Transarchitectural Form: The use of Mixed Reality and New Media to Explore a Hybrid Spatial Architecture

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Abstract: Transarchitectural Topography and Non-Linear Inhabitation explore the idea of using live video media to visually link disparate spatial locations within existing built structure. Live video connections are constantly in flux resulting in a dynamic network of interactively linked physical spaces. This dynamic process is governed by individuals exploring a virtual recreation of the structure in an online inhabited virtual environment. As the virtual individual (or avatar) moves throughout the virtually recreated structure, the structure shifts and reconfigures itself real-time in response to the virtual inhabitant. Reconfigured virtual spaces then govern the connection between physical spaces via fluctuating live audio/visual linkages installed throughout the built structure.

1. Liquid Architecture, Transarchitectural Topography, and the Causal Chain

Transarchitectural Topography:

This project began as an investigation into Mixed Reality Architecture to discern how physical and virtual spaces can begin to communicate and become expressed formally. The goal of this study is to outline conditions and parameters for how these spatial interactions might take place and become situated in architectural space. Groups across Europe and Asia have recently been experimenting with Mixed Reality on both a formal and informal basis. The experimentation extends from individuals recreating physical spaces in online inhabitable virtual environments to labs that experiment giving lectures from one reality into another.

As we begin to consider the architectural implications, we must examine the architectural opportunities that arise through the intersections of these two realities, as well as the ability for informational exchange to take place. This requires an examination into the properties and limits of virtual space, the formal properties as the architectural form transitions from the physical to the virtual, as well as the technological infrastructure which will connect the two qualitatively different types of space.

Liquidity of Virtual Space

Paul Virilio, Marcos Novak, as well as many other architects and media artists have written extensively about the virtual in both theory and application. Novak describes the virtual as space that has a liquid quality. As a result, the architecture produces in such space may be known as liquid architecture. In one of his earlier descriptions of liquid architecture, Marcos Novak introduces a series of plates and presents his description of liquid architecture "architecture whose form is contingent on the interest of the beholder: it is an architecture without doors and hallways, where the next room is always where it needs to be and what it needs to be." Novak describes the virtual as ever-changing shifting and responsive entity, and holds no less a definition for the Transarchitecture that he presents as a result of it.

Transarchitecture, as described by Novak, is an architecture that exists between worlds (specifically the virtual and the physical). Novak identifies a single framework that extends between the virtual and the physical, where each branch (the physical and the virtual branch) consists of both a visual and non-visual component. The visual is described as the actual formal architectural presentation (form), while the invisible represents the underlying system (structural in the case of physical architecture and infrastructural with respect to the virtual architecture). Novak describes the architecture(s) as containing a 'twofold character' when he says, "Within cyberspace it exists as liquid architecture that is transmitted across the global information networks, within physical space it exists as an invisible electronic double superimposed on our material world." My interpretation of Novak's description is a space which contains its own set of possibilities where any given physical space is the realization of an infinite number of possible (virtual) spaces. The virtual allows for a visualization of those spatial possibilities, and Novak sees the two as intimately entwined as would a 'Mobius strip (Transarchitecture Paper from Marcos Novak Website).'

Based upon this understanding, the virtual becomes a window into a set of spatial possibilities for any given dimensionally fixed physical space. Novak is describing this Transarchitecture by outlining its boundaries or limits without delving into descriptions or examples. Due to this vacuum in understanding, the aim of this project is to examine a practical application of the idea of Transarchitecture as it applies to existing architectural space. Before going into specifics of how this might occur, I feel it is important to clarify certain concepts and methods that will be employed in this proposal.

In attempting to see how this architecture will span across two different spatial types (the virtual and the physical), we must first examine and define two conditions which give rise to this relationship - Transarchitectural Topography (the medium) and the Causal Chain (the interaction).

The Causal Chain

I define the causal chain is the ability for one set of events in a given space to affect events in another physical space. This may be as simple as a conversation, two digital devices communicating, or a physical action of some kind. For example, when we have two adjacent connected spaces, it can be said that physical events occurring in one space can have a direct physical effect on events in the adjacent space. If a fan is switched on in one room, the air will circulate and cool the adjacent space as well. In this condition, the two spaces are said to be linked causally. Using the same illustration, if we have two non-adjacent spaces, with a switch in one room and a fan in the other, when we flip the switch we will see an effect of the fan spinning in the next room. The causal chain between the two spaces still exists, but has now been mediated by technological infrastructure (electrical wire). Another example of this is two rooms linked through a climate control system. When we introduce climate control systems, we get an effect (blower turns on in a separate room to supply air) when a thermostat (located in a space separate from the blower room) registers past a certain point. There has been established a causal link between these two spaces mediated by the infrastructure of the climate control system.

The third example is the condition which will be focused on for the purposes of this study. In a third example, we have two non-adjacent spaces connected by an intercom system. Both rooms are occupied by an individual and one room contains a small fan with a switch. If one individual calls the other through the intercom and instructs the individual to turn on the fan, then a causal chain has also been established here mediated through both technological infrastructure as well as human intervention. An event within one non-adjacent space (the initial request to turn on the fan) has caused a series of events that end with the resultant event in the secondary non-adjacent space (the fan gets turned on). Though the causal chain passes through a series of media (electromagnetic, air, and even human intention) one event has caused another and the causal chain is said to remain established between two rooms.

In some cases the causal chain is less desirable, such is the case with a noisy neighbor and a thin party wall, but as a fundamental property of space, the causal chain links spaces informationally. When two spaces are causally linked, communication exists between them and thus information is necessarily passed between them. The previously mentioned examples highlight different ways this may occur and different media through which this might occur, but the introduction of digital and new media technology has allowed this information exchange to reach unprecedented levels. Spaces may be causally linked through simple adjacency, mechanical, or

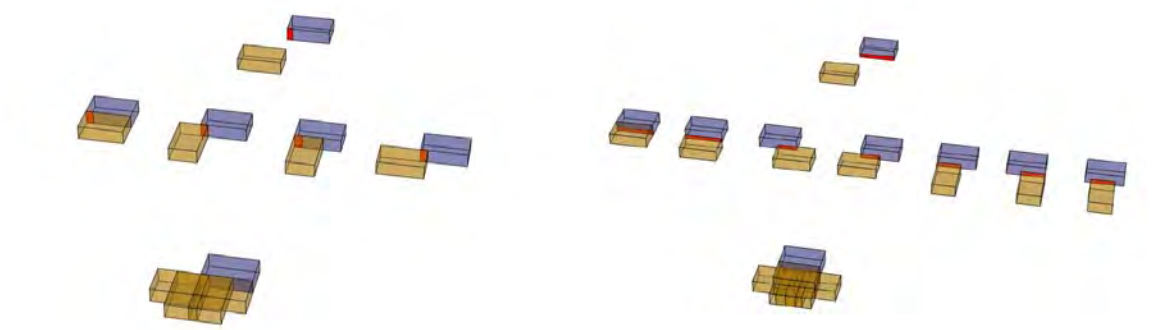
digital means as long as information is allowed to be exchanged between them. This project will seek to take advantage of both the causal link between the virtual and the physical, as well as causal links established between physical spaces.

Transarchitectural Topography

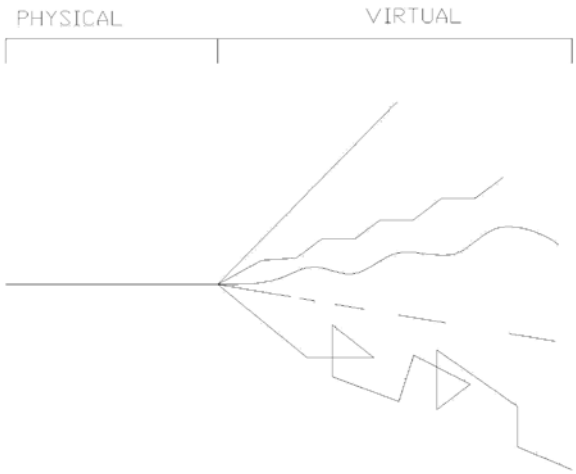
I define Transarchitectural Topography as the substrata or virtual/physical topography which underlie all connected virtual and physical spaces. For the purposes of this study, Transarchitectural Topography shall encompass a physical location, virtual location(s), and any infrastructure that connects the two. Specifically in this case, the Transarchitectural Topography extends from a single physical space, into a single virtual space uniting the two. As Novak explains, Transarchitecture contains both the visible and the invisible manifestations in the virtual and the physical space. The invisible is referred to as the underlying structural system or infrastructural system which supports the architecture in either case.

When Novak continues to describe the virtual, he describes it as a set of possible spatial iterations which exists within a given physical space. If we think of the dimensional topography which underlies these two conditions (the physical and the virtual) it moves from a fixed to a fluctuating position or from the actual to the possible. As a result, the topography must move from a fixed position (or a defined set of *fixed* coordinate points) to a non-position or set of possible positions (*range* of Cartesian coordinate points).

If we examine this scenario with a more concrete example, we can look at a case of two rooms that might be positioned adjacently. One of these is fixed in space and the other room is a virtual space that has no set location, but may exist within a range of locations. Much like the Heidegger principal in quantum mechanics, the instant we attempt locate the second space, it becomes dimensionally fixed in space and loses its status as a virtual object. It is easier to think of the second space as simply existing as a virtual set of possible locations. The figure below displays how this might be spatially considered (fig. 1.1). The single grouped piece at the bottom represents the addition of all the possible ways two spaces may connect given a common boundary. The blue represents the physical while the gold represents the virtual possibilities for combination and placement. If we try to fix the virtual space in definitive coordinates (for example if we were to superimpose holographic elements into a fixed room) then that space becomes a physical space as it is now defined and bounded by a set of fixed dimensional coordinate points.



To further explain this paradox, let's imagine drawing a straight line from a physical space into a virtual space. The line remains straight until it arrives at the boundary between the physical and the virtual, and then breaks off into an infinite number of possible lines. The physically drawn line is the physical manifestation of all possible lines for a given context which then become visualized as we enter the virtual (fig. 1.2)



It is for this reason that the virtual may be called liquid, as its underlying construct is constantly in flux until it crystallizes into actual form - much like water and ice. When water is exposed to a particular condition, it hardens and takes on a fixed dimensional form. Any of the H2O particles of water can become part of the ice, but are not considered ice until they become restructured and defined in a fixed position. The same analogy may be used for the Transarchitectural Topography. The physical architecture that we see and experience is a crystallization of all possible forms that may occur in that space. Another analogy is that of kinetic and potential energy. Potential energy stores within it the capability to be converted to kinetic energy (movement) at any given time. While we do not say that the potential energy exists necessarily as a tactile property of the object, it is a way to understand the possible physical actions that an object might take. As a result, the physical form or physical space contains within it all possible forms or spaces that may occur, but only the physical may be occupied due the physical nature of our bodies (also fixed dimensional physical elements).

This project will specifically examine the causal link between a singular physical space and a virtual space (which will be a recreation of the physical space). In other words, I will construct a building within a virtual environment that mirrors the building's existence in physical space. As the physical structure approaches the virtual it will begin to represent all possible spatial iterations contained within it. This space will be identified further in the study, but for now let us consider the parameters of our investigation. When we speak of hybrid spaces that combine the physical and the virtual, these spaces have been defined over the past 10 years as Mixed Reality spaces. Due to the recent proliferation of this idea, I find it important to have a good understanding of this term, its definitions, and its boundaries within the architectural condition.

