. As exemplifications, we mentioned the Danish and Chinese flags, the bicycles and pedestrians at the pavilion, Chinese signs and The Little Mermaid. On a technical level, we introduced our visualization tools and the format to design for. After these introductions the work commenced.

Most of the designers and animators worked with Flash, while others worked in video-effects or video editing environments. A small group began filming persons walking and bicycling, and animators were creating small animations transitioning between Danish and Chinese flags. Others took different approaches like programming visual effects in Java or using post-production video effects to generate unique experimental designs. Around fifty different design experiments were created and tested on our visualization tools. Some of them were short animations lasting one or two minutes, others were infinite evolving visuals without a restricted duration.

Figure 31: A selection of graphic expressions for the facade

The expansion process was most profound during the design workshop, but throughout the entire design process from November 2009 to the final delivery on May 1st 2010, new ideas and design experiments came up frequently and were presented at our weekly design meetings. As the pool of designs expanded, it was sometimes reduced by new reflections from experiments on the visualization models.
STAGE 2: REDUCTION
The reduction process was initiated as early as during the design workshop itself, but the reduction was not explicit until the final hours. At the end of the workshop day the design team reviewed the designs and a handful was selected for further studies. The selection criteria were primarily based on perceptual visibility of the content, but the designs were also partly judged according to the design values described earlier.

One of the major challenges we encountered when designing the content, was the low resolution, the high pixel-pitch, and the angled pixel-pattern of the pavilion facade. Due to these factors it was almost impossible to imagine how a design would look until it was tested on a visualizer. Many designs looked very convincing on a standard computer screen, but became fuzzy and unclear when we tried them out on the models. While the visual-perceptual qualities were perhaps disappointing, the many less-convincing designs led to a reflective learning process that slowly made us realize the actual limitations of the facade as a screen medium and how these would have to affect our design.

The pixel-pattern, in particular, meant that half of the pixels in our animations were discarded in the mapping process, which made them very hard to perceive as they were intended.

Making our designs in a flat, two-dimensional graphics environment on computers made placement of graphic elements on specific spatial locations become major challenge, as it would not be obvious when working on the design. This was a concern that we had been aware of since the beginning of the project, as discussed earlier, but became more evident as designs were tested on the visualization models.

Apart from the judgments on perceptual qualities, the designs were subjected to judgments of a more qualitative character. These included assessment of the values expressed through the design and the visual qualities of the designs. Discussions on these were shaped by the values described in our manifesto, but were also influenced by personal taste among the designers. As time progressed, opinions converged into a shared understanding of the direction of our work.

After reviewing the designs created at the workshop, we decided to proceed with a handful designs, among them being: slow moving smoke, walking and bicycling silhouettes of people, Chinese characters, black-to-white gradients moving around the building, and a shimmering noise-like surface, creating constantly evolving patterns on the facade.

STAGE 3: FINALIZATION
After months of weekly meetings with discussions on the design, expanding and reducing the pool of designs, we finally ended up with a collection of around ten design ideas. A small presentation film was sent to the architects at BIG in order to consolidate our current progress. The reply was positive although sparse, and made us confident that our work was moving in a direction that suited the BIG's expectations.

Once the architects had approved our ideas, our work then became focused on finding a concept for implementing the various designs in an overall concept for the lighting.

The final decisions concerning the design were mainly made after the first trip to Shanghai and during the second and final trip. Due to the complex nature of the design job, we found it necessary to postpone the completion of the design until we were able to validate it on the actual building. A lot of our original designs were discarded and a few new ones were produced during the final trip to Shanghai.

First trip to Shanghai
The purpose of our first trip to Shanghai was to install our light- and temperature-sensors and to make sure that all the technical installations had been made to suit our needs. The trip lasted only five days and was planned to coincide with the installation of lighting fixtures by a technical crew from Martin Professional. Fortunately, almost all lighting fixtures
had been fitted, which enabled us to perform some preliminary tests on the façade, even though the tubes had not been fitted yet. It turned out that a lot of the content we had prepared was extremely difficult to perceive from the outside. The walking and bicycling silhouettes became blurred flashes of light that were indistinguishable from each other. Other content like scrolling text worked far better, but were still not as clear as we had seen it on our visualization tools back home. We all hoped that the expression would become more distinct when the tubes were installed, but there were no way to know for sure. Somewhat bewildered we went back to Denmark to discuss things over. Unfortunately, there was not much we could do in this stage of the process other than taking these observations into consideration when designing the final content.

