ARCHITECTURE'S LIMINALITY: VIRTUAL SPACES WITHIN THE BUILT FABRIC

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Architecture is judged by the eyes that see,
by the head that turns, and the
legs that walk. Architecture is not
a synchronic phenomenon but a successive one,
made up of pictures adding themselves
one to the other, following each other,
in time and space, like music.
This is important, indeed it is capital and decisive:
the star-shapes of the Renaissance
gave an eclectic architecture,
intellectualized, a spectacle seen
only in fragments of intention....
The cone of vision is in front,
concentrated upon a concrete field which is,
in reality, a limited one,
and limited still more by the mind....
(that) can interpret, appreciate and measure
only that which it has time to grasp.

Le Corbusier, The Modulor[1]

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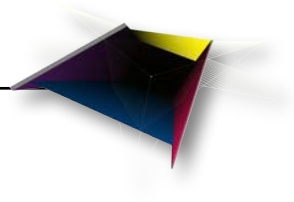
[1] Corbusier Le, *The Modulor; a Harmonious Measure to the Human Scale, Universally Applicable to Architecture and Mechanics* (Cambridge, Mass.: M.I.T. Press, 1968).

ABSTRACT

Projected spaces have appeared throughout history upon the physical forms of reality to suggest virtual spaces. By using visual cues, innate to our lexicon of understanding the world around us, representations have the ability to suggest space that is not physical. Cultural Spatialization compounds over the historical timeline of societal spatial understanding. It responds to new visual stimuli that emerges with new methods of spatial representation. *Visual Interplay* allows for the exchange of perceptual qualities between the elements of reality and the virtual. This exploration identifies the visual cues used by the architectural fabric's physical forms that *define* space. It also defines those used by visual-virtual representations or "projected spaces" that *suggest* virtual-spatial additions. Through an evaluation across the historical timeline of projected spaces, the potential cultural spatialization of today is identified. It suggests that present day built environment and visual-virtual representations are not yet fully reflective of these capabilities. The breadth of modern spatial experiences is then categorized to bring to light modern cultural spatialization. By contextualizing the modern viewer in light of these discoveries, the architect will be able to sculpt the visual interplay made possible by the technology that assisted in elevating our cultural spatialization.

1 INTRODUCTION



The realm we occupy, reality, is both naturally occurring as well as designed, to provide spatial understanding for its occupants. We utilize the architectural form to bring definitions to the space we occupy. The physical form of the architectural fabric is understood through visual cues, which are then decoded by the brain. It is these perceptions that shape the spatial understanding of our reality and the world around us. Perceptual abilities are also capable of building spatial understanding of visual-virtual or "projected" spaces. That which we visually create, like art and cinema, mimics the spaces of reality, and often representations are virtual realms created as a compliment to reality. This is a result of both the representation and the physical form, triggering the same visual cues utilized to determine spatial understanding. The architectural form *defines* space, and a representation *suggests* a projected space. Being that the architect is the manipulator of the architectural canvas, it is likely that these abilities of orchestration would parallel in their efficacy in a visual-virtual application.

A projected space, when implemented within the architectural canvas, is reflective of the abilities of the spatial imagination, or cultural spatialization. Cultural spatialization is the breadth of spatial understanding typical of a time or society. Cultural spatialization is influenced by spatial visual stimuli, real or virtual, that saturates the world around us. Spatial experiences created by physical form, and representations, create a variety of spatial opportunities where design is necessary to provide order to the visual information that occurs from their application. Through a qualitative interpretation of historical examples and emerging phenomenon, this evaluation categorizes spatial experiences, starting with the natural state of reality, and through to augmented experiences created by visual-virtual additions of space. The understanding of this range of spatial experiences exposes future

potentials as well as the state with which the architectural profession is responding and could respond to the cultural spatial abilities.

Being that we are within a time saturated with the emergence of new technologies, our cultural spatialization points towards the emerging methods of representations and the direction with which they are going. A method of note, due to its heavy manipulation of visual cues, projection mapping, provides an insight into upcoming opportunities for the generation cultural spatialization. Modern projection mapping is an excellent example of visual interplay that allows for the visual cues of reality and visual-virtual to equally contribute to the spatial understanding of an occupant of the built environment. The findings of this investigation proposes new avenues and methods, which if adopted into the design profession, allow the architect to shape a future built fabric that will be reflective of the heightened abilities that are the modern cultural spatialization.

1.1 REALITY AND THE ARCHITECTURAL CANVAS

The manipulation of physical form, is what defines our reality. It shapes how physical definitions can trigger the visual cues with which we utilize to understand the spatial surroundings of reality. These forms are the *Architectural Canvas*, and throughout will refer to the physical, architectural forms used in reality to define the space around us. The lexicon of visual cues of the by the architectural canvas, triggers the spatial understanding for an occupant and sets the foundation for examining parallel "virtual" cues that are used in projected spaces. The understanding of these two methods of triggering visual cues, both virtual and real, assist in shaping the relationships that form the categorized spatial experiences.

1.1.1 REALITY, AND ITS MEANING FOR THIS INVESTIGATION

The most basic faculties that we are equipped with from the day we are born is our five senses. These senses of sight, sound, smell, taste, and touch allow us to perceive our surrounding's stimuli and assemble that information into an understanding that provides meaning to the world around us. By discovering through perception, we are able to formulate and define a shared reality because operate with the same set of sensing abilities. The definition of reality, is a shared agreement driven by anatomical senses.

Through shared understandings and stimuli of our reality, we build a perceptual common ground for the culture of our society. Through sensing we are able to perceive and express the emotive qualities that define us as human. The actuality of our senses is what helps us decide what is real and what is virtual. Juhani Pallasmaa, Finnish architect and theorist of phenomenology, defines "the dominance of vision over the other senses-- and the consequent bias in cognition" being "observed by many philosophers." Pallasmaa attributes that 'beginning with the ancient Greeks, Western culture has been dominated by occularcentric paradigm, a vision-generated, vision-centered interpretation of knowledge, truth and reality.' "[2] Vision is a highly more powerful sense than others, but it is also the most easily fooled. It is ironic that unlike Pallasmaa has declared, vision is not a direct

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[2] Juhani Pallasmaa, *The Eyes of the Skin : Architecture and the Senses* (Chichester; Hoboken, NJ: Wiley-Academy ; John Wiley & Sons, 2005), 19.

"interpretation of knowledge, truth and reality" but rather a perception that can be directed by implementing its own methodologies. .

It is also dreams and vivid memories that can be mistaken for experiences of reality. Marcel Proust, French critic of the late 1800s examined that " memories are virtual: 'real without being actual, ideal without being abstract.'[3] While we may recognize the difference between actual and these imagined or recollected events, the richness and power of such experiences makes them important to us and highly valued in many cultures."[4] The sight of each other, or the touch of a mother to her child, are qualities that bind us together and bring meaning to the cognitive information these abilities provide for us. We also build the meaning of our culture by how we utilize these abilities. We express understanding outwardly, to confirm shared understanding through a multitude of cues that are constantly being pushed to the brain. Society utilizes these shared tools exchange understanding with each other and express the emotions that they conjure.

In the earliest of our emotional and expressive evolution, we began to utilize the tools around us as much to survive as we did to express the meanings of our perceptions. We bring internalized perceptions back into the world through expressions that are capable of triggering the same perceiving senses. In that sense, we perceive the world around us, internalize and reiterate our vision by bringing it back into becoming a shared reality. The expressions we create develop the *cultural spatialization* which is built upon prior shared understandings. An amalgamation of methods for representation evolves our ability to perceive increasingly complex triggers to our senses. Erwin Panofsky, an evaluator of symbolism and iconography states: "The laws which the intellect 'prescribes' to the perceptible world and by obeying which the perceptible world becomes 'nature' are universal; the laws which artistic consciousness 'prescribes' to the perceptual world and by obeying which the perceptible world becomes 'figuration' must be considered to be individual or 'idiomatic.' "[5] Personalized representations, like art, are equipped with an internalized meaning, which is then externalized often to become a shared perception.

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[3] Marcel Proust, *Remembrance of Things Past* (New York: Random House, 1981).

[4] Rob Shields, *The Virtual* (London; New York: Routledge, 2003), 25.

[5] Erwin Panofsky, *Perspective as Symbolic Form* (New York; Cambridge, Mass.: Zone Books ; Distributed by the MIT Press, 1991), 12.

1.1.2 ARCHITECTURAL CANVAS

Architecture possesses a powerful ability to assist in our understanding of the lived world. As we are accustomed to this type of immersion within space, to which most virtual experience cannot compare. The architectural canvas is a method of triggering our senses to bring definition to the world around us. Pallasmaa describes that "Every touching experience of architecture is multi-sensory; qualities of space, matter and scale are measured equally by the eye, ear, nose, skin, tongue, skeleton and muscle. Architecture strengthens the existential experience, one's sense of being in the world, and this is essentially a strengthened experience of self. Instead of mere vision, or the five classical senses, architecture involves several realms of sensory experience which interact and fuse into each other."[6] If we occupied an endless void it would not be able to be recognized until it possessed triggers for our senses to decode the shape of its reality. An open space begins to be understood when visual information provides edges to define that form. Occupying a limitless space would be perceived as occupying nothingness. Rudolf Arnheim, specialist in the examination of the architectural form determined that "Space, once it is established, is experienced as an always present and self-sufficient given, the experience is generated only through the interrelation of objects. Space perception occurs only in the presence of perceivable things." [7]

Starting with the visual information of the natural environment, man then created architecture to further give form to our surroundings. "Physically, space is defined by the extension of material bodies or fields bordering each other, e.g. a landscape of earth and stones adjoining bodies of water and air. The measurable distances within such a rag rug of different materials are aspects of physical space. Beyond that, it is the mutual influences of material things that determine the space between them: distance can be described by the amount of light energy that reaches an object from a light source or by the strength of the gravitational attraction exerted by one body on another, or by the time it takes for one

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[6] Pallasmaa, *The Eyes of the Skin : Architecture and the Senses*, 45.

[7] Rudolf Arnheim, *The Dynamics of Architectural Form : Based on the 1975 Mary Duke Biddle Lectures at the Cooper Union* (Berkeley: University of California Press, 1977), 10.

thing to travel to the next. Apart from the energy that pervades it, however, space cannot be said to exist physically."[8] Architecture defines the open space and gives form as well as meaning; providing shelter, ownership and setting the mood for the places with which we occupy. We physically create the barriers, openings, planes and volumes to define physical space and we reside within this realm, which is reality. The architectural canvas is the physical constructs we utilize to define space, and the architect manipulates these forms to trigger desired responses when occupied. "But though we may overlook it, space affects us and can control our spirit; and a large part to the pleasure we obtain from architecture-pleasure which seems uncomfortable, or so for which we do not trouble to account-springs in reality from space. Even from a utilitarian point of view, space is logically our end. To enclose a space is the object of a building: when we build we do but detach a convenient quantity of space, seclude it, and protect it, and all architecture springs from that necessity. But aesthetically space is even more supreme. The architect models in space as a sculptor in clay. He designs his space as a work of art; that is he attempts through means to excite a certain mood in those who enter it."[9]

The architectural space must be occupied to really be understood. We perceive architecture spatio-temporally because it is occupied from within, around, above, etc. The architectural space is activated by the occupant, just as a painting is activated by a viewer. Scott Geoffrey, architectural historian of the early 1900s described space as "in fact, is liberty of movement. That is its value to us, and as such it enters our physical consciousness. We adapt ourselves instinctively to the spaces in which we stand, project ourselves into them, fill them ideally with our movements." [10] The art of the architect is to master the spatial understanding of physical form and how those forms are perceived visually by the occupant. Architecture is also about the movement throughout that space. The architect recognizes that unlike sculpture or painting his work is seen as an evolving discovery, and the understanding of the space is often built upon of a collection of visual information. "If everything about matter is real, if it has no virtuality, the proper 'medium' or milieu of matter is spatial. While it exists in duration, while clearly it is subject to change, the object does not reveal itself over time. There is no more in it 'than what it presents to us at any moment.' By contrast, what duration, memory and consciousness bring to the world is the possibility of unfolding, hesitation, uncertainty. Not everything is presented in

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[8] Ibid.

[9] Scott Geoffrey, *The Architecture of Humanism; a Study in the History of Taste.* (Gloucester, Mass. : P. Smith 1965), 168.

[10] Ibid., 170.

simultaneity. This is what life (duration, memory, consciousness) brings to the world."[11] In addition, the complimenting perceptual information of sound and touch, possibly smell, all contribute to the understanding of our surrounding. The architect is essentially maneuvering the physical forms to expand or contract the perception of a spatial surrounding.

Ralph Weber begins that "architecture is always perceived three-dimensionally" always moving and always surrounding. He also determines that "two-dimensional representations cannot simulate the actual conditions under which buildings and open spaces are experienced." Indeed the actuality of that statement is correct but he limits the understanding of spatializations ruling that "space is always sequentially experienced by my body, head or eye movement, and still the image does not do justice to this perceptual reality." He concludes by mentioning that "a further shortcoming, is that I have necessarily limited my discussion to the visual aspect of perception whereas architecture is normally experienced synaesthetically."[12] Weber correctly states that the synaesthesic nature of the built environment assists in the spatial understanding but fails to recognize that the image has changed in its affect to the perceptual reality, because images have increased in their presence of daily life. The contrasting perceptual abilities of the representation and the architectural canvas do exist, but their abilities are moving towards each other as we adopt more and more image-based perceptions into daily life.

Ironically, in contrast to what eventually occurs once occupied, the education of the architect is primarily concerned with physical masses more so than it is towards designing the response of the senses. The majority of tools in architect's arsenal is massing. Pallasmaa describes the work of Alvar Aalto to the contrary, "instead of the disembodied Cartesian idealism of the architecture of the eye, Aalto's architecture is based on sensory realism. His buildings are not based on a single dominant concept or Gestalt; rather, they are sensory agglomerations. They sometimes appear clumsy or unresolved as drawings, but they are conceived to be appreciated in their actual physical and spatial encounter, 'in the flesh' of the lived world, not as constructions of idealized visions." [13] In reality, it is the void of which they define that is the real product of architecture. In addition, the methods the architect uses to describe the space they design are often described through an assembly of two-

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[11] Pallasmaa, *The Eyes of the Skin : Architecture and the Senses*, 76.

[12] Ralf Weber, *On the Aesthetics of Architecture : A Psychological Approach to the Structure and the Order of Perceived Architectural Space* (Aldershot: Brookfield, USA : Avebury, 1995). As mentioned in: Jan Marie Lambert Peters, *Pictorial Signs and the Language of Film* (Amsterdam: Rodopi, 1981).

[13] Pallasmaa, *The Eyes of the Skin : Architecture and the Senses*. Pg. 76

dimensional representations. Bruno Zevi, modernist architect, known for his abstract principals of both architecture and representations said that "since up to now there has been no clear conception or definition of the nature and consistency of architectural space, the need for its representation and mass diffusion has consequently not been felt. As we have seen, the methods of representing buildings most frequently employed in histories of art and architecture consist of plans, facades, elevations and photographs. We have already stated that neither singly nor together can these means ever provide a complete representation of architectural space."[14]

These two-dimensional representations, used in concert, are intended to express the spatial product, but as stated earlier, the actual space that it produces cannot be truly understood until occupied. Ironically, the architect is not often instructed on the cognitive visual cues that man utilizes to understand the products of architecture. Yet it is with these visual cues we acknowledge the definitions of the space created by the architect. It is implied then that the architect is capable of imagining the final product and virtually moves through it in the mind's eye. His virtual occupation of the space of his mind's eye is then the inspiration for bringing these forms and experiences into reality. The architect also builds the intended meaning of a space, to set its tone and suggest its program. Paul Frankl, architectural historian evaluated that "The visual impression, the image, produced by differences of light and color, is primarily in creating our perception of a building. We empirically reinterpret this image into a conception of corporeality, and this defines the form of the space within, whether we read it from outside or stand in the interior. But optical appearances, corporeality, and space alone do not make a building.... Once we have interpreted the optical image is not a conception of space, enclosed by mass, we read its purpose from the spatial form."[15] The irony lies in that the architectural product is an assembly of aspects collected from prior spatial experiences. It is then reassembled in the virtual mind of the architect. Thus the physical-architectural experience, built for reality, initially began as the mind's eye, virtual-experience of the architect. It is then occupied and once again reinterpreted into the virtual, by the observation of the occupant. Though each experience comes from the same visual information of reality, the virtual reconstruction of it will vary for each occupant. "When the building takes into account man's ability to see, it does so in order to display and explain not only its practical functions but also the three

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[14] Bruno Zevi, *Architecture as Space; How to Look at Architecture* (New York: Horizon Press, 1957), 46.

[15] Paul Frankl, *Principles of Architectural History; the Four Phases of Architectural Style, 1420-1900* (Cambridge, Mass.: MIT Press, 1968), i.

dimensional nature of its shapes and their expressive qualities." [16] It is these understandings that form the visual meaning for the architectural configuration. It is also where the visual potential of both real and virtual forms are capable to work in concert.

The physical form in reality, architecture, is essentially a painting that is occupied. "In memorable experiences of architecture, space, matter and time fuse into one singular dimension, into the basic substance of being, that penetrates our consciousness. We identify ourselves with this space, this place, this moment, and these dimensions become ingredients of our very existence. Architecture is the art of reconciliation between ourselves and the world, and this mediation takes place through the senses."[17] The architect, just like the painter, adapts to create based on how we will perceive the final product. The best architect can design without rectilinear restrictions but rather with the imagination of the resulting perception of the final product. He understands that reality responds to accommodations drawn from both psychophysiological realities.

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[16] Arnheim, *The Dynamics of Architectural Form : Based on the 1975 Mary Duke Biddle Lectures at the Cooper Union*, 134.

[17] Pallasmaa, *The Eyes of the Skin : Architecture and the Senses*, 76.

1.2 VIRTUAL AND PROJECTED SPACES

A representation of a real world space is known as a Projected Space because it is in essence, projecting a virtual reality, that is applied upon an architectural form. When the physical form is mapped, the visual representation is able to use the visual cues of the real world form, to complement the visual representation and give it depth. The following section describes these abilities and how visual illusions and virtual realities suggest space. The modern technology of representing space, the projection map is introduced to contextualize the construction of modern projected spaces.

1.2.1 VIRTUAL REALITY, TROMPE L'OEIL, ILLUSION

The comprehension of the abstract and the non-physical realm evolves throughout time. The contemporary understanding of the term 'virtual' suggests that virtual is intrinsically abstract, personal, as well as social in its expression. This modern interpretation described in the Oxford English Dictionary goes as follows:

> 'Virtual: Latin 1. virtus 2. vistuous. Possessed of certain physical virtues or capacities; effective in respect of inherant natural qualities or powers capable of exerting influence of such qualities (rare)'[18]
>
> (Oxford English Dictionary)

Physical virtues of the "virtual" space are triggered in ways similar to those of our understanding of reality. Visual-virtual representations are capable of exerting influence to the senses and give illusion to the assemblage of reality. To gather our understanding of reality we rely upon perceptual information that is decoded to bring an "all encompassing" idea developed from a wide array of perceptual observations. Traditionally named, *illusion* or *Trompe-L'oeil,* virtual reality is a projection of a virtual space on a map of the architectural

[18] J. A. Simpson, E. S. C. Weiner, and Press Oxford University, *The Oxford English Dictionary* (Oxford; Oxford; New York: Clarendon Press ; Oxford University Press, 1989).

canvas, thus a *projected space*. A projected space acts as a representation of reality upon an architectural canvas and thus creates a 'virtual reality'.

The "physical virtues and capacities" that virtual representations possess have been utilized to represent the real world or vision of the imagination, throughout history, as far back as portrayal of bison in the cave of Alta Mira, 40,000 years ago. Representations such as these were said to be visualizations of a mental hallucinations conjured by a shaman. Used to describe his vision, it was depicted on the cave ceilings using the natural physical configuration to achieve the spatial form of the vision. The separation of what is within the realm of reality and what is virtual is almost in the eye of the beholder. "Mental images could well have provided the earliest distinction between object and representation. So perhaps could certain natural physical configurations. And so, certainly, could mimicry, especially depictive gesture (drawing shapes in the air), for to be meaningful such (unfrozen) gestures would have to be seen as resemblances."[19] This reflects back to what was stated earlier, that a depiction is a reiteration of the imagination with the attempt being to share the understanding of reality in a gesture itself is building its own virtual realm. In an examination of architectural representations Perez Gomez and Pelletier define that "A representation holds power that "needs not be a reductive device, a tool of prosaic substitution. Projection evokes temporality and boundaries." Using similar tools that the architect utilizes to shape reality it is by "defining the space between light and darkness, between the Beginning and the beyond, it illuminates the space of culture, of our individual and collective existence." Representations are "closer to the origins of our philosophical history, projection was identified with the space of representation, the site of ontological continuity between universal ideas and specific things." It is reiterated that there is importance in recognizing that it is "the architect's task, beyond the transformation of the world into a comfortable or pragmatic shelter, is the making of physical, formal order that reflects the depth of our human condition, analogous vision to the interiority communicated by speech and poetry and to the immeasurable harmony conveyed by music."[20] The evaluation of specifically the architectural representation, is now defined as the *projected space*.

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[19] Iain Davidson et al., "The Archaeology of Perception: Traces of Depiction and Language [and Comments and Reply]," *Current Anthropology* 30, no. 2 (1989): 144.

[20] Alberto Perez-Gomez and Louise Pelletier, *Architectural Representation and the Perspective Hinge* (Cambridge, Mass.: MIT Press, 1997).

1.2.2 PROJECTED SPACES

Representations on the architectural canvas expand the spatial potential of the visual interpretation of the world around us. The application of images of wild animals about the dome ceiling of the Alta Mira cave immersed the viewer into a panoramic surrounding spatially representative of how the bison would be viewed the real world. "Fortunately, visual perception and imagination are not limited to the range of optical images on which they rely. The sense of vision is not a mechanical recording device. It organizes, completes and synthesizes the structure found in the particular optical images.--When the visible part of an object presents enough of a sufficiently compelling structure the object will be seen spontaneously as a whole. This perceptual tendency may be misleading when the hidden part of the object does not complete its form in the simplest, most consistent way."[21] This cognitive reality suggests that we need only a compelling amount of information to deduct our own reality of a form. In this fashion, the architectural canvas, and a representation of a space, even when two-dimensional, is capable of assembling enough information to suggest a depth and spatial construction from a few visually compelling elements. As discussed earlier, even the architectural canvas alone is not required to define every edge to suggest a spatial definition.

A projected space is a representation of reality on an architectural canvas, creating a 'virtual reality'. Oliver Grau, a modern historian of media art historicized that: "Virtual reality was discovered early on by artists, who appropriated it with their own methods and strategies. Virtual reality forms part of the core of the relationship of humans to images. It is grounded in art traditions, which have received scant attention up to now, that, in course of history suffered from ruptures and discontinuities, were subject to the specific media of their epoch, and used to transport content of highly disparate nature. The idea goes back at least as far as the classical world, and it now reappears in the immersion strategies of present day virtual art."[22] Though vastly different, the essence of "the virtual" has always existed as a same, place aside from the one we occupy. Whether to compliment, critique or provide an escape, the virtual behaves as a parallel to reality.

The evolutionary timeline of social knowledge and visual understanding through math and science developed dimensional concepts which brought forth new capabilities for depicting "virtual" representations in the built environment. In fact, the virtual is not that

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[21] Arnheim, *The Dynamics of Architectural Form : Based on the 1975 Mary Duke Biddle Lectures at the Cooper Union*, 110.

[22] Oliver Grau, *Virtual Art from Illusion to Immersion* (Cambridge, Mass.: MIT Press, 2003), 3.

foreign to many cultural spatializations. Rob Shields, who specializes in the analysis of modern technology describes that, in a simple form "if the virtual has meaning of 'virtue', of being 'almost-so' or 'almost-there', one does not need to look far to find virtual worlds which surround us or their historical counterparts. Virtual worlds are simulations. Like a map, they usually start out reproducing actual worlds, real bodies, and situations; but, like simulations, they end up taking on a life of their own." Essentially virtual creations are spawned from those same cognitive methods and that is what allows them to be easily implemented to communicate space, as is done so on the map. And then, "somewhere along the way they begin to diverge, either when it is realized that no map can be so complete that it represents an actual landscape fully, or when they become prized as more perfect than messy materiality. As virtual worlds they become 'virtuous', utopian."[23] Unfortunately it is less often that they are utilized in the utopian application as they have been for more practical implementations.

The critical moment of success for a virtual form is created by the interaction of the medium (often the technology, whether it be perspective technique or a projection) and the canvas upon which it is applied (often an existing form or one intended to represent that medium). This interaction sparks the emergence of a reality/virtual conversation of space. When a physical and visual characteristic is shared between an actual physical element and visual representation, it is difficult for the brain to determine which object (visual or real) it belongs to. In these circumstances, or co-incidences of qualities, the understanding of the visual representations is heightened and perceptually understood with the physically real components. The later categorization of spatial experiences evaluates these relationships and how their interaction, co-operation or resistance to each other affects the cultural conception of space.

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[23] Shields, *The Virtual*, 4.

2 CULTURAL SPATIALIZATION AND ITS MANIFESTATIONS

Recognizing the nature of cultural spatialization allows us to hold the power to shape our reality. Comprehending changes in our spatial understanding requires us to look outside what is already known. Changes in technology, methods of representation and defining the built environment evolve with social understanding of space. Visual information, though critical to spatial understanding, alone is meaningless. Visual cues are able to provide accurate definitions of space, but also can deceive the eye and change the understanding of spatial surroundings, even without a virtual intervention.

Cultural spatialization is influenced in a variety of ways. Methods of representing the world around us are reflections of the capabilities of the cultural spatialization of that time and of its society. This investigation will focus on western history and its precedent examples. Spatial understanding compounds over time. The understanding of reality also is evolutional, and ever changing as is the resulting understanding of what we create. Visual information that overlaps both in its application to reality and to virtually suggesting space are co-incidental visual information. These co-incidences are capable of augmenting the previous scope of spatial understanding. Unfamiliar or unknown visual information that is new to the cultural spatialization may not affect the spatialization whatsoever until that visual information is adopted into the cultural spatialization.

> The importance of communities of practice and the way they negotiate change have several implications for design for the future. Designers need to cultivate an awareness of communities, getting close enough to be able to understand community practice and evolution in a thoroughly situated way. In particular, the designs they produce should be usefully under-constrained, helping, not inhibiting, evolution of the community's practice. Designers also need to be in a position to watch new communities emerge and even to help seed them where

> that is possible. For much industrial design, this points to a thorough reconceptualizing and repositioning of the design community and its work.[24]

It is the social impetus for shared spectacles that responds and pushes for the emergence of new tools for spatialization. This symbiotic momentum allows us to sculpt our landscape and select the brushes with which to paint it. There is a reciprocal relationship between the spatial understanding of representations and the methods that are used to create them. "In a historical context, a new art form can be relativized, adequately described, and critiqued in terms of its phenomenology, aesthetics, and origination. In many ways, this method changes our perception of the old and helps us to understand it afresh. Thus, the older media, such as frescos, paintings, panoramas, film, and the art they convey, do not appear passé; rather, they are newly defined, categorized, and interpreted. Understood this way, new media do not render old ones obsolete but rather assign them new places within the system.'[25] Thus as technologies emerge, limitations on its use begin to drop away as they are embraced and understood by society. We adopt older representations as conventional and understand how they function enough that we begin to look for the next iteration. This similarly applies to technology. An example of a reciprocal transformation was the mobile phone. When first introduced, it was understood much like a regular phone, only was no longer chained to a static place. The conveniences that mobile communication brought to daily life then increased the desire for further conveniences provided by the mobile device. As a response to the demand for these new conveniences, the mobile phone now visually brings people together allows us to capture motion pictures and move through places we may never physically travel to. Though not strictly a spatial evolution, the smart phone broke through our imagined technological limitations, while at the same time distorting our social exchanges, not just limited to communicating, but also sharing, observing, learning and even civically speaking.

The changes cultural spatialization incurs are rapid and may not be noticed while they are occurring. For example, the invention of the method of perspective was not initially designed for pictorial representations. It was actually intended to behave as a systematic understanding of the mathematical construction and analysis of reality. Because it possessed elevated abilities to depict reality, perspective brought forth a "virtual realm" because the visual products it created exceeded the capabilities of previous methods of representation.

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[24] John Seely Brown and Paul Duguid, "Rethinking the Border in Design: An Exploration of Central and Peripheral Relations in Practice," in *The Edge of the Millenium : An International Critique of Architecture, Urban Planning, Product and Communication Design*, ed. Susan Yelavich (New York: Whitney Library of Design, 1993).

[25] Grau, *Virtual Art from Illusion to Immersion*, 8.

As a new technology for creating a representation, it infused awe and inspiration to the visual experience of space, so much so that it was adopted as a method of elevating the spatial experience in places where fantasy and heightened grandeur were expected.