2. Mixed Reality

Definitions and Clarifications of MR

Mixed reality as a popular term tends to confuse a few ideas and it is necessary to examine what this specifically refers to as well as which portion this proposal will focus on.

With the proliferation of Virtual Reality over the last 30 years or so, there has been a recent emergence and a variety of projects that have begun to explore the fusion of the virtual and physical space. As explained previously, this has become commonly referred to as Mixed Reality. Mixed Reality has been defined by Milgram & Kishino 1994 as that which, "Joins or overlays physical and virtual environments to varying degrees, using a number of different approaches, technologies, and interaction paradigms." Another definition by Benford et.al.1998 describes Mixed Reality as that which "Link(s) and overlay(s) multiple physical and virtual spaces that have three spatial dimensions and one temporal dimension." Milgram and Kishino seem to encompass the

general scope of Mixed Reality spaces defining it as both an approach as well as an application while Benford et. al. identifies the spatial characteristics and most importantly the common temporal dimension. Another definition from (Canon Technology 2001 citation and definition here). This project will focus on the perceptual characteristics of mixed reality space and will refer often to the latter definition.

One of the latter studies sought to divide Mixed Reality into two components along a socio-perceptual scale. This study differentiated perceptual Mixed Reality (visual construction and cohesion) from socially based Mixed Reality (or the ability to communicate). This particular project defined MR as a form of social consciousness where the Mixed Reality only existed to the degree that there were conscious beings perceiving the space in 'real-time.' Consistency of social interaction (as defined by Inga Tomic-Koludrovic, Mirko Petric and Ivica Mitrovic (2002) Mixed Reality or One Reality: A Social-Semiotic Approach to Hybrid Multiagent Environments, Journal of Artificial Societies and Social Simulation vol 5 no.1 published 2002). This study introduces the term, "hybrid multi-agent environments" which refer to cross social communication between virtual and actual which is not necessarily the focus of this project. This proposal will take into account these ideas, but will primarily focus on the perceptual characteristics of MR as it applies to spatial inhabitation.

Perceptual MR encompasses two simultaneous *perceptual realities*; the virtual and the physical. These projects usually fall along a sliding scale between projects primarily based in physical or virtual reality. If we look at the example of a music concert, there have been examples of bands creating avatars and piping their music into a virtual recreation of a stadium or coffee shop. There have also been examples of concerts that simply place screens or portals into virtual space to allow virtual viewers to see the actual concert through a screen from a virtual location.

Projects which are primarily based in physical reality with minimal MR intrusion I have labeled 'Pbased' projects as these tend to focus on interface screens or digitally integrated objects into the physical environment. These projects focus on an event or an environment that is based in physical reality where the connection to the virtual is simplified or minimized spatially or programmatically. The physical becomes the primary medium and is required for navigational cues.

Virtual based or Vbased projects are primarily experienced though an avatar or virtual representation of the self. Acting though the avatar brings with it the possibility to focus and respond to virtually constructed events and environments. Vbased projects usually include concerts or sports events held in SL where reality is pumped in and experienced through the virtual medium. A recent example of this is a Wimbledon match that was recreated real-time in a virtual environment. Attendees are able to see and track the movement of the players and the ball which are constantly being updated with actual information from the live event. Another example is the recent creation of a landscape consisting of boxes representing the business of the S&P 500. As stock prices change, the boxes change from red to green and size themselves according to their current price. The result is a constantly shifting virtual landscape which is being fed with real-time data from a physical space.

While this project will seek to exist as both a Pbased and Vbased project, the focus will be on the Pbased aspect due to programming and time limitations.

3. The Mixed Reality Boundary

The Mixed Reality Boundary and Mixed Reality Architecture

Mixed Reality has seen its most accelerated development over the last 10 years as the advent of the internet has allowed for popular usage and exploration of virtual environments. Beginning with text based virtual communities and extending to the visual and immersive modern example of Second Life, virtual environments have engendered online communities to communicate and collaborate through innovative and non-traditional ways. The ability to program scripted behaviors into objects allows for unprecedented forms of architectural collaborations as well as opportunity for social connection and spatial exploration.

By definition, Mixed Reality denotes an overlap between to qualitatively differing types of

space. In this project I will attempt to examine a specific causal relationship between the physical, the virtual, and varying degrees in between. The scenario will operate in a singular temporal stream (real-time as denoted by Paul Virilio) as to promote a sense of continuity.

The very fact that we have two intersecting types of space implies a boundary or zone of interface where the definition of one type of space ends and another begins. This has been recently referred to as the MRB or Mixed Reality Boundary. The Mixed Reality Boundary has been examined and further defined by Schnadelbach et. al. in a recent series of papers regarding Mixed Reality Architecture. Schnadelbach and his group (reference) have studied the connection of physical spaces by a common virtual space (as examined in Mixed Reality Architecture - Data Collection and Analysis). This boundary has most commonly taken the form of digital display monitors or projected surfaces. Any virtual environment is ultimately information that has been constructed to be visually compatible with the human visual perceptive system (constructed into a 3D environment with recognizable visual cues, systems of order and consistency). For this reason, most MRB's operate in a visual manner to maintain consistency of experience-this will be explained in more detail later.

In this case I am attempting to delineate spatial types utilizing causality as a bifurcation tool. In other words, a spatial boundary in this case is defined by both its causal relationships and perceptual boundaries. So called Hybrid Space develops when those causal systems begin to move across the physical/virtual boundary. This boundary need not be physical, as is the case of the MRB or any other screen or digital interface, but this boundary exists informationally as well. Information or actions that an individual might pull from the Metaverse can be brought into their daily lives and so this causal relationship has extended between realms through the means of information and action based upon that information. This project will attempt to extend the causal relationship between physical space, virtual space, and a separate interaction between to physical locations.

Examination of the Mixed Reality Boundary (location within physical architectural space)

The MRB is by nature an applied intervention meaning it can be positioned or moved into a variety of locations and contain multiple layers of information. One of the stated goals of this project is the development of a causal link between the physical and the virtual, and the way to do that is by minimizing the amount of interference that arises between the two types of space. In other words, the more consistent the experience between two spaces, the easier information may pass between them (though this is not always the case and will be examined in the following examples.

Consistency of Experience

One of the most important aspects of the MRB is the ability to achieve a seamless experience. One way to achieve this is through leveling or setting even the floor plane and extending traditional architectural elements into both spaces. This achieves consistency through perspective continuity (we perceive the spatial change, but it seems as though one space bleeds into another and so it is easier for us to understand the flow of information across it. As the user looks through the MRB the rules which govern the different types of space appears consistent. This was introduced to the public at the conference "Living in Mixed Realities," which took place at the Kunstmuseum in Bonn 2001 where the topic of discussion 'stressed issues such as 'seamless integration' of the virtual and real space rather than issues about agent modeling.' This conference also saw the introduction of the term 'shared reality' dubbed by Stephen Johnes.

Consistency of information

The causal chain is allowing information to be exchanged between the virtual and the physical, and this information may take on many forms. The information exchanged might be textual, visual, encoded, iconic, semantic or perceptual based. For example, one of the main complaints of hybrid multiagent environments is the inability for an avatar to quickly and accurately convey facial expressions. As a result, the flow of information is hindered and quickly moves toward a text based operation when the more subtle communication method fails. For this reason, it is desirable to have consistency in information that is being translated across the MRB. The more consistent the information is, and the less it needs to be converted into one form or another, the

more easily it can be exchanged between environments.

Social Vector and Image Coherence

If we examine the example of virtual projects being diffused or intersected with physical space, we come across the issue of vector. Most recent projects involving the MRB will specifically focus on its use as a window or portal for the display of virtual space onto a specific structural surface or physical location. For this reason, it is crucial to examine the ability of the device to achieve and promote immersion. The MRB must be established in a position that allows for ease of immersion but may also vary this condition. As a result, the MRB must be positioned in space so that the environment which is being displayed is perceivable in a spatial manner. In other words, an individual must be looking at a coherent perspectival image of the virtual space to properly 'see' into that environment (they must be facing a screen and be able to perceive the displayed environment properly).

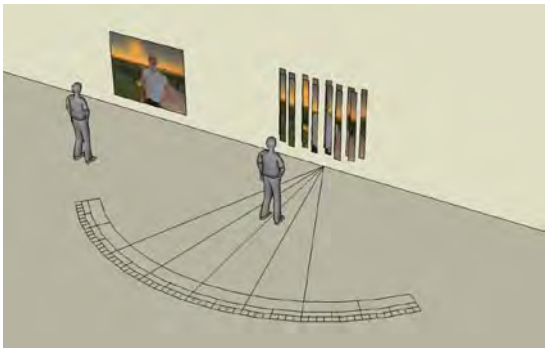
As we begin to break apart the MRB in some manner, the image becomes less clear and the immersion/inhabitation becomes less potent. If, for example, we were speaking about a screen with a projected image of a virtual space; and this screen were then cut into linear strips and then adjusted along a similar axis of movement. The same virtual space projected onto the screen would appear somewhat normal as you were looking at the image head-on, but as you moved a few degrees to the right or the left, the user would lose their ability to properly discern the virtual space being projected.

This is similar to Geshtaldt therapy which requires the individual to discern an image from seemingly abstract graphical information. As the information becomes organized in a certain manner, the picture becomes clear and discernible. At this point, the image is said to lose its coherence as the projected visual data becomes dependent on the angle of observation. This becomes a crucial consideration in the inhabitation of virtual space which requires the user to be able to inhabit such an environment which then requires the proper angle of observation. For this reason, the ability for the individual to inhabit MR space (and consequently interact with those in virtual space) depends upon the user's position within physical space.

Zones of Interaction

Based upon this positional information, we can begin to analyze how we can take advantage of this property to create *zones of interaction.* A zone of interaction is defined as that zone which allows the user to interact spatially or visually inhabit a MR environment. This may occur as a private or public zone depending on how many people may inhabit the zone. For example, a zone of interaction may require a very narrow field of view, but have many people that are able to access that view. This would be considered a public zone because it is simultaneously accessible by many, but it is also private in the sense that it requires the user access it by placing themselves in a certain position or context.

Because the zone of interaction is so heavily dependent upon the spatial positioning of the individual, we can begin to generate possible configurations of spatial interactions within existing architectural spatial environments.



Accessibility and Accountability or Public vs. Private

The question may also be raised about notions of privacy with the advent of such audio/visual portal systems. MR is primarily used for communicative as well as perceptual augmentation, but these systems have the potential to alter notions of the public and private (or at the very least highlight them). For example, the large screen becomes seen and experienced by many and so the screen might be thought of as public. A scaled down screen or one that may only be seen or experienced by one person at a time may be considered private. This becomes blurred when we refer to projects that do not follow a social vector. In this case, the private becomes less spatial and more about information and access to it. Privacy becomes a matter of being able to access someone's information and in this scenario access becomes the division line between public and private.