Second trip to Shanghai
When embarking on the final trip to Shanghai, there were still a lot of unresolved issues. The main problem was, that we were reluctant to make final decisions about the design before being able to test it out on the building. Based on this concern, we decided to create a lot of potential designs before going, and then make the final decisions after testing them out. Shortly after arriving in Shanghai, we had our new software running and started the process of trying out different visual approaches. It soon became clear that there were several issues about the façade that made it difficult to perceive the content as we had hoped. First of all, the light emitted from the tubes was not as powerful as anticipated. We had previously performed experiments with this back at CAVI, but the scale of the pavilion seemed to require more light than expected. Secondly, the light inside the building was, on the other hand, more powerful than we had anticipated. This meant that light from the inside was visible through the holes in the façade and even reflecting on the surface of the tubes – thereby resulting in lower contrast between the media façade and its background. Despite all these concerns we manages to find a selection of suitable designs that balanced the line between being subtle and spectacular. This actually meant slowing down some of our animations to half speed and reducing the contrast in the image. The decision was made to use only white animations during the early evening hours in order to support the function of illuminating the building. After nine p.m. we would then go into another set of animations that would be more suitable for late hour-situations – like hanging out in the bar. After a constructive discussion with the architects we made a few minor adjustments to the sequence of animations.

DESCRIPTION OF THE FINAL RESULT
The lighting design for the Danish EXPO pavilion features a facade with 3,600 LED dots including interior, as well as exterior, dynamic lighting fixtures. The entire installation is controlled by an advanced management system, developed by CAVI, which adjusts the illumination
of the pavilion based on light measurements around the pavilion. Sixteen photo-sensors are placed at regular intervals throughout the length of the facade to ensure reliable daylight-data for the management system. This system then adapts the illumination of the pavilion to create a smooth transition from daylight into nightfall. At the late afternoon, when daylight starts to fade, interior illumination is set to full intensity, although barely noticeable due to the high levels of daylight. The facade starts to playback some flickering white animations that are perceived as vague variations on the surface. As daylight turns to dusk, the animations are replaced with smoother expressions that mainly consists of white surfaces that are broken by lines, fades or silhouettes of people walking or bicycling on the facade. The interior lights are, at the same time, dimmed slightly and exterior lights are turned on. When daylight is almost gone, lights inside and outside the pavilion are dimmed to a comfortable level and some of the fixtures fade to a warmer color-temperature. At exactly nine p.m. a more extravagant show reel of animations are displayed on the facade, including shimmering, abstract graphics, sweeps, fades and animations along the entire length of the facade. Colors are kept in white and red, which also changes the colors on some of the exterior lights accordingly. The show ends at eleven forty-five when the pavilion is closed for visitors and cleaning personal need a bright and steady illumination of the pavilion. This bright illumination is switched of at four in the morning, and a new day starts all over.

To account for special needs of lighting, CAVI has produced a touch-screen interface to override the automation of light levels and colors. The personal at the pavilion can optionally control every single illuminated element inside or outside the pavilion to a set of preset settings.

Please se the video-presentation on: www.cavi.dk

POST-PROCESS REFLECTIONS
The process of designing the Danish Expo media facade has proved enlightening in many ways. First of all it has shown the complexity of the work that goes into such a project. Besides being a major task logistics-
wise, the project has required new ways of conceptualizing and communicating between designers, and to architects and lighting-contractors. This has comprised developing new tools and technologies that were not existing on the market, and implementing these tools in a workflow among the designers. And even with those specialized tools, we finally realized that the media facade on real building looked very different. Many aspects were impossible to predict, especially since we were designing while the buildings was being built. It was both a challenge and a frustration to work on something that might not look as anticipated.