Tools utilized within methods of representing space are also varied in how they are applied. Though methods may be understood within the cultural spatialization of a time, they may lay dormant or unused for amounts of time. Sigfried Gideon, mid century critic of space and architecture, examined that within "contemporary science and contemporary art, it is possible to detect elements of the general pattern which our culture will embody." He described our culture as "an orchestra where the instruments lie ready tuned but where every musician is cut off from his fellows from a sound proof wall." This is accurate in reaction to new virtual additions to the architectural canvas because it is unknown what impact these applications will have to each other. He goes to say, "it is impossible to foretell the events that will have to come before these barriers are broken down. The only service the historian can perform is to point out that situation, to bring it to consciousness."[26] In reaction to this phenomenon, we cannot predict where a cultural spatialization will head in its course, but rather examine our place within it. By reflecting upon how cultural spatialization has emerged before us, we begin to recognize that change is indeed occurring. We can frame the "instruments" within our time, and begin to imagine how they might be able to sing together. Some "instruments" may no longer belong amongst the orchestra, because they have simply been over used or implemented for purposes no longer pertinent to the modern observer.

This evolution of cultural spatialization is represented by expressions of our senses. Based on the shared abilities of our senses, cultural spatialization is representative of a journey based on the actualizations of what we create. And reflectively, what we create is derived from what we perceive. Cultural spatializations also evolve as the tools we utilize to express them excel. "When a new medium of illusion is introduced, it opens a gap between the power of the image's effect and conscious/reflected distancing in the observer. This gap narrows again increasing exposure and there is a reversion to conscious appraisal. Habituation chips away the illusion and soon it no longer has the power to captivate."[27] With new tools emerging faster than predecessors can be adopted, we reside in a time to look across the board, without a cold shoulder to change, within a time to be compelled to

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[26] Sigfried Giedion, *Space, Time and Architecture : The Growth of a New Tradition* (Cambridge, Mass.: Harvard Univ. Press, 1967), 17.

[27] Grau, *Virtual Art from Illusion to Immersion*, 152.

bridge these mediums. Giedion frames the historical timeline indicating that "With our inheritance from preceding generations, we are obliged to adopt a different starting point and follow another route. We must take our departure from a large number of specialized disciplines and go on from there toward a coherent general outlook on our world." Through drawing attention to the importance of other disciplines and their influence on cultural spatialization, we realize that the response is interdisciplinary and "It is the route present realities force us to take. Unity, for us, will have to come about through the unintended parallelisms in method that are springing up in the specialized sciences and the equally specialized arts. These are the indications that we are nearing a spontaneously established harmony of emotional and intellectual activities."[28]

The architect should inherit from previous generations that adopting parallelisms from other disciplines expands the toolbox for the architect. It allows him to observe the domain he designs with the eyes of the occupant who passes throughout all arts and sciences. Giedion is correct in suggesting that there is to be a harmony of emotional and intellectual activities. The coherent outlook we are to obtain will come from new types of social relationships, spatial constructions, and other departures that will become coherent as the product that they assemble is reality. Giedion originally made these examinations in 1941 and already, prior to modern advances, had understood how spatial definition, innovation, and creation occurred. Ironically, he did not anticipate the exponential rate at which we innovate and create today.

The phenomenon of "cultural" or "social spatialization" has been evaluated using different methodologies by many theorists. As described by Shields, "The term 'social spatialization' designates the ongoing social construction of the spatial at the level of the social imaginary (collective mythologies, presuppositions) as well as interventions in the landscape (for example, the built environment)." This recognition of the influence of the imaginary is critical to the application of spatial representations and "it encompasses both the cultural logic of the spatial and its expression and elaboration in language and more concrete actions, constructions and institutional arrangements."[29] Shields' definition implies that the social impetus drives the evolution of social spatialization. This means that cultural spatialization is not limited to an evolution of cognitive abilities, but rather we evolve for the purposes of extending what the imagination is capable of or desires to accomplish. The reciprocal relationship between creating and observing elevates the absolute spirit of spatial

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[28] Giedion, *Space, Time and Architecture : The Growth of a New Tradition*, 17.

[29] Rob Shields, *Places on the Margin : Alternative Geographies of Modernity* (London; New York: Routledge, 1991), 31.

representation and imagination as human nature never settles with current tools as they are. Humans extract all that these tools are capable of and imagine the next iteration of what they could be.

Art and imagination respond both as reactions to real world stimuli but also as a response to an inexplicable and innate desire. At this point in time, the capabilities of cultural spatialization are evolving faster than they are appearing within built fabric. A historical evaluation of responses to cultural spatialization shines some light upon what may be occurring currently, but will only frame aspects that are falling short. "The degree to which its methods of thinking and of feeling coincide determines the equilibrium of an epoch. When these methods move apart from each other there is no possibility of a culture and tradition."[30] Presently we are in a time of few traditions. By examining the emergence and role of traditional categories of spatial understanding, we can apply these methods to create new traditions, which are constructed to be coherent and denotative of the future.

"Metaphorising the transformations of discourse in a vocabulary of time necessarily leads to the utilization of the model individual consciousness with its intrinsic temporality." He suggests that "endeavoring on the other hand to decipher discourse through the use of spatial, strategic metaphors enables one to grasp precisely the points at which discourses are transformed in, through and on the basis of relations of power." [31] This reflects towards the qualitative, evaluational method utilized in this investigation to categorize spatial experiences both across history and today. Indeed cultural spatialization transforms throughout the passing of time, but in contrast to Shields it rather references spatial discourses that are changing from the social consciousness, more so than the basis of relations of power.

It is more appropriate to identify unspoken or unacknowledged changes in social consciousness, based on how that change emerges, and as precise points of transformation, rather than those of the relations of power. "Foucault problematises the imagined, unthought distinctions that are often used to set up a 'natural table' of realities. Above all what needs to be questioned is what we may term the 'spatial notion of reality': reality as a well-marked-out closed space with an inside and a beyond."[32] Architecture behaves as a

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[30] Giedion, *Space, Time and Architecture : The Growth of a New Tradition*, 17.

[31] Michel Foucault and Colin Gordon, *Power/Knowledge : Selected Interviews and Other Writings, 1972-1977* (New York: Pantheon Books, 1980), 69.

[32] Mark Cousins and Athar Hussain, *Michel Foucault* (New York: St. Martin's Press, 1984).

well marked out closed space, and at times distorts the understanding of what belongs inside or beyond. The architect is not the designer of absolutes, he utilizes visual cues to create a malleable sense of reality. The central focus of this examination is more regarding the potential imagination of cultural spatialization than the actual.

The biggest evolution of cultural spatialization is what is able to be adopted into how society constructs its spatial understanding of reality, regardless of how accurate that may be to the physical reality. Shields declares "the solution is not to debate the reality of the virtual, but to develop a more sophisticated theory of the real and the ways in which the virtual and the concrete are different really existing forms, how they are related to each other and to non-existing abstractions and probabilities. " This brings value to the virtual and recognizes its place within the cultural spatialization. He says "to do this, we want to build up, out of its shadings and partial uses, a model of what people understand by 'the virtual'. This will allow us a strategic insight into how commonsense notions of the world at large are changing, and how people's understandings of their powers and possibilities in the world are following suit, with the result that they act in ways which would be unexpected according to previous models of reality-- one which left out or did not value the virtual. Perhaps this will help us understand what we mean by reality these days."[33] Shields recognizes that change is always upon us and that its adoption elevates the existing experience and motivates change in spatialization.

Though there may be physiological traits and cultural influences, the true understanding of the impact of the virtual is seen in cultural spatialization. As stated by Shields, the changes of people's understandings follow suit to those of the world reflective to the history of models of reality and how they responded to the virtual. However when the virtual is isolated from the physical reality (for example, by boxing it into a specific place, like a theatre) it holds indirect potential to influence the spatial understanding of society. However, when the virtual is adopted naturally into the built environment, society adopts it to manipulate our understanding of the spatial construct.

The abstract concept of space as assembled by Henri Lefebvre would be more accurate to the vision of space discussed in this investigation. "Lefebrve has argued that this reductionalist view of spatialization, which has passed into the discourse of Western social science, conceals from view the fragmentation of the elements of spatialization. " Lefebrve gave merit to include and value representations saying "a divorce takes place between

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[33] Shields, *The Virtual*, 21.

representations, at the level of the imaginary or mythical, and practices in the interest of founding socio-technology of control in the service of power. In the commonsensical world that we inherit from the Enlightenment, 'space' has little concreteness: unobservable to as such, it is presumed not to exist." He is recognizing that the value of the imagination and the virtual spaces that it constructs are not be defined concretely and "what exists in the imagination of people and affects their everyday decisions must be considered in social science."[34]

This acknowledgement of the imaginary, able to affect their everyday decisions, elucidates the power of the virtual and its influence on the cultural spatialization. "For Lefebvre, it was important to distinguish between "spatial practice" properly speaking (the process of the production and reproduction of space, as well as the relationship of society to space); "representations of space", or conceptualized space (the space of planners, urbanists, technocratic subdividers and social engineers"); and "representational spaces" or spaces that are "directly lived", overlaid on actual physical spaces, and appropriated symbolically."[35] Are we producing spaces that are reflective of what we are spatially capable of experiencing? How much of our cultural spatialization is a part of our "lived space"? Though representations are technically "overlaid" onto the physical space and can only be conceptualized, they still posses a direct relationship to how society occupies the space.

"While represented as an entirely new phenomenon, the virtual environment, or cyberspace, is not without its historical precedents, nor is it independent of the particular cultural predispositions that have assisted its establishment."[36] As far back in history as the adornment of an ancient cave, the visual-virtual allowed us to reiterate both the outside actual world (reality) and the internal world (visual imagination) of our mind's eye, back into the real world. To the cave dweller, visual representations of today would be far outside their lexicon of understanding. "In other words, the virtual image evolves toward the virtual sensation and the virtual sensation toward real movement: this movement, in realizing itself, realizes both the sensation of which it might have been the natural continuation and the image." [37] This exchange of imagination, internalization and a representative reiteration show how we observe and understand the world we share. We elevate methods of representing the virtual-vision by implementing methods that activate

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[34] ———, *Places on the Margin : Alternative Geographies of Modernity*, 50.

[35] Henri Lefebvre, *The Production of Space* (Oxford, OX, UK; Cambridge, Mass., USA: Blackwell, 1991), 33.

[36] John Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture* (New York: Princeton Architectural Press, 1998), 29.

[37] Henri Bergson, Nancy Margaret Paul, and William Scott Palmer, *Matter and Memory* (New York: Zone Books, 1988), 131.

the senses from which we share in our understanding of reality. We utilize methods of art to understand as well as represent. Society also assembles new tools to define the edges of those spaces to bring ownership and form to our world. The interaction of art and architecture act as our tools to enhance and evolve the imagination of our cultural spatialization. We take in and express our observations using all of our senses to push that perception. This cycle is compounded and evolutionary. For this reason, the symbiotic relationship of shaping space and representing it are forever connected. Continual evolutions in this marriage push the definition of our social space and abilities to represent it.

Representations of our world can only reach as far as social consciousness and cultural spatialization will allow. Visual dimensions were made possible through the creation of technology for representation. The x and y coordinate, the three dimensional concept of perspective and the recent understanding of the space-time experience of the fourth dimension, all brought opportunities of visual-spatial representation to the designed space. Architecture has continued to be utilized as a canvas for applying this knowledge and brings the representative-visual world closer to the real world in which we occupy. Previously applied in lavish or specialized instances throughout history, like Baroque churches and cathedrals, the immersive dimensional experience is now again being applied in the public arena. Though not commonly immense in scale, or overwhelmingly popular, the simulation of "space" drew some notoriety and exploded during trends like the panorama, the prospettiva and great surrounding friezes, creating an internal utopia. Today, experiential applications utilizing truly modern technology aimed to create immersive, spatial experiences, are beginning to emerge yet again, especially advancing in installation art applications. Through the examination of the evolution of "trompe-l'oeil" has continued to be applied over time in the built environment, this exploration seeks to describe the role of the modern viewer to these types of installations. What is the modern viewer looking for? What is he capable of understanding? What is he accustomed to?

Through the adaptations of understanding visual and mathematical "dimensions," the viewer has progressed from being an external viewer of a representation, to an occupant, and now to an experiencer. The architect has the ability to be at the helm for shaping the modern next "dimensional" experience and must be able to bring viewer to an active participant, as their own designer of dynamic spaces made possible with modern technology. "Mathematician Hermann Minkowski, in the early 1900s, envisioned this understanding and saw the built environment as an indivisible continuum. 'Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a

kind of union of the two will preserve an independent reality.'" [38] The modern practice of applying emerging technologies to represent virtual spaces, is growing in its ability to be visually accurate to the reality-space around us. Due to the adaptation or acclimation to representational abilities, the perception and definition of what is reality and what is "virtual" has changed over time.

Early representations were simplistic in their methods but equally as powerful as those used today because the viewer of that time had not perceived more complex representations. The concept of a "virtual" experience changes with the perceptual abilities of society, as they embrace new, mediated experiences and visual constructs. A virtual construct, once perceived as "real" by a viewer 200 years ago would bore the modern viewer and be brushed off as mediocre. "Illusions, mirrors to extend the space of a room, (such as the Palace of Versailles' Hall of Mirrors) and Trompe L'oeil decoration fascinated eighteenth-and nineteenth century writers." Though mirrors are still utilized today, they have been adopted as standard to our cultural spatialization. The Lumière brothers created the cinema camera, over one hundred years ago, and photographed a single-shot film of a train that nears the camera and "increased gradually in size as it pulled in, until it seemed it would crash through the screen into the room itself."[39] The images represented on film were so visually foreign to society at that time, it caused members of the audience to physically respond to the moving image. They jumped or ran in fear as though they needed to preserve their life. These advances in representing the real world bring the viewer to a new conceptual "dimension" and continually expand their skills of visualizing the virtual. "Virtual worlds become important when they diverge from the actual, or when the actual is ignored in favor of the virtual -- at which point 'they are more real than real', as Jean Baudrillard, a theorist of the 'ironies of late-twentieth-century cultures, has pointed out." [40]

Technology of today, is poised to create next "dimensional" experience but is not yet being applied in the built environment to its full potential. Historic progressions of cultural spatialization indicate that today, we are capable of comprehending more complex methods of visual-virtual applications. Through evaluating the history of our spatial understanding Shields indicates that "we can clearly find historical types of virtual realities, fictions, simulations and perception games which tricked the mind and body into feeling transported elsewhere." These spatial additions have been adopted within the built

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[38] Giedion, *Space, Time and Architecture : The Growth of a New Tradition*, 14.

[39] Mark Cousins, *The Story of Film* (London: Pavilion, 2004), 23.

[40] Shields, *The Virtual*, 5.

environment. He indicates "it is clear that there has been a history and succession of 'virtual worlds' which anticipate the ability of information and communication technologies to make present what is both absent and imaginary." Not only does he mention their merit but stretches as far to include "cinema as one example, and any number of rituals create, through a willing suspension of disbelief, milieux in which rules other than those that govern face-to-face interactions of actual bodies are the norm (for example, flashbacks, and other temporal reorderings, leaps from scene to scene and 'superhuman' powers)."[41] This stretches beyond the pictorial representation, but also any methods that activate the senses to spark that willing suspension of disbelief. It is for this reason that cultural spatialization is evolutional, because we have never departed from having that will.

This history evolved as a compounded progression of the spatial understandings that came before us. Though "transportations" to feeling elsewhere exist without a visual representation, those that are visual are strongly tied to what we experience in reality. Strictly visual constructs provide cues for our senses that are capable of being understood as reality. Visual triggers, are more influential because they occur in the lived space (reality) and thus, have a more resonating impact than those of dreams or fiction.

Precedent examples of architecture and their use of representational technology across various eras, determine visual baselines and how they evolved throughout time. From the cues of these baselines, the foundation for a more technologically-based lexicon will resonate with that which we naturally know and understand. It is also for this reason, we are able to push heavily "virtual" understandings into the scope of modern cultural spatialization. The modern architect should be able to utilize virtual-visual representations as strongly as real-physical forms. Today, the social understanding of virtual is practically an innate ability, because its relatable to the abstract, technological, state of mind we experience daily.

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[41] Ibid., 11.

2.2 CONSTRUCTING THE MODERN SPATIAL EXPERIENCE

Both the architectural canvas and the projected space are a response to the state of cultural spatialization. Though they contrast in nature, they operate on similar visual triggers. This section identifies the visual and physical spatial methods used by the built environment or architectural canvas. The framework of the modern cultural spatialization exposes opportunities the architect can utilize to extend their responsibilities as the designer of the spatial experience.

Spatial understanding for the modern occupant, is capable of being fed immense amounts of visual information. Due to the saturation of visual information in the built environment, society responds differently to representations than previous generations. Modern technology like the computer, has advanced with the ability to create virtual "universes" for motion pictures and video games. The modern citizen is able to observe life occurring thousands of miles away from us, in real time, at full scale. With these capabilities, the architect could adopt construct a heavy visual-virtual construction and the viewer would comprehend it as easily as he does a physical arrangement.

Even secluded suburban houses have theatre sized televisions and gadgets streaming visual information to an occupant all the time. Even traditional, recreational media becoming excessive and renovated. Former films that have previously broken box office records are now being rereleased to the drooling masses in 3D to bring billions once again. "Television and computer screens have become my replacement windows to the world. Their flickering vistas do not offer me apertures of transcendence, or even escape. Ultimately, I'm led back to my monstrous and ever hyper accelerating self, which floats in digital ouroboros as informations traveling at the speed of light devours itself as quickly as it can be produced."[42] One would ask, why do we have this immense desire to submerge ourselves in these visual circuses? When the television moved into our home as the centerpiece for an entire room, the cultural spatialization took a turn to include a miniature window, the television, to look out into a virtual universe, and it was the norm. Also, as

[42] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 7.

opposed to dedicating an entire building , the theater, to the immersive experience of entertainment, that experience has now moved into every aspect of daily life. John Beckman, an advocate of the virtual believes "that we are among the last generations that will enjoy or suffer (depending on your point of view) non-virtual subjectivity." He also visualizes that "the divide between an artificial, electronically or chemically conjured reality and that which is more directly apprehended by the senses is the dominant issue that we confront as designers. " He visualizes a battle of responding to cultural spatializations saying "the post millennial struggle will surely be about space and autonomy, about the politics of limit to the mind and --more relevantly-- body." Understanding the oncoming merge of the real and the virtual, he questions "if the virtual reality jockeys are able to conjure sensations of physicality that are either indistinguishable from or better than the quotidian version, it may be time to move along, chill out, to fire up the CAD and design the fleshy ergonomic toggles to switch the Holo to VR mode."[43]

As future technologies emerge, the heartbeat of modern society is tied to these technological innovations. The sensitive, artistic, collaborative new forms of media and the spatial experiences they develop combined reveal the next "dimension" of spatial understanding. They will reveal the future potential, as well as responsibility, to build the virtual and physical bridge, capable of creating the modern, visual-virtual. The interest in immersive spaces has brought technology into the mainstream built environment, and through the understanding of existing tools and the identification of future technologies, that embody spatial potential, the architect will be equipped to respond to the cultural spatialization of today.

Precedent examples drawn from existing applications reveal a need for structure and methods to the visual madness that is becoming our cities. Being that, in places like Shanghai, Las Vegas and New York City, there is no method or regulations to the application of digital media, upon the built environment, places like Times Square have become explosive competitions for visual grandeur. "Indeed, there may be something very beneficial to the human psyche that comes from the ability to tame those images, experiences, and events that we find most disturbing. The issue, though, is whether the theme park experience should be the guiding principal behind the construction of public spaces in cities. When the form and content of the public spaces are orchestrated in this way to create a marketable environment, they become antithetical to a diversity of uses and

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[43] Michael Sorkin, "Vr the World," in *The Edge of the Millenium : An International Critique of Architecture, Urban Planning, Product and Communication Design*, ed. Susan Yelavich (New York: Whitney Library of Design, 1993), 234.

users."[44] This brings about an argument of the social and political messages associated installing digital media in the built environment. It is not within the scope of this argument to analyze the messages under that umbrella, but it is worth noting that ownership and messaging follow a long history of visual ownership, that ideally would not be a problem in the future methods of design discussed here.

As of now, the strictly architectural, built fabric is still able to capture the attention of a present day occupant. Modern society is able to be inspired by the spaces we construct. Should the digital age continue to advance and grow at this exponential pace, and its ability to control the attention of society, the future occupant of architecture will no longer experience space as we do today. Architecture could unfortunately become the backdrop for advertising and motion graphics without the recognition of their influence upon each other. "We are witness to the emergence of architecture and its "chromed" double, an architecture that casts no shadows. An electro-shadow-less architecture made by vampires for vampires, forever condemned to live a soulless immortality in front of flickering phosphorescent glow of computer displays as cities crumble around them."[45] Beckmann speculates that architecture itself will spawn new iterations of the virtual and create an architecture that casts no shadows, but should the profession resume as it has, ignoring the displays that creep across all vertical surfaces, architecture will become a structural backdrop for advertising.

Should the vertical skies of large cities be splashed with advertising or can they reclaim their responsibility of being the spatial ceilings to the open spaces of the city? Being that many roads are being converted into pedestrian plazas, the opportunities for the design of the vertical walls and "virtual ceilings" are innumerable. By shaping these overhead spaces the architect is working at a scale much larger than the average interior. He would assist in preventing the architectural gestures surrounding these plazas from being overcome by advertising. These plazas also represent the shared space of the modern city, like outdoor living rooms that citizens of cramped apartments flock to for some decompression.

Heidegger describes, "The most elemental process of modern times is the conquest of the world as images."[46] This modern call to action for the understanding our world as images is a result of the changing ability of visual understanding of the "cultural

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[44] Alexander J. Reichl, *Reconstructing Times Square : Politics and Culture in Urban Development* (Lawrence, Kan.: University Press of Kansas, 1999), 179.

[45] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 15.

[46] Martin Heidegger, *Holzwege* (Frankfurt: Klostermann, 2003), 92.

spatialization". "The 'activation' or 'domestication', of the human senses lay with changing forms of art and media."[47] Present day is more representative of this phenomenon than ever before. More of the time we spend in daily life resides within the technology we use to communicate.

So if the modern occupant is capable, and the technologies exist, and the architectural canvas is in need of an advocate, how have we ignored the opportunities these relationships could control? How has the architect not responded in outrage to his work being covered up? How has the urban citizen not demanded a voice in designing his urban "living room". We know not where these outrages will go, but we do know that they are occurring. Because the architect has always had the responsibility of designing these realms, this investigation continues to explore the parallels that his art has to respond to cultural spatialization. Beginning with methods the architectural canvas possesses individually, followed by those of the projected space, we will begin to understand the opportunities and responsibilities made possible by utilizing visual technology on the architectural canvas in place of advertising. Since the architect is already the designer of spaces within reality, could he not also design visual-virtual space? Parallels of the methods of defining space of the built environment, and those of suggesting space in the virtual, bring ease to imagining how the architect is to respond to cultural spatialization of today.

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[47] Grau, *Virtual Art from Illusion to Immersion*, 6.

2.3 PHYSICAL AND VISUAL METHODS TO DEFINE & SUGGEST SPACE

PERCEPTUAL DEPTH CUES

Pictorial Depth Cues
- interposition
- light (relative brightness)
- shadows
- detail perspective
- aerial atmospheric
- verticality
- horizontality
- relative size
- elevation
- texture gradient

Kinetic Depth Cues
- relative motion parallax
- motion perspective
- kinetic depth effect
- apparent scale

Physiological Depth Cues
- convergence
- accommodation (retinal blurring)
- binocular disparity
- cone of vision

Motion Depth Cues
- contrast
- motion biases

*Cues listed here gathered from various sources. See Additional Reading

Architectural form and visual representations are both observed by the same pictorial depth cues. The cues discussed here are applicable both representation of space and the built environment. The methods introduced here, will later be utilized in the categorization of spatial experiences including historic and modern architectural canvases with projected spatial applications. Visual cues are critical because their implementation allows for the exchange responsibility of visual-spatial information between the real and the virtual. Physiological cues do not fall within the scope of this investigation but are mentioned here for reference. Because the projection map will later include images in motion, the kinetic and motion depth cues will be included in this evaluation. The pictorial depth cues work in a two-dimensional fashion. Thus they are particularly effective in representations, but operate on the same premise in the built environment. The occupant faces each approach or 'image' of an architectural space with a framed vision, limited by the range of our eyes. The snapshots the brain assembles, to decode a space, work similar to that of viewing a painting or a moving camera on the cinematic screen. Indeed the lack of immersive experience separates the painting from being perceived quite the same as the physical occupation of a space, but again, the efficacy of the representative image is strongly influenced by the capabilities of cultural spatialization.

VISUAL CUE DEFINTIONS:

PICTORIAL DEPTH CUES

Interposition: Occurs when one object occludes the object that falls behind it.

Relative Brightness (Light): Nearer objects appear brighter than those in the background because the reflected light from nearer objects has to travel less distance.

Aerial/Detail Perspective: Objects that are father from the viewer lose their clarity and have a smaller degree of contrast from the background. Light rays that have to travel farther to reach the eye, lose their brightness. This also occurs because of the density of atmosphere between the viewer and farther objects.

Elevation: Objects that are farther away from the viewer are higher and nearer to the horizon than those close to the viewer.

Texture Gradients: Objects closer to the viewer are larger and more detailed and those farther away are more tightly spaced and have less detail.

Relative Size: Objects that physically are the same size, appear larger the closer they are to viewer.

Shadow: Shadow provides context of distance between the object causing the shadow, the source of light and the surface upon which the shadow falls.

Horizontality and Verticality: Due to the orientation of the eyes being on a horizontal axis, horizontal objects provide lesser visual cues than those that are vertical. The eyes can perceive from their angled configuration that a vertical object is farther or closer because three sides may be visible. A horizontal object may allow for the observation of less sides and less depth information.

KINETIC DEPTH CUES

Relative Motion Parallax: Objects nearer to the viewer move faster then objects in the distance. Objects in the distance can appear almost static as they get closer to the horizon.

Motion Perspective: Objects recede into the distance and become smaller as they move away from the viewer. The observed speed also appears to visually slow as the object moves farther away.

Apparent Scale: A familiar object that is always about the same size, provides contextual information about the distance from the viewer.

PHYSIOLOGICAL DEPTH CUES

Convergence: The stereopsis and angle between both eyes allow those images to merge. The effort for the eyes to combine those two images reduces as the distance of the object increases.

Binocular Disparity: The observation by both eyes allows for a triangulation of an object and each eye is essentially verifying the image provided by the other. Objects farther away would appear similar if viewed with one eye closed, but as it nears the eye the difference becomes more apparent.

Cone of Vision: The cone of vision is the amount of visual information that is obtained without the use of peripheral vision. Objects that are outside this cone of vision require more distance in order to be perceived (without the assistance of peripheral vision)

Accommodation: Accommodation occurs by the lens of the eye changing to bring objects of various distances into focus. Far away objects require less accommodation from the eye to be in focus.

2.4 ARCHITECTURAL CANVAS: ELEMENTS TO PHYSICALLY DEFINE SPACE

The basic building blocks of an architectural space are especially important to how we decode the built environment, because they work in concert to create diverse experiences. "Architectural space is always experienced space in that it enhances and constrains human activities. Thus the perception of architectural space is never a homogenous or faithful recording of geometric characteristics and dimensions. Rather, every location possesses a different value depending on use and meaning assigned by the inhabitants. It is of note that the architectural space is always experienced synaesthetically-- that is, as a compendium of sensations involving light, sound, touch, smell, temperature and of course movement. And this quality also adds to its potentially 'distorted' character."[48] Visual, audio and even temperature cues posses additional spatial abilities. They can guide how people move throughout space, changing pace, how they occupy it and the perceived scale.

The visual information that represents the space around us is competing with other cognitive cues at all times, some of which will assist in the understanding, others which will work in contrast. Being that information and technology saturate the daily lifestyle, the methods of representing the space of reality are lost in a sea of competing virtual disciplines. The physiological fact that we experience the built environment instead as a visual two-dimensional "picture", in a technical sense, would appear limiting. But we cannot forget that those visual images are bursting with an immense library of cues for the brain to dissect and from that information alone, is able to reconstruct whole worlds. The imagination is the true orchestrator of the equation, creating the entire perception of reality and surroundings that one is observing and occupying.

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[48] Weber, *On the Aesthetics of Architecture : A Psychological Approach to the Structure and the Order of Perceived Architectural Space*, 133.