One issue brought up by the introduction of the public in Mixed Reality spaces is the idea of accountability. This was introduced by (1) a study done by Schnadelbach et al. where they discuss the idea that, "The architecture emerging from this process is available publicly in principal, which makes interaction within it accountable." Second Life becomes an excellent example of this where a user is able to engage in a discussion with other users, and this discussion becomes accessible (word for word) to any one in the group. In other words, this produces an instant transcript of all interactions between the individuals of the group to see and explore at their leisure. In this sense, any phenomenon mediated through technology ultimately contains its own accountability. The process of translating physical phenomena into quantized bits of information (the digital) means that that information is segmented into defined parameters and can be recorded, played back, filtered, or translated as necessary. This has been utilized by phone taps and really any recording device that has the ability to reproduce information continually and accurately over time.

This idea may also be applied to MR space because it follows a similar format of communication mediated through technology. Because this communication is generally mediated within a MR context, it always has the capacity of being recorded and thus every individual is accountable for their actions which all end up passing through a data infrastructure of some kind. In other words, every action has a user associated with it and thus every action has a definitive authorship. For this reason, we must be very conscious about how this is introduced into public space and the level of accessibility / accountability afforded to each individual.

Another issue cited by (1) and introduced by (Purbrick, 2001) is the flexibility of such a system and its ability to accommodate direct changes by the user. Purbick states that, "the lack of appropriate restriction of this flexibility can lead to problems for users in terms of their ability to interact with each other and the environment." If, for example, we have a large screen in a public space that allows the public to interact with this is best understood as a static fixture where the individual knows where it will be and how the interaction will work. If we introduce flexibility into such a device or the possibility for the individual to move this screen in space, this may adversely effect how the public engages such a system in physical space. For example an individual might decide to move the screen so others would not have access to it. For this reason, a MR public space may require a level of stability and predictability that allows the public to engage the system confidently and consistently. (1) calls this a, "similar quality of access to the linked space."

A private MR space should not be affected by such issues as it is ultimately meant for the individual to manipulate for their own purposes. This would suggest that the private part of the

system might be more flexible to allow for individual engagement and customization. The virtual engagement will enable this type of flexibility as (1) suggests, "in comparison to physical reality though, virtual environments to allow much greater flexibility in their topology and this property will be exploited for the construction of MRA."

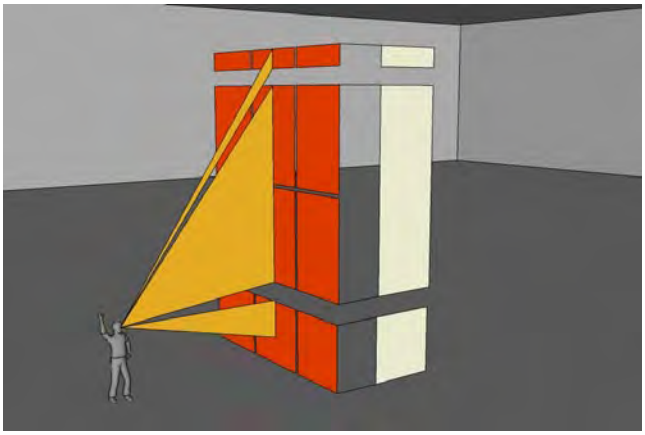
In their discussions of physical space (1) also introduces the idea of 'equal level of access' meaning that the idea of *public* becomes the ability for people to interpret the same information in the same way. Within this definition, (1) also clarifies that, "people present in the same portion of physical space will perceive almost the same underlying data, while they might well perceive a different mediation of this data." for this reason, public may also be considered a different mediation of the same data presented to a group of people. This speaks more about the translation device which may simply represent the differences between people and their perceptions, or this may be a digital or mechanical translation device engineered into the system.
The qualifications for the term *public* in this context become the underlying information being presented and whether this information is consistent across individuals or groups.

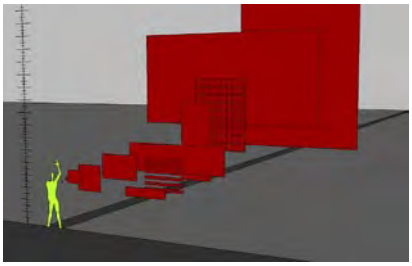
(Greenhalgh, Purbrick and Snowdon, 2000) also state that another property of virtual space is its ability to tailor the level of access to it resulting in differing experiences for different people. Another way to think of this situation is to be publicly distributed and privately consumed. (Greenhalgh) then goes on to say that this experience then becomes private when certain elements of it are only visible to certain groups. For this reason, we must consider both how the system is viewed, how the content is distributed or projected, and how this is accessed by the public within the physical space as well as how it is accessed by the public in the same space. (1) carry this further as they talk about, "individualizing the link" where the MRB can be catered or customized differently for different people. (1) also introduces the idea of 'degrees of access' for individuals depending on the type of link employed, as well as the 'bodily' access that is automatically granted in physical space (also cited from (Purbrick 2001).

Scale

MR projects enter into physical space on a variety of scales all of which carry different weight in the spatial environment. The drive-in movie was scaled up so many could watch at the same time which has to do more with visual access. The resultant form utilized vertical structure and ad 2D interface due to the projector technology which proved to be most efficient for this setup. This may be considered public because the form follows the function which is to maximize visual line of sight to display meaningful content. The computer monitor and TV exist at another scale which seem to constantly approach a 1:1 scale as the technology continually develops. This occurs in both scalar quality as well as size as the recent proliferation of HiDefinition T.V.'s bring us ever closer to the 1:1 experience. If we had a large screen exhibiting the same 1:1 scale, it would be seen and experienced by many at the same time and may be considered public.

Within the context of MR projects scale seems to occur at two different levels; that of the MRB itself and that of the represented virtual environment. This also applies to the augmented space which is simply an MRB at a 1:1 scale with a smaller window. For augmented space, the MRB scale does not apply as closely because it is not an experience like a traditional MRB, but becomes integrated into the sensory experience itself.

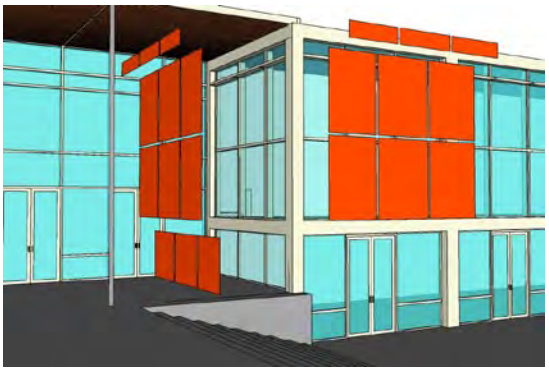


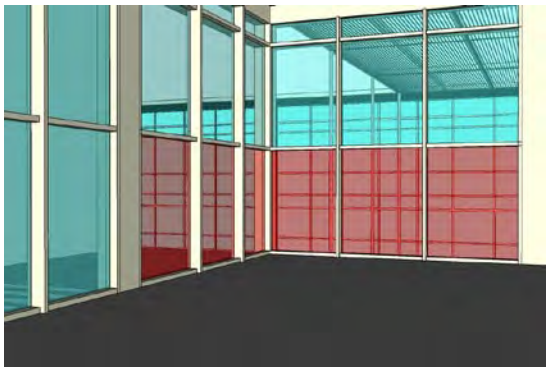


The scale of the MRB itself becomes important when we consider both the interaction of the users and its placement within the environment. When Virilio speaks about 'life-size' he speaks to humanities changing perspective and the diminishment of scale enabled through technological revolution. The MRB acts to reverse this process as the infinitesimal digital is translated back into the life size to allow individuals and environments to interact. This is the reason for 1:1 scale as it seems the best way to maintain the haptic and consistency through environments. When the camera angle changes or positions itself away from user eye-height, the user becomes conscious of being an observer and the immersion factor is lost. For this reason, 'life-size' connection between spaces has been maintained and the MRB scale reflects this.

Structure

The structure may be embedded or integrated into the existing structure, attached externally, or exist entirely as a separate layer. The structure is critical because it is how the form of media interacts with structured architectural space. The MRB may fit within traditional architectural systems, such as a defined unit of measurement like a mullion frame, or may operate on its own logic independent of the structural system. I would argue that this does not constitute architecture as much as it does installation, so the desired effect is to allow the MRB structure to work within an existing architectural framework.





Digital Systems Architecture (Device Placement)

At this stage of Mixed Reality Architecture, systems are heavily dependent upon media technology such as a variety of screens, cameras, microphones, and other media translation devices. Each of these devices requires specific locations to operate ideally (for example a microphone must be placed correctly in a defined zone to pick up sound or voices properly). These technological constraints generally define placement of such devices as they each require very specific ideal zones to operate most efficiently. While this is the case, I believe it is the role of the architect to find expression in such placement which clearly defines the device's role in the mixed

reality experience. We can look to an analogous situation in the automobile industry with the headlight. Over time, the headlight has progressed from a simple tool to light a pathway into an expression of overall design. It is sometimes seen as the 'eyes' of the car and the design reflects this as such. The same must be thought of for the camera and the microphone as interface devices integrated into design.

Expression of Digital Systems Architecture need not be a dominant feature of the design or even a visible feature. This particular project explores the idea that the technology begins to disappear and is expressed through its absence. Atectonic expression in traditional architecture involves a violation of perceived gravitational forces expressed through architectural structure. There is an expected architectural outcome based upon our traditional notions of material, mass, and gravitational pull. When we introduce a digital presence into an environment, our common knowledge of technology tells us that there are systems supporting that technology. When we do not see these systems there is a discrepancy that occurs: the event without the means to cause the event. This usually results in a brief search for the underlying technology and then a concentration on the event itself. In this case, the reduction of the visual presence of digital systems architecture allows the user to concentrate on the experience. The goal of the project is the appearance of a portal or bypass between two points in space allowing non-linear inhabitation to occur. For this reason, I felt it necessary to minimize the DSA to promote that effect. For this reason, the screen contains minimal structure and fits within traditional architectural elements (in this case mullion dimensions or within standard panel dimensions).

Siting

MR projects may be situated in the periphery, center, distributed or a variety of positions in space. The MRB is generally dictated by content and interface: if the central purpose of the MRA is to maximize social interaction than it makes sense to situate the hybrid space in a highly visible, heavily trafficked public area. If the central purpose of the MRA is to invoke a perceptual twist, than it seems that the MRB should be placed in locations that begin to question traditional spatial relationships. This project will examine perceptual aspects of MRA as it traverses the Transarchitectural Topography, and will develop rule sets which define the placement of the MRB, and in turn the causal chains which link virtual and physical spaces.

4. Virtual Space: A new categorization

Description of Virtual Space (within the context of MRA)

Mixed reality is ultimately a combination of what we think of as a perceived combination or hybrid of virtual space and physical space. This project relies heavily on a specific type of virtual space and for this reason I feel it is necessary to begin to identify qualitatively different types of virtual space and to focus on the virtual spatial type utilized for this project. Through extensive personal experience and research on the topic, I have been able to identify three main categories which virtual space may fall into. These may be known as the Virtually Recreated Environment, the Virtual Fantastical Environment, and Virtually Collated Space.