CONCLUDING REFLECTIONS

Over the course of this thesis I have pursued a vide range of perspectives on media architecture seen as transformations in both screen culture and the practices of architecture. This process has included an exploration of architecture as a communicative medium as well as investigations of the concept of “the screen” and its origins in visual culture. The scope of this perspective has proven to become very wide, incorporating various literatures from my backgrounds in Art History and New Media studies. This wide perspective demonstrates how media architecture is, and can be approached from, an interdisciplinary discourse. This has allowed me to elaborate on the subject in many interesting aspects, but has, on the other hand, prevented me from going into details with one particular subject. The future task will be to narrow down the focus and come up with a theoretical framework that may be applied a better understanding of the subject.

My work on the Expo project has provided a lot of insights into the challenges of working with media architecture in practice. It was interesting to observe how the media facade evolved conceptually among us designers, from initially being "a screen" to eventually becoming rather a visual feature of the architecture. This was truly a realization of going from looking "through the screen" to looking "at the architecture".

Experiences from Shanghai have additionally provided me with a perspective on how the spectacle of media architecture is relative to its environment. Although we have made many attempts to promote our installation to a global audience via online blogs and newsletters, the feedback have been rather disappointing. A plausible cause for this lack of publicity may be the fact that Expo in Shanghai is being "overexposed" with spectacles, which makes the Denmark pavilion less spectacular in the overall picture. If the spectacle is defines as a
violation of the rule, in Eco's sense, the repetition of such violations may "become the rule" and thereby loosing its aesthetic value (Eco, 1976, p. 264).

One of the greatest challenges for the future of media architecture might be to find interesting and relevant approaches to the design of concepts and content for media architectural installations. This thesis has intentionally avoided the issue of content due to the scope of the text. A few months ago I had the opportunity to talk with Jan Edler from realities:united about their work and how they approached the design of media architecture. We discussed the issue of content and how content can sometimes oppose the architectural intentions of the media facade. Edler argued that the owner of a media facade building will often also operate the facades, and they will have an interest in using the facade for promoting themselves. The result of this could be that the media facade would eventually be used for displaying corporate logos and propagandist messages—much against the aesthetics of a building in Edler's opinion. In order to oppose this trend, realities:united design facades that in themselves are extremely expressive, regardless of content. The limitations that are imposed, in regards to resolution and color representation, reduces the possibility for the building owners to utilize the facade for "improper" content.

This view is interesting in many respects. First of all, because it shows a potential conflict between the designers and the controllers of public space. There are many different stakeholders when it comes to deciding the future of media architecture, and each of these have their opinion about its use. Another aspect to draw from Edler's statements is that the designer must impose certain expressive constraints on the media facade at the lowest level of representation: the pixel itself. Only by building constraints into the very core of the screen, does it become an aesthetic medium. Ambiguity becomes a premise, not an option.

The dichotomy of hot and cold media, transparency and reflexivity, window and mirror, is certainly still relevant. Even though virtual reality was largely abandoned in the 1990s, we are still striving for immersiveness by developing screens with increasingly higher definition. Does this "heating" of media result in disengagement and uncritical consumption, as McLuhan would argue, or is it an unnecessary skepticism? A partial answer to this ambitious question might be that both approaches are needed in order to form a balance in the visual perception. Extensions of vision in high-definition may provide distracted immersive experiences, but critical reflections pull us back to reality where the screen is still a virtual surface.
SUMMARY

This text explores the concept of media architecture as a phenomenon of visual culture that describes the use of screen-technology in new spatial configurations in practices of architecture and art. I shall argue that this phenomenon is not necessarily a revolutionary new approach, but rather a result of conceptual changes in both modes visual representation and in expressions of architecture. These are changes that may be described as an evolution of ideas and consequent experiments that can be traced back to changes in the history of art and the various styles and ideologies of architecture.