Just as physical science philosopher, Immanuel Kant described in his *Critique of Judgement*[49], that we will never truly know the "actual form" of an object but we can only claim knowledge of how it appears to us. Though Kant's philosophy is a practical perspective on the matter, it is recognized that even as early as the Hellenistic and Roman period if not sooner, architects recognized this reality and used the method of entasis, in the creation of Greek temples to visually "correct" the appearance of the columns to increase their apparent strength and mass. This demonstrates that a visual declaration of power and technical prowess by manipulating the appearance was of more importance to society than knowledge of the "actual form". To bring the foundation of the virtual, which is man's mental image, back into reality can be done via infinite methods. In reality, the architect, painter, or cinematographer has the ability to express internal virtual constructs, by using the shared understanding of reality (the common language of the five senses). To give some regularity and method to the virtual representations of the real world and the virtual view of the world in our minds eye, we create and utilize more structured disciplines to give foundation to the abstractness of this shared consciousness.

In addition, the architectural experience cannot remove itself from the real-world reality of being observed spatio-temporally. Time is only moving forward at a constant pace, and the viewer is limited by the physical abilities of their vehicle for moving throughout the space. Though this is the reality we have occupied since the creation of man, the human brain is able to perceive or imagine worlds outside of the "lived space". To better understand this potential and how it has been implemented in architectural space throughout history as well as its future potential, we must understand the foundational methods that physical architecture utilizes to express its own individual spatial qualities. Our visual senses, beginning with the eyes, flattens three dimensional reality to a two-dimensional picture, only to be reassembled by the brain, using a vocabulary of spatial cues to suggest what we understand as the three dimensional reality. In addition, a representation often is a "moment" in time captured or frozen in a snapshot of the mind. The viewer essentially holds the power of providing the certainty, and acceptance of reality to any spatial circumstance. Art itself is not restrained by the representation of a spatial moment. When a spatial representation is implemented on the architectural canvas, they are capable, like mirrors are, when utilized in modern interior design to expand the size of a room. Shields includes this phenomenon in his declaration of the virtual "One of the most interesting historical uses of the virtual anticipates the way in which people now refer to

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[49] Immanuel Kant and J. H. Bernard, "Kant's Critique of Judgement," Macmillan and Co., http://lookup.lib.hku.hk/lookup/bib/B31445561.

virtual realities or virtual teams. This is found in the discussion of mirror reflections as 'virtual images' and of the way we experience dreams as 'virtually real'." In optics, a 'virtual image' is formed by the apparent, but not actual, convergence of light rays to make an apparent but not counterfeit of the real." Shields is drawing attention to discern the distinct difference between the actual and the representation, noting its "not simply a matter of perfect resemblance, however, for the image is reversed left to right. The image is virtual in that it suggests a potential mirror-world on the other side of the glass an early precursor to the power of simulation."[50]

This implies that we suspend our disbelief, even casually, all the time. It is when these types of representations of the real world are adopted into the cultural spatialization, that the technical accuracies are then ignored. For as long as the mirror has been around, it has been both utilized for its practical application but also its spatial capabilities despite the fact that is a clear reversal of reality. The brain understands this phenomenon so naturally it is never questioned. Almost as though it is an architectural duplicate, and it moves in respect to how we move in relation to it, we understand it is not a place with which we occupy in first person.

The visible, immersive presence of the lived space allows us to understand its depth. But when we approach an architectural form straight on, it gives an overall frame to the picture, but loses its spatial information. Even approaching a building within reality holds a degree of mystery and unknowing as occurs with a representation. Arnheim describes "frontality, as the display of a principal aspect of the building fully, indeed, allows this one aspect, to monopolize the scene. When one faces a cube head-on, one gets to see nothing but the frontal plane." Here it is though even the architectural canvas can appear as a pictorial representation if approached head on. He suggests "one though, can combine the best of both worlds by using isometric perspective. Here the front face appears in full, undistorted extent, but at the same time two of the orthogonal faces, for example , the top and one side face, are visible." There is a degree of actuality of orthographic methods but "such an image is accepted in the two-dimensional plane as a representation of a regular cube. But a three dimensional solid would yield this projection only if it were crooked, oblique, and divergent-not a likely candidate for architecture."[51] So what he is suggesting is that there is a reversal. The actual can be viewed head-on and appear as a depiction and that even the depiction, in some methods of representation is understood as fake because

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[50] Shields, *The Virtual*, 7.

[51] Arnheim, *The Dynamics of Architectural Form : Based on the 1975 Mary Duke Biddle Lectures at the Cooper Union*, 135.

a conventional construction would not be distorted in such a fashion that is ignorant to the function of the eye.

This representational phenomenon of orthogonal or isometric representation is discussed in a later chapter in relation to projection mapping technologies. It is mentioned here because the visual opportunities of these methods are not as widely applicable to real world forms in architecture. "Hexagonal or octagonal buildings, such as baptistries, also display their volume for the viewer., and the same is true for octagonal turrets of San Antonio in Padua. Artists, too, take advantage of this device when they are not bound by the rules of central perspective."[52] The irony here is that the artist is free to apply an orthogonal methodology on paper, because the representation of reality is not required in a work of art. The artist is also capable of mimicking the real world form on paper by "bounding themselves to the central perspective" but do so with the intension of being accurate to reality. The architect on the other hand, rarely tries to mislead the occupant to misunderstand his surroundings. The architect is most often an artist of honesty and makes spatial representations that assist in spatial and visual understanding more than mislead. It is for this reason that each visual element of architecture have visual power assist in the spatial understanding. "Architectural perspective, forms so simple and compelling a system of converging edges that it detaches itself easily from the building and thereby enables the viewer to see the building in its objective shape." We have come to excuse the abstractions of our own perception, "deformations wrought by perspective are never entirely absent from the buildings appearance and that their effect is felt even though the are not commonly acknowledged as objective properties of building itself." Arnheim describes that "perspective removes the building from its stable repose of the frontal plane and conveys it into the dimension of depth." By identifying that it is our own perceptual perspective that is acting on defining the real world depth, we can comprehend why it holds its spatial potential in the representation. "Because depth is the realm of coming and going, when a building's shapes conform to perspective, the building partakes in the movement.[53] Arnheim is suggesting that the architectural form has to participate with the visual perspective, and that if it works against our conventional spatializations the architecture itself can then become its own pictorial representation.

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[52] Ibid.

[53] Ibid., 143.

3 SPATIAL REPRESENTATIONS VS. SPATIAL EXPERIENCES

3.1 TYPOLOGY OF SPATIAL REPRESENTATIONS

A representation of space is able to be created by both the most basic and complex of methods. Starting as far back as simple line pictorial representations on the cave wall, varieties of typologies of spatial representations have brought the virtual to the built environment. These typologies here are evaluated historically. They also indicate the parallel evolution of the cultural spatializations that triggered them.

Representations began as simple expressions utilizing the best tools and knowledge available. The establishment of the Cartesian Coordinate System, the method of perspective, and the spatio-temporal concept of the fourth dimension were created through mathematical knowledge, yet directly impact the social conceptualization of how to depict the world around us, and thus also the cultural spatialization. Anthony Vidler, specialist in the psychology of architecture noted that "The formal experimentation of the first avante-gardes was, in part at least, an attempt to represent the spatio-temporal dislocations of relativity in philosophy, mathematics, and later physics, while at the same time registering the psychic effects of modern life on the individual and mass subject." [54] Beginning with the intention of bringing systematic order to the discussion of the spatio-temporal existence, the creation of these methods later brought forth the technologies that allowed the creation of near reality representations. These themselves were virtual duplications of reality. "Technology has always evoked new representations of reality." [55] These systematic approaches increased the emergence of methods more capable of creating images visually nearing reality, which were inspired by and also evolved the cultural spatialization of that time. When a viewer is capable of both physically occupying a space

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[54] Anthony Vidler, *Warped Space : Art, Architecture, and Anxiety in Modern Culture* (Cambridge, Mass.: MIT Press, 2000), 6.

[55] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 12.

and visually imagining oneself within another, the spatialization of that individual expands. When the first viewers saw themselves represented within a photograph it was though they were looking at someone else. This static "duplicate" of oneself gave merit to the alternate space of the virtual, more relatable than a representation of a fictional space.

> The (perspective) way of viewing the world corresponds historically to the emergence of the idea of 'I', the subject, separate from the world as object. Such an approach led to the scientific investigation of the physical world, establishing laws of physics and optics, which in turn led (logically enough) to the discovery of photography and the camera. It is often assumed that this is the way the world is, that objective reality accords with the way the camera sees it. But we do not actually experience the world like this; instead we move around in a physical environment, touching things, sensing them in other ways, penetrating space rather than simply observing it. [56]

The progression of dimensional thought was centered around mathematical and theoretical desires for definition and ordering of the world around us. "A continuous scientific and technological progress made possible the large scale-diffusion of poetry and literature, painting, sculpture and music, enriching the spiritual heritage of an ever increasing number of people."[57] Though early representations in art were centered around expressing forms to the best of the ability of the artist at that time, it began as an abstraction of reality and a pictorial reference to real life, three-dimensional forms. This "flattening", representing only the height and width shape of a form, remained as the artistic form of representation for thousands of years.

Over time we evolve and expand the kit of parts in correlation with the changes of cultural spatialization. An example like Cartesian Coordinate System, allowed us to bring the measure of actual height and width to the abstractness of representation. That coordinate system was later followed with the understanding that depth is a third measurable dimension. We later devised a set of rules called perspective to bring representations towards visually appearing more like reality. As the abstractness of visually sharing our spatial understanding became less foreign we were able to push the limits of our methods. In recent history we understood that our movement through space and time also has meaning in the equation. The progression of these advancements, was fueled by a longing to trick the eye and to bring value to our representations as real, and for them to become immersive spaces to assemble our own "virtual" worlds.

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[56] Brian Ashbee, "Animation, Art and Digitality," in *Architectures of Illusion*, ed. Maureen Thomas and Francois Penz (Bristol; Portland (Or.): Intellect Books, 2003), 35.

[57] Zevi, *Architecture as Space; How to Look at Architecture*, 45.

Since technology, artistic and social changes are able to direct society's understanding of their surroundings, we must identify the direction of the oncoming change in our spatial perception. Take the historical precedents of changes in trends of art, for example. That which was once understood as surreal or abstract, as well as breaking into its own "dimension" in a sense, would not appear as too much of a stretch to the modern viewer. One of the most recognizable instances of this transformation was the creation of the tools of perspective created by Filippo Brunelleschi, which drastically changed the face of art during the Renaissance. A viewer of that era, new to visualizing an image of this type left the rendered image as indistinguishable from reality for a viewer of that time.

Figure 1: Girl Playing the Mandolin (1909) Pablo Picasso

Another milestone in the visualization of "space" on a two-dimensional medium was analytical cubism. Introduced by the manipulation of shadow an artist was able to visualize depth and a suggested image from a series of simple shadowed lines. Not only did it create an implied depth on the canvas, it also embraced visualizing objects from several visual points of view. Seen in this iconic example shown in Figure 1, cubism captured depth and movement on the static canvas. These experimental and transformative applications to visual mediums changed how art was conceptualized and visualized, and since continues to be an influential practice of our modern society. Its presence and resonance in the visual medium is likely a result of its marriage with other social transformations of the time. "Cubism was the first art movement that was synchronous with the multidimensionality that characterized the new scientific theories of relativity formed by Einstein and Bohr."[58] Surrealist and abstract painters of the 30s not only reflected discoveries in science, they also adopted the new technology of cinema and cinematography to suggest, distort and change the perceived reality of their paintings. Salvador Dali was a mind before his time, but implemented the knowledge of the golden ratio and a hypercube to visually suggest a forth dimension. These advances shaped the conceptual imagination of society at the time, and were a primer for the explosion of technology and science we thrive in today.

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[58] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 4.

"Cubism [broke] with Renaissance perspective. It views objects relatively: that is from several points of view, no one of which has exclusive authority. And in so dissecting objects it sees them simultaneously from all sides-- from above and below, from inside and outside. It goes around and into its objects. Thus, to the three dimensions of the Renaissance which have held good as constituent facts throughout so many centuries, there is added a fourth one-- time." [59] As Giedion had predicted the transformations that the birth of that style were envisioning, we are indeed upon yet another new visual horizon and cultural spatialization. A modern capturing of space, first introduced by motion picture photography, is now being reintroduced and investigated by three dimensional virtual reality computer rendering. A new era of "perspective" or "cubism" is upon us and in addition to being visually and scientifically driven, it is now also dawning with the parallel, virtual society that drives the inter-webbed universe of communication, the internet. Not only is the discussion of the built reality and visualization of space on the table, the virtual society that is being built parallel to our actual societies, introduces yet another built environment to shape. Our social frontier lies in the merging of two if not three or four "realities" we occupy. "Novel sorts of space arise in relation to cultural and social transformations; at the same time [there is a] recursive relationship where architectural space is an active participant in the construction of subjects and social ordering. .... Architects might return to the matrix of rooms as a point of departure for spatial armatures fostering multiplicity and complexity through the use of time." [60] Cubism was a multidisciplinary discovery and merging of many disciplines, looking to cinematography, science and theory, but artists ran with those tools to forge a new "perspective". "Picasso had been called the inventor of cubism but cubism is not the invention of any individual. It is rather the expression of a collective and almost unconscious attitude. 'There was no invention. Still more, there could not be one. Soon it was twitching in everybody's fingers.'"[61] The technology of representations can be categorized as they represent over history, starting with pictorial representations, then perspective, which includes orthographic and Cartesian Coordinate Systems, and modernly, to build upon the photograph, cinema. Each will be introduced here and also contextualized against the contrast between the moving and static image.

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[59] Giedion, *Space, Time and Architecture : The Growth of a New Tradition*, 369.

[63] Michael Hensel, Achim Menges, and Christopher Hight, "En Route: Towards a Discourse on Heterogeneous Space Beyond Modernist Space--Time and Post-Modernist Social Geography," in *Space Reader : Heterogeneous Space in Architecture* (Chichester, U.K.: Wiley, 2009), 32.

[61] Giedion, *Space, Time and Architecture : The Growth of a New Tradition*, 367.

3.1.2 PICTORIAL

CARTESIAN COORDINATE SYSTEM AND ORTHOGRAPHIC REPRESENTATION

The rectilinear or cartesian system is used in reference to Euclidean space. This Euclidean space, is defined by three coordinates, allowing a height, width and depth to be defined. Created by the mathematician Rene Descartes the Cartesian Coordinate System was the first representational method utilized to create a measured reality, helpful to Renaissance architects that previously used more two-dimensional drawings to describe their work. This method of representing spatial coordinates, when orthogonally oriented, often at 30, 60 or 45 degrees, this coordinate system allows for the identification of measurable distances, but is not capable of representing the reality seen by the human eye. Though mathematically dependable, it is never visually accurate. This made possible the plan elevation and section which are still utilized today to describe the form of a work of architecture.

The irony lies in the fact that the Cartesian Coordinate System is able to represent the measurable reality, but ends up being a visually-virtual situation, if one were positioned from a skewed angle and place and the form was working in favor of counteracting the perspective. Rudolf Arnheim, whose expertise expresses the dynamics of architectural space, describes the method of cartesian coordinates as being "the notion of space as a container that would exist even if it were completely empty is reflected in the Newtonian assumption of an absolute base of reference, against which all distances, velocities, or sizes have equally absolute measurements." Marking the descriptive capabilities of the Cartesian Coordinate System Arnheim describes the spatial potential as "to which all locations, sizes or movements in a three dimensional space can be related. If for example, nothing but a single ball-shaped object is given, the spatial position with regard to the framework can be determined by three coordinates indicating distances from the frame of reference." Mathematically and visually descriptive, it acts as an additive method to describe objects but "makes no sense when we deny the existence of absolute space and instead consider space the creation of existing objects. In this view no three-dimensional framework exists

for the solitary ball suspended in emptiness." Thus the coordinate system is more capable of defining the edges of masses but not the spaces that are captured within. This is a result of there being "no up and down, no left or right, neither size nor velocity and no determinable distance of any kind. Instead there is a single center surrounded quite symmetrically by emptiness in that no direction is distinguishable in any way from any other, and consequently the notion of direction does not come up at all. Space is, in this case, a centrically symmetrical sphere of infinite expanse. It should be noted that the situation I am describing here is not simply physical but experiential, presupposing a conscious space that somehow inherits in that single, ball shaped object."[62] Not only is the Cartesian Coordinate System not relatable to the visual perception of an object, it is also not applicable to the interior perception of a space. The orthographic representation is irrelevant to the interior observation of a space. Though it is often used to show three sides of an architectural exterior, it would not assist in the understanding of an interior space. It also neglects the position of an occupant or a viewer.

"Antique perspective is thus the expression of a specific and unmodern view of space (although it is certainly a genuinely spatial view). Antique perspective is furthermore the expression of an equally specific and equally unmodern conception of the world. And only now can we understand how the unique world was able to satisfy itself with what Goethe called 'such a precarious, even false' rendition of the impression of space."[63] The evolution of the Cartesian Coordinate System and orthographic representation suggested the longing for accurate representation of how we see physical reality. It sufficed to satisfy the cultural spatialization of that time, enough to be adopted onto the walls of architectural applications, but did not diminish the desire for near realistic representations. Thus the methods to create perspective was passionately pursued. As Panofsky describes this pursuit, it is an excellent example of the reciprocal relationship of the evolution of cultural spatialization. If "this mode of representing space suffers, in comparison to modern mode, from a peculiar instability and internal inconsistency." This refers to the abilities of the cultural spatialization and how "this modern vanishing-point construction distorts all widths, depths and heights in constant proportion, and thus defines unequivocally that apparent size of any object, the size corresponding to its actual magnitude and its position with respect to the eye." Panofsky treats the accomplishment of perspective as an homage to

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[62] Arnheim, *The Dynamics of Architectural Form : Based on the 1975 Mary Duke Biddle Lectures at the Cooper Union*, 10.

[63] Panofsky, *Perspective as Symbolic Form*, 43.

the consideration of the eye. Perspective "is precisely the enormous advantage of the modern method, precisely why it was so passionately pursued. A constant distortion is impossible under vanishing -axis principal because the arrangement of the rays has no validity"[64] Panofsky is recognizing that a method of representation that does not recognize the achievement of responding to the human condition of viewing is no longer relevant. Panofsky's description both touches upon how the cultural spatialization is driven but also that the shortcomings of out-dated representations has added fuel to the fire to bring to fruition a method which more accurately represents the capabilities of the cultural spatialization of that time.

[64] Ibid., 40.

3.1.3 PERSPECTIVE

> Thus (through perspective) every sort of confusion is revealed within us; and this is that weakness of the human mind on which the art of conjuring and of deceiving by light and shadow and other ingenious devices imposes, having an effect upon us like magic... And the arts of measuring and numbering and weighing come to the rescue of the human understanding – there is the beauty of them – and the apparent greater or less, or more or heavier, no longer have the mastery over us, but give way before calculation and measure and weight? -Plato

Created to elevate the method of orthographic representations, perspective was designed to be accurate to how reality is represented by the eye. It placed the importance of the viewer over that of accurate representations of measurements or angles. It also became a way to take the forth dimensional experience of life, height, width, depth over time, into a three dimensional frozen representation of a moment of time. The method Fillippo Brunelleschi utilized to confirm his methodology was by using a mirror. A mirror in a sense is itself capable of capturing a two-dimensional representation of space, though is still capable of honoring the passage of time. He used this two-dimensional medium the mirror to act as the picture plane with which he was capturing that moment of reality. The mirror or the perspectival representation though visually convincing cannot honestly represent reality because it is only showing a representation from one point of view at one moment in time. An image by the artist M.C. Esher best displays the illusionary capabilities of this new method to represent reality. (Figure 2)

After its discovery, perspective was quickly adopted into the architectural application, but again was only able to respond accurately to a viewer in one place that aligned the viewer to the vanishing point with which it was designed. "The history of perspective may be understood with equal justice as a triumph of the distancing and objectifying sense of the real, and as a triumph of the distance-denying human struggle for control; it is as much a consolidation and systemization of the external world, as an extension of the domain of the self." This struggle for control made perspective a true triumph of the Renaissance, representing both mathematical and systematic ordering, as well as representing the importance of the viewer. "Artistic thinking must have found itself constantly confronted

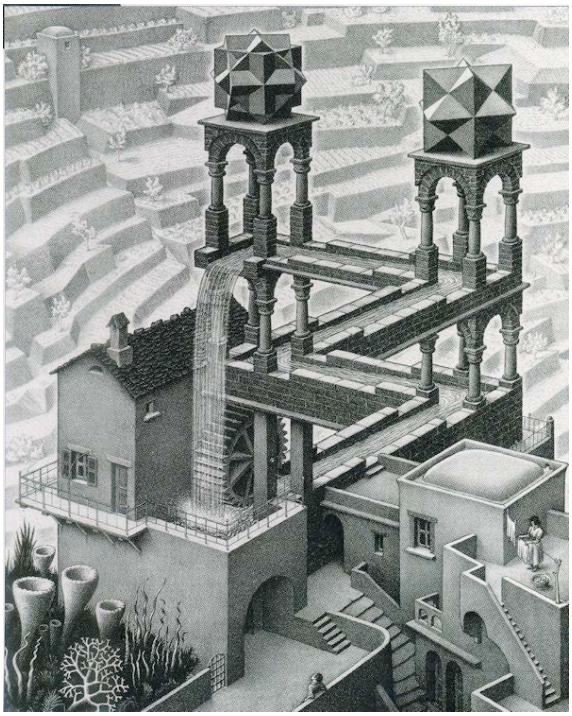
Figure 2: Waterfall by M. C. Escher, (1961)

with how to put this ambivalent method to use. It had to be asked (and indeed it was asked) whether the perspectival configuration of a painting was to be oriented toward the factual standpoint of the beholder (as in the quite special case of "illusionistic" ceiling painting, which goes about laying the picture plane horizontally, and then drawing all the consequences from this 90-degree rotation of the whole world); or whether conversely the beholder out ideally to adapt himself to the perspectival configuration of the painting." [65] By exchanging the responsibility of the representation being for the viewer with the representation being activated by the viewer, perspective steps outside of being either of reality or virtual. It possess its own deceptive identity.

This method was not ambivalent because the emergence of perspective was appropriate for the cultural spatialization of that time. Being in the time of the Renaissance, a time where all things new and imagined were welcome, perspective had a welcome place with the artistic, architectural and scientific thinkers of the time. It's use on the architectural canvas was pushing the potential of its understanding. Being that the cultural spatialization of that time was in a time of dreaming, awe and imagination, this new method, being magical in its own capabilities needed to be implemented where it was inspired, in churches and other spaces that architecture had shaped to create awe.

Perspective also brought about the idea of a vanishing point that meet at a point of infinity. The horizon, on the contrary, is an easily grasped idea because we are able to see it when outdoors in a landscape. To imagine this abstract distance at which these lines could meet required abstract thought because it contrasted these known realities of distances and angles. Essentially perspective disobeys the mathematical representations of space because math does not react in relation to man. "Perception does not know that concept

[65] Ibid., 68.

of infinity; from the very outset it is confined within certain spatial limits imposed by our faculties of perception." [66] Not only was the method a discovery but the abstract thinking of our place within the world was also integral to the cultural spatialization.

The viewer needed to be taken into consideration when perspective was created. Representations are created to be visually observed, so it wasn't until this was taken into account that man was able to create a reproduction that was read in a manner similar to how we observe reality. "Perspective mathematizes visual space, and yet it is very much visual space that it mathematizes; it is an ordering, but an ordering of the visual phenomenon. Whether one reproaches perspective for evaporating 'true being' into a mere manifestation of seen things, or rather for anchoring the free and, as it were, spiritual idea of form to a manifestation of mere seen things, is in the end little more than a question of emphasis." [67] When the physiological realities of man were placed in the hands of the representation, man could better "occupy" the virtual places that representations created. Architecture on the contrary is created in reality and thus can use mathematical definitions, because the eye observes those realities. Perspective understood that the visual-virtual existence of a representation meant that the virtual needs to preemptively define how it will be seen by the eye, because in essence it never exists in reality but rather only in its perception. "The invention of perspectival representation made the eye the centre point of the perspectival world as well as the concept of self. Perspectival representation itself turned into a symbolic form, one which not only describes but also conditions perception."[68] Perspective was the first response to creating a virtual representation, which only existed to be perceived. Later technologies like the photographic camera and the cinema camera, are their own perceivers, and thus the replications they create of the real world already posses those accommodations.

These technologies of representation are integral in understanding the progression of the projection map and its relation to the cultural spatialization at the time of their creation. They bring meanings to the interventions they made when applied to the architectural canvas and also introduced further potential with which to pursue and push the evolution for later applications of the representation. The evaluation to follow outlines this history and the impact from its evolution. Pallasmaa describes that the "exact perspectival construction is a systematic abstraction from the structure of this psychophysiological

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[66] Ernst Cassirer, *The Philosophy of Symbolic Forms* (New Haven: Yale University Press, 1953), 83.

[67] Panofsky, *Perspective as Symbolic Form*, 67.

[68] Pallasmaa, *The Eyes of the Skin : Architecture and the Senses*, 18.

space. For it is not only the effect of perspectival construction, but indeed its intended purpose, to realize in the representation of space precisely that homogeneity and boundlessness foreign to the direct experience of that space." Reflective upon what was mentioned earlier by Arnheim, perspective and the architectural form are both working to represent space, whether flattened by the page or physically formed by masses. "In a sense, perspective transforms psychophysiological space into mathematical space. It negates the differences between front and back, between left and right, between bodies and intervening space ("empty space"), so that the sum of all the parts of space and all its contents are absorbed into a single 'quantum continuum.'" It is actually ignoring the rules of the orthographic points in space and behaving exclusively for the viewer. "It forgets that we see not with a single fixed eye but with two constantly moving eyes-resulting in a spheroidal field of vision. It takes no account of the enormous difference between the psychologically conditioned "visual image" through which the visible world is brought into conciseness, and the mechanically conditioned "retinal image" which paints itself on our physical eye. For a peculiar stabilizing tendency within our consciousness-promoted by the cooperation of vision with the tactile sense-- ascribes to perceived objects a definite and proper size and form, and thus it tends not to take notice, at least not full notice to the distortions which these sizes and forms suffer on the retina." So perspective has fallen outside of being a descriptive method of quantifying space, and works both for behaving as its own reality, dressed to respond to the realities of the eye. "Finally, perspectival construction ignores the crucial circumstance that this retinal image--entirely apart from its subsequent psychological "interpretation" and even apart from the fact that the eyes move--is a projection not on a flat but concave surface. Thus already on this lowest, still pre-psychological level of facts, there is a fundamental discrepancy between "reality" and its construction."[69]

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[69] Panofsky, *Perspective as Symbolic Form*, 31.

3.1.4 MOVING AND STATIC IMAGES

Works of art behave as a reiteration of our interpretation of reality. The static representations described above behave as a captured moment frozen in time. Though architectural spaces and the natural landscape rarely are in motion, they are constantly observed in motion. A static image behaves as though there is only one point in time/space that this virtual projected space can be seen. It is for this reason that the point of view and vanishing point are critical to the spatial contribution of a static representation.

When occupying reality we are understanding, as Arnheim describes, that a "visual experience is not typically limited to one aspect of an object. In the course of moving around in our environment, we see things from different viewpoints. We may change our position deliberately to gain a more comprehensive view." This is part of what allows architecture to behave distinctively, yet at times, similarly to other methods of art. "A work of sculpture can only be seen if one walks around it, and the same is true for architecture. From the multiplicity of views the mind synthesizes an image of the sculpture's or building's objective three dimensional form." Arnheim recognizes we respond similarly to these varied experiences via cognitive observation. "Synthesis is aided by the fact that these various views do not come unrelated, as might a series of photographs from which one tries to form an idea of a building. Rather, the viewer moves around an object, or the object turns in front of his eyes, he receives an orderly sequence of gradually changing projections. The coherence of this sequence greatly facilitates the identification of the object, to which all the particular views refer."[70] Arnheim is expressing how even the architectural experience of reality is a series of changing projections. The virtual is a single moment in time captured as a static projection, and until recently has been locked in that moment. The modern projection map on the contrary has been able to reactivate itself into a series of projections, the moving picture.

Indeed the projection map and other digital interventions have the ability to be in motion, but they too suffer from representing an accurate vanishing point since they can

[70]Arnheim, *The Dynamics of Architectural Form : Based on the 1975 Mary Duke Biddle Lectures at the Cooper Union*, 111.

only represent a single point of view at a time. Some visual cues are able to create the same visual representation from any angle. Light and shadow for example are able to be slightly more ambiguous about the direction with which they are visually accurate. Other methods of representation like perspective for example are optimally seen from a single point, so even when in motion may not be accurately read from all directions.

Motion is also able to draw out a more extended visual experience because of the quality of persistence of vision. The motion picture operates on the premise that it only needs to create "tweens" between images close enough as 24 frames per second as needed for the human eye to understand it in motion. This visual opportunity is hugely helpful for the projection map because when a visual cue is shared between a form in reality and the virtual projection, that cue can be visually moved away from the physical form for quite a duration of time before the eye catches up to understand that the visual-virtual image is breaking the rules and it is not really occurring. This phenomenon will be demonstrated in the projection mapping precedents to follow. .