Virtual Recreated Environment

A virtual recreation is constructed from information directly pulled from the physical environment. This includes visual geographical data, 3D computer models of buildings, or processes that occur in such environments. This type of virtual environment is usually employed for the purpose of research, design, or a sense of nostalgia or familiarity. It correlates as closely as possible to physical space which makes it useful for operations such as simulation and rehearsal. These environments are usually constructed to transmit information or to test hypothesis about physical processes or materials. For example, a virtual city may be reconstructed to allow visitors to ease navigation and plan routs before visiting the city in physical space. Another example of this is the use of 3D modeling software by companies to virtually construct a product for pre-production tests ranging from the physical properties of the product in certain conditions to how that product might fit into a human hand.

The idea here is that Virtual Recreation exists on a 1:1 correlation with physical space meaning that it resembles, reflects, and reacts in a similar manner to what we think of as our

traditional physical environment. Events in Virtual Recreated Environment (VRE) are predictable because they operate through the same (or similar) physical properties (enabled by algorithmic programming) that we experience in our everyday lives. As a recent example, this seems to have become an ideal for many recent war video games that try as closely as possible to reproduce the extreme conditions, environments, and even sounds experienced by soldiers of war. In fact, many of these game production companies actually conduct hundreds of hours of interviews as well as land surveys to recreate historical environments for the purpose of online virtual battle. Another clear example is the recent development of programs such as Google Earth which I believe will become ever more refined, detailed and interactive as years pass, data accumulates, and the technology continually develops. In a way a recreation of our physical environment is to understand it by capturing it in a sense - we can now hold a virtual earth in the palm of our hand.

Virtual Fantastical Environment

Virtual fantasy exists as a type of space that follows select rules of physical space while also introducing outside elements and processes. When we explore a fantastical world through a created character, we might be able to fly, fight dragons, or listen to animals talk; but some elements (be it gravity, anthropomorphized characters, a narrative, or familiar objects) always ground it to some element of our familiar environment. This grounding becomes the common language which allows different users to interact with the environment. For example, to talk to another person most Virtual Fantasy environments require the user to be within a certain physical proximity of another avatar or character. This is quite intuitive and I have observed many new characters that immediately approach another character to speak with them (through a textual interface). So while the user's avatar might be a dragon flying through the clouds, they are still required to be in earshot of another character to interact with them. This is an example of the realistic grounding that creates the common language for communication. In other words, elements of the Virtual Fantasy environment may be out of place or unfamiliar, but for the environment to work as a common communication platform for a individual in physical space to interact with meaningfully, it must have some familiar elements of physical reality written into it.

Inhabitable virtual environments such as Second Life begin approach virtual recreation in places like Amsterdam (10 city blocks of Amsterdam virtually recreated in virtual space), but the ability for avatars to fly and the lack of complete construction methods (usually just textures plastered onto solid blocks) pushes this into the territory of Virtual Fantasy. Other environments such as SimCity approach Virtual Recreation in another direction by concentrating more upon the inner workings and complexities of a physical city. While this may be the case, these games remain in the realm of Virtual Fantasy for the reason that many enter these environments for a form of escapism or exploration. For this reason, Virtual Fantasy is usually employed for such environments for the purpose of making it different from, but still tied to reality.

Virtual Collated Space

Virtual Collation seems to be reserved for special use and is generally the medium of digital artists or theorists such as Mark Novak's Liquid Architecture. Virtual Collation is the compiling of different layers of information, input, or measured readings layered together either spatially or programmatically (code) in a meaningful way. The resultant combination may have a spatial quality, or may simply be represented by an object or even an individual. The information or input may be directly translated into graphical representations (2D - 4D) or is usually translated somehow into a common format to be interpreted by the inhabitants of this environment. Most of the recent interactive architectural projects utilize this type of virtual environment as it tends to provide insight or meaning into physical phenomena.

Physical phenomena utilized by this type of space can include light, sound, human input, environmental conditions, weather, or data. These are usually translated from local sensory equipment directly into a virtual spatial form. A great example of this is the project Synthecology which takes a musician's music (being played on a physical stage) and translates it into virtual sculptures which grow in a virtual garden. As the musician's change chord, tempo, or cadence, the virtual environment receives this information and incorporates it into the virtual sculptures accordingly. Thus, the sculpture becomes a virtual collation of information received and translated from the physical environment.

Other projects take this to a higher degree and actually produce types of space that are formed or changed spatially due to direct input from people in the local environment. An example of this type of spatial condition is the (Artist Studio) project that takes input from an art show (provided by the visitors to the show) and collates these physical experiences of the art into a virtually created environment. Thus the artwork is represented in a different form to be consumed differently and the visitor gets to experience the art show in an entirely different way (that still somewhat follows the meaning of the show). This way, the virtual environment becomes dependent upon the physical environment and this sets up a dynamic interaction between the two.

Simulation Space

Finally, what I am calling Simulation Space takes advantage of the virtual recreation category as it benefits most from a 1:1 correlation to physical space. Simulation space recreates physical space to a degree that it becomes useful as a practical tool or utility. Examples of this include flight simulators for pilots, software for 3D physical object development, and even some types of video games. Simulation space is the most direct form of Virtual Spatial Recreation as it is literally programmed with the Newtonian properties of physical space. This is addressed more comprehensively in a separate paper On Simulation that discusses the topic of simulation and culture in depth.

5. Second Life

This project will ultimately examine the implementation of MRA into traditional spatial architectural types for the purpose of social interaction. MR space ultimately requires the use of a virtual spatial type and would ultimately benefit from a custom virtual space designed especially for this project. Due to lack of programming experience or a staff of individuals to work with I have decided to examine existing models of virtual space that would work with this type of project. Due to the social (causal) component of the project I have determined that the online environment Second Life will be most beneficial as it provides a stable, pre-inhabited virtual platform with established cultural norms and the ability to construct objects in-world.

Second Life is a virtual space that lies somewhere between a VRE and a VFE as it has many features that incorporate physical properties and reproduce physical environments, while still allowing the user to depart from these properties if so desired. The user is able to explore, build, or create land as they see fit and must purchase the land with Linden Dollars to do so. There is a currency exchange rate and select groups have made a great deal of money dealing in virtual real-estate. People are able to buy or sell goods and there are even services which will 3D print objects from Second Life into Real Life. Second life utilizes a viewer platform which allows the user to construct and manipulate the environment through a 'build' tool which works much like any 3D program on the market today. For this reason, Second Life will serve as the virtual platform onto which the Transarchitecture will extend and its virtual form will be expressed.

6. Immersion, Inhabitation and Perception

Threshold of believability and Immersion

Each of these conditions represents a varying degree of medium that I call the threshold of believability. This medium acts as a filter or distortion device which varies the degree to which the simulated space resembles traditional physical space. When this correlation is low (1:1) the proportions and the scale are the same and the physical properties and environments mirror those found in physical space. An example of this is SimCity or any other game or environment constructed to mirror or resemble physical space. Projects like (Metropolis and SecondLife:Amsterdam) are examples of this as they reproduce the actual physical environment into the virtual environment at the same scale.

This also implies a different correlation in the idea of texture and objects. Objects created in virtual environments can range from the familiar to the outlandish. A lamp, for example, may be designed with traditional textures (wood, metal, brass, cloth) within virtual space. The lamp is ultimately virtual, but it is constructed of elements that we recognize and those elements are constructed in such a manner that we associate their presence with a certain function. When we start to take away physical elements such as gravity or collisions (or design a lamp made of water), then we get a lamp that appears to float or move through walls. The lamp still serves the same function, but the defining and differing conditions (lack of gravity and collision) remind the user that they are in an environment that functions differently. Thus the environment becomes less believable in the sense that it is unfamiliar to our traditional sensory and navigational systems. When the lamp approaches the point where the form becomes unrecognizable, then we lose our ability to interact with the object or environment in a familiar manner. This point is said to be past he threshold of believability. Inhabitation is ultimately separate from the threshold of believability, as an environment does not have to necessarily resemble our traditional environment to inhabit it. The threshold is to be considered an objective quality.

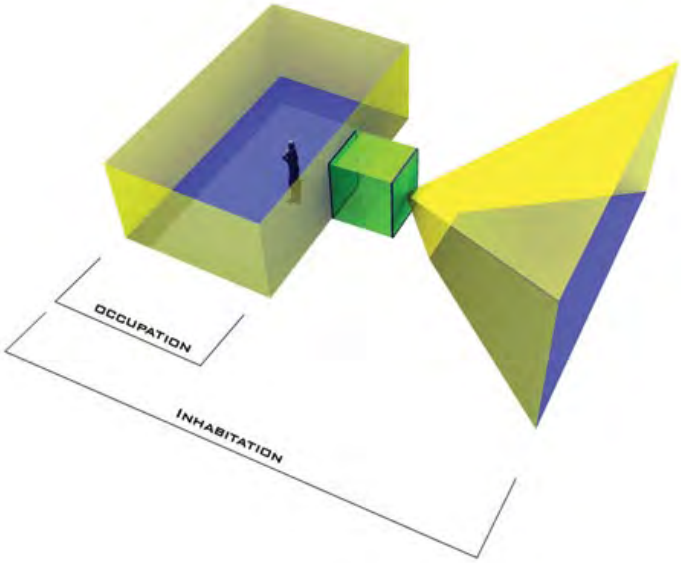
Spatial Inhabitation vs Occupation

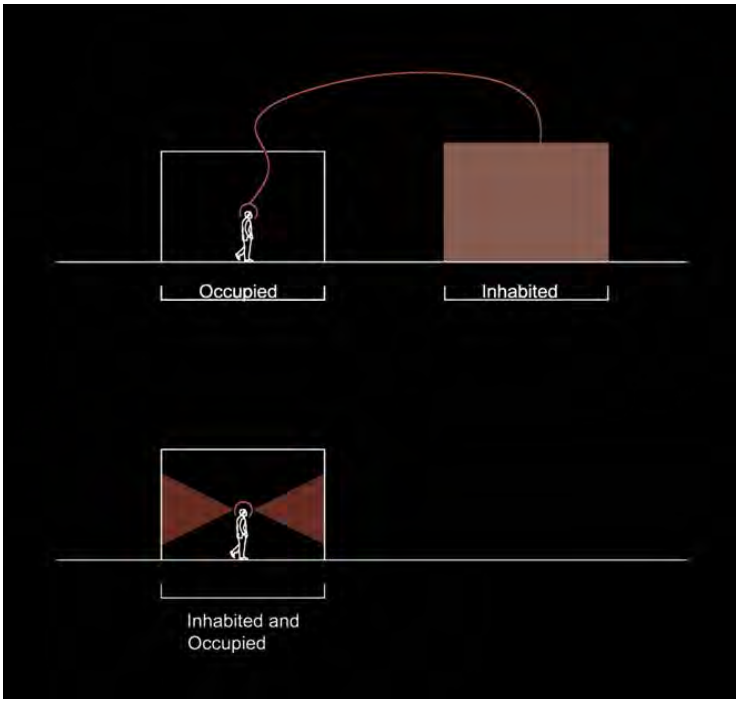
Due to the nature of MRA and the ability for people to communicate across a digitally mediated space, it is necessary to engage a discussion of immersive virtual environments and the level of interaction/inhabitation that might occur in such an environment. The nature of virtual space forces the mind to engage a space that the body necessarily cannot. In MRA this becomes confused and it is important to make distinctions between these two conditions. Experiments by Sutherland (Sutherland, I.E. (1993), "Virtual Reality Before It Had That Name", videotaped lecture before the Bay Area Computer History Association, Xerox Parc, Palo Alto) demonstrate the ability to immerse a subject in a virtual environment producing an emotional effect. Recent trials with pediatric cancer patients have also analyzed the benefits of immersion through divertive techniques. One particular game allows the children to fly within a virtual body 'zapping' bad cells (cancer cells) to divert the child from pain associated with treatment (citation).