This text proposes that a new approach to what is known as "the screen", is emerging as it adopts spatial formations and enters into public space. I shall argue that these phenomena that appear in both architecture, art and domestic screens are not the result of a revolution of new technology, but rather an evolution of both existing visual media and architectural explorations that has been evolving for many years. The screen inherits its flat, rectangular surface from a tradition of perspectival representations that can be traced back to the invention of the linear perspective. This paradigm of screen culture, which include photography and painting, has during the last few hundred years made several attempts to escape the paradigmatic surface and evolve into three-dimensional space. Screen culture has, especially through art, undergone experiments that transformations inherent perception mode from looking through to looking at the screen. New experiments with screen technology manifest itself in recent phenomena like media facades, where entire building surfaces get wrapped in pixels, but also in the field of art, where new experimental artists use pixels suspended in space or image projections on three-dimensional surfaces. Concurrently, the field of architecture has undergone vast transformations in regards to expressions and construction methods. Various styles or ideologies have dominated through the last hundred years, and each have their own particular approach to function and symbolism. These approaches can be characterized in their communicative relationships with either the surface or the form of architecture. Form and surface make up the expressive signs in architecture. In this respect, I refer to Eco's theory of signs as a method for analysis of expression ideology. The aesthetics of architecture can be analyzed in terms of ambiguity and being self-focusing, which can be described as transformations in the specific codes of expression. All these aspects support the articulation of architecture as a communicative medium that seeks new ways of expression.

The argument is constructed in three parts. The first part serves as an introduction to the field, which describe some of the current approaches to media architecture on both theory and practice. This part will also touch upon the existing understandings of urban screens, media facades and media architecture in general. The second part traces to motivation behind media architecture to an understanding of architecture as a communicative medium. The third part describes the physical evolution of screen as an offset for current trends of spatial screens. And finally, the fourth part, will attempt to unite the two previous parts by analyzing current trends in media architecture through a series of "lenses" or interpretations of the field. This includes seeing media architecture as: screen, architecture, virtual architecture, relational architecture, and finally, transformations of public space. Different examples and theories are emphasized along with the interpretive perspectives. These "lenses" must be regarded as perspectives that are open to further investigation and serves to prove how vast the field of media architecture may be.

The term "media architecture" is at once the offset and the etymological frame for this exploration. By regarding media architecture as a convergence of media and architecture, it becomes a reversed metaphorical figure for the movement from surface to space. This dichotomy of surface and space, and the various attempts to transgress from one domain the other, is the central focal point for this thesis.
As a final perspective, I have included a case study describing my work with developing a media facade for the Denmark Pavilion at Expo 2010 in Shanghai. The process is described by first explaining the foundations for the project – in terms of analyzing expo as a concept and describing the Danish participation – and afterwards going through the individual steps from initial ideas to final result. This includes explaining the need for new tools for media architecture and how different unforeseen obstacles can arise underway. The descriptions serve to highlight both technical issues, but also reflect on the process as an insight into general concerns for media architecture.

REFERENCES


NOTES

1 For further insight into the literature see:
   b) Visual Communication (Sage Journals Online): June 2006, 5 (2): http://vcj.sagepub.com/content/5/2.toc


3 Drawings of from the initial competition proposal can be found at: http://www.richardrogers.co.uk/work/selected_works/centre_pompidou/completed

4 Information about JomboTrons are based on wikipedia: http://en.wikipedia.org/wiki/JumboTron

5 Further information about KPN Tower:
 http://www.renzopiano.com/
 http://www.mediaarchitecture.org/graffiti-research-lab-on-kpn-tower-rotterdam/

6 Blinkenlights website: http://blinkenlights.net/

7 BIX website: http://www.realities-united.de/#PROJECT,69,1

8 Examples of media architecture can be found at: http://www.mediaarchitecture.org/

9 The term ‘architecture parlante’ was used in an anonymous essay “Etudes d'architecture en France”, Magasin Pittoresque (1852), p. 388,

10 The distinction between “looking at” and “looking through” is borrowed from Jay David Bolter in “Writing space: computers, hypertext, and the remediation of print” (2001, pp. 184-186), where he compares it to the experience of transparency and hypermediacy, respectively.

11 See discussions about political implications of urban computing in: Greenfield et al. (2008): “Urban Computing and its Discontents”


13 Text found at: http://www.bie-paris.org/site/en/focus-on-the-theme.html

14 The idea of having a famous sculpture, as a major attraction is far from new. At the 1964-65 New York World's Fair, the Vatican Pavilion featured various roman-Italian artworks including Michelangelo’s Pieta from the Cathedral of Saint Peter in Rome. Going further back to 1929, the German Pavilion by Mies van der Rohe was surrounded by a U-shaped water basin including the sculpture Alba by Georg Kolbe. Architect Bjarke Ingels as an inspiration has mentioned the latter reference during the design of the pavilion (Arkitekten, June 2010).