3.1.5 CINEMA

Projected spaces on the architectural canvas, behave like the parallel medium of cinema. Through the art of cinematography, cinema is able to step back and forth across a spatial threshold. The same evolution and manipulation of dimensional understanding in art has also allowed the experience of cinema to evolve. Beginning as a two-dimensional experience, cinema first captured tableaus, and later evolved to become a three-dimensional experience, with the introduction of the spatio-temporal movement of the camera. This dimensional experience assisted in shaping the cultural spatialization and dimensional understanding of modern society and allowed us to experience spaces that we can actually never occupy. Recent advancements in 3D imagery have transformed its methodology and has reemerged as the desired experience because of its spatial/ experiential capabilities. Due to the capabilities of CG (Computer Generated) imagery, technology for the cinematic camera brings new representations of virtual worlds to the big screen. Cinema is able to suspend the belief of a viewer and allow them to cognitively understand spaces that they do not physically experience in reality. The architectural canvas and projection map, is the next dimension *trompe-l'oeil*, and will bring new traditions to the built environment.

Successes of the medium of cinema, give emphasis to the capabilities of the modern viewer. The art of cinema exists on the premise that the belief of a viewer can be suspended and manipulated upon the whim of the cinematographer and scenic designer shaping the world upon the screen. They are able to implement visual tools to not only stretch the understanding of the space the characters are occupying, but also the observer's understanding of time, scale, emotion, etc. The cinematic eye of the camera also utilizes visual tools to create a spatial-temporal understanding to express as well as define the location and narrative of a film. Because of growing exposure to cinema and other mediums, modern society even has become accustomed to mediums of this type suspending our belief and virtual representations are appearing and accepted in daily life. To pay homage to the cultural spatial abilities of the modern occupant "The linguistic model of architecture must be supplemented by a perceptual one. In motion and media, a

building is understood no as an autonomous object, but as part of a web of routes, narratives, and milieus--a road journey, a plot driven movie, a book of photographs. The modern "zoomscape" liberate a building from its status as an object, they also free it from site and from our bodies. The influence of place on our understanding of architecture is less pronounced than ever. The non-visual senses, especially touch, play a diminishing role. Today, sight moves with the swiftness of vehicles and or camera edits. It shifts off-site with camera images, or with vehicles, to a state one could call passing-site."[71] Schwarzer sets the stage to understand the visual differences between cinematic space and the space we occupy. The spatial experience when observing cinema is a remote observation, that will be defined in 3.4.3.

Reality	Film Narrative	Architectural Canvas
• Three-Dimensional • Spatially Extended • Time is Continuous • Time moves only forward • Perception is always from one's viewpoint • Lighting is arbitrary • The spatial experience is modernly shaped by the built environment	• Two-Dimensional • Spatially Limited by frame • Time is discrete by shots • Time is multi-directional • Perception Shifts from spectators to character's viewpoint • Lighting can affect viewable "space" • Views to surroundings • Can be constructed and viewed from places not able to be physically occupied in reality	• Three-Dimensional • Spatially Extended but Defined by Architecture • Time (Pacing) discrete by spatial configuration • Time moves only forward • Perception is from one's own viewpoint but viewpoint can be directed by architecture • Lighting can affect viewable "space" • Views through openings connect the "spatial experience"

> "While moving pictures are lifted above the world of space and time and causality and are freed form its bounds, they are not certainly without law." - Hugo Munsterburg, The Photoplay: A Psychological Study, 1916.

Defining space within the cinematic narrative operates under its own set of visual cues. Of course it is not removed from triggering the same visual cues observed within reality, but it uses the following methods to distort the screen's spatial understanding through the following methods:

[71] Mitchell Schwarzer, *Zoomscape* (New York: Princeton Architectural Press, 2004), 20.

COMPOSITION :

- Lighting
- Movement within the Frame
-

EYE OF THE CAMERA

- depth of focus (focal point, length, plane)
- Light (relative brightness)
- Shadows
- detail perspective
- aerial atmospheric
- aperture

CAMERA AND LENS FRAMING AND CAMERA MOVEMENT

- Zooming in or Out
- Focusing or Defocusing
- Perspective (Lens Convergence)
- Relative Motion Parralax
- Motion Perspective
- Racking Focus
- Tracking and Panning
- Depth of Frame

POST (LAB PROCESS OR DIGITAL MANIPULATION)

- Dissolves, Supers, Mattes, Etc.
- Fades & Transitions
- Split Screens
- Montage
- Lens accomodation
- Binocular Disparity

RESTRICTIONS TO FILM SPACE

- A cue is required to signify space and time
- Imaginary Axis
- Reverse shots to prevent disorientation
- On screen-off screen continuation
- Focal Rules

3.2 DIGITAL TECHNOLOGY IN THE BUILT ENVIRONMENT

Digital media, not always spatial, has a history of its application upon the built fabric. This history stems from the desire to bring forth "the future" which is somehow been attached to digital technology since before it existed. The inspiration to apply mediated interventions comes from the cultural spatialization and the representative typologies that allow the next generation to be explored in real world applications.

Mediated installations most similar to those that exist today began following the installation of audio-visual media systems designed for the World Expo. The World Expo sparked a long tradition of experimenting to examine the potential use of audio-visuals in the built environment, and were first implemented to mimic what society then imagined as the future. "Until the 1980s, World Expos continued to be incubators for experimentation with the newest techniques, new combinations of media and space, and new forms of spatial communications. From the 1960s onwards, there was a transition from cohesive to more impressionistic installations." The types of installations were changing and they began to become "'multimedia environments' and a festival of 'happenings' and 'events'. Their creators considered the mixed-media pavilions and the multimedia total installations in Osaka to be a taste of the future age of information where visitors could learn to select and separate within this bombardment of images." Ironically it was "Architect Kurokawa, one of the lead designers of this World Expo, [who] felt, like many of his colleagues, that architecture was destined to become 'metaphysical' or immaterial. In his opinion, the architecture of the future could no longer be static and would no longer be concerned with physical things such as walls, floors, and windows. All of these elements would somehow become images. He saw a wealth of images as the (future) norm for the urban dweller."[72]

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[72] Herman Kossmann, Mark W. de Jong, and Kossmann.dejong, *Engaging Spaces : Exhibition Design Explored* (Amsterdam: Frame, 2010), 28.

Figure 3: "Glimpses of the USA", by Charles and Ray Eames, Moscow World's Fair 1959

It is likely that the change seen at the World Expo of 1970 followed a model previously set forth by Charles and Ray Eames in 1959. The Eames' exhibition at the World's Fair that year, was the first immersive experience created using a majority of audio and visual electronics. (Figure 3) It was the start of embracing the then emerging connection between communication, technology and the world around us. The Eames' presentation utilized 14 synchronized projectors to explain how both the human brain and computer obtained sensory information, and fed it to the brain (the central processor). This exciting origin brought welcome to the existence of technology in daily life. Even then the modern urban dweller began to equip themselves with an observant and open minded nature for this upcoming "space age". In the mid fifties, 56% of American home had a television in their living room, and by 1962 it jumped to 90%. In relation to this rapid increase of televisions in the American home, it is surprising this trend waned in its application in the built environment. After this initial excitement, the thrill of technology in our built environment dwindled until the influence brought by personal computer which emerged in the 1980s. Likely related to cost and the rapid change of the technology and its size, the television nor cinematic projector were not able escape the confines of being limited to the living room or theatre. The influence that television had to cultural spatialization, regardless of where the television was located, cannot be ignored. Though never implemented with

the intention of its spatial potential, both the television and the cinema screen changed the meaning of spatial experiences. "'The camera in cinema, like... the panorama and the diorama... mobilizes the audience across the gulf that opens now between static spectator and mobile spectacle.' [73] Television offers a sort of mastery of this space, like Jules Verne's universal porthole: 'allowing the viewer to select any current activity on the face of the planet to in on. The visual media of the moving image embraced the prospect of vision as unlimited travel.'"[74]

Should the architect have embraced this method of installing media into the built environment at that time, it is likely there would have been less elegant solutions than what we are capable of today. "Certainly, in a moment when space warp has become an almost daily experience as we are hurled at apparently mind-numbing speed through computer-simulated corridors of the latest CD-ROM game release, early twentieth-century spatial forms may seem a little quaint, if not primitive."[75] Previous iterations, before technology had become thinner, brighter and more adaptable, and before the internet, the mechanics required to host a visual image were heavy and visually distracted from the actual image. Now that technology is getting more precise and more adaptable, the cumbersome mechanics are reducing their presence and allowing for more elegant, seamless interventions.

Due to the rapid nature of advancements, there are visible "generations" of technology that surround us. If one were to simply look at the utilization of digital media in Times Square, for example, even the untrained eye can identify the age of each display in relation to each other. In order to honor the elegance and precision that architecture is capable of exuding, technology applied to the built form will only resonate when the medium is expressing its abilities and the mechanics are not a visible part of the equation.

In a visually saturated landscape, one can only wonder what is capable of catching the visual attention of the modern occupant. " The rapid development, in little more than a decade, of a vast array of computer graphics techniques is part of a sweeping reconfiguration of relations between and observing subject an modes of representation that effectively nullify most of the culturally established meanings of the terms observer and representation. The formalization and diffusion of computer generated imagery heralds the

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[73]Sean Cubitt, *Digital Aesthetics* (London; Thousand Oaks, Calif.: SAGE, 1998), 78.

[74] Shields, *The Virtual*, 62.

[75] Vidler, *Warped Space : Art, Architecture, and Anxiety in Modern Culture*, 7.

ubiquitous implantation of fabricated visual 'spaces' radically different from the mimetic capacities of film, photography, and television. "[76] With social knowledge of these visual "spaces" on the cinematic screen, phones, televisions and other technologies, it is impossible to know the end of how far we are able to extend ourselves into these micro realities.

We must examine the current of the implementation of digital media on the architectural fabric specifically to frame both its potential, as well as, the more undesired possibilities that could arise. Due to the rapid evolution, no medium will be ignored. The dichotomy of what possess potential application by the architect and what would make him cringe are of equal importance to understand the modern cultural spatialization and direction of this trend.

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[76] Jonathan Crary, *Techniques of the Observer : On Vision and Modernity in the Nineteenth Century* (Cambridge, Mass.: MIT Press, 1990).

3.2.1 PRESENT DAY ARCHITECTURAL APPLICATIONS OF VISUAL TECHNOLOGY

"The site for all of this--at least in the near term--is likely to be the seam between virtuality and physicality." Sorkin recognizes that the change in application of technology is beginning. "A vast discourse of prosthetics of translation is already arising, yielding a class of objects that bridge between a spatial, non-dimensional world of virtual space and body bound world of antique reality. " He further elaborates that not only will architecture experience an influx of technological applications but "these will range from stereoptic laser scanning glasses able to beam virtual images straight into the retina, to a myriad of stimulating implants, to a million shrinking appliances bringing numberless images into our shrinking homes. Already children learn to hold the TV remote before a fork."[77] The rapid increase in use of technology brings us upon a threshold of being within a generation of prosthetics and electronic gadgets that rule our lives. Though this investigation does not extend into examining prosthetic or stereoscopic additions to our perceptual abilities, these advancements are worth acknowledging in the context of possible invasions into the realm of what is commonly controlled by the architect in relation to the built environment.

Ranging from implementing overhead canopies that suggest a virtual forest, to large-scale advertisements the size of a high rise, there is no shyness from attempting to use digital displays, less often spatial, upon the architectural canvas. These examples fail to acknowledge the architectural canvas and its geometric opportunities and are prosthetic appendages upon an existing or historical work of architecture. They neglect spatial opportunities that were even adopted as far back as representations upon cave walls. These invasions into the built fabric also neglect to acknowledge their visual responsibilities to the neighboring visual landscape.

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[77] Sorkin, "Vr the World," 234.

Figure 4: The Podium by Tameer Holdings, Majan Dubai, 2013

The reality is that moving visuals are distracting us from our physical surroundings are plastering any vertical real estate available. Digital "televisions" in the subway flash advertising in a daily commute. Traditionally, when a new vertical barrier was constructed it is immediately branded with "Post No Bills" to prevent the plastering of public messages and images. As technology advances, the invasion is slowly moving from being that of Billboards or graffiti but rather public televisions. Because media is overtaking the walls of public space is it not the responsibility of the architect to shape and define these interventions? The architect needs to address and define the negative repercussions that could arise by ignoring this inevitable invasion of media into the built environment. And if these decisions were in the hands of the architect, as opposed to this "occupation" of media in public space being solely commercial, there is likely to be many positive outcomes from using these mediums to interact with and extend our spatial surroundings. Currently, large scale projections and digital displays are beginning to plaster every vertical surface (Figure 4 & 5) similar to how large scale static billboards have crept across the city skyline. Some digital billboards are as large as an entire high-rise as seen in Figure 4.

Many examples of technology utilizing these tools are becoming common, both in large scale applications for music as well as for advertising. The technology company, Nokia, used this public facade as a display for its technical prowess and created a virtual "dimension" within its two-dimensional facade. Is the face of

Figure 5: 14th & 1st Ave Subway Entrance, Photo by Author, 2012

any large scale building as equally free for the plastering of advertising as any wall? If so, could one create another visual universe within to draw in the visual attention of passers by not merely 100 feet away, also on the order of hundreds or thousands of yards? (Figures 4 & 6)

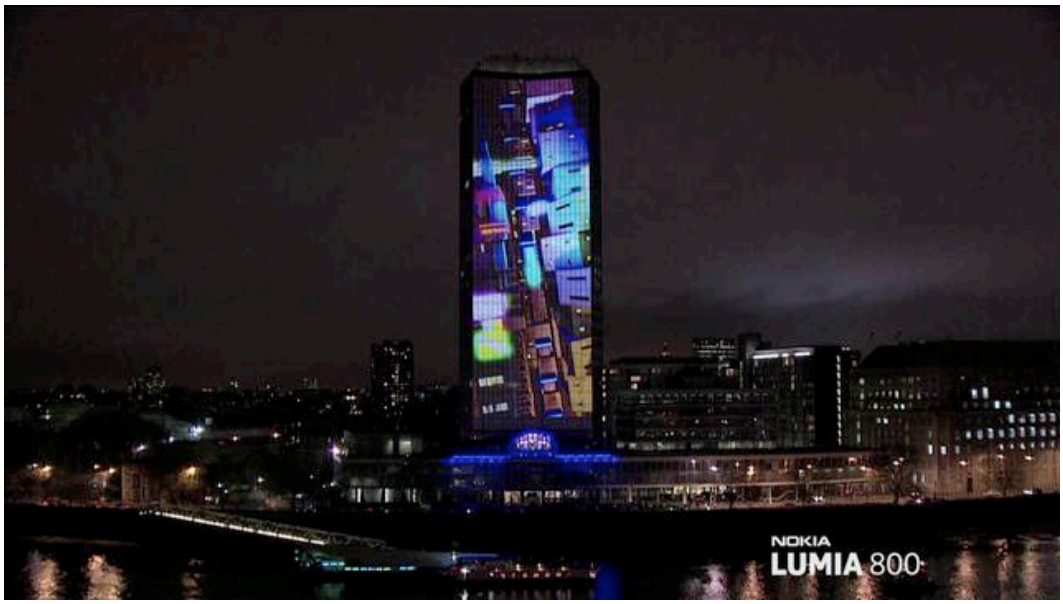

Figure 6: Millbank Tower, London 4D Projection by Nokia and Deadmau5, 2011

To really know the current state of affairs, and the rapid evolution of this visual phenomenon, one simply needs to travel to New York's Times Square. Iconic examples of digital mediums in architecture as well as the next fad in technological applications are displayed here in full form. It makes sense that Times Square is one example to watch, because it has a long running history of being the public space that sets the trends for visual innovations. Historically, it has been the first to demonstrate and experiment with large scale adventures that are usually applied upon the urban facade as opposed to being a compliment to the existing architecture.

The actual "architecture" of Times Square has nothing to hide. Some of the buildings covered with moving displays are not visual eyesores at all, but rather some are historic icons with a strong sense of place attached to them. At times, the battle of historic preservation of New York was up against full-scale overhauls simply created for a desire for trendy-style. Luckily in the 1960s and 70s the middle and upper class residents were a voice of preservation. "They objected to the widespread 'creative destruction' of the built environment and to the severe modernist aesthetic that guided the redevelopment of the city. While the austere Internationalist Style appealed to architects and planners as an

expression of rationality in its urban form, it frustrated the middle class population that was denied its prized cultural resources. In this context, preservation based development emerged as a revitalization approach that appealed to the cultural tastes of the middle and upper-class groups. They could embrace massive development as long as it was linked to cultural resources in the form of historic districts and arts facilities."[78] More than forty years later, the preservation efforts against the "modernist aesthetic" is indicating have indeed resulted in a revitalization. But what is the next architectural frontier of Times Square? The importance of recognizing an evolution of form, and public spaces moving into the hands of advertising is tragically apparent here in New York. Even many smaller public streets feature miniaturized digital advertisements, warning that any vertical real estate is at jeopardy of being covered in a moving advertisement. There are some iconic New York moments that also feature these atrocities and thus it is obvious no type of space is left uncovered.

"Powerful visual symbols and messages--buildings as billboards--announce the means to gratify needs and desires instantly, while enjoying largely ersatz and temporary experiences. It (Times Square) is an environment of enormous visual and sensory overload. There is still another form of motion that compounds the experience, characteristic of no other time: movement of the design elements themselves. It is tempting to treat this brilliant, kinetic environment as colorful distraction but it is not, like so much studio art, a theoretical exercise." [79] Times Square was never a historically "beautiful and iconic" *architectural* example, but rather it has been known as the space that has lighted the avenues of Manhattan since 1880. Known as the "Great White Way" following the world's first giant electric sign, it also was the first public square, outside of World's Fair applications, to be lit by electric lights. So essentially, Times Square has always been destined to be defined by emerging technology. It is here that prime examples of innovations in technology have always been plastered over every available space. The invention of neon tubing allowed for lit advertising to then embrace movement or animation in 1930s. The history of Times Square, even through tough times such as Prohibition and the 1928 stock market crash, as well as the transition to being the home of all things Burlesque, allowed for the eventual permanent zoning which mandated the incorporation of electric signs into the local building front designs in 1987. Since the re appearance of The Walt Disney Company in 1994, Times Square has adopted a "Disney-like" persona behaving like a theme park for tourists to gawk at and be transported to a place like no other. Since that change of persona, Times

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[78]Reichl, *Reconstructing Times Square : Politics and Culture in Urban Development*, 167.

[79] William Robert Taylor, "Inventing Times Square : Commerce and Culture at the Crossroads of the World" (New York, 1991), 358.

Square has is no longer a place of tradition or a model of historic preservation, but rather a testing ground for the innovative spectacle. "Clearly the question "Can Times Square be saved?" is rhetorical and sentimental. The efforts to do so are focused on preserving myths and illusions and some emblematic characteristics divorced from their original functions and meaning--metaphors, of a sort, for Times Square. Times Square cannot be saved in any form resembling what so many want to save; the process of physical and economic conversion is overwhelmingly and irreversibly at work." [80] Rather than halting change, the direction of change should emphasize creating a symbiotic and elegant solution in response to these changes in form.

Figure 7: Times Square, Forever 21 Billboard, 2012

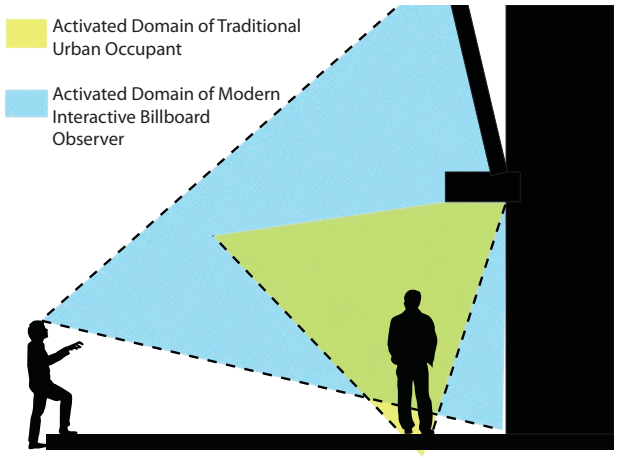

Figure 8: Spatial Domain of Urban Plaza, Activated by Digital Interventions, Diagram by Author, 2013

So where has this history of visual billboards gone in the most recent advancement? The first modern interactive billboard (still for use as advertising) was created in Times Square by Allied Vision Technologies and Forever 21. (Figure 7) This high tech installation uses real time image cameras, Prosillica GX 1910, to display moving images of the crowds below. Not only do the large screens project the people below, models captured on the big screen are able to interact with the people below. The large screen is a LED Display by Dynamic Digital Displays who specialize in the type of screens used in Times Square. This screen is 1,380 sq. ft and rises over 30' high. The stunning result of this creation

[80] Ibid., 370.

is a crowd of people who stop in the street and interact with a large digital display over 200' feet away. This draw of attention to this billboard encloses Times Square as a large space with a "virtual room" to linger and observe the interactive screen.

As opposed to becoming a real world "Disney World", Times Square could act as a testing ground for a real-world investigation of the future potential, not envelopment, by digital media and a symbiotic relationship with architecture, regardless of the building being traditional/historic, or even modern or an upcoming design. From its innovative history the potential of Times Square is definitely apparent, but also of concern threatening to succumb to an inevitable future designed by commercial interest and that "Disney" personality. Times Square should rather explore the spatial potential of the displays acting in concert. If used together, the array of digital canvases could almost visually allow Times Square to "disappear."

If a large scale landscape or horizon was stretched across each screen and oriented accurately, the viewer would see a virtual landscape as though they were looking beyond the physical buildings. (Figure 9) There are also opportunities to use this large scale public space as the testing ground for distorting the public spatial experience since recent revisions that prioritize people in Times Square over cars. On a cloudy day, Times Square

Figure 9: Times Square Billboards with Horizon Intervention, Image by Author, 2012

could create a virtual park with brightness to compensate for the lack of sun. Times Square could also capture and exude emotions. These installations could achieve a virtual tranquility by using calming visuals, or even create tension to clear the space when it needs to be closed for the set up of a large scale event. One major need that would be required to enable this type of phenomenon to occur would be a collaborative effort of existing technologies to work in concert as opposed to competing with each other.

Figure 9 represents mock up of what the saturated Times Square would look like if the blanket of digital billboards projected a virtual horizon as opposed to advertising. In this respect, this cramped over populated and visually saturated landscape could achieve tranquility and in a way, beauty. Imagine the heightened sense of space given to the concrete jungle. If you are going to cover the architecture it might as well be beautiful.

EXISTING TRENDS OF DIGITAL TECHNOLOGY IN THE BUILT ENVIRONMENT

Figure 10: Comcast Center Lobby, Philadelphia

Examples of architecturally integrated digital displays are rapidly increasing in popularity. Most of these displays strictly function to express their size and shock factor. Though not spatial or interactive by any means, these digital displays reveal a small scale possibility that digital technology could behave as a virtual paint or wall paper. Although these applications function to share information or present stunning graphics, they suggest that a wall can be many things. This example is the largest LED display in the United States installed in the Comcast Center in Philadelphia. (Figure 10) Costing over $20 Million and comprised of over 10 million pixels requiring six dx-700 digitizers, this display is basically the largest television screen in a lobby ever built. It is the optical potential that speaks in this application. Its brightness and seamless appearance could harness the same feelings of wonder one experiences at an IMAX movie.

The entertainment industry is flooded with technology because there is money invested in creating elements for shock value. What is being displayed here is more often an experiential installation than those created for advertisement. They are employed to elevate the viewers experience of the concert or film rather than communicate a message or product. The architect who constructed the lobby in Fig. 10 likely did not anticipate a giant virtual galaxy being displayed in motion on this wall and it distorts the entire intention of the architectural form design. The awareness of these types of interventions is critical to the architect.

Lucy Bullivant describes that we are at the end of a generation of architecture and that "the days in which conventional architecture was driven by a social agenda are now far behind us. They are secreted in the distant past of the most senior generation of architects when professionals worked for local authorities and housing projects were solely publicly funded." Being that the motive for design has changed it implies that "interactive design environments are, by comparison with postwar utopian projects that could tackle large-scale urbanism such as new towns, and swathes of residential tower blocks, small-scale interventions. " It contextualizes to whom the digital intervention would be directed and that "their power [is] to transform people's experiences and perceptions. They may not aspire to irrevocably change an individual's quality of life or life course; what they can do, however, is shift the way people interact both with those around them and also with the space around them." Is would be most likely to be within "an urban context, where the major cities of the world are densely populated, often with populations often over 10 million, they turn the anonymous passer-by from just another face in the crowd into an individual, and often a playful one at that." Interactive installations that fall outside of four walls adopt new citizens to interact within the urban "living room". [81]

These types of interventions only slightly acknowledge a reflection of cultural spatialization, because it demonstrates that we are not phased by a 40' galaxy in the lobby. If the modern occupant is accustomed to such an intervention, what does that suggest when the intervention has the intention of changing the spatial understanding. It is plausible that rapid movement and more movie-like visual graphics will not imply a spatial evaluation. These types of installations that utilizes shocking graphics and loud noise are recognized as those to be reacted to, not adopted into the existing spatial understanding. When someone visits a museum or a carnival they are prepared to be evaluating works within the space, or prepared to be surprised with something grand. It is unlikely that the above galaxy would be examined like a work of art. It more likely would be interpreted in passing, in a moment of brief awe and move on. This implies that a installation with the intention of being spatial would need to be subtle in its application so as to be evaluated the same as the presence of the architectural elements.

The digital application of the 65,000 square foot digital canopy in Beijing uses 14.5 Million LEDs to create a visual canopy in a large urban open space called "The Place". Created by Opto Tech Corporation of Taiwan and Electrosonic of UK, these five HD video

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[81] Lucy Bullivant, *4dsocial : Interactive Design Environments* (London; Chichester: Wiley-Academy ; John Wiley, distributor], 2007).

players have become the worlds largest digital aquarium. The largest drawback of this installation is the scale of the project, living at over 82 feet above the plaza. The oversized "lobby" that is created below encourages no one to linger to watch the show above. In addition the planar form of the architectural canvas is not best utilized for representing natural landscapes but could rather be more impactful if used to create a new, more architectural, visual overhead. Figure 12, shows the spatial difference between an animated canopy and a projection mapping mirroring the vanishing point of the plaza, creating a large scale feeling of towering high rises emerging above the plaza. An element to bring the visual phenomenon to a complete end point touching the plaza (closer to the space that the viewer is occupying) allows the result to climb from ground level to the plane overhead. It also defines a horizon as well as the vanishing point

Figure 11,12,13: The Place, Beijing, Canopy Only (Left), Actual Digital Forest (Center) Suggested Digital Installation (Right) Diagrams by Author

Figure 14: Lobby of IAC Center, NYC, NY By Frank Gehry

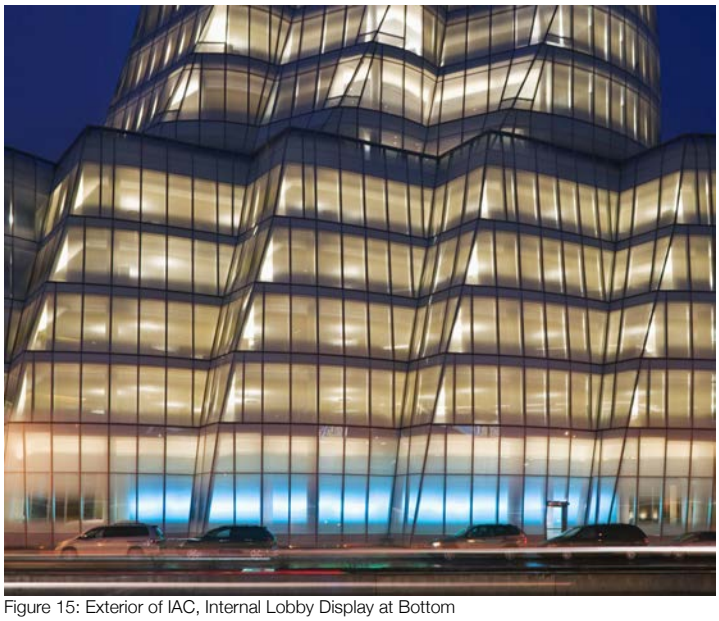


Figure 15: Exterior of IAC, Internal Lobby Display at Bottom

An example of a more subtle and integrated application of this same concept resides in the main lobby of the IAC. (Figure 14) This New York building in Chelsea, on the west side of Manhattan, resides near the popular new High Line. Not only did this building once feature an external light show using 3D mapping, though not permanent, it features a floor to ceiling internal display in the lobby which is permanent. Because this is the headquarters of the large media company IAC, it makes sense that they are using technology to compliment the modern form of their headquarters designed by Frank Gehry. What is most promising about this installation is that it is intended to be utilized when the lobby is rented for events. This allows the visuals to be customized for individual experiences, as opposed to selling a product or exuding the wealth of a company. In addition, this internal display has a presence on the exterior view of the building and draws the passerby into the space by revealing the transparency of the exterior.