I will begin by identifying two conditions of spatial usage that further define the relationship of person and place. These are known as occupation and inhabitation.

I define *occupation* as the physical space (bodily volumetric displacement) that the body resides. This space contains direct physical causal relationships and its limits are defined by the boundary of human perception (Discreet Space). Due to the face that Physical causal relationships allow the occupant to have a direct physical effect on the immediate space and this space is said to be space occupied by the user. Occupation requires both user and physical space and as the number of users increases the volumetric displacement of the occupied space increases.

I define *inhabitation* as the ability to perceive oneself within an environment and to have the capability to interact with that environment to some degree. Inhabitation is ultimately a perception based phenomena but I do not think it need be subjective. Inhabitation is dependent upon human perception which is tied to the psychological mechanism known as the attention filter. The idea behind inhabitation is that as the user visually and acoustically engages another environment operating on a similar temporal sequence, that user is said to inhabit that environment. This can be seen clearly when any individual is engaged deeply in a movie, book, or video game. The difference between these modes is the position that the user is placed. In the case of film or book, the perspective is generally 3rd person where the user is placed as an outside observer. This does not constitute inhabitation as I describe it, where inhabitation places the user as a participant.

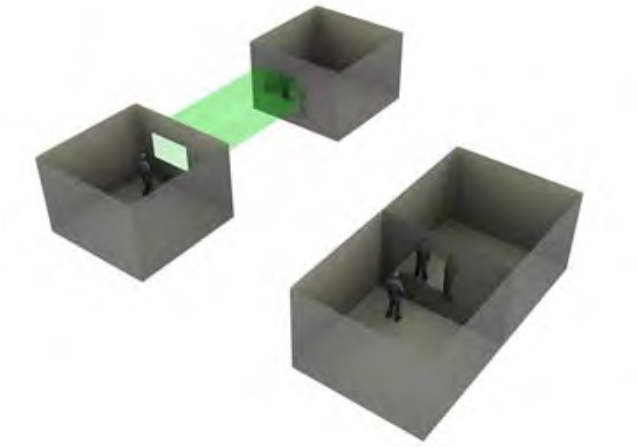


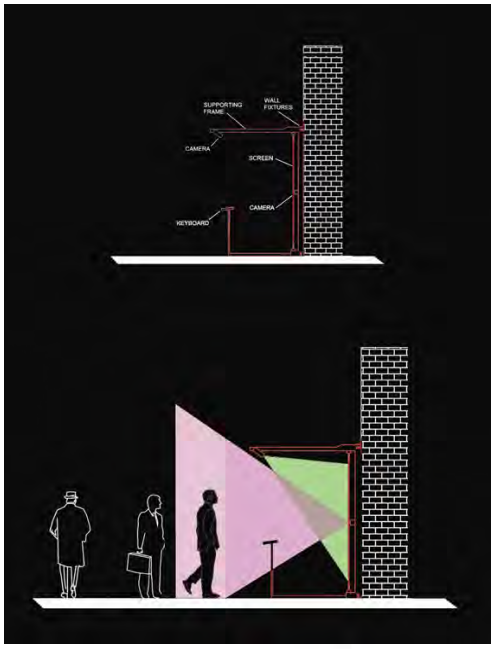


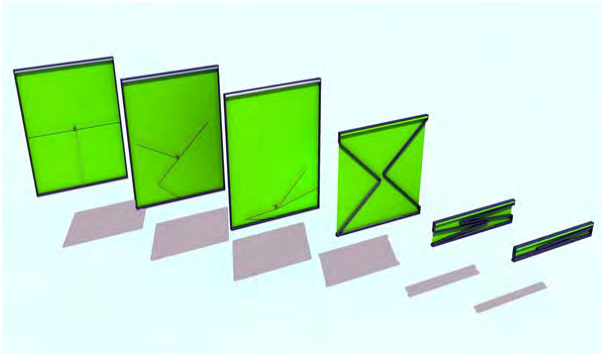
This introduces the second element of inhabitation - interactivity. This interactivity extends the causal chain into another physical space where, for example, behaviors or events are affected by events on the other side of the spatial bypass. An individual might see or hear something occurring through the portal that would effect how they use or occupy space. Thus the causal chain has now extended through the spatial bypass to affect events on the other end. The portal is then said to be interactive as events are linked causally through the spatial bypass. So interactivity becomes a requirement for inhabitation to take place. In other words, to inhabit a given spatial environment, the user must attentive to the surroundings of that environment (responding to visual or audible cues) and have the ability to effect events (through a two-way interaction) with such space.

7. Proposals

Portal Project (The Spatial Bypass)







This investigation began with the development of what I have labeled the *spatial bypass*. The spatial bypass links two non-adjacent spaces through a real-time audio/video screen. Initially, the screens were situated in social spaces allowing for possibility of random social encounters and high social visibility. In this example, two bars are linked through a portal positioned behind the bar. The communication is ultimately mediated through digital means and this may be taken advantage of to communicate through textual or other informational modes. In this particular example, the informational overlay may contain social symbols (e.g. the emoticon or other familiar digital social images) or overlays containing data on how the space was previously occupied (fading overlay of silhouettes denoting past occupation. This project served as an introduction to the spatial bypass theory and was designed to be applied to existing spatial and structural conditions.

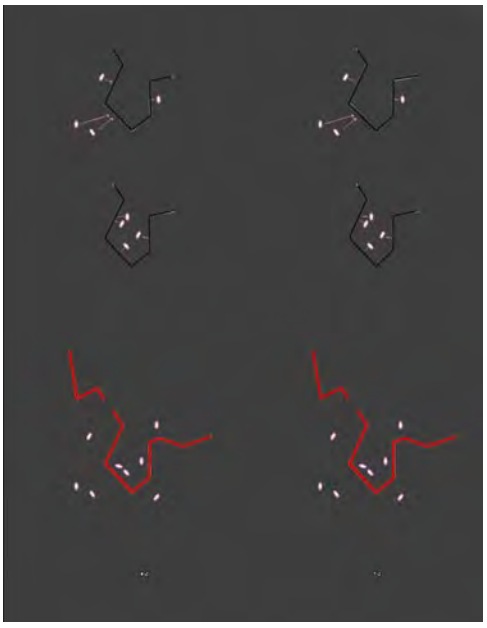
Rift Project

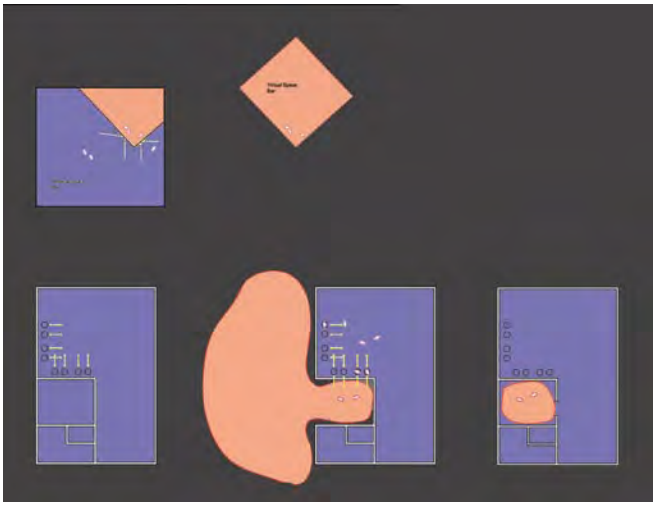
The Rift was designed along similar technology. This project holds true to the traditional nature of the MRB as it stands as a connection between a virtual and a physical space. The innovation in the Rift project comes through its application to Second Life, producing the hybrid multivalent environment described by (citation). The rift project began with a focus on social interaction, but quickly began to present multiple opportunities for spatial connection (causal linkage). I began to explore linkage of multiple physical spaces across a single space in Second Life, and even produce the ability to interact with another physical space through virtual space. This was accomplished by facing two MRB's toward each other so the user at one end could effectively look into another physical space through a parallel portal in Second Life.

The exploration began to examine the types of space that might be linked and the opportunities this might engender. I began to experiment through juxtaposition uniting unlikely spaces such as an college classroom with times square or the interior arboretum of a library with a college quad. The idea is to extend the causal link between spaces that would normally not be exchanging information or be associated with each other. With the ability to communicate two-way between a virtual and a physical location, the causal link has now been established between the virtual and the physical. As with any telecommunication system, the Rift allows for information to be exchanged between the physical and the virtual in a two-way interaction. While this has been occurring for years, the scale and familiarity of environmental cues provided by the Rift allow for a more robust communication. For example, we may see an avatar wave hello and wave in return to the avatar seen on the screen. We know the avatar would see this image and the greeting is familiar to us so the user might respond with a wave in turn. This would not occur if the user were to receive a textual 'HELLO' where the greeting would most likely be returned with a few keystrokes. For this reason, the Rift began to demonstrate the strength of the causal chain as well as develop questions as to its location and placement within architectural space.

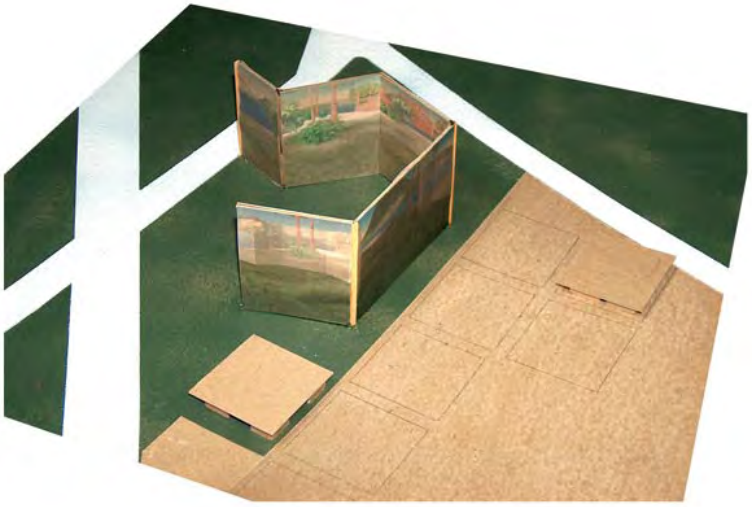
At this point, these two introductory explorations have experimented with the ability for the causal link to be established between two points in physical space, and a physical and a virtual space. To accomplish the Transarchitectural entity, we must take into account the Transarchitectural Topography the resultant Transarchitectural spatial form, and the resultant causal chain that will occur between these types of space.


Mia: Hello, where are you guys?
1: I'm Jeff, were at a conference. Where are you?
Mia: Japan.

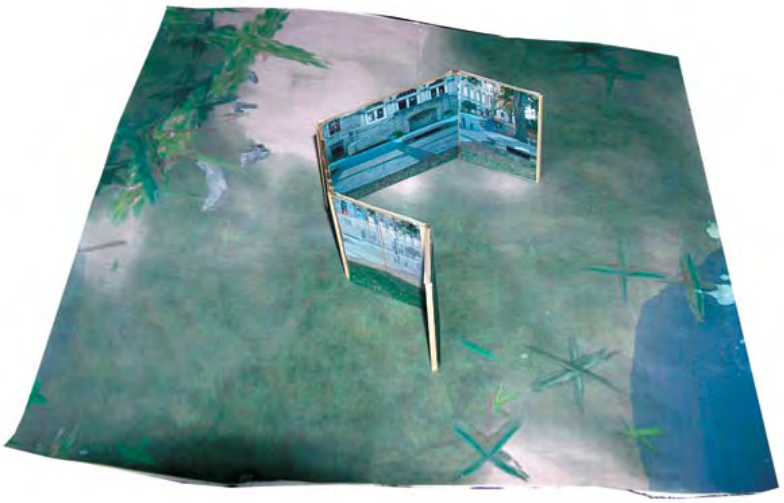


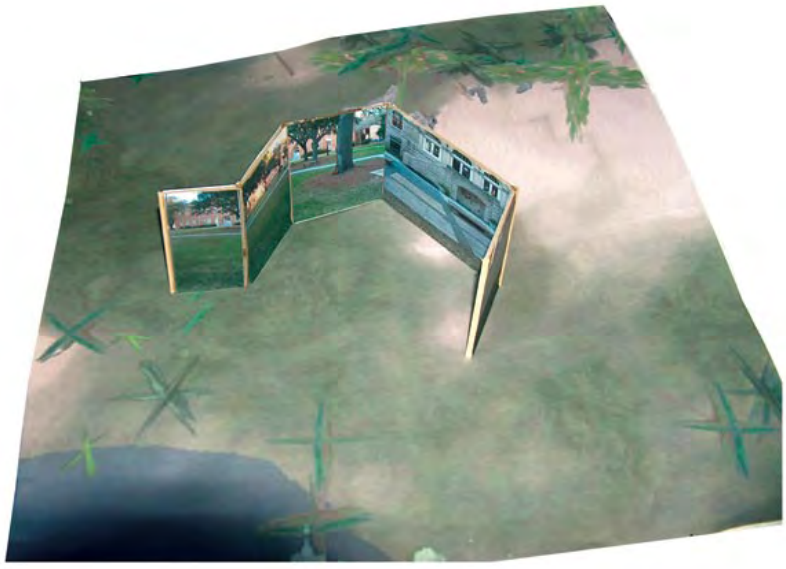


MRB Spatial Pocket: View from physical perspective



MRB Spatial Pocket: View from virtual perspective

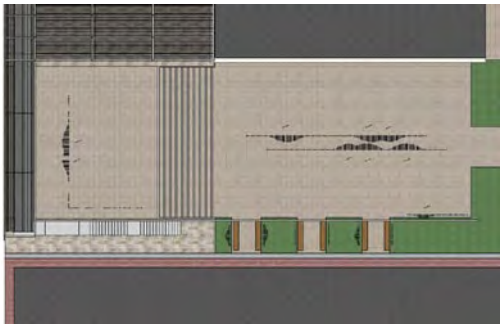


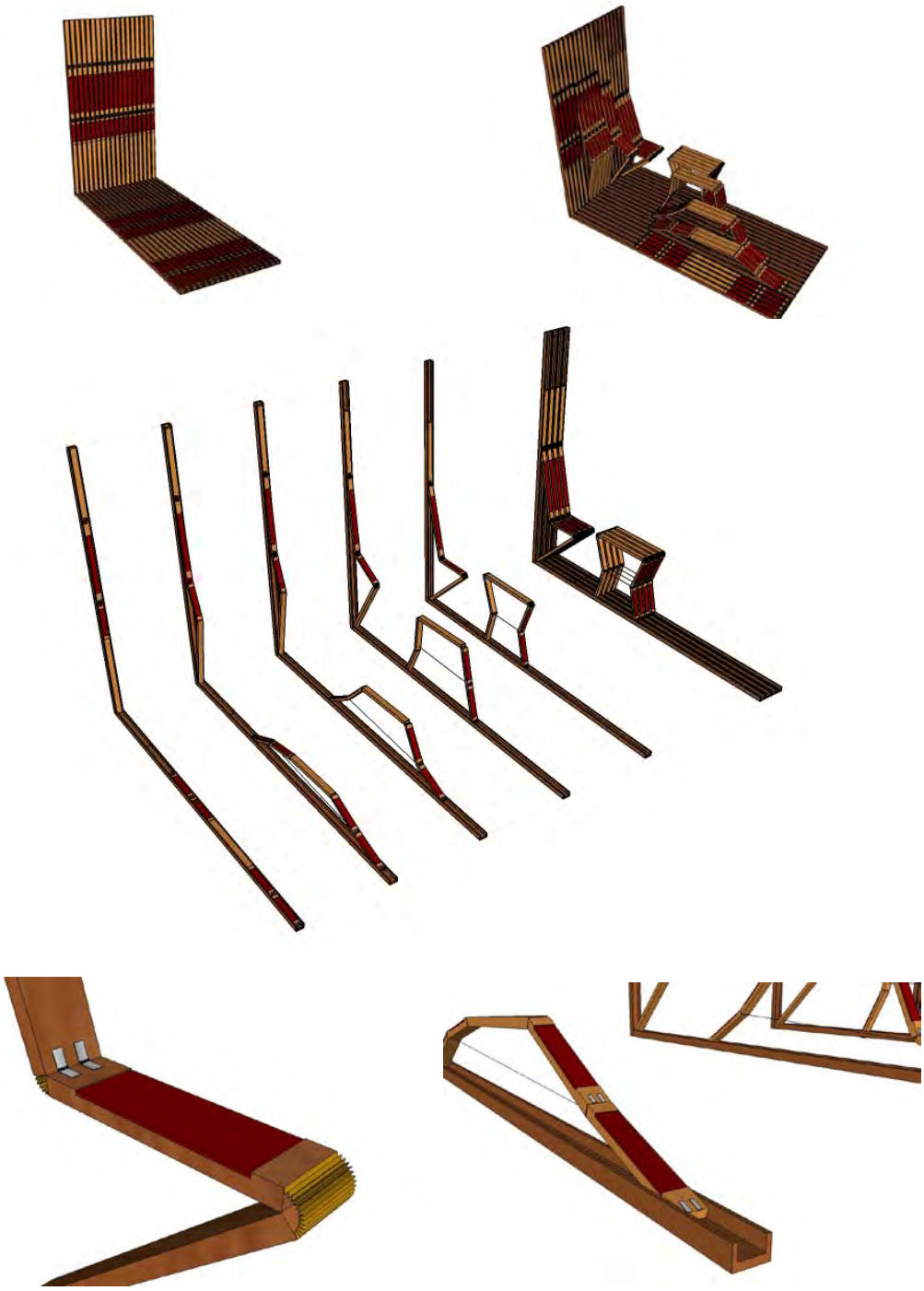


The MRIK (Mixed Reality Interactive Kinetic) Surface

The MRIK surface became a natural extension to the investigation into virtual/physical causality. The central architectural surface deforms to reflect the presence of a virtual or physical person in a given architectural space (in this case the courtyard of the student UC center on the Tulane University campus).

A replica of physical space is constructed in SL and as the individual explores the space in SL, there is a physical reaction in the actual space through the means of this surface. The surface continually updates information between the two objects (the kinetic one in physical space and the scripted one in SL) so it acts as a single flowing entity existing between two worlds. This becomes visualized as a spatial surface ripple in a sense. As the surface reflects the presence of both SL and RL people, it continually undulates reflecting 'virtual' presence of individuals through images or personal profile information. This would eventually be displayed on the surface. For example, a SL visitor might activate a surface which would deploy the chair and table for a RL person to sit and have a discussion. The idea is that a visit to SL might have physical consequential actions in real space and vice versa with virtual space. It is still more of an installation, but that is changing shortly.





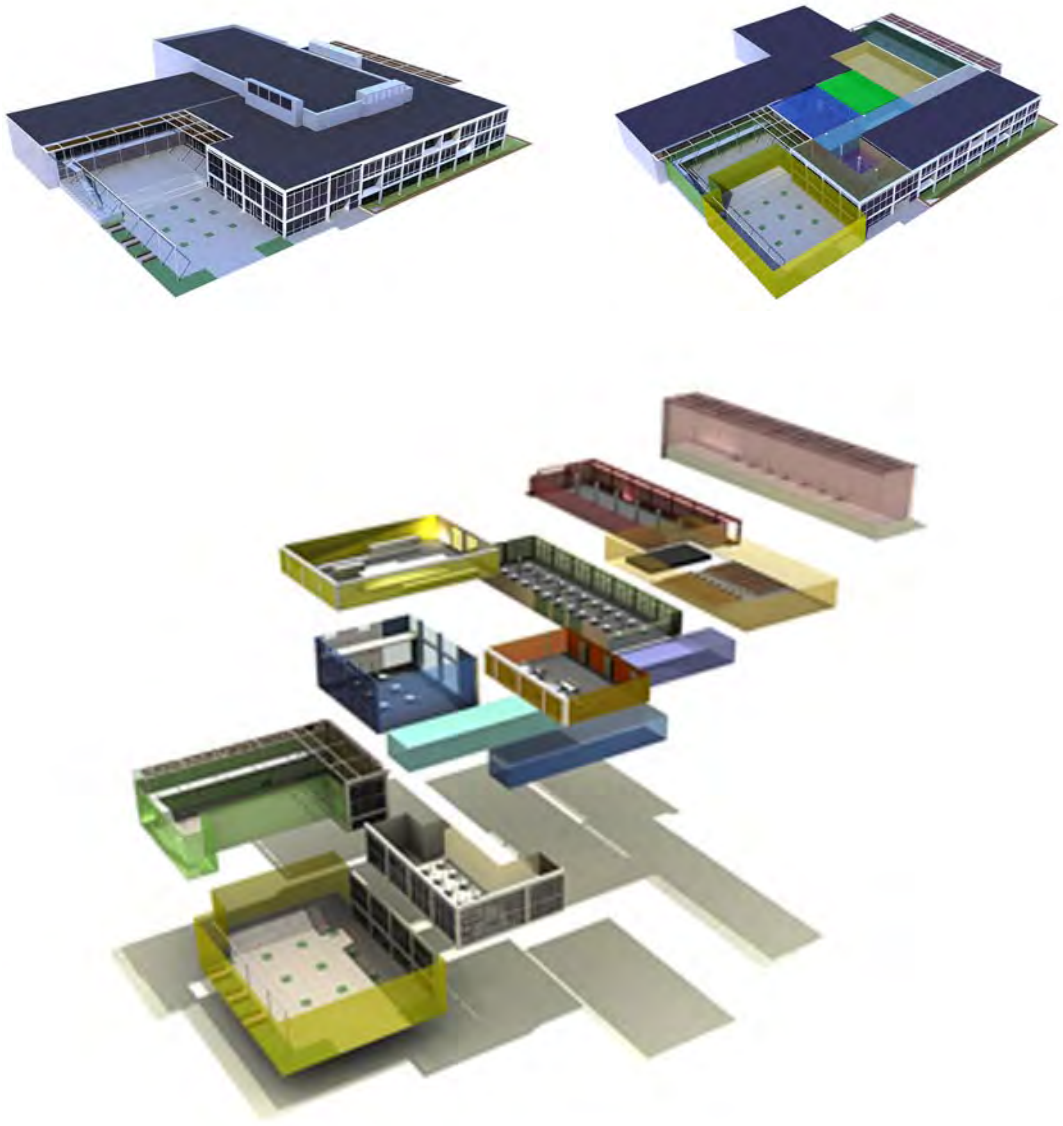
Transarchitectural Spatial Form

The final iteration of the causal chain results in two physical spaces causally linked with a third virtual space. The Transarchitectural spatial form cannot be understood without the Transarchitectural topography, because the form is dependent on the topography. An analogous situation in physical space would be the consideration of a structure without the effect of gravity. A physical architectural structure is understood to operate under the forces of gravity and the design reflects this tectonically (either through affirmation of or rejection of gravitational pull). The Transarchitectural spatial form must operate under the conditions of its own environment, so when a physical space extends into the virtual environment, it must then bend to reflect those rules. For this reason, as a physical space begins to enter the virtual environment, it begins to split into its various possible iterations. When we enter Second Life into the equation, we gain the ability to inhabit this Transarchitectural spatial form (liquid architecture) in its many manifestations. It is as though we had the opportunity to enter a given physical room and have the ability to shift the room into any other form that the room may have taken at any given time. The shifting room may follow the desire of the user, or it may shift randomly independent of user activity. The shifting form is representative of the changing Transarchitectural topography as the structure passes from one spatial type to another.