3.2.2 NATURE OF THE INTERFACE

The above examples express that there is no surface that is not being utilized for a digital application. The problem with any of these installations from being spatial are the interfaces with which they are applied. Each example discussed above is placed without intention, upon any existing open surface of the architectural fabric. Though an example like the canopy at "The Place" is erring on the side of being immersive, it misses the point with its scale and choice of visuals that it features. Even the text included within this frame (its own interface in a sense) begins to lose its connection to the chapters of text that precede and follows it.

The projection map, as discussed in the following chapter brings potential because it operates without the confines of a flat, rectilinear surface bound within a frame like the television. The light emitted can stretch across amorphous surfaces without limit. In addition because it does not require a high electric wiring interface, the projection map allows those visuals to emerge from a boxy display that already creates a vast separation between the digital installation and the architectural canvas.

By removing the digital intervention from being framed in rectangles scattered on the architectural canvas, you begin to remove the feel of being in a museum or art gallery. When the psychology of viewing art enters the picture, the honest spatial understanding begins to withdraw from the representation. The interface behaves as a prison cell preventing the representation from escaping its visual-virtual confines to participate as part of the spatial experience of reality. The differences of spatial experiences, including those that occur as a result of the obstruction of the interface ,are discussed in the Chapter titled "Types of Spatial Experiences".

3.3 PROJECTION MAPPING

The projection map is a recent method of projection utilized upon a mapped canvas. As opposed to the traditional form of projection upon a flat canvas, the mapped form allows for anticipated three-dimensional forms to have three or four dimensional qualities. The premise of a mapped projection is that by aligning the projection with the geometry of the physical form, the virtual and real forms become capable of exchanging visual qualities. Not only does the projection map understand the geometry of the canvas, it also takes into consideration the vanishing point from where the projector is throwing its image. Its history and how it is currently being employed is demonstrated in this chapter.

In contrast to the plastered digital interventions described above, other technologies enable the projection map to both project and to see. The strength of projection mapping is based on how the projectors anticipate the shape of the surfaces upon which it will be projected, and also the point of view of the projector. Because the source of the projector is capable of anticipating the "vanishing point" and perspective of the architectural canvas, the images can follow every surface of the physical form with the intention of utilizing those spatial opportunities for the benefit of the final image. These projectors behave as the eyes of the viewer and also as the painter of the scene. An array of projectors are capable of covering every visible surface and then essentially direct every instance of light and shadow of the architectural canvas. The objects then behave as the "canvas" and the visual cues they once possessed are then within the control of the projector and its mapped image.

To create a projection map, the architectural canvas is three-dimensionally "mapped" to adapt the projection to match its edges. It is not as simple as creating an architectural form in the computer, but rather it is vital to know the distance and angle the projector or projectors (multiple) will have towards the architectural canvas. In addition, aspects as subtle as the lens size and shape need to be taken into account because each of these aspects contributes to the accuracy of the map. When all of these considerations are taken into account, the visual opportunities are endless.

Figure 16 and 17: Ralph Lauren Building and Projection Map Installation

Figure 18: Ralph Lauren Projection Map Polo Scene

Early projection mapping used existing architectural facades, being that it was recently an emerging technology. When utilized upon an existing facade, the opportunities for the projection map to suggest depth are limited to the existing edges and depth changes of the building.

This is an example of a projection map upon the exterior of an existing work of architecture. Created for one time use as a part of a runway show by Ralph Lauren, this example attempted to use the existing architecture as well as redefine it and suggest some new attributes. Figure 16 is the existing architectural canvas, and Figure 17, the addition of the projection map. The projected image creates a large scale staircase and ceiling overhead to enclose a virtual space, being understood it will be observed from below. This method is more effective on an exterior and may not be spatially influential due to

the distance of the observer to the suggested space. The visuals are limited to opportunities already made available by the existing architectural form. Things like windows and fenestration cannot be ignored in that they fragment the projection and require extensive mapping to overcome. They also behave as visual opportunities should a continued pattern of these windows be desired. In Figure 18, they act as a backdrop for a virtual polo scene created to represent the Ralph Lauren brand.

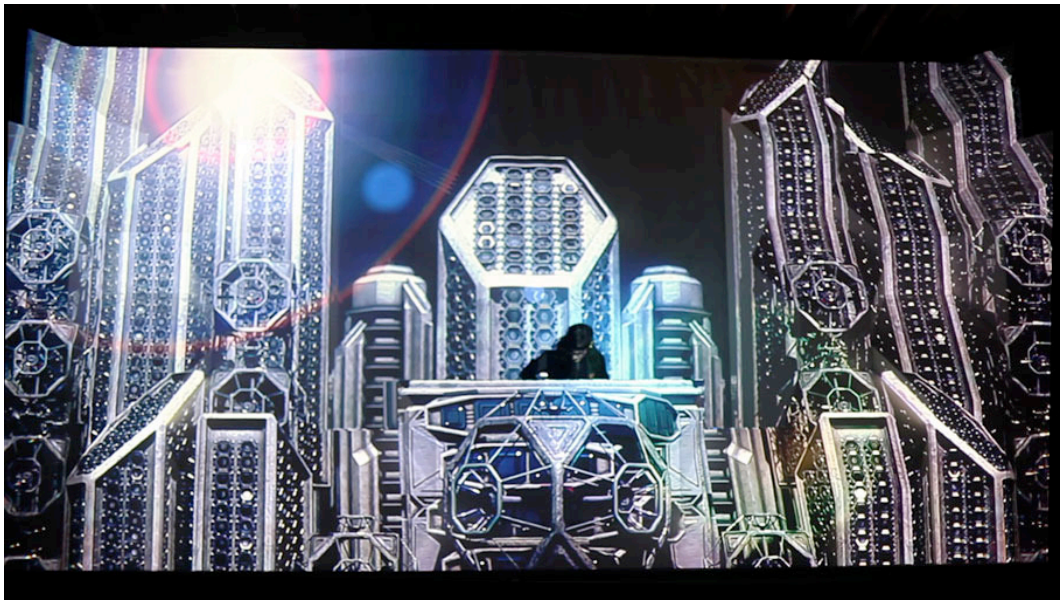
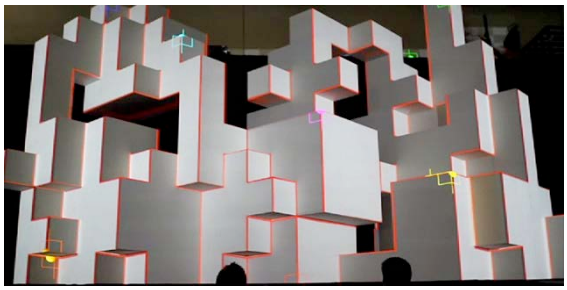


Figure 19: Skrillex Installation Projection Map

In the past 5 years the medium of projection mapping has exploded on the main stream media market. The majority of successful uses of projection mapping have been implemented for large scale concerts. The reason these are more successful is because both the stage form and the projection are designed exclusively for the performance as well as the pairing with the music. When the components are designed together they are able to create intentional visual co-incidences where a visual form and a digital projected form share visual edges and thus it is more difficult to distinguish between the real or the virtual. A notable example of this method was utilized by Skrillex and became a huge new trend for music performance. Advanced projection mapping projects utilize geometric opportunities to allow for the visual movement of geometric forms. In this set for Skrillex, the hexagonal forms around the artist were created to visually rotate and move up and down. This was emphasized because the canvas uses an array of visual depth cues to trick the eye. By using a precise marriage of physical form edges and massing that can best represent the form of projected virtual shapes, the visual coincidences operate as a visual interplay to assist in defining the physical and virtual massing. Not only does this give mass

to the visual form, it also is able to coincide with forms that occur during instances of movement. This creation is successful because it was designed with the intent of representing the interaction between the medium (projection) and the canvas (the built form). Only when both the physical form and the visual representation share the same visual cue are they able to make this exchange.



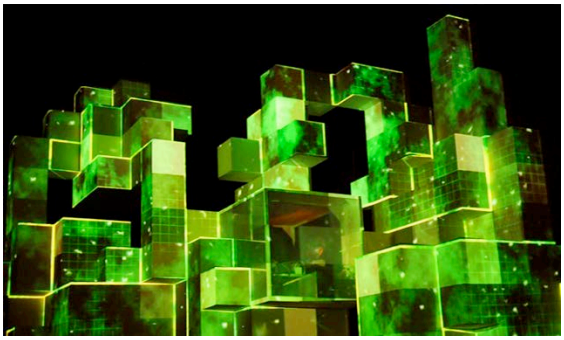


Figure 20, 21, 22: Amon Tobin Projection Map, Bare Form Top, Activated Edges, Natural Form on Geometric Blocks

> "We now confront a reality that has become psychically overstuffed; a mad accumulation of reality that is bifurcating between the real as we know it, and the teleschizoid assemblages that we have yet to fully formulate."[82]

This highly geometrical example of a projection map/architectural canvas, (Fig. 20, 21, 22) is one of the most recent highly advanced productions of projection mapping. This installation was created for the Amon Tobin ISAM show which premiered at MUTEK on June 1st, 2011. It utilizes cutting edge software for projection mapping, called Touch Designer by Derivative. The intent was both to bring motion to the geometric pieces of which the architectural canvas is built, as well as bring depth and motion to natural (non geometric) figures and also architectural experiences. It is less often for natural forms, like the human body to be utilized in this type of application, because the natural forms do not coincide with the geometric edges of the architectural canvas. In this application it is effective because the overall depth of the form matches the protrusion of the cubes. At a concert for example, all instances of light are able to be controlled, the geometric backdrop can be blacked out, and the faces lit the same so the cubic nature of the canvas is less relevant then the spatial co-incidences between the natural form and its relative massing in relation to the viewer. "Where tactile sensations vanish, where only light and dark tones lying side by side are

[82] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 3.

perceived, the way is paved for painterly presentment." This indicates that it is not additions of information that provide understanding but rather the explicit nature of what they are expressing. "Not that the impression of volumes and space is lacking; on the contrary, the illusion of solidity can be much stronger, but this illusion is obtained precisely by the fact that no more plasticity is introduced into the picture than the appearance of the whole really contains..." The painterly method is that of providing discerning information only. The painterly product is then more left to interpretation. "Painterly is treated essentially as a matter of perception in the sense that it does not matter about the object, but that of the eye, of its own free will, can perceive everything in one way or the other."[83]

Even a round ball could be represented on a mapped cube because the cube and a ball share the same massing. When the tactile information is removed, the visual cues are able to direct the "reality" of the solid. The projection map can subtract the cube's edges by lighting it appropriately that they are no longer recognized. "Most of the new design/ mythology has to do with explaining technology and our relationship to it. At the end of the millennium, there is tremendous ambivalence toward technology." The increased acceptance of technology in the daily life has essentially removed our acknowledgement of it. "At the same time it plunges us into severe social and ecological problems, it offers us hope by expanding our reach and understanding of the world. It is threatening and enabling at the same time. Thus new design often embodies this paradox, presenting possibilities that are both exhilarating and frightening. Design is not a neutral act of simply packaging the established trend. It can be proactive, proposing possibilities."[84] This project indeed did just that, it tried to push the limits by creating moving visual geometry as well as visual voids and amorphous entities like fire and smoke. The image in Figure 23, best displays a projection map both utilizing visual co-incidences, as well as creating visual-virtual

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[83] Heinrich Wolfflin, *Principles of Art History : The Problem of the Development of Style in Later Art* (New York: Dover Publications, 1950), 23.

[84] Susan Yelavich, "Product and the New Technological Juggernaut," in *The Edge of the Millenium : An International Critique of Architecture, Urban Planning, Product and Communication Design*, ed. Susan Yelavich (New York: Whitney Library of Design, 1993), 133.

Figure 23: Visual Virtual Depth as a Projection Map

depth. The cubes around the peripheral edges are textures whose shading coincides with the actual faces of the set. In the center area, the projection crawls across the angled surfaces of the form and remains aligned giving the impression of one planar base receding into a vanishing point. Should a traditional projection be done, without the mapping, the image would be fragmented and turn across the varied surfaces. It is also for this reason that multiple projectors from various angles (all mapped) assist with a projection map because all light and shadow are under the control of the visualization and surfaces can be intentionally washed out or shaded as desired. Also, much like watching a motion picture, the brain is capable of persistence of vision to fill in the gaps between images. This works to the advantage of the projection map on the built environment because even when the images as moving away from the coincident corner or edge with which it originated, we are essentially ignoring information to the contrary because of persistence of vision.

This installation also begins to utilize transparency as a method of doubling the amount of physical edges to use with the projection map. When a physical form shares an edge with a visual projection, they exchange visual information to support an understanding of depth. Because the visual information is coming both from real world forms and visual-virtual ones, the brain has a harder time deciding where the visual information resides. Another concert installation for Etienne De Crecy built a geometric frame with transparent fabric stretched across the surfaces. This projection map was less complex in its physical form. It was a large cube assembled of smaller cubes to form a grid. The projection map was then projected on the front face, as well as needed to protrude within the cube to provide visual information to the smaller cubes within. At one point this opportunity was reversed to make the facade disappear and make it look like the cube was far deeper than it actually was, by moving the visual vanishing point. As with all projections the use of the transparent surface is a prime opportunity for projection mapping because the projector can use the translucency, but also wash the surface to appear solid. It is only required to have a surface with moderate opacity, just enough to catch the light. When little to no light

is shined upon it, it resumes its transparent appearance to reveal internal structural geometry.

These examples for concerts and large spectacle applications are advancing quickly because they are financially lucrative. Those fields recognize that the viewer of a concert or product introduction is expecting the most innovative experience that show business is able to offer. If these spatial applications are blowing minds at concerts why can they not be applied to change the daily quality of the built environment. Why are they not currently being examined by the architectural profession?

3.4 TYPES OF SPATIAL EXPERIENCES

Occupying a space results in a wide variety of spatial experiences. When representations are utilized in the built fabric it creates a more diverse vocabulary of experiences. This evaluation categorizes them into four distinct typologies: Natural Immersive Spaces, Remote Experiences, Staged Observations and Augmented Experiences.

The modern viewer seamlessly changes his attention between the built environment that surrounds him and the virtual digital "portals" he places in front of himself. It is unclear if he is able to simultaneously place both seamlessly within his attention. The Pixar film *Wall-E* satires this evolving phenomenon. Citizens of a future space ship, who fled a destroyed Earth, have become obese and ambulate on floating chairs, whose view is directed by a digital display. When a future citizen's display ceases to function, the citizen then notices architectural features and amenities for the first time, as though they did not exist until they were acknowledged, without the distraction of the display. Reality is we are nearing this mode of ignorance to our surroundings. This is the most plausible next step in the evolution of our occupation of space. We have shrunk the physical space of our surroundings to a tight envelope around our person, and expanded the virtual world before us, to exist wider than the observable, real-world has been perceived across history. Stages of cultural spatialization are able to be tracked throughout the introduction of technologies of representation previously introduced. Perspective began an era of the virtual as the first method of representation able to reproduce a moment in time image visually nearing reality. Much later, the photographic camera and then the cinematic camera,exponentially and rapidly expanded cultural spatialization because they were making replications of reality that appear so visually accurate that its as though reality was then able to be carbon copied into a record. Those records of reality, allowed real-world images to be shared and documented in a method that sparked memories to mimic what was lived the first time. The introduction of the cinema screen projecting an in-motion capture of real world events, exponentially expanded the social-spatial imagination. It is from this rapid

expansion that we were able to welcome a portal, like the television, into our living room. We were now tapped into observing the broader world, all the time. "We have, in effect, fallen outside of ourselves, as the once hard distinction between remote and local stages become even further dispersed, and the exposure intervals between time and space, inside and outside, mind and body, imaginary and real are no longer quantifiable factors."[85] Though not architectural, the television initiated an observation of more than just our own surroundings. Shortly thereafter, the internet broke down the practice of being outwardly observing and created a two-way exchange of worlds, not only inviting outside worlds into our own, but extending our own out as an offering, to any one inclined to view. The response and affect of these methods are included in the following comparison of spatial experiences.

"Presently the interface restricts our experience. Visual simulations give us only a small window into the virtual dimension. If (visual) simulations function as convincing experiences, it is predominately due to the phenomenon of consensual hallucinations; the participants agree to believe in mediated illusions. The cognitively induced deception of perception is a useful phenomenon for visual simulations, but why not extend the psychological relationships between real and virtual worlds and mold deadly and sensuous phenomena into a virtual dimension?"[86] As occurring within the historical evaluation the success of creating the virtual dimension, occurs when reality and the virtual share visual qualities. This is what elevates the deception of perception because when visual qualities are shared it is increasingly difficult to ascertain whether to attribute them to the virtual addition or the existing space of reality. An example that represents this activation of a virtual dimension is an Ames room. (Figure 24) This is a space exclusively constructed within physical reality, but is done so with the intention of visually distorting the representation. This is a direct visual-virtual representation of reality. The physical form is being oriented to optimize the visual opportunities to create a virtual picture that is dishonest to the understanding of reality. Though there is no virtual world being depicted, the world that is observed is virtual in the sense that it is a cognitively induced deception of perception that is a convincing experience. The irony here is that the understanding of this space is only able to achieve this when being observed from a particular point of view and is no longer the same when occupied. When occupied, its "virtual capabilities" are lost and it remains an oddly shaped architectural form of reality.

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[85] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 3.

[86] Ibid., 21.

Figure 24: Ames Room Diagram

In the Baroque churches that brought moments of awe to the citizens of its time, it would be very unlikely to find that citizen trying to decode how it was accomplished like the modern citizen does for everything today. Modern citizens are in a time of "need-to-know, now." The attention of the modern citizen is surprisingly brought to pause when he goes in search of an answer to something he doesn't already know. Being that there is so much that we automatically understand, it is that which we don't automatically understand that sparks awe for the modern occupant. We are within this need-to-know now, because Google is our second brain and we behave that way, because we need not go very far to get the answers we seek. These phenomenon suggest that the digital installation in the built environment would not be treated as an invader in the architectural canvas. We are welcoming technology into more private moments of our life than we are in what spatially surrounds us.

"The gist of the conception is that future computer technologies will allow users to become acting elements in a space engineered and defined by technology; elements and spaces which need bear little relationship to how we understand our present embodiments and their spatial location."[87] It is implied that the occupant possesses prior understanding of this ability to control the space around them. This attribute of temporality comes with the territory of the virtual representation. It also allows each individual to define what should be and should not be public. Much like what sparks an urban dweller to draw the curtains

[87] John A. Hughes, "Some "Real" Problems Of "Virtual" Organisation," *New technology work and employment.* 16, no. 1 (2001).

or not, knowing his neighbors have a clear view. This public permeability is getting more fluid and difficult to control, as we open an increasing amount of our lives to the internet. This two way mirror, allowing viewers to reach out in any direction and receive a direct line-of-sight view into virtual windows, causes the stretch of our personal dwelling to expand.

The gesture of the a projected space was first welcomed in Baroque churches because it possessed an ability to elevate the spatial experience to that which was worthy to be the house of God. So why have we allowed "invasions" of advertising onto the architectural canvas before spatial applications? The architect has not recognized the opportunity of the digital installation, like projected spaces that were used in the renaissance. The clunky, heat emitting screens recently had no appeal to a master of plastic, volumetric perfection. The architect is upon a time of reversal where visually stunning displays and digital projections can begin to shine upon the architectural canvas. Time is waning to start the exploration of how these technologies can be elegantly adopted to the benefit of the architect.

CRITERIA FOR EVALUATION:

- Direct or Indirect?
- Applied or Integrated?
- Reality or Virtual Dominant or Mutual?
- Static or Spatio-Temporal?
- What is the Architectural Canvas of Reality?
- What is the Projection Method of Virtual?
- What is the Technology and Visual Cues of the Projected Space?

Direct Spatialization

Elements of reality directly define and affect spatial constructs. Spatial elements are integrated naturally with built fabric to create a direct spatialization.

Indirect Spatialization

Representations of space, when applied upon the built fabric that are not integrated in their gesture, indirectly affect spatialization. These methods suggest virtual spaces or projected spaces but do not directly define them.

3.4.1 NATURAL IMMERSIVE EXPERIENCES:

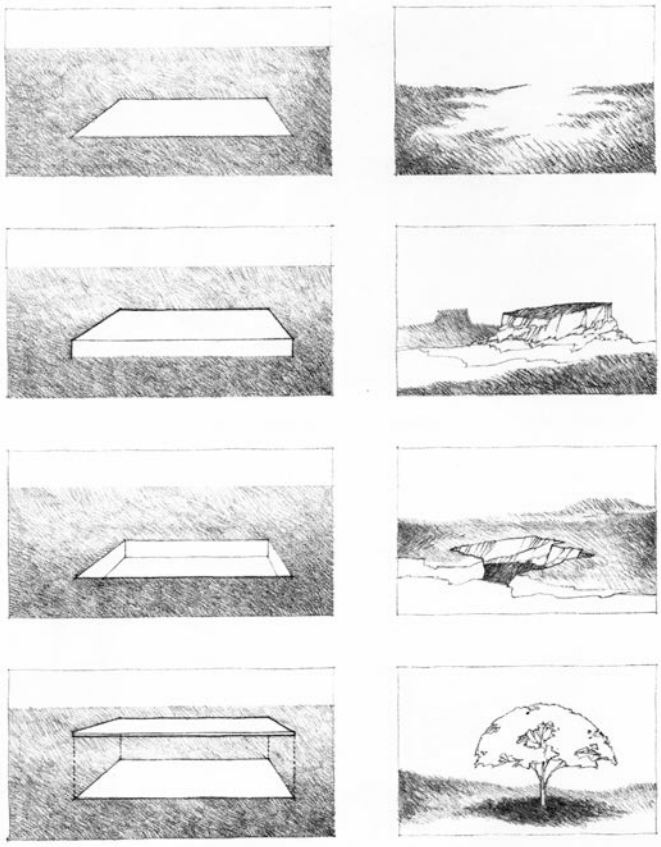

Figure 25: Francis Ching, Form, Space, Order

Natural Immersive Experiences: Direct, Exclusive to reality, occupied and are independent.

Examples are:

•Natural Landscape
•Architectural Canvas

The most basic of spatial experiences starts with the natural landscape. Unaltered, it would be a space with which we would not escape. Defined by the horizon and any landscape forms of nature, the natural landscape is the baseline for all understandings of space. Basic elements of the architectural canvas, like the base plane and overhead plane, begin to mimic edges of the natural landscape. The elements of a Natural Immersive Spatial Experience are defined by physical elements of reality. Because the natural landscape is the outer edge of this spatial experience, it itself is always immersive. Smaller internal enclosures can be created through subtle gestures to define boundaries.

As illustrated by Francis Ching, (Figure 25) the architectural canvas has drawn inspiration for defining space from the natural landscape. Volumes are able to be understood, even when not explicitly enclosing the edges. To a certain degree the enclosure can simply be suggested.

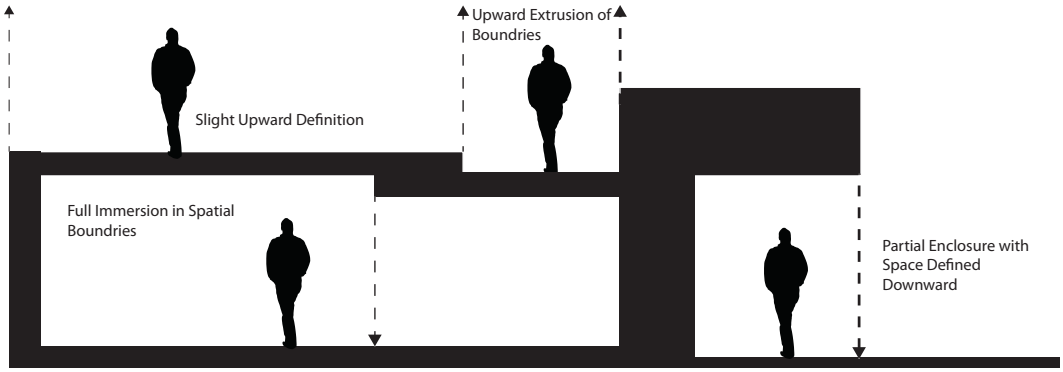

Figure 26: Spatial Enclosures Created by Architectural Gestures, Arrow Suggests Direction of Gesture to Imply Closure, Diagram by Author

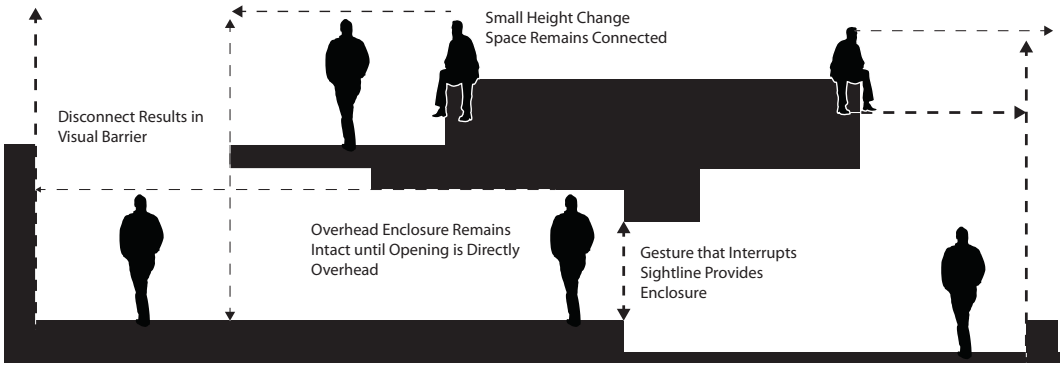

Figure 27: Gestures that provide connection or disconnection between adjacent spaces, diagram by Author

These edges also determine how a person resides within the space. Various degrees of enclosure also change the spatial experience. A raised plane gently articulates a volume with which to reside within. The higher the wall the greater sense of enclosure until eventually it becomes an immersive spatial experience. Continuity is either created or interrupted and is what defines the degree of enclosure or immersion. Spaces can also become connected or isolated from each other depending on the degree of change of plane or vertical barrier.

This is a direct spatialization because all components are participating in their actuality. Their proximity to the viewer increases their effectiveness but cannot be removed from affecting the spatialization of the viewer. These elements behave in an integrated manner whether physically connected or not. That is a unique aspect of the natural and architectural spatial experience. Any method of defining the space is working in concert with other elements. The natural immersive experience does not utilize virtual interventions.

3.4.2 REMOTE EXPERIENCES:

Remote Experiences: Indirect, Virtual Barrier to occupying reality, and the projected space is independent from the observation of reality.

Examples are:

- Computer Display in Built Environment
- Tablet or Other Display in Built Environment (not applied upon the Architectural Canvas)

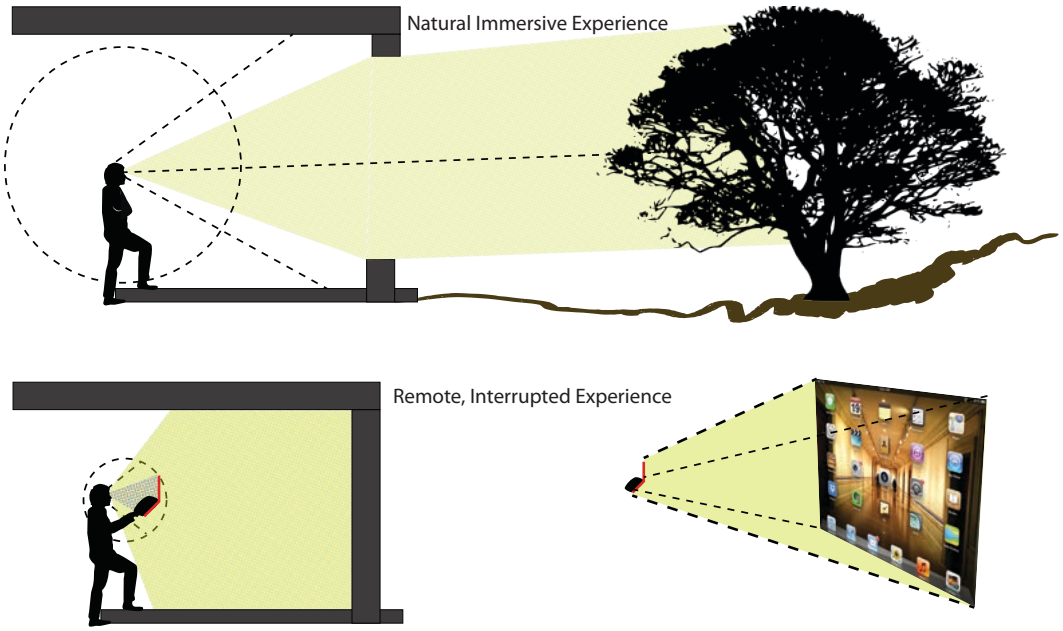

Figure 28 & 29, The Natural Immersive Experience and the Remote Experience

A remote spatial experience again begins with the natural spatial experience. Whether inside an architectural space or outside in the natural landscape, a remote spatial experience occurs when a non-integrated virtual dimension is observed. Often as a tool of technology in the spatial occupants hand or in front of their cone of vision on a desk, a

remote spatial experience interrupts the broader spatial surrounding. This interrupted experience shrinks the perception of reality and expands the virtual domain, and must be activated by the viewer.

A mobile display in the palm of one's hand or on the desk, acts as a barrier between us and the world around us and as a window into a projected space. The computer screen, can attract all of our attention and remove our notice of the spatial surroundings. We may not yet be treating the laptop or television screen as an actual window or opening in the physical sense, but we do behave through it as though it could be. If the modern occupant is in a constant mode of observing "the virtual" in their peripheral vision, and the palm of their hand, the spectacle of that experience is no longer spatial.

"Experimental video, computer graphics, and virtual images have radically transformed the late-twentieth-century understanding of reality and continue to challenge the complex discourse surrounding visual representation." The cultural spatialization is inspired by "the fragmentation and temporization of space initiated by film montage and modernist collage have opened up a truly infinite realm of poetic places for the human imagination, which await their translation into architecture." This schism in our perceptual abilities came about "during the last two decades, the seductive potential of virtual space has expanded beyond all expectations, through both technological breakthroughs and artistic endeavors," and Perez-Gomez acknowledges that "yet the architectural profession is still reluctant to question the transparency and homogeneity of its means of representation."[88]

The resulting indirect spatialization is not an integrated gesture in the architectural canvas. In fact, this type of spatial experience is one that detracts from the architectural gesture.

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[88] Perez-Gomez and Pelletier, *Architectural Representation and the Perspective Hinge*, 3.

3.4.3 STAGED OBSERVATIONS:

Staged Observation: Direct or Indirect, virtual, complimentary, applied projected spaces additive to reality, though independent from the architectural canvas.

Examples examined in this Chapter are:

- Movie Theater (Direct, Immersive, Spatio-Temporal)
- Villa Dei Mistrei (Friction due to scale, height, interface)
- Chambre du Serf (Friction due to Orthographic)
- Concerts with Projection Map installations (Indirect, Staged)
- Kredi Bank (Excellent Example, because Architectural canvas and Projection Map designed for each other, its just not immersive)

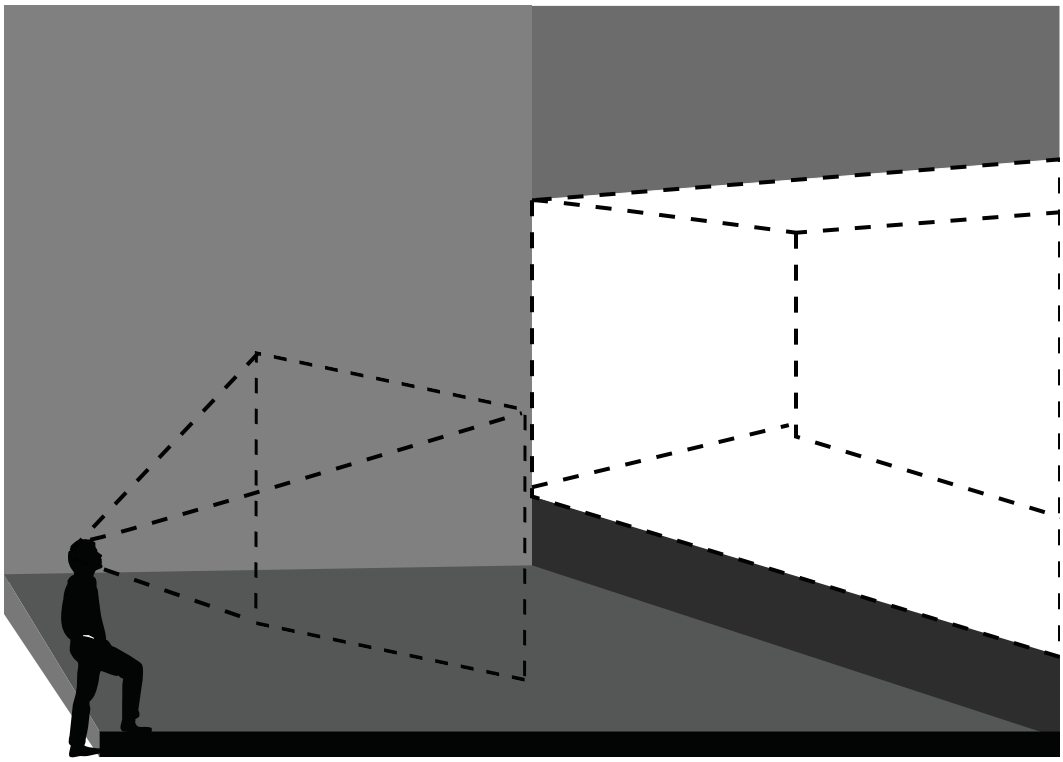

Figure 30: The Visual Divide While Observing A Staged Experience

The staged observation spatial experience is similar to the remote experience being that it includes a virtual intervention that contains its own projected space. A major difference between the remote experience and the staged observation is that the latter occurs outside the spatial domain of the occupant. It extends the occupants personal space but is not immersive because there is a degree of removal or spatial friction that removes the spatial experience from being within the direct domain of the occupant. Some qualities that result in a staged experience over an immersive one are as follows:

- Presence of Interface
- Change of Scale or Height/Level from Viewer
- The Occasion of Presentation is non architectural (Concert or Art installation)
- Relationship to Observer (Not Occupant)

The staged experience is natural for a concert or conventional gallery installations, "in museums, where they allow the visitor to enter into a totally different relationship with works of art. Whereas conventionally the visitor is asked to stand back and view in awe a cordoned-off venerated object, with an interactive artwork touch and noise, if not a prerequisite, are generally encouraged on the visitor's part.What they can do, however, is shift the way people interact with those around them and also with the space around them."[89] Even if the walls between the projection and the architectural canvas are without interface, the interface becomes implied due to the occasion of observing that space.

The difference between the laptop portal and the projection map utilized in a staged experience, is that the projection map draws attention to the architectural canvas, not removing the occupant from that built surrounding. The projection map's integration with the architectural canvas has the intention of manipulating the occupancy of the built reality while introducing the start of a virtual extension, never removed entirely from the built reality. One contrast to that experience is the movie theatre. (Figure 31) The movie theatre experience intends to remove the attention from the surrounding spatial experience in order to submerge the viewer into the cinema or theatrical experience. This becomes more like the remote observations like those involving technology because by withdrawing light and visual information from the surrounding space the staged experience takes over the power of the spatial surrounding. In this example, the physical surrounding architectural canvas is intentionally removed from participating in the spatial experience so as to heighten the spatial experience of the film.

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[89] Bullivant, *4dsocial : Interactive Design Environments*.

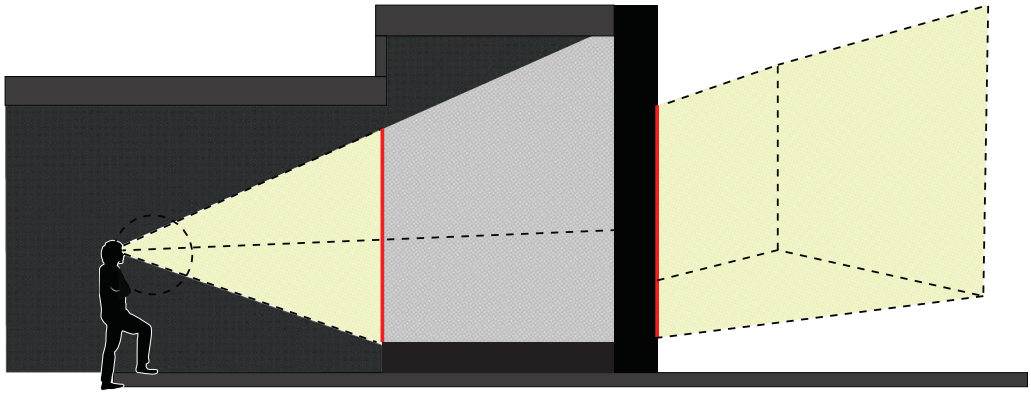

Figure 31: Staged Experience in Theatre withdraws information from the Architectural Canvas

3.4.3.A VILLA DEI MISTREI:

ORTHOGRAPHIC 2D PICTORIAL IMAGERY
LIGHT AND SHADOW
MADE MAN RECTILINEAR FORM, 60 B.C.

Inspired by the cult of Dionysius, this example, more than 14,000 years later than the work in Alta Mira, the Villa dei Misteri, brings representations of the human form itself into this immersive example. The occupant is not only surrounded in a 360 degree spatial representation, they are also paired with life sized representations of human form.

The main visual advancement that this space posses, respect to innovation of the depictive method, is the use of the pictorial depth cue of interposition. Interposition suggests both depth between the people of the image and the "virtual" back wall which mimics physical architecture by representing virtual columns. There are no shadows cast by the figures, but the relative brightness suggests an edge to the floor panel depicted at the bottom of the image. A visual incongruence is a man made block at the center of the image fails to achieve the appropriate perspective, (which was not known at that time) but it does gesture to indicate an accurate depth of form in some respect.

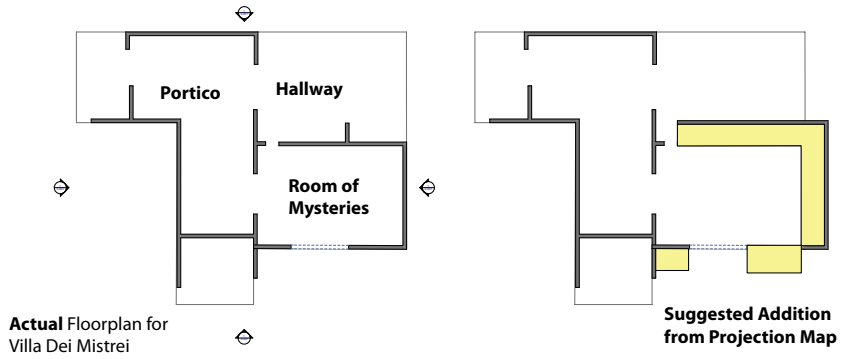

Figure 32: Actual Architectural surroundings (Left) and the visually suggested additions (Right)

Figure 32 depicts what space is being virtually suggested within the actual space. This addition exchanges few visual cues because the depiction is essentially created upon the three surrounding walls and uses no edges, shadows of the actual space. Because there is

not an exchange of visual qualities between the architectural canvas and the projected image, it not a mapped representation. This results in an indirect, virtual, suggested space.

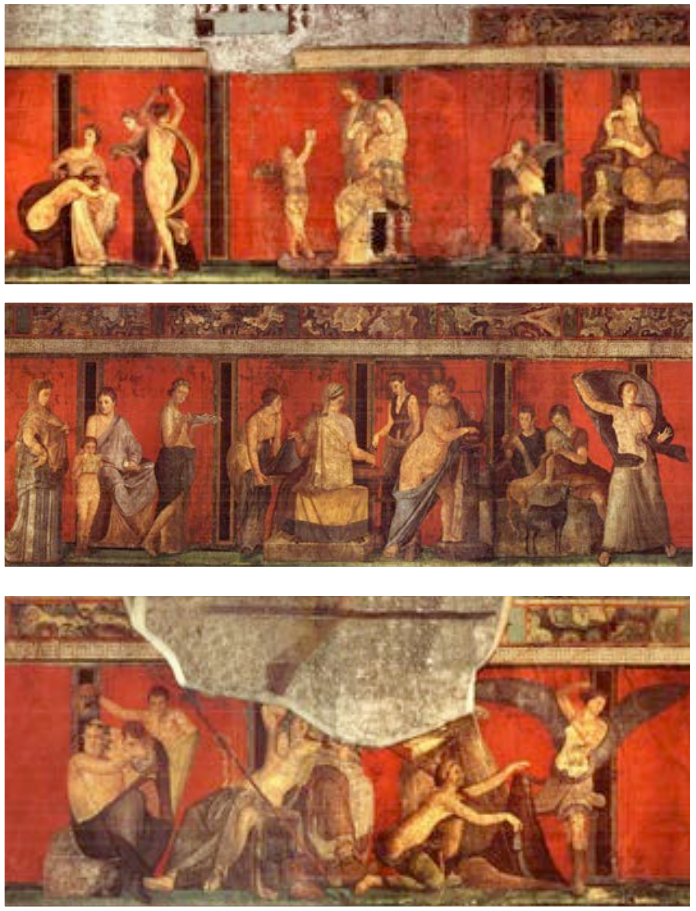

Figure 33: Photo graphs of the three projected additions.

"In the second Pompeiian style of late Republican Rome, there were wall paintings that extended the room through representations of views into other spaces. A particularly forceful example is shown in one of the most famous frescos of antiquity: the Villa Item, the so-called Casa dei Misteri at Pompeii, which dates from 60 BC." [90]

An example of this time places a long timeline upon this method of pictorial representation. "The audience finds itself amidst a series of life-sized, highly realistic figures. Some appeal directly to the recipient; while others communicate with each other from wall to wall across the real space." In comparison to other examples in this examination, this would not modernly be the case, but placed within its time and cultural spatialization these gestures have the described efficacy. "The borders between visual and actual space seem to dissolve as the figures apparently move in real space. Visitors are trapped in the gaze of the figures, which hit from all sides and do not let go. The illusionary space surrounds the spectators entirely, fixing them into the same place and time."[91]

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[90] Oliver Grau, "Into the Belly of the Image: Historical Aspects of Virtual Reality," *Leonardo* 32, no. 5 (1999): 90.

[91] Ibid.: 365.

Figure 34: Corner with figures gesturing to each other.

In this example, the edges of the image are clear borders, reminiscent of the frame around a television. Despite suggesting that these borders dissolve, Grau accurately mentions that the characters are activating the space of reality by visually connecting two figures across the architectural space. Grau's statement reaches to imply the audience being amidst the figures, saying that "the overall effect is to break down barriers between the observer and what is happening with the images on the wall."[92] This does not occur because the figures and the occupant are not at the same height within the space. Though this gesture is one of the earliest examples of using representations of people to "place" the viewer within that image, the separation occurs being that these accurate and fairly realistic representations of people are three feet above floor level, which would create a visual and experiential schism for the occupant. Grau states that the image of the viewer accomplishes a "unity of time and place" by "a suggestive appeal to the observer from all sides that utilizes illusionism techniques."[93] The unity of reality and the virtual does not occur because they share very little visual qualities. This example of visual innovation by depicting the occupant while utilizing pictorial depth cues is indeed innovative for the time, and surrounds the viewer by

[92] Grau, *Virtual Art from Illusion to Immersion*, 25.

[93] Ibid.

being on three walls, but does not achieve an immersive virtual experience because of the indirect relationship between the architectural canvas and the representation.

This may be the oldest example of depicting a room within a room and utilizing visual architectural components to represent a "virtual" extension of that space, but the gesture in combination with the architectural space is so subtle that it misses a majority of spatial opportunities. One example, seen in Figure 34, that is successful is where the interaction of the depiction monopolizes on the adjacency of the images and reaches to suggest real world depth by visually having one figure gesture across to another on an adjacent wall. "Her gestures and expression are reactions to what is happening on the adjacent right-hand wall; according to the logic of the work, they point across the intervening area, traversing the space of the observer." [94] Grau indicates that this gesture in particular is capable of "meld(ing) the observer spatially with the mythical scene, demands a pictorial form that will envelop the observer hermetically." Grau may be reaching with this aspiration, but the application of this tactic for a dedicated spiritual chamber indicates the power of the visual capabilities of this piece.

[94] Ibid., 26.

3.4.3.B CHAMBRE DU SERF PAPAL PALACE, AVIGNON

ORTHOGRAPHIC 3D
INTERPOSITION & DETAIL PERSPECTIVE
RECTILINEAR INTERIOR ARCHITECTURAL FORM, 1343

Figure 35 Chambre du Serf, Papal Palace Avignon

The Papal Palace, Avignon, fourteen hundred years later, begins to utilize new technology for the representations utilized within the Chambre du Serf.(Figure 35) They attempt to represent an exterior image by creating a chamber free from physical architectural elements, like columns and decoration, aside from the rectilinear walls. By removing columns and architectural decoration, the representation visually overtakes the physical configuration. Matteo Giovanetti not only desired to utilize every square inch of this space to create his fresco representation of the outdoors, he also made the gesture

responsible for "virtually" expressing architectural elements by painting crown moulding across the upper edges of his garden.

Aside from the vertical walls themselves and horizontal floor and ceiling, the fresco attempts to be uninterrupted in its field of vision. Without the presence of a real world physical element like a column, the architecture is less responsible than the visual outdoor garden for defining the space.

orthographic projection— n
1. a style of engineering drawing in which true dimensions are represented as if projected from infinity on three planes perpendicular to each other, avoiding the effects of perspective

2. a type of zenithal map projection in which the area is mapped as if projected from infinity, with resulting distortion of scale away from the centre

Figure 36: Photo from eye level depicting height of projected space

By removing the interface the image nears having immersive qualities. Modernly, this method has been utilized in creating dioramas for museum installations and the like. Dioramas use a curved wall painted with a receding landscape, and full scale figures are placed in the small enclosure. (Figure 37) Additional foreground elements obstruct a clear view of the background and an aerial atmospheric representation on the background, painted on the seamless surface, mirrors the look of a real world landscape, in a small interior space.

Figure 37: Diorama at the Natural History Museum, NY

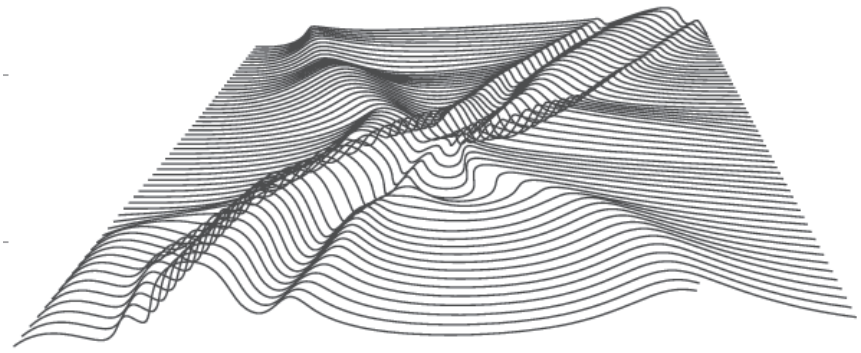
Ironically, in the Chambre du Serf, there are, are clearly intended representations of architectural elements within the fresco, that attempt to suggest depth, utilizing an orthographic method of representing rectilinear man-made details of the outdoor garden. To utilize orthographic, pictorial representations, of a real world object, is misleading because one could never observe a shape in real life and achieve this view and because it lacks a vanishing point. "Although contemporary painting techniques were unable to render a horizon effectively, the desire to create a pictorial illusion and the attempt to portray in perspective are apparent."[95] Orthographic representations were advanced at this time, and were obviously being employed to suggest depth, though a representation of an outdoor landscape would not require it. Oddly enough, the pictorial-architectural elements are also fighting against this ability because they over frame what otherwise could otherwise be seen as a visual addition or even a window to the outside. Not only does that upper edging frame the image like a picture, the physical jog in the form at the corners creates a difficult visual incongruence between with the image and physical visual depth information. This change in level and addition of visual architectural elements that create an interface for the representation is what brings this example into the category as being staged experience. In this case, it is the interaction where the spatial potential fails, despite being a notable attempt at the time.

[95] Ibid., 35.

3.4.3.C YAPI KREDI BANK, GALATASARAY SQUARE, ISTANBUL

"4D" PROJECTION MAPPING
CG PROJECTION USING LIGHT AND SHADOW
TRANSPARENT RIBBED FACADE -2012

"The project brings together disparate disciplines like architecture, sound and the visual arts which influence one another to such a degree that it is impossible to separate them. While the project aims to interpret the world in visual and aesthetic terms, in its capacity as an "interdisciplinary transformation" project it also questions the point where art and architecture stand today and the point they might reach in future."[96]



Transformations of splines in U/V directions into the surface.

Figure 38 &39: Photo of Projection Map on Facade and Design of Splines for Surface

[96] Paul Petrunia, "Augmented Structures: Architecture Beyond Visible," http://archinect.com/news/article/34031961/augmented-structures-architecture-beyond-visible.

Utilizing the vertical real estate of a building adjacent to a large plaza, this project assembled a physical intervention designed to visually represent a projection map inspired by audio gathered from the plaza. (Figure 39) The audio not only inspired the pairing of visual projection and audio, it also defined the physical form of the intervention and how the audio visually appears across it.

The resulting physical form was constructed of a series of ribs applied to a common flat wall with geometrically dispersed rectangular windows. The ribs were covered with a semi translucent fabric that when stretched across the ribs form geometric edges to the three dimensional form. Already, the physical form that is created, independent from the visual projection or audio, begins a narrative of its shape through shadows, creating caverns and mountains on the previously static facade. In addition the transparency of the fabric creates a visual rhythm of the vertical ribs.

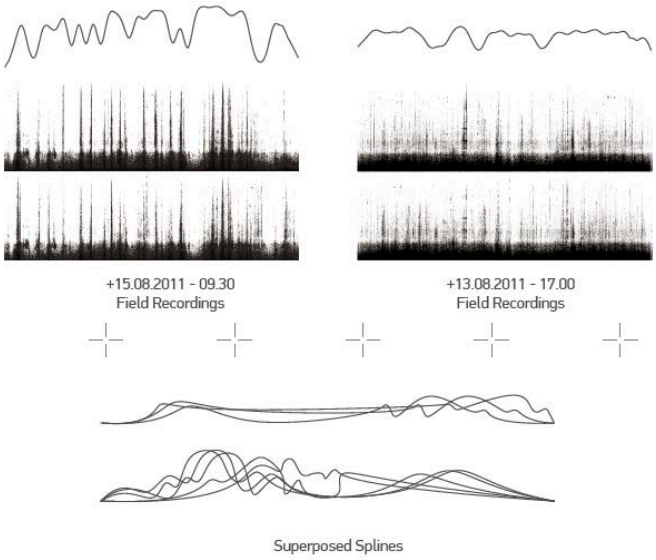


Figure: 40 Audio wave forms that inspired ribbed facade.

The projection mapping assembled for this application is mapped based on the geometry formed by the undulating edges of the ribs. (Figure 40) The physical form, audio accompaniment, and visual imagery were all created from the same audio waves. By understanding the physical form it is simple to apply coincident visual corners to the projection mapping that monopolize on the physical geometries of the architecture. This project expresses a wide array of methods as described earlier through the prior historic evaluation. Its gestures utilize visual co-incidences that push visual understanding of both the physical and virtual form. The resulting projection map implements a geometric pattern to the presentation in order to coincide with the vertical ribs and assist in the spatial understanding of the form. The shadows alone define the edges of the fabric but may not be contrasted enough to give visual form to the surface. The geometric mesh heightens the visual suggestion of depth. With the geometric mesh in place, and the projection set in motion, these visual edges begin to move away from the actual backdrop, and the mesh assists with the geometric pattern.

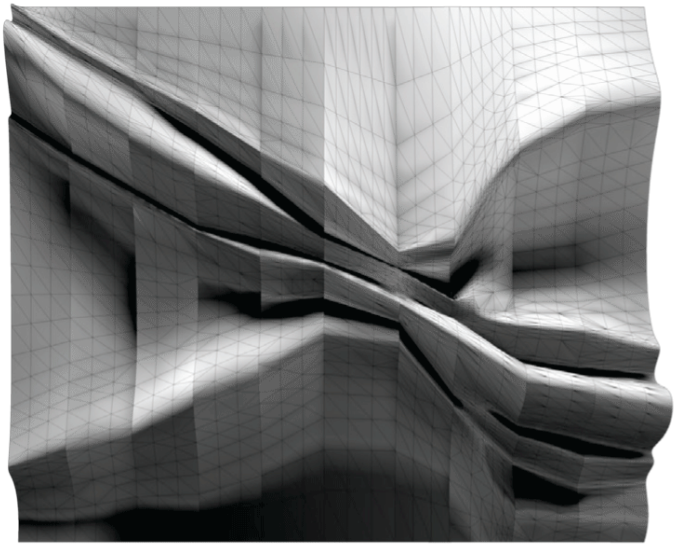


Figure 41: Rendered Facade of Ribs and Projection

The audio from which it was inspired, emphasizes the visual phenomenon. Appropriately placed sound effects solidify the understanding of the special effects of the cinematic screen. When the form is designed with the specific intent of extending the projection map, it assists in the perceived height. This is apparent in the ceiling in San'Ignazio, or the Sistine Chapel, because the gesture of the representation accurately coincides with the gesture of the architectural canvas. To solidify the whole experience in Kredi Bank, the addition of the audio orchestration, is able to emphasize the movements that are occurring across the facade. By audibly suggesting stretches and deformations of the visual movement, the virtual experience has more cognitive cues suggesting depth in its favor rather than in contrast to the physical reality. The modern occupant would be more inclined to respond to a visual stimulus accompanying an audio existence, just as it heightens the belief of a cinema goer when special effects are created with audio on the big screen.

This example applies the principals of persistence of vision by starting with shared visual cues between the architectural canvas and the projection map. (Figure 41) When the projection shares shadows and edges with the physical form it begins to exchange the understanding between reality and the virtual. The projection map then begins to move and the suspension of that original spatial understanding persists. If the projection map were to move too far away from the physical form the virtual would then be understood strictly as a representation, no longer as a shared spatial existence with the physical form.

Figure 42: Naturally Lit Shading of Ribbed Facade

The qualities of projection mapping shown in the Kredi example, (Figure 42) are elevated in comparison to other projection mapping examples, especially those applied on an architectural facade, because it is a rare example where the projection map and the architectural canvas were designed for each other. This example, as well as others to follow emphasize the importance of the architect in the role of designing these creations.

This staged experience occurs due to the height and distance of the viewer compared to the installation. It is also unique because this installation on a facade attempts to recede into the building more often than extend outward like the ribbed addition does. Instead of attempting to protrude out towards the viewer, as commonly happens in a stereoscopic 3D film, this form uses the method of perspective and geometry that coincides with the ribbed forms to make it appear as though the building has a cavern that sucks into the building only to fill back out to meet the physical facade. This causes the viewer to be visually drawn into this virtual space being created. Because it is not happening above or around the viewer he is not internalized within this visual experience, but watches it happen away from him. This iteration of projection mapping appears to posses all the right elements and methods to create an augmented experience but rather remains an observation somewhat remote to the intended audience.

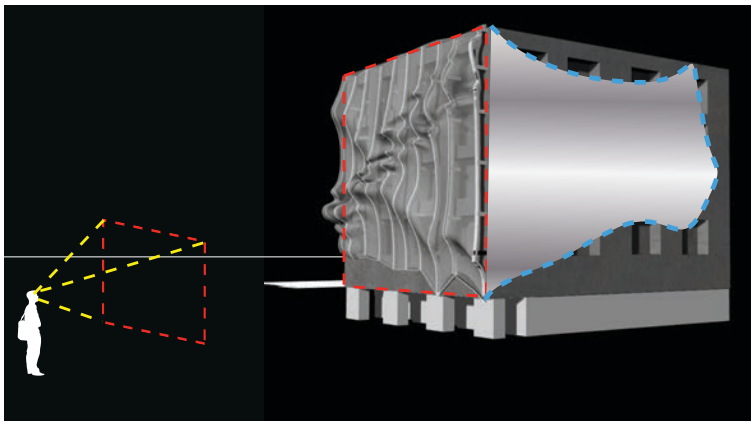


Figure 43: Remote Observation and Suggested Depth within Building

3.4.4 AUGMENTED EXPERIENCES:

Mutually Direct and Indirect participation of the projected space and architectural canvas. Immersive, and create a merged spatialization.