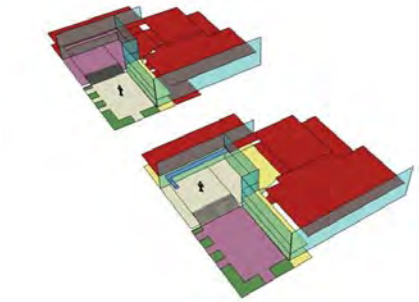
This investigation found it necessary to utilize a preexisting architectural form. This decision was made to see how an existing form would be affected by the transition from the physical into the virtual (across the Transarchitectural spatial topography). The recently constructed UC Student Center at Tulane University was chosen as the physical site/form that would be extended across the Transarchitectural topography to form the resultant Transarchitectural spatial form. The following image shows an overlay between the physical and the virtual of what conceptually is happening in this transition. It is a montage of one set of virtually possible spatial recombinations for the UC superimposed on the fixed dimensional physical structure. While the virtual end of the Transarchitectural form may be thought of as occupying the same space conceptually as the physical end of the form, this need not necessarily be so and the image is meant to be simply a conceptual construction of the underlying function of the shifting Transarchitectural topography.

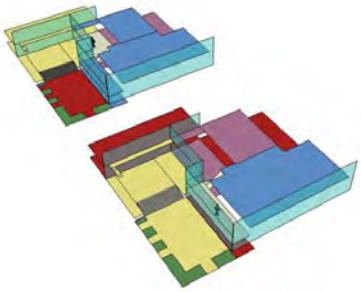
The first step is construction of the UC in Second Life. The aim of this investigation is to examine the resultant Transarchitectural form as it spans the Transarchitectural Topography, but as it is necessary to set causal links between these spaces and necessary to invoke a sense of inhabitation, the virtual reconstruction has retained the fixed dimensions of its physical equivalent. The individual rooms retain their dimensional form, but gain the ability to move and shift as the Transarchitectural topography (in this case virtual space) has now allowed the UC to become a fluid expression of itself. The individual spaces gain the ability to shift and recombine allowing the UC to continually reshape itself as individuals travel through it. In this sense, the UC has extended itself along the Transarchitectural topography to the point that it begins to lose coherence as a fixed set of spaces and begins to approach a virtual expression of spatial recombinations. The UC begins to express itself in the virtual topography by continually redefining itself as possible spatial recombinations.

Discreet Spaces



The UC has been divided into what I call Discreet Spaces. A Discreet Space is a space bounded by human perception. This brief diagram shows how the idea of discreet space changes as an individual moves through the spaces of the UC. This diagram in particular looks at the visual and the audial as spatial boundaries so when an individual occupies any given space, the discreet space ends at the boundaries of their perception. This differs in the case of the audio and the visual, but for the purposes of this study we will consider the discreet space to be that which is normally perceived as a separate architectural space. Because the virtual UC will be inhabited by Second Life users, it is important to retain familiar aspects of the physical. This both increases the strength of the causal chain (visitors might decide to visit the actual UC after the virtual visit) as well as maintains an element of the physical within the virtual.



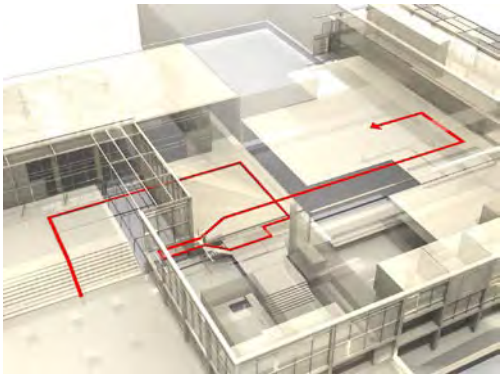


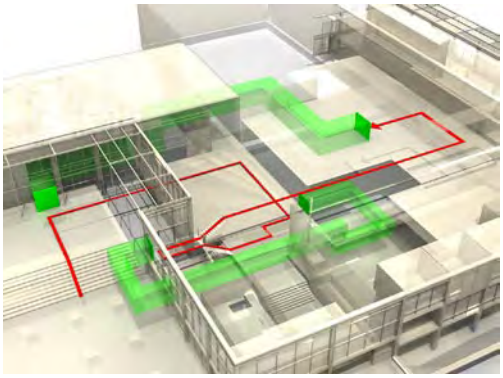
Programming

Second Life provides the ability to encode objects with behaviors. This property is exploited as discreet spaces may be embedded with code and respond to the behavior of the individual. As the individual enters the virtually recreated UC center, and move from space to space, the spaces rearrange themselves in front of the user as they cross a given discreet space threshold. The spatial arrangement follows a random pattern so as the user attempts to walk from one space to another, the UC center randomly pulls other discreet spaces and lines them up in front of the user. The result is a continually shifting UC center which rearranges itself real-time as any user decides to explore the space. This continually shifting representation of the UC is the virtual expression of the Transarchitectural topography and becomes a formal expression of the virtual side of the Transarchitectural form. This shifting liquid structure becomes the embodiment of the UC as it begins to adopt the rules and topography of the virtual.

8. Non-Linear Inhabitation and the Causal Link

In order to extend the causal link between the virtual and the physical ends of the Transarchitectural form, portals are established both between physical spaces as physical/virtual spaces. To establish causal links between non-adjacent physical spaces of the UC, portals are established between select points within the physical structure. As previously explained, these portals utilize live audio/video feed to produce live connections between differing physical points within the structure. This allows the causal chain to extend throughout the UC as events within one space can now affect events within another space. This is otherwise known as enabled non-linear inhabitation which is defined as the ability to inhabit different locations within a structure simultaneously.

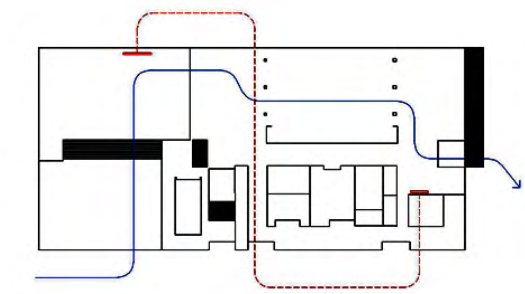


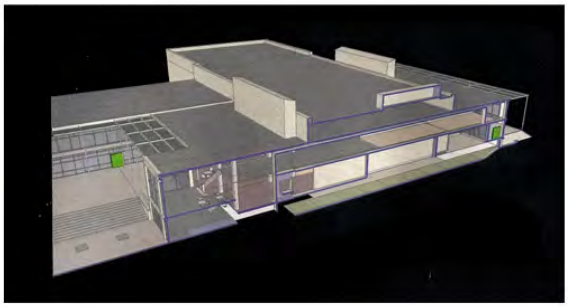


As an individual normally passes through a given space, they operate along a linear path: that is to say they have a set of physical experiences along a constant timeline that produces a linear experience. Through enabled inhabitation, we utilized new media technologies to set up

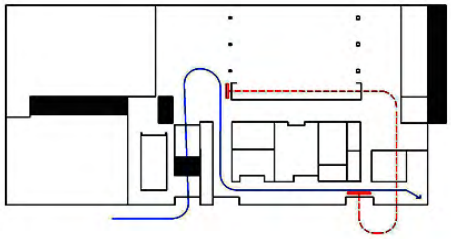
causal links between physical spaces, and in effect we produce a non-linear inhabitation of sorts. As the individual walks through a building, they may now encounter locations in space that allow them to affect events in another part of the building or vice-versa. This allows the individual to inhabit a structure non-linearly and produces the resultant non-linear experience of space. This led to a set of rules that govern how physical spaces may be causally connected with regard to the chosen site of the UC. These conditions are labeled as follows: Non-Linear Planar (parallel); Non-Linear Planar (perpendicular); Non-Linear Sectional (parallel); Non-Linear Sectional (perpendicular); Linear Planar (parallel); and Linear Sectional (parallel). Each of these conditions is diagrammed and the diagrams become more refined as we see the condition applied to actual space.

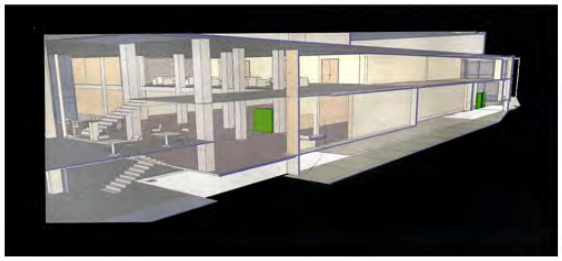
Non-Linear Planar (parallel): This condition describes the connection of two points where the portals are oriented in a parallel position but are non-linear in nature as it shifts laterally in physical space. In this case, I have united the two main entry conditions which follows the logic of consistency of experience as users will encounter each other in a similar condition (entering the building). The screens remain 1:1 scale and to follow the consistency of information and experience rules. As a result, the floor plane appears to extend between the two spaces and continuity of experience is achieved. The parallel orientation of the portals simply addresses the vector associated with the spatial bypass. As the user is looking through the portal, they are facing (inhabiting) the same direction as seen on the other end of the portal.

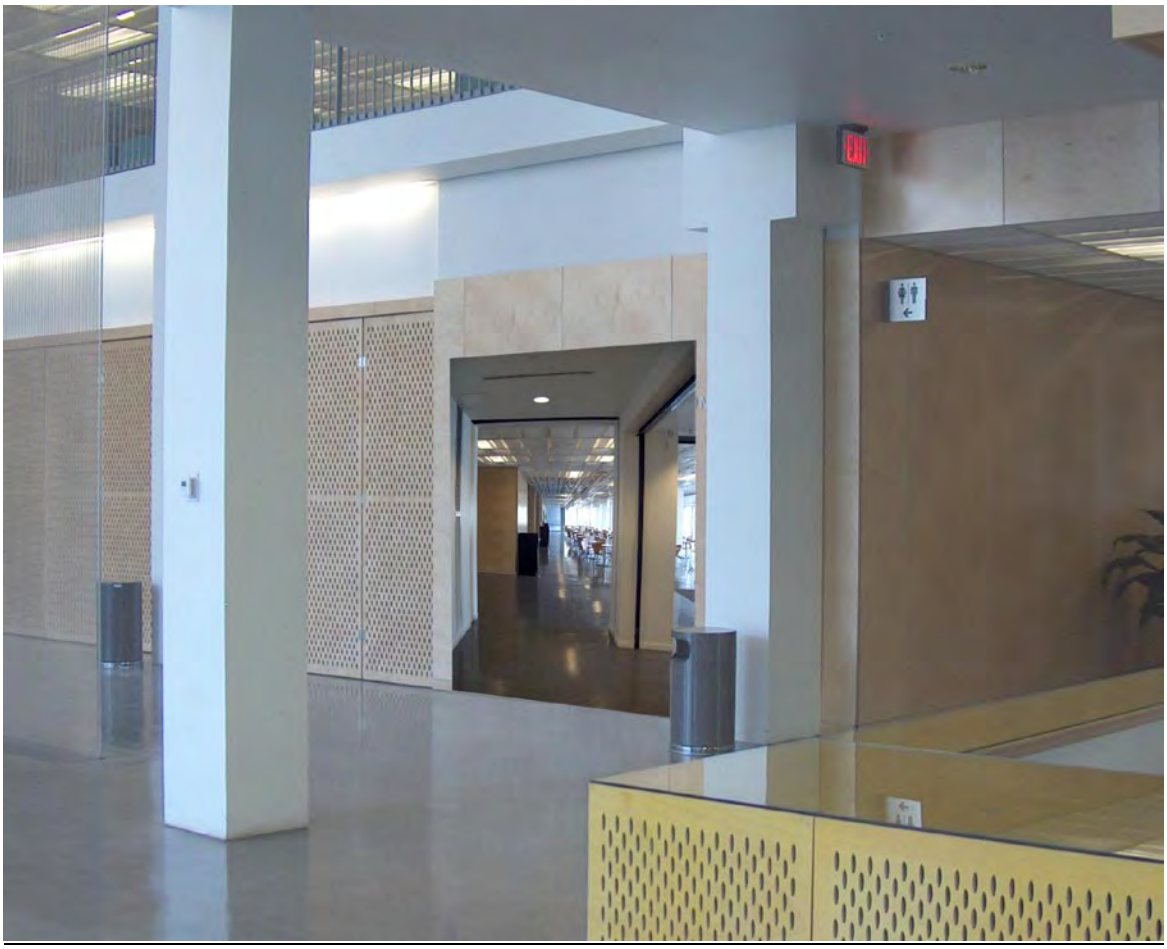




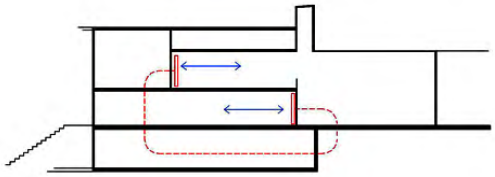
Non-Linear Planar (perpendicular): This example links two interior conditions in a perpendicular orientation. In this case, the portals are positioned in high traffic areas to maximize the ability to produce chance social occurrence. The experience is still considered non-linear as the path between portals is not in direct line of sight.

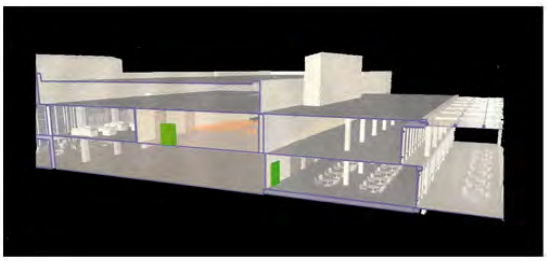




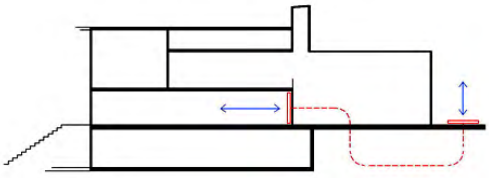


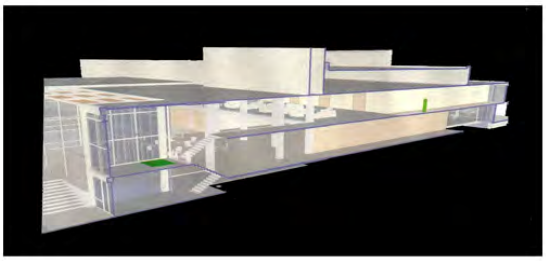
Non-Linear Sectional (parallel): This condition describes a situation where two floor heights are united in a parallel orientation to allow the user to inhabit two vertical positions in space simultaneously. The user can communicate between floors which begin to collapse the vertical distinction between spaces and links vertical spaces in a horizontal manner.

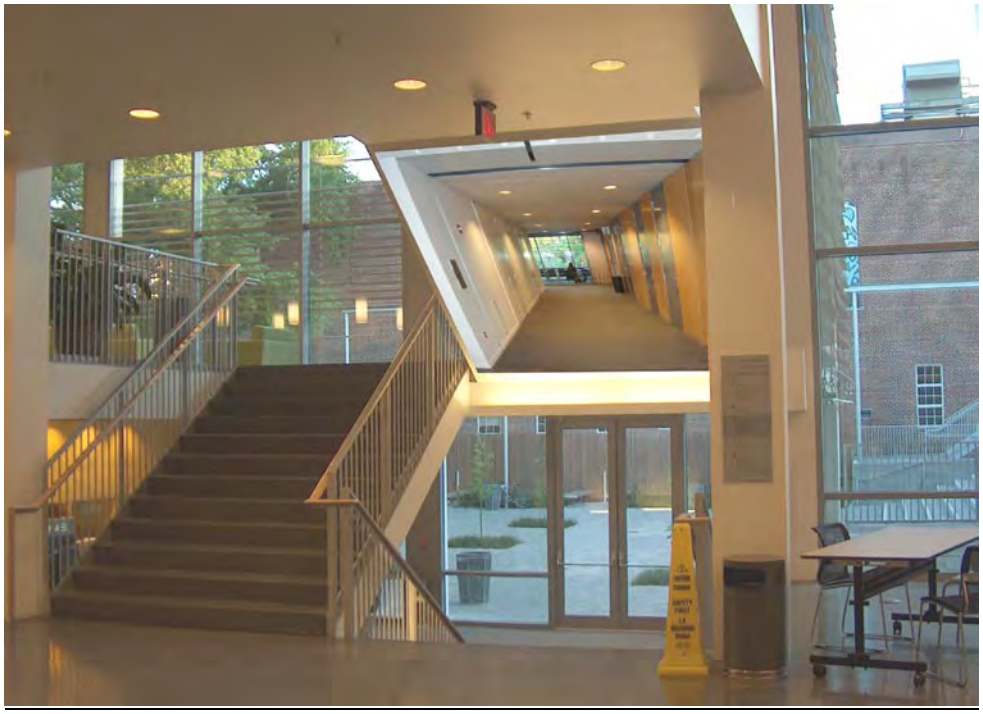


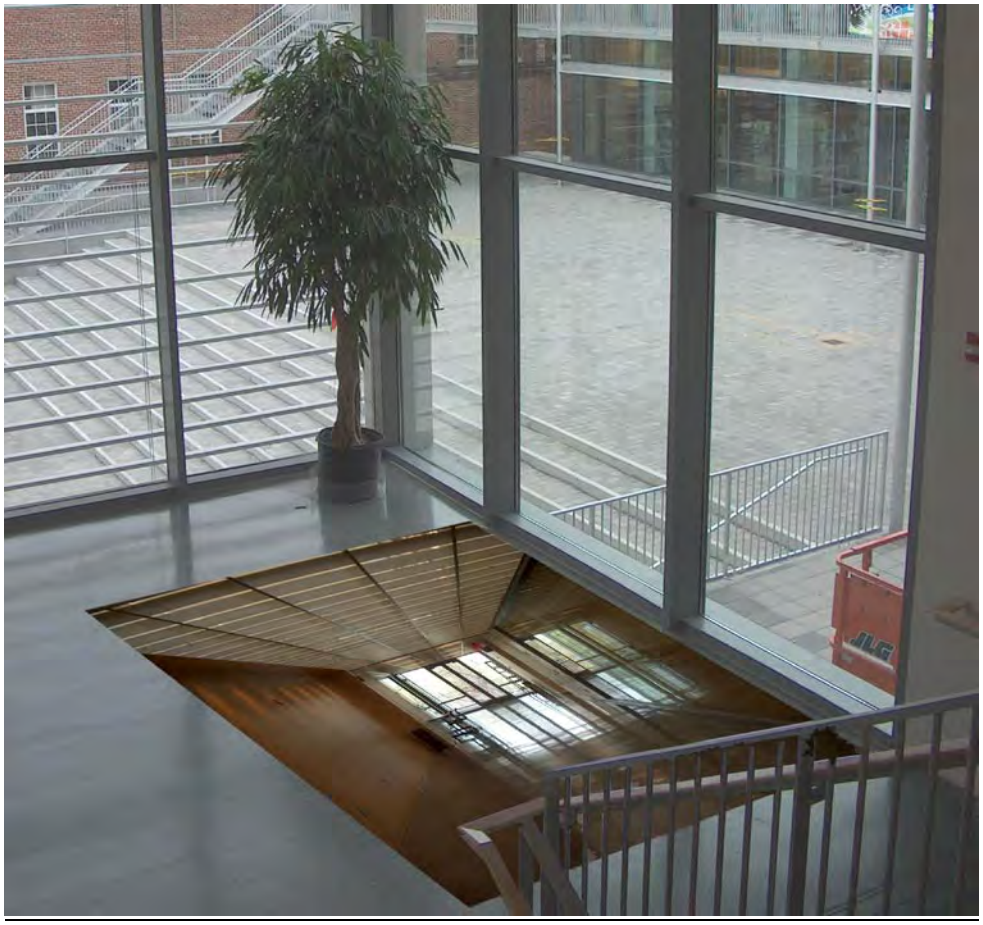


Non-Linear Sectional (perpendicular): This condition begins to unite the vertical and the horizontal as the user is able to inhabit both a vertical and a horizontal position simultaneously.

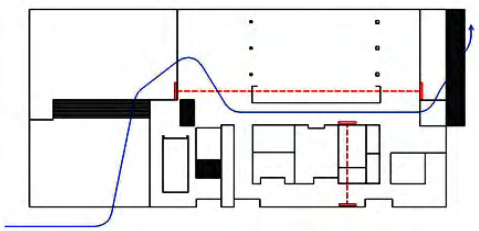


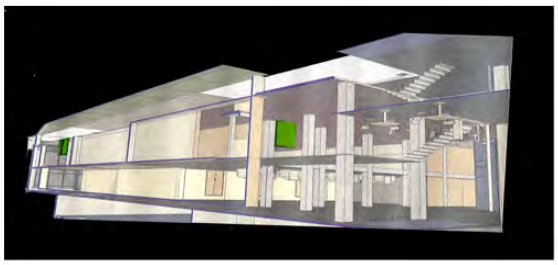