Examples are:

- Alta Mira
- Baroque Churches
- Projected Space
- Current "4D" Projection Maps
- Google Glass
- Augmented Reality

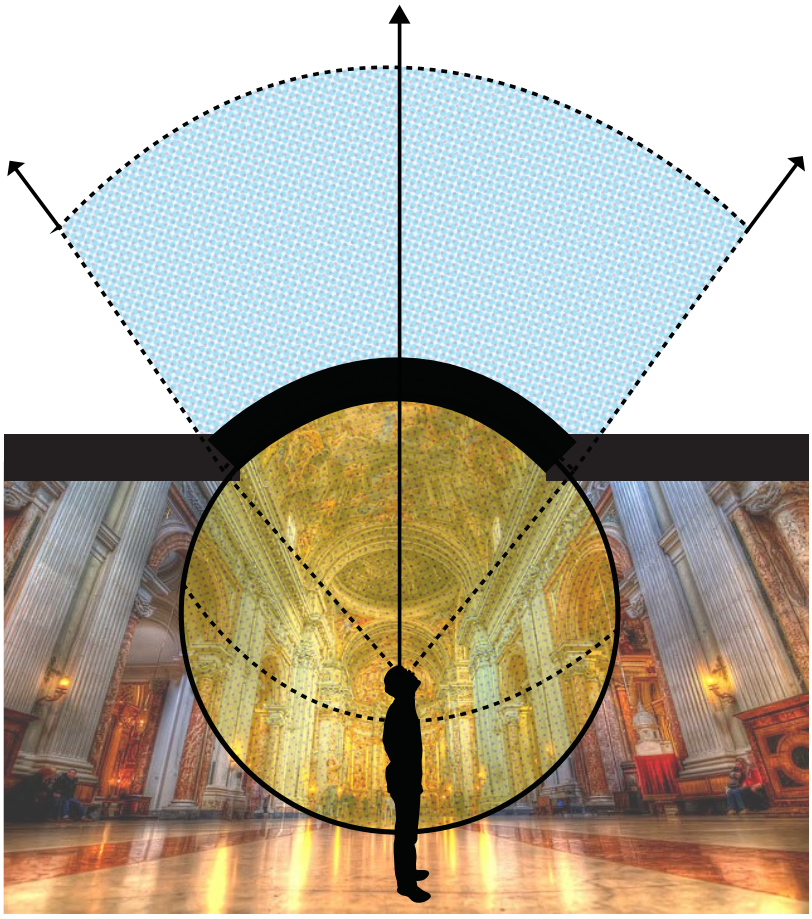


Figure 44: Augmented Experience Extension of Space

An augmented experience is a mutual, direct experience where the architectural form of reality is contributing equally to that which is being suggested by a projected space. The most successful augmented spaces occur where the architectural canvas and the projection are designed with the intent of being utilized together. The spatialization begins to gain spatial understanding or *augmentation* when visual cues of the projection and the architectural canvas are shared.

To contrast the previous precedent examples of the staged observation and the remote experience, the augmented experience has a drastically integrated interface. The point of view, location and scale of the representation is direct towards the occupant. The gesture is intended to be seamless so as not to provide a frame for the installation but rather appear as though it exists within the existing reality rather than next to it. The distance of the viewer is also critical to define the difference between a staged experience and an immersive one. As diagrammed earlier in Figure 44, the gesture of the architectural form and the projection is similar to the inclusion within that spatial experience. Figure 45 shows a staged observation and the gap of space that separates the observer from sensing an *immersive* experience. When the architectural form creates a degree of enclosure and that is reciprocated by the projected space the space not included within the spatial experience is minimal, shown right in Figure 45.

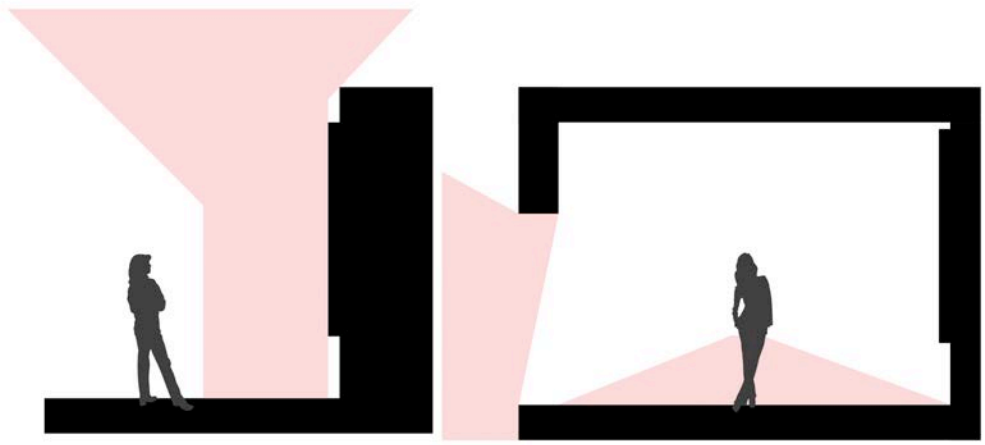


Figure 45: Staged Observation on Left Augmented Experience Enclosure to Right -Red Field indicates space not acknowledged in spatial experience

3.4.4.A ALTA MIRA CAVE

TWO-DIMENSIONAL PICTORIAL
INTERPOSITION & RELATIVE SCALE
BTWN C. 16,500 AND 14,000 YEARS AGO

Early artistic representations were limited to forming basic outlines of bodies. These outlines did not yet utilize basic pictorial depth cues. As a result, they are presently understood differently than when originally conceived. Panovsky refelects that "at this point we are bound to wonder whether and in what way antiquity itself might have developed a geometrical perspective." To place our understanding through the eyes of people of that time Panvosky suggests "the ancients, as far as we know never swerved from the principal that apparent magnitudes were determined by distances not angles." This implies that representations were not based on geometric understandings of objects in relation to one another but rather actual orientations of one form to another based on distance. "On the one hand, it is clear that as long as it respected this principal, antique painting cannot very well have contemplated projection upon a surface, but rather would have to adhere to a projection upon a spherical surface. On the other hand, there can be no doubt that antique painting was even less prepared than was the Renaissance to work in practice with "stereographic" projection.[97] This rather then becomes the first projection map being that the images projected upon the surface were taking advantage of the physical form.

Figure 47: Bison and Limited light of Alta Mira

If the ancients, understood space through distances as opposed to angles, thus, the physical canvas of a cave ceiling was an authentic way to apply images of figures. This resulted in figures being at an actual, scaled distance from each other, as opposed to an abstraction on a flat surface to imply distance. With the best of their representational knowledge of the time, Alta Mira is the earliest example of spatially adding a virtual projection or "augmenting" the occupant's experience. The form of the space allowed the artist to bring depth to the basic two-dimensional depiction of a bison. It brought movement and depth to the depiction bringing it closer to the actual view or

[97] Panofsky, *Perspective as Symbolic Form*.

mental vision that inspired it. In addition, the representation had no edges, like the frame of a painting, but rather flowed across the cave ceiling and likely depended on how the light entered the cave. Because the overhead form and the representation were both "endless" (of what could be seen with the small amount of light in the cave) information to suggest that the bison were not dancing across the "landscape" was not enough to debunk the virtual existence of the bison.

Also guided by how natural light reached into the cave, the artist was able to suggest spatial depth through the placement of the representations. The bison's orientation and distance relative to each other replicates how the bison would appear in nature, larger ones physically close the viewer and smaller ones actually being farther away. The arrangement of the bison from this vantage point created a view like reality, of a field of animals if seen from above, as looking down from a hill. Because it is not a space being represented but rather the figures that occupy it, this does not create a virtual space per se, but rather creates a virtual scene upon an existing space. In this sense, this is a cultural spatialization reflective of augmenting existing spaces. Man was beginning to imagine the virtual dimension and did so by using natural forms that could represent what they envisioned. It has also been suggested it was created as a representation of abundance of the hunt visualized above as a dream from the heavens, which would correspond to a vision of a shaman. Likely seen by light of fire below, the sight of these creations would likely provide less information of the form and shape of the room but more-so the depth and distance of figures laid out before them.

Figure 47 and 48: Pictorial Bison that appear on Alta Mira Cave, Bison with Texture and Shade from Architectural Canvas

"For most cultures, however, collective 'conjuring' of altered modes of perception and understanding are more common practices. These virtual spaces that populate the anthropological literature are lived more strongly than the more 'consensual hallucination' envisioned for cyberspace.'"[98]

Fig. 47 and 48 indicate the visual change that occurs from the introduction of one visual cue, shadow, adopted from the physical form of the cave ceiling. When the shade and form of the cave ceiling is removed, the diorama of animals loses the spatial attributes of their configuration. The pictorial outlines then appear as a jumbled sketch of lines. When those same images are placed onto another form the understanding of their visual depth and configuration again is influenced by the canvas upon which they are applied. (Figure 49) The physical attributes of the cave ceiling are adopted by the drawings because they share the attribute of their configuration and visual importance of the shadow. Notice how the collection of animals increases in its density as it increases in distance from the viewer. This also occurs when we view objects in a field in reality, as the distance between the viewer and the objects increases they begin to converge in the distance and get smaller in size. The shadows of the cave ceiling are incorporated into the visual image of the pictorial animals and the array of animals emphasizes the distance of the cave ceiling based on their configuration. Thus there is an exchange occurring, the form and shadows of the cave form a reality providing visual cues to elevate the visual perception of the virtual figures.

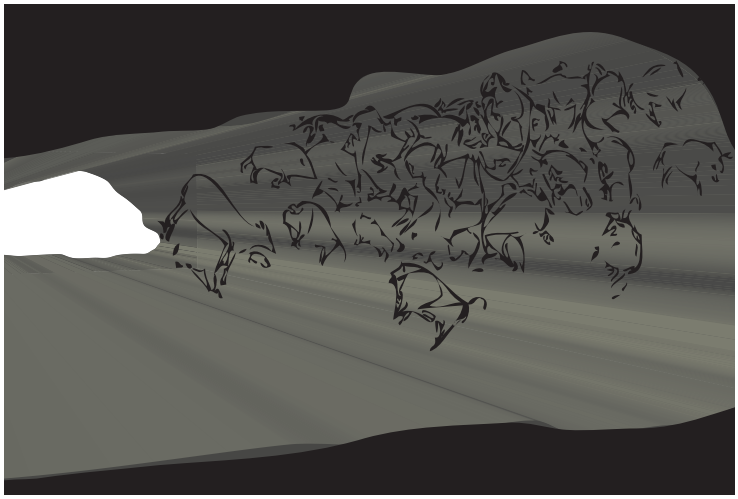


Figure 49: Rendering of Bison Pictorials on Un-Mapped Surface, by Author

This is a very simple example of how important it is for the physical form to match the representation. The reason why the depictions of the bison are a "projection map", is because they are oriented upon the architectural canvas appropriately to respond to that physical form. Because there is an exchange of visual qualities between the actual form and the depiction, this creates a directly connected virtual depiction and physical space of reality.

[98] Shields, *The Virtual*, 11.

If you distort the physical "canvas" upon which these pictorial images is displayed, the visual information can either emphasize the appearance of distance or provide conflicting information that leaves the viewer visually "seasick" and undecided on the spatial reality of the space. Fig. 49, utilizes the same pictorial outlines of the bison and applies them to a physical canvas, that does not correlate with its configuration. What results are conflicting visual cues that lose the spatial impact suggested in the Alta Mira application. From this basic example, the exchange of visual information is apparent despite the simplicity of its representational gestures.

The success of this example acts upon the representative capabilities of that time, as well as the limited imagination for the virtual. This architectural canvas was not yet designed, but it did display its spatial opportunities with that were implemented to benefit the observation of the depiction. Being that these figures are represented on the only visible surface of the cave, this begins to suggest an augmented, immersive experience. The scarcity of light may have resulted in all visible areas including the depiction of the bison. The augmented visuals appear as a result of the physical form working in concert with the layout of the bison.

Visual Cues of this Projection Mapping:

- Interposition
- Scale
- Orientation

3.4.4.B SANT'IGNAZIO BAROQUE CHURCH SALLE DELLE PROSSPETTIVE

AERIAL ATMOSPHERIC
FORCED VANISHING
POINT PERSPECTIVE
DOMED CEILING
C. 1688-1694

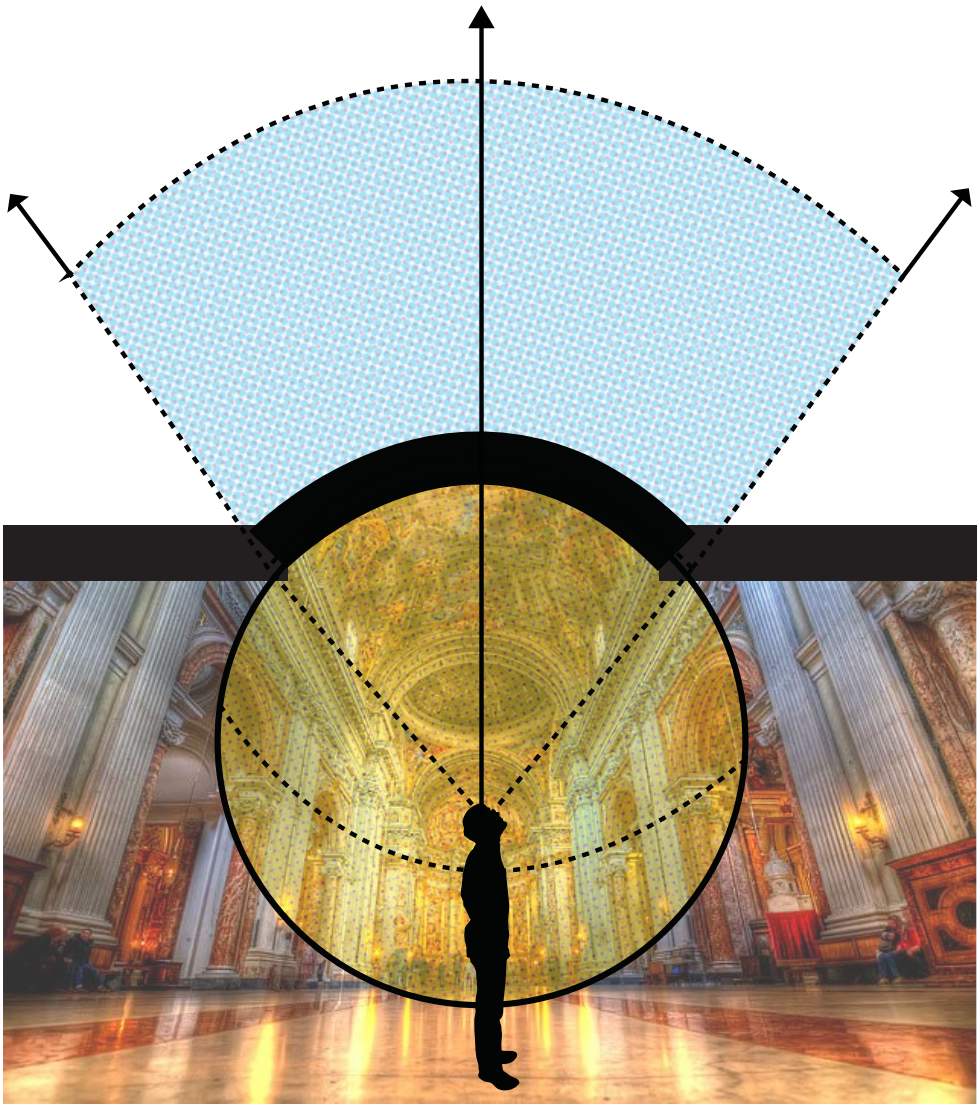


Figure 50: Augmented Experience Extension of Space

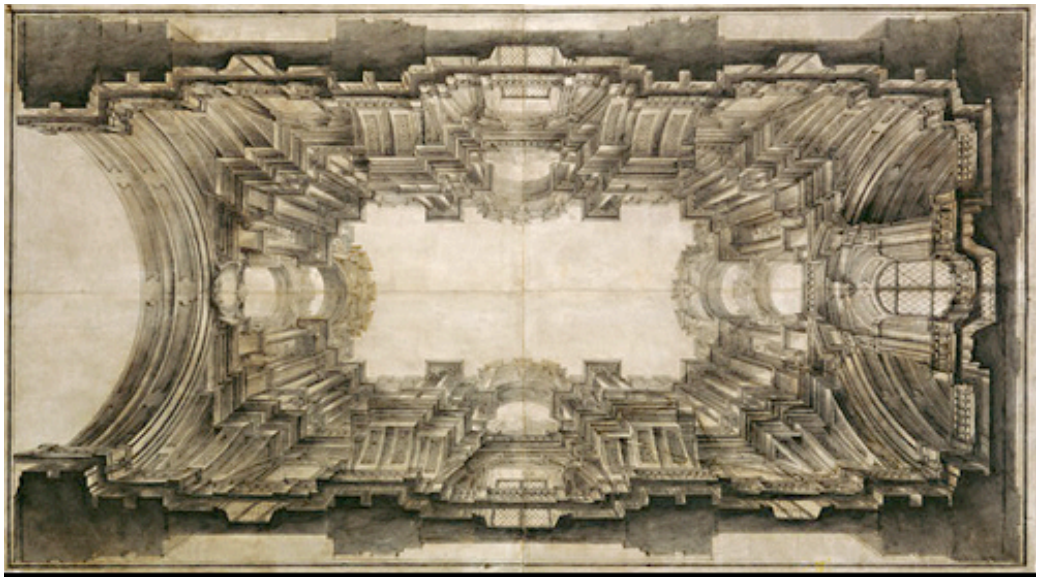


Figure 51 and 52: Fresco by Andrea Pozzo, 1685, (Top) and Rendering of underlying suggested Architectural Canvas (Below)

Figure 53: San Ignazio Church, Rome, 1684, Paintings by Andrea Pozzo

The sixteenth century saw an explosion of installations of spatial illusions, influenced by changes to the major religious establishments of the time as an application for expressing their wealth as well as the emotive power that they sought to share. "At its pinnacle, Baroque offered the throughly mediated interactivity of audience participation in the spectacle of its own rule... We need to understand the culture of spectacle in the first Baroque as the beginnings of our own."[99] Through the use of spatial frescos painted across domed ceilings of churches like the Sant'Ignazio, the church was able to elevate the awe and inspiration often achieved by the large scale architecture of the church.

The creation in Sant'Ignazio is one of the earliest examples in architecture where the medium is responding to the architectural form with the direct purpose of utilizing the form to best bring awe and depth to the fresco. It did so as a response to the intention of elevating the experience of the church to be greater than was perceptible to an occupant of that time. "Perspective, in transforming the *ousia* (reality) into the *phainomenon* (appearance), seems to reduce the divine to a mere subject matter for human consciousness; but for that very reason, conversely, it expands human consciousness into a vessel for the divine."[100] Not only is the physical spatial depth contributing to the illusion, but the fresco was adapted to the form of the dome and the perspective adjusted

[99] John Beverley, *Against Literature* (Minneapolis: University of Minnesota Press, 1993), 64.

[100] Panofsky, *Perspective as Symbolic Form*, 72.

accordingly to emphasize the visual depth. As seen in Fig. 52, which indicates the bare physical form being visually suggested shown without figures moving about it, there is an intended visual recession of the image, to bring understanding to the form of the dome. In addition, this form has the advantage of being observed from a small array of vantage points. Because the visual image occurs above the viewer, the reality of the vanishing point is emphasized because it can only be approached by looking directly up, and thus varying heights of viewers does not distort a horizon line. Those abilities also occur because no hard edges occur in the physical form of the dome. "Pozzo himself had argued for the *punto stabile* that guaranteed correct spatial form and lasting illusion--at least with regard to architecture. The architectonic space, with Christ at its focal point, confronts the representation of church and religious dignitaries, so that these constellations of heaven and building, respectively, gape apart. One might term this effect stereoscopic, yet only in a narrow sense. "[101] The narrow range of view that results in an accurate perception of space is an issue that remains through later installations of projected spaces, but is also soon to be resolved as is discussed in future installations, examined to follow.

[101] Grau, *Virtual Art from Illusion to Immersion*, 48.

3.5 CONCEPTUAL FUTURE INSTALLATIONS

What is currently understood as the immersive experience may soon be mediocre in relation to drastic advances in technology and leaps in conceptual-future applications. Projection Mapping has recently elevated itself above being a surface decoration for the facades of installations created simply for shock value. They are now being evaluated for their potential in more common applications. There are small successes emerging from experimental films that utilize projection mapping to display space for the camera.

An exploratory example is a short film done by a creative production studio called Marshmallow Laser Feast. This internal projection map project is created with all in-camera effects. Through the use of multiple projectors mapped for both the interior of this stage, as well as mapped for existing objects, this projection map is capable of making elements of

Figure 54: The physical confines of the space and the projected additions.

the set disappear, to be overwritten with spatial visual information from the projection map. Through the use of a grid system, the actual space of the set *visually* expands to appear like

the space has actually grown. Seen in Figure 54, the physical edges of the space are shown in pink and the mapped or projected space is created through the use of a perspective grid. These types of internal projections are likely to be a small step into the adoption of projection mapping within the architectural fabric and would begin by allowing visual material and paint changed to the interior of spaces.

A loftier exploration, created by visual artist, filmmaker and futurist, Keiichi Matsuda, explores the future augmented reality that is already in development with interfaces like Google Glass in the works. This short film displays how the personal digital interface is soon to become a spatial orchestra that occurs immediately around us. Some of the designed interfaces follow the occupant and encircle him in an egg shape (Fig. 55) surrounding, all within arm's reach since its controlled by his hands.

Figure 55: The small space that is recognized by the occupant of a personal augmented space

He is also designing his surroundings as he moves through space, choosing a room type and style to appeal to his own preferences. Later in the film he is walking down the city street and chooses the wall pattern and graffiti that covers the architectural facade of his journey. There are also an array of advertisements that attempt to attract his attention as he moves down the street. (Figure 55)

Figure 56: Augmented City Street with mini icons following the occupant

Though fictitious at this time, technologies of this type are currently in development. It is of note that Matsuda has donned the characters of his films each with glasses, as though to imply that is one method with which they could experience a technological interaction of this type. The Google Glass interface has the potential to resolve many of the issues that arise from projection mapping.

The Renaissance examples of projected spaces required the viewer to be within a specific *punto stabile*, and minimized the range of locations from where it could be seen accurate to the perspective. If an interface like Google Glass were to be implemented in the built environment, a simple system of QR codes could trigger the Google Glasses and provide information to assemble an appropriate visual correspondence to the real world elements. This would be a highly seamless augmented reality. The virtual projections could be designed to specifically integrate with the architectural canvas. The faux vanishing points created to imply depth in virtual additions would be able to visually move with the viewer. This could also allow for customized responses for each viewer. Two occupants could share the same physical experience but have starkly different visual products projected by their Google Glass.

Figure 57 is a mock up of the use of a Google Glass style augmented cityscape. There are small QR code triggers around the corners of activated spaces. When the viewer walks

down the street the camera in the Google Glass will be able to correlate its orientation to that surface or space. This will allow for a corresponding movement of the projected space to the viewer from any angle.

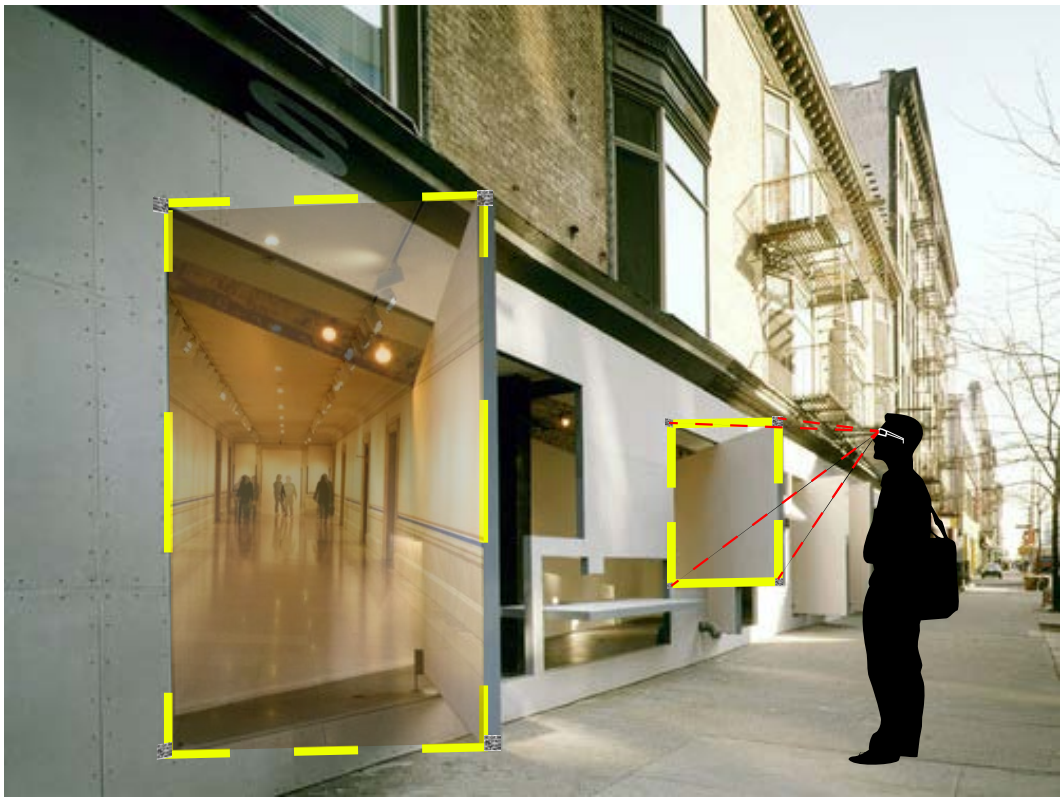


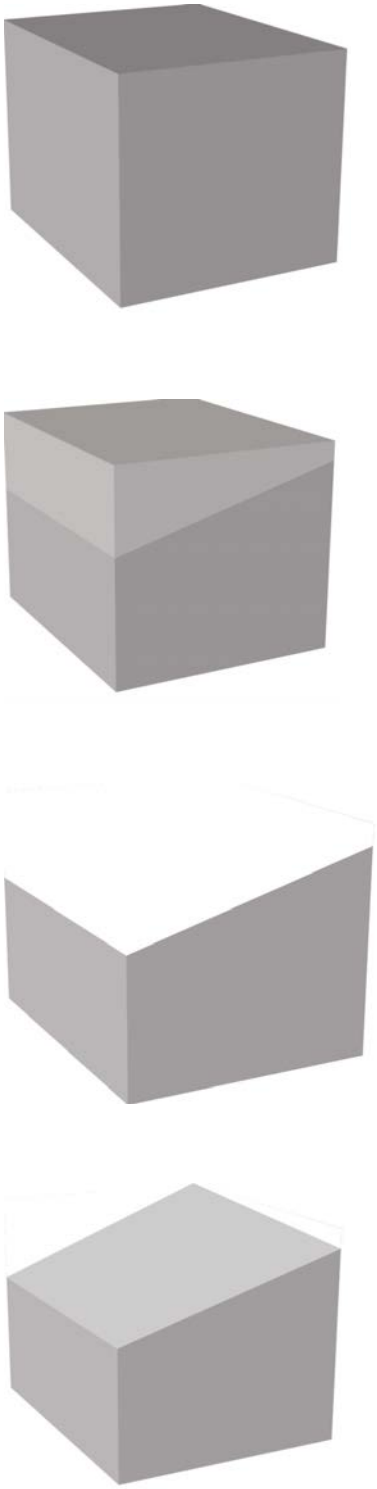
Figure 57: Mock up of Architectural Facade with QR code activated Google Glass

4 VISUAL INTERPLAY

Forms of reality and projected shapes from the virtual work in concert when implemented in an Augmented Experience. These visual methods are also effective in the staged application but are more compelling when utilized in an immersive experience. The biggest benefit that projection mapping and the architectural canvas bring when designed in combination with each other is the ability to work in concert with each other or exert visual power over the other. The projection map seeks visual opportunities where it is able to match or compliment existing spatial qualities of reality, and from this launching point, strays to define its own to express movement of the physical forms of reality. By doing so it is utilizing a huge array of visual qualities that allow for the exchange of perceptual qualities between reality and the virtual. It is when these perceptual qualities are contributing equally, creating a symbiotic *visual interplay*, that the most convincing, immersive experience occurs.

Various methods of using projection mapping on the architectural canvas will be explored and defined here to provide a visual lexicon for the architect to implement and to create *augmented experiences* that are mutually real and visual-virtual.

To start the evaluation of this perceptual ballet, a simple cube will be utilized to provide simplicity to understanding these visual concepts. This simple cube, a physical form in reality, shown in Figure 58, is lit from one side and resides within an empty stage where all light and shadow are within control of the artist.



BRIGHTNESS OVERWRITING OR "WASHING OUT"

Beginning with a simple cube lit from a general light, the size orientation and form of the cube is simple.

Because the content of the projected image matches the physical form exactly, it is able to selectively light the object to distort how the orientation, and form of the cube is understood.

The projection map begins to take control of the visual cues of reality. Because these virtual-visual cues originated with complementing those of the physical reality of the cube, there is an elevated degree of belief regarding the appearance of the cube.

As the projection map begins to make a hard edge lighting across the faces of the cube, it visually resembles a new form being separated across the top of the cube.

As the brightness of the light increases it is able to wash out the visual existence of the top of the cube all together. What remains though is a spatially confused and inaccurate form that appears like two paper thin planes oriented at a 90 degree angle from each other.

For the projection map to complete the spatial information needed to perceive the new mutually visual-virtual and physical form of reality, a final plane is projected upon the form of the cube, to provide enough visual information to accept this new virtual construct as that same physical cube. The virtual projection has now overwritten the visual information of the physical cube of reality, creating a symbiotic, augmented form.

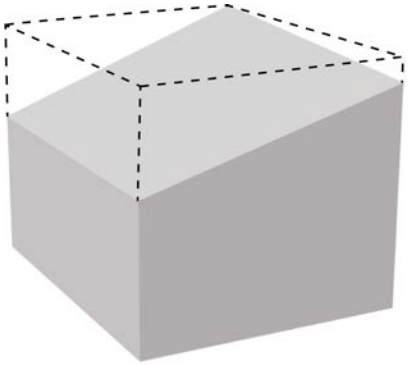
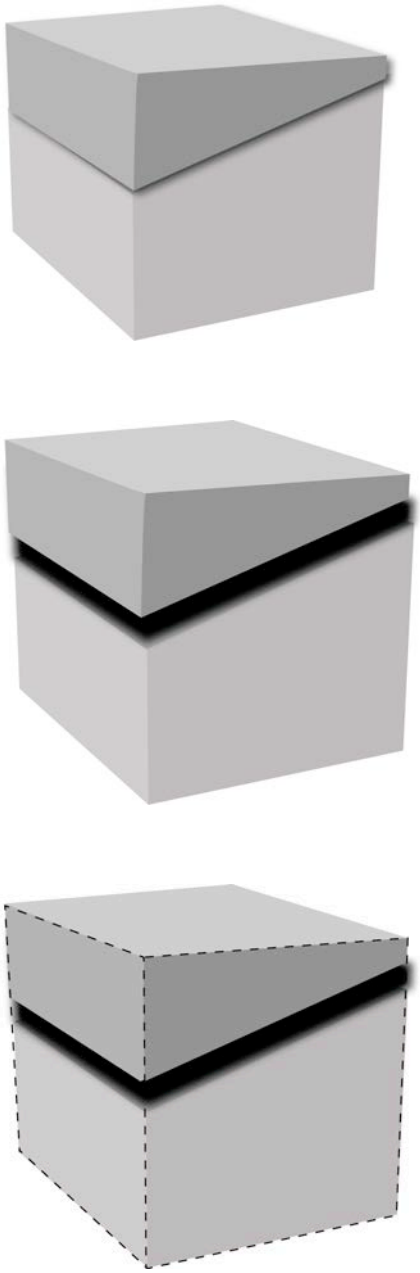


Figure 58: Cube, Cube with Lighted subtraction, Cube with washed out Subtraction, Cube with Projected Angled Surface



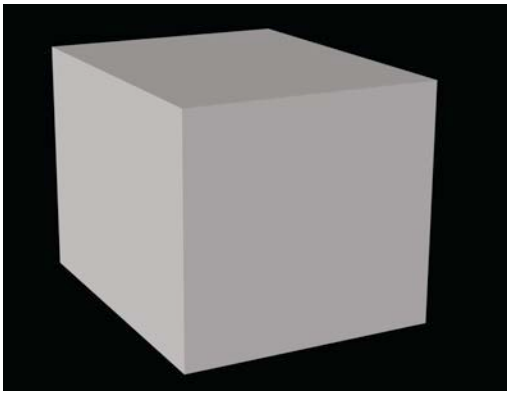
SHADOW IMPLYING DISTANCE

If those varied brightnesses are left intact to imply that separation of the cube, a simple gray edge shadow can be introduced to begin to suggest a height difference of that component of the cube.

In this first cube the mapped projection has selected to decrease the brightness of the top part of the cube and has introduced a suggested shading around the edge of the visual-virtual separation.

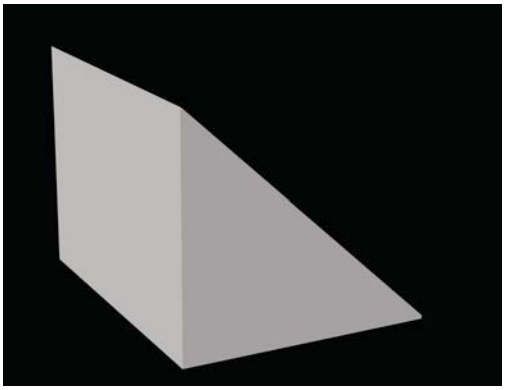
With no actual physical movement, the increasing density and size of the shadow increases the visual depth between the virtual base cube and the virtual top portion. The physical form remains unchanged but the visual form is in motion.

Figure 59: Cube with False Shaded Edge, Cube with False Elevated Shade of Edge, Cube with False Shaded Edge and Dotted Line as physical form



OVERWRITING PHYSICAL FORM WITH DARKNESS

When light and shadow are fully controlled by the visual designer, it allows for the projection map to overwrite some visual qualities of the physical forms of reality. When this same cube is lit solely by the projection map, each face is able to be activated by the map. These faces are also able to be overwritten by the removal of light from activating their physical form.



INTERPOSITION

The visual cue of interposition spatially frames elements in relation to each other. In a projection map application, interposition can be faked by visually projecting the occlusion of one edge over another.
These series of vertical elements are better understood through the addition of visual cues to assist in the understanding of their relation to each other. The rectangles to the right represent a series of columns without any visual depth information. Upon the addition of a volume they are easily read as a series parallel to each other. In Figure X, the lower rectangles without volume represent the effect of interposition on how each rectangle is understood in relation to each other. The volume of columns to its right are in the same position but the interposition (or order of placement) is simply reversed, revealing how interposition is able to contextualize the volumes in relation to each other. Information from light and shadows assist with providing additional information to determine the physical depth of the space.

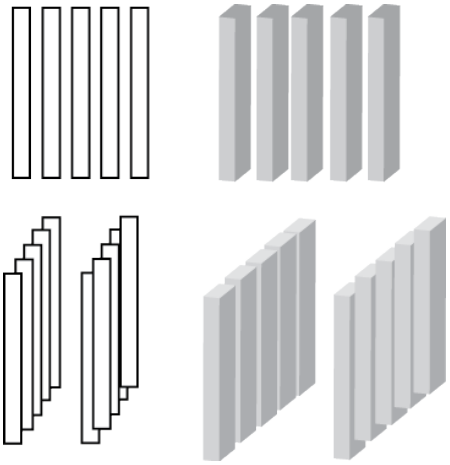
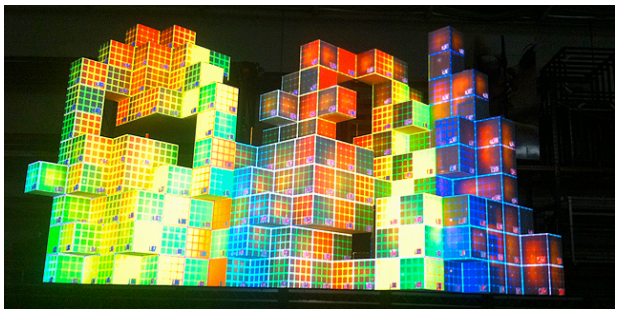
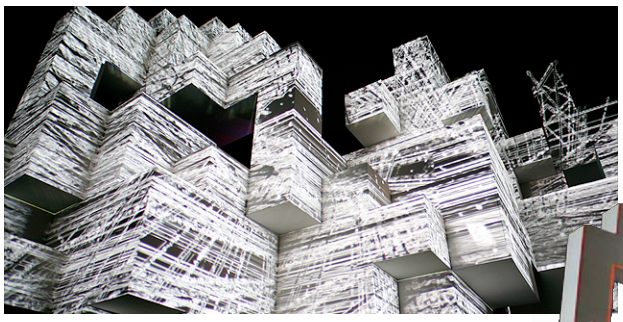
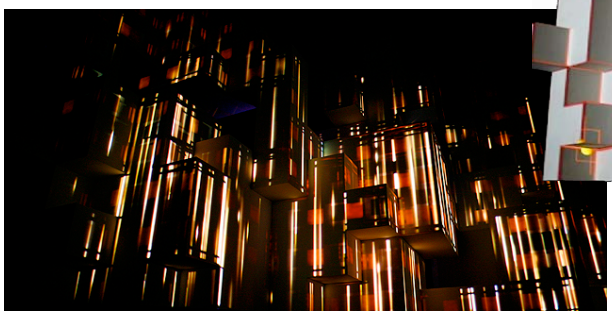


Figure 60 & 61: Normal Cube, Cube with Overwritten Subtraction, Series of Columns with Interposition Cues







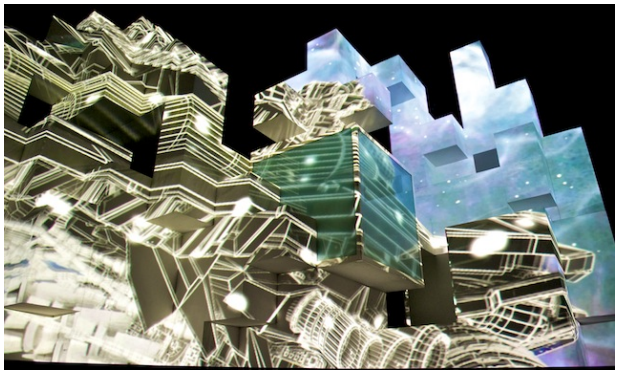
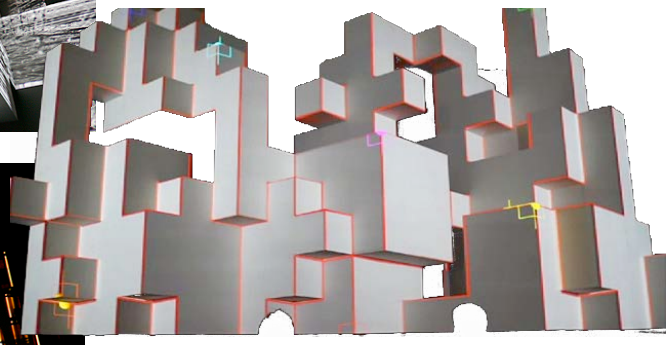


Figure 62, 63, 64, 65, 66: Blank Amon Tobin Installation (Middle Right) and Projection Map results.

COINCIDENT EDGES

Figure 62 is the physical geometry for this Amon Tobin installation. The red edges are activated by the projection map. By having the visual edge coincide with the actual edge of the physical form, the visual cues are actually exchanging ownership between the visual-virtual projection map and the physical form. This visual exchange of ownership disorients the viewer from being able to identify which visual aspects are created by reality or visual-virtual.



Disorienting visual information is one of a few qualities that catches the attention of the modern viewer. Once the viewer's attention has been captured, the projection is then capable of distorting and removing those visual coincidences to further distort the spatial understanding of this visual interplay. Figures 63, 64, 65, and 66 are examples of activating and removing coincident visual cues.

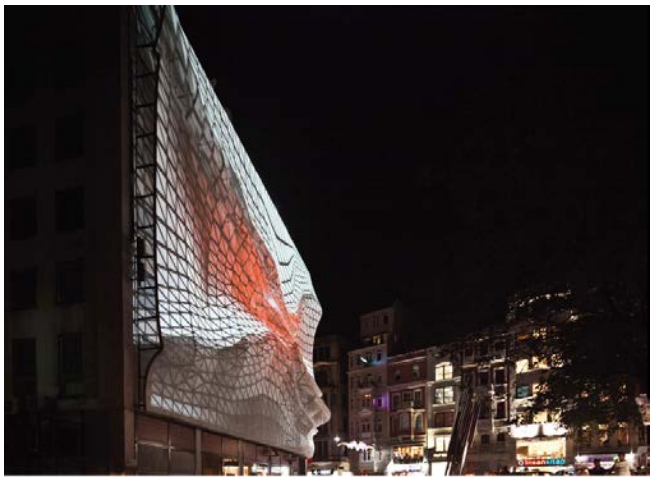


Figure 67 & 68: Geometric Mesh of Yapi Kredi Facade

GEOMETRIC ADDITION OF FORM TO EMPHASIZE PERSPECTIVE

When a geometric mesh is implemented via the projection map the movement of these visual edges emphasizes the perspective vanishing point. A less articulated surface that only operates on shadows may be too subtle to express visual depth, thus the geometric grid assists in providing additional visual information. Figure 69 is an example of an augmented immersive projection map that utilizes a vanishing point grid to display an expansion of visual space.

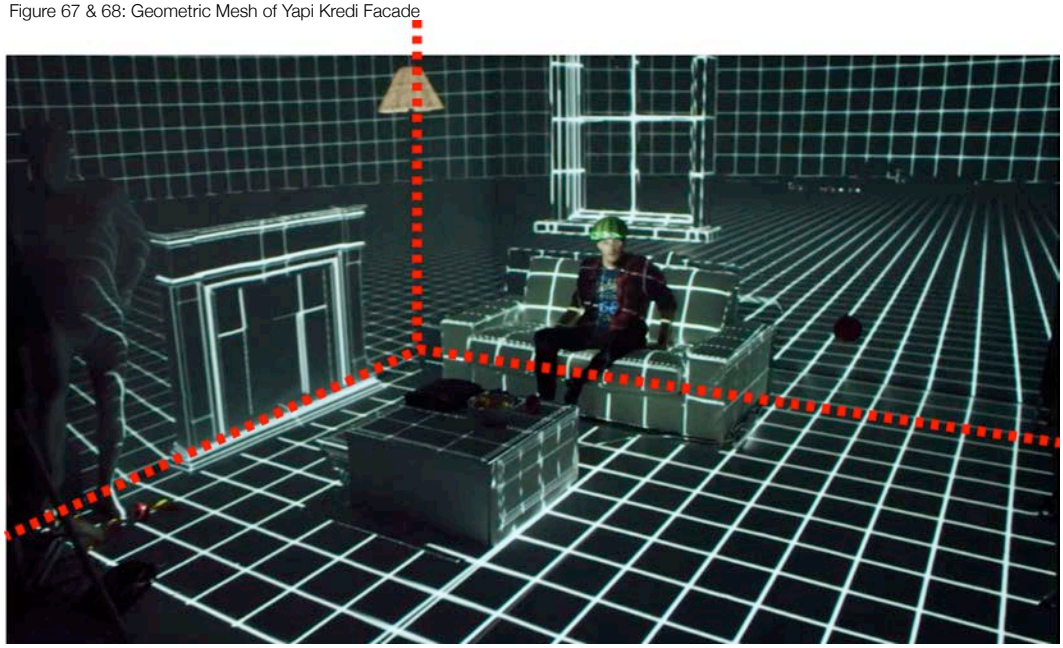


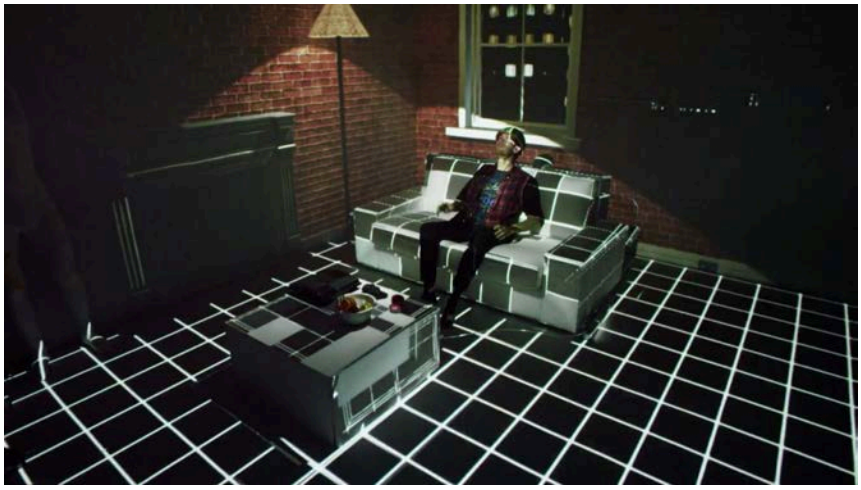
Figure 69: Actual boundries of physical space indicated in red, geometric pattern in perspective to suggest virtual addition

Figure 70: Photo at MoMA NY, 2013

CREATING VISUAL OPENINGS

Even a mirror in an interior space, because it reflects light, is able to suggest another space or the extension of a space. When a projected addition shares the same visual vocabulary of the real world space that it occupies, it is also able to convince a viewer that it is an opening to an adjacent space or the outside. Because it is conventional for a window to be an opening to the brighter space of the outside, any brighter interruptions in an interior plane could be interpreted as an actual window. or door. Often times a real world window only frames a bright blue sky giving little indication to what occurs outside, so for this reason, in a sense even a bright painting could operate as an opening and cause visual interplay of being a protrusion through the solid surroundings.

Figure 71: Virtual Windows Projecting a False Exterior



PROJECTION MAP INTERCHANGEABLE MATERIAL APPLICATION

Figures 72, 73 and 74 are from the same immersive augmented experience but the projection map controls the materials for all the walls and the floor.

5 CONCLUSION

> With the development of immersive and augmented environments we have indeed reached a strange new plateau in the human condition, as we rapidly transit from analogue to digital modalities. These are zones of pure simultaneity, absolute simulation, instability, and instant electronic transmission. All representations of the physical, if desired, can be removed--no vanishing point and no horizon. The once stable laws of time and space have been effectively rendered null and void; entropic delirium slips across the curvatures of time. Space is no longer something one moves through--space now moves through us.[102]

This occupation of new spaces, those that are virtual, remote and connected are more a part of our daily life than the real world spaces within which we reside. These spaces and those that are mutually real and visual-virtual are those of the current cultural spatialization. The modern citizen projects himself into his virtual communities through the internet. He projects himself via video to conduct his meetings and projects himself into the virtual space of a projection map, that doesn't even physically exist. The marriage of the physical form of the architectural canvas and the virtual projection map creates a *liminal architecture*, a spatial perception equally based on physical configurations in reality as it is virtual-visual observations. The liminality of this next generation spatial experience exists from the spatial ambiguity we are able to create despite the diverse spatial imagination of the modern occupant. Each augmented experience will be interpreted and examined through critical eyes that may never decisively determine what is real and what is virtual.

The time is now to begin designing architectural spaces to be symbiotic visual-virtual spaces in the built environment. "Today for buildings and cityscapes to be noticed, they must be viewed in states of mediated perception--energized in velocity or dazzling light and sound effects. Architecture must merge into the flow of information, into a spectacle of media. Fredric Jameson is correct to describe postmodernity as the condition in which the

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[102] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 4.

traditional fine arts (including architecture), are mediatized, in which they come into consciousness of themselves as media within the media system."[103] By using visual tools to manipulate how we perceive life around us, artists and designers have the ability to deceive or direct the visual experience. Being that "vision has been understood as the privileged sense of truth and of divine revelation,"[104] the designer has the power to design the visual realities we perceive and should quickly adopt and integrate any emerging virtual, representative technologies that express spatial potential. Through the use of visual interplay, the future liminal architectural space will engage the modern occupant and directly connect to the current cultural spatialization.

The architect is likely to increase in the use of spaces that are immersive, seamless, and equally weighted in virtual spatial contributions as well as physical forms of reality. The realm of the projection map will require its own methodologies, that are accurate to its own nature, so as not to attempt to mimic reality. Because we are at the cusp of change in our cultural spatialization, we can direct the methodologies for the virtual to benefit the virtual-spatial experience over that of digital-advertising and other utilitarian applications. When the architect begins to adopt forms intended for receiving a virtual intervention it activates the exchange of visual qualities creating a direct and immersive virtual experience. When the imagination of the architect begins to visualize these outcomes, over time he will change the natural forms of architecture. This could result in the blurring of some spatially defining aspects of the architectural canvas, but will result in an adaptable, augmented experience that begins to be applicable to cultural spatialization abilities. "Architecture must inevitably hemorrhage in this seismic mix. It must flow out in other less predictable directions. New spatial aggregates will require multiple escape routes. Formerly, architecture hoarded forms by creating variations of closure. Freezing the mobility of relations of the in-between by storing an energy that now can only circulate. It attempted to capture a spatio-temporal event within a formal framework, an anthropomorphic diagram, an envelope of recursive, cell-like boundaries that mirrored our conception of the cosmos, and our place within it."[105]

The framework for projection maps on the designed architectural canvas will be informal and gestural, juxtaposed in the built environment against the former boundaries of the cityscape. The upcoming methods for mutual visual-virtual interventions on the

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[103] Fredric Jameson, *Postmodernism, or, the Cultural Logic of Late Capitalism* (Durham: Duke University Press, 1991), 14.

[104] Shields, *The Virtual*, 10.

105 Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 13.

architectural canvas may not be predictable but will follow in the style of our predecessors, in the stride that the architect is the multidisciplinary maestro and is able to visualize from all directions. "Architects are not, after all, simply tools of power and agents of spatial abstraction; they do have a distinctive material understanding of space and its relations to social praxis as something that can be modulated in varying qualities and to diverse effects." [106] The symbiosis and varying qualities of directing both the architectural canvas and projection map requires the full control of the environment. To allow a projection map upon the architectural canvas to best suggest its form, it must work in concert with the physical canvas so as to err on the side of a comprehensive view that does not reveal visual information that could spoil the illusion.

All instances of light and shadow are integral to allow for the exchange of visual qualities. Similar to how it was done in the previously discussed example for Amon Tobin, and other projection mappings, every square inch of surface space must be accessible by the projection map or other controlled light sources. This requires the architect not only to imagine the surfaces that bound the architectural surroundings but also the extensions that can be created upon them. This allows the presence of the projection map to be as strong or stronger than those of reality. In a sense, reality will be "overwritten" with visual information contributed by the projection map as though the light acts as an eraser for the architectural form.

It is the success of the *interaction* between the representational medium and the architectural form that brings quality to experiential-spatial moments. The method of revealing a visual-virtual gesture hinges on its appearance being flawless and effortless. As mentioned in the historical precedences discussed earlier, the biggest downfalls originally arose from those seams, edges, and separations that draw attention to the friction of the architectural and representational vocabularies. These installations would otherwise be capable of expressing a harmonic image of the virtual and reality. The new methodology for the architect is to bring a seamless nature to these digital "windows." The way that the modern occupant is going to ponder the existence of a spatial, digital intervention is by sparking that thought process that requires evaluation. To bring pause to the modern viewer accustomed to visual-digital chaos, he needs to wonder what is real and what is virtual. Our cultural spatialization is where it is today because of an over saturation of both physical details and visual stimuli. Both the architectural canvas and the mediated display

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[106] Hensel, Menges, and Hight, "En Route: Towards a Discourse on Heterogeneous Space Beyond Modernist Space--Time and Post-Modernist Social Geography," 24.

have an immense array of details and are no longer simple like the a traditional, rectilinear architectural construction or the medium of the black and white newspaper. Not only are we currently constructing visually complex architectural forms, but we are also plastering them with motion graphics complemented with sound. In order to direct a spatial evaluation by the modern occupant, the architect will need to bring pause to the experience so it is not auto-digested by this new, automatic, digital digestion system of the modern citizen.

The answer to breaking down the interface from getting in the way is the mode of deception of perception. Earlier it was discussed how visual cues behave similarly in the built environment as they do in the visual representation. In some examples of projection mappings on the architectural canvas, it was when the projection and physical form shared a visual cue that the experience was heightened. The deception of perception occurs, forcing the viewer to determine what was real and what was virtual. When a modern occupant has to dissect what he is looking at, his attention is grasped because of the "need-to-know" reaction.

In addition, as discussed earlier, the current array of digital interventions that saturate the built environment are less and less causing the occupant to pause and contemplate. This is occurring because the scale and gesture of how the media and the built form interact with each other. Some examples behave like moving wallpaper, and thus could only mildly set the tone of space more so than lead to any spatial changes observed by the occupant. "This dehabituating of perception tends to occur as a result of certain psychological conditions, such as when the participant's attention is intensified and is directed toward sensory pathways; when there is an absence of controlled; analytic thought; and when the participant's attitude is one of receptivity to stimuli rather than defensiveness or suspicion."[107] The moment of contemplation occurs when the occupant or observer is actively performing analytic thought and suspicion. He has to have cause to wonder what it is he is observing. It is the challenge of knowing that brings a larger spatial response and dehabituated observation. "As a central metaphor within the motion of being, "space" provides a means of negotiating such a dilemma, having sufficient ambiguity to enable the discourse to drift between a cornucopia of real and mythic spaces," Having sufficient ambiguity allows for the suspension of belief and also puts the responsibility of adopting the spatial information as part of the spatial reality or choosing to identify it as virtual. The viewer is able of categorizing his own adoption of visual information "between,

[107] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 147.

the 'space of the screen,' the 'space of the imagination,' 'outerspace,' 'cosmic space,' and literal, the dimensional, physical 'space'. The power of 'space' lies in the possibilities it implies: immersion, habitation, 'being-there,' phenomenal plenitude, unmediated presence, all fall within this domain. Without 'space' there can be no concept of presence within an environment, nor, more importantly, can there be the possibility for the authenticity that 'being-in-the-world' allows."[108] Even the prior determined categories for assembling spatial experiences would provide varied results that could result in a multi faceted experience. It is then the responsibility of the occupant to adopt whether he is being within that world. The viewer is whom is responsible for deciding to fall within our outside the virtual domain, though the implementation of methods should compel him one way or the other.

When observing a projection map of a concert or museum installation, there is a sense of predictability. Not only that, but there is a lack of immersion or habituation occurring, because there is a wall of separation between observing the show and the show itself. When the projection map on the architectural canvas is integrated with domain that we occupy, we will begin to experience the "immersion" that will draw familiarity since will be no longer separated from our conventional domain. The modern cultural spatialization will begin with that familiarity and then draw the awe and immersion starting from that moment of deception of perception. The occupant will desire to participate, direct, and determine how to digest the visual information. Some may accept and submerge themselves, regardless of the facts of what's real or what's visually virtual. Others may exhaustively attempt to debunk the visual information, until it is absolutely clear to them what is occurring. Either way, the experience has transcended being a background, like the moving billboards of Times Square. "By changing space, by leaving the space of one's usual sensibilities, one enters into communication with a space that is psychically innovating. For we do not change place, we change our nature."[109]

From the criteria stated within this investigation, there is a start of a vocabulary of visual products that can spatially resonate with future occupants. "The primary task at hand is to illicit new movements toward the virtual by tripping up repetition, purging habit and reason, and encouraging difference. The virtual, and this is a point worth clarifying, lies outside the actual--it exists in force, not a space. It operates and acts on another plane, in another dimension. It is a continuous unfolding on the road to becoming other. Form

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[108] Ibid., 29.

[109] Gaston Bachelard and M. Jolas, *The Poetics of Space* (Boston: Beacon Press, 1994), 203.

follows fold."[110] To cause the occupant to pause and explore these types of spatial experiences the architect should be designing with both the architectural canvas and the visual projection map in mind. The responses should be immersive scale, and direct to the size of the viewer, not removed or bound by an interface or frame. Those edges should be blurred and only intentional to create co-incident opportunities for the projection. Just like the fenestration of an opening and the texture of the materials used in the architectural canvas affect how those spaces are perceived, each visible detail has a role of contributing to the visual-virtual augmented spatial experience.

The most effective spatial solution will be that where the architectural canvas and visual-virtual projection map are capable of contributing equally to the spatial cues of an experience. When a projection map washes out a component of the architectural canvas, it begins to lose it own visual cues that assist the viewer in understanding its physical form. It is in this fashion that the architectural canvas and projection map can exchange control of the visual product. It is also for this reason that it is imperative I that both the architectural canvas and the projection map are designed with the intention of being utilized together. When the architectural canvas is designed for the projection map, it is designed with a variety of visual opportunities to create co-incidences of visual cues in order to enable the visual exchange or control of suggesting spatial depth. This was emphasized in the contrast between the examples discussed above. The examples above that utilize existing buildings as their canvas are not as strong of a spatial experience as those upon a designed form. In addition, the scale of utilizing an architectural exterior removes the viewer from directly interacting with the new spatial addition.

Not only are future augmented spaces going to be dynamic in their use and potential programs they are also going to be shared in a new and unique social experience. If each occupant is capable of being the designer of his surroundings, two people may not ever observe the same physical space in the same way. How will this affect our cultural spatialization? If the language of the senses is not able to act as the shared language of understanding reality, how will that affect the relationships that we create, not only in the virtual realm but also in the physical spaces of reality? Will these new opportunities to customize the architectural fabric result in skewed perceptions of the world that we share? It is the hope that new methods of sharing, communicating and relating to each other will elevate the shared experience as oppose to alienating us from each other.

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[110] Beckmann, *The Virtual Dimension : Architecture, Representation, and Crash Culture*, 16.

The liminal architectural gestures should be those to spark internal evaluations of our shared understandings. They should push the limits of what we are capable of and what we dream to visualize or materialize for that matter. A liminal architectural experience should be poetic and gestural like the best historical accomplishments across the history of the built environment. They will become timeless and create an awe inspiring experience that resonates for the long term and does not become mediocre and passé. Because the premise of a liminal experience is contemplation, it could also renew itself each new time you experience it. It could change for every occasion and even respond with an appropriate mood. In this sense, liminal architecture could share the ability to feel. Being that there is an infinite amount of experiences that can be created and even orchestrated by the occupant, liminal architecture will have the ability to inhale and exhale. This could bring the architectural experience back to being more like those experiences created by nature, ever changing, at times ambiguous, ever mysterious, and always the awe inspiring house of life.

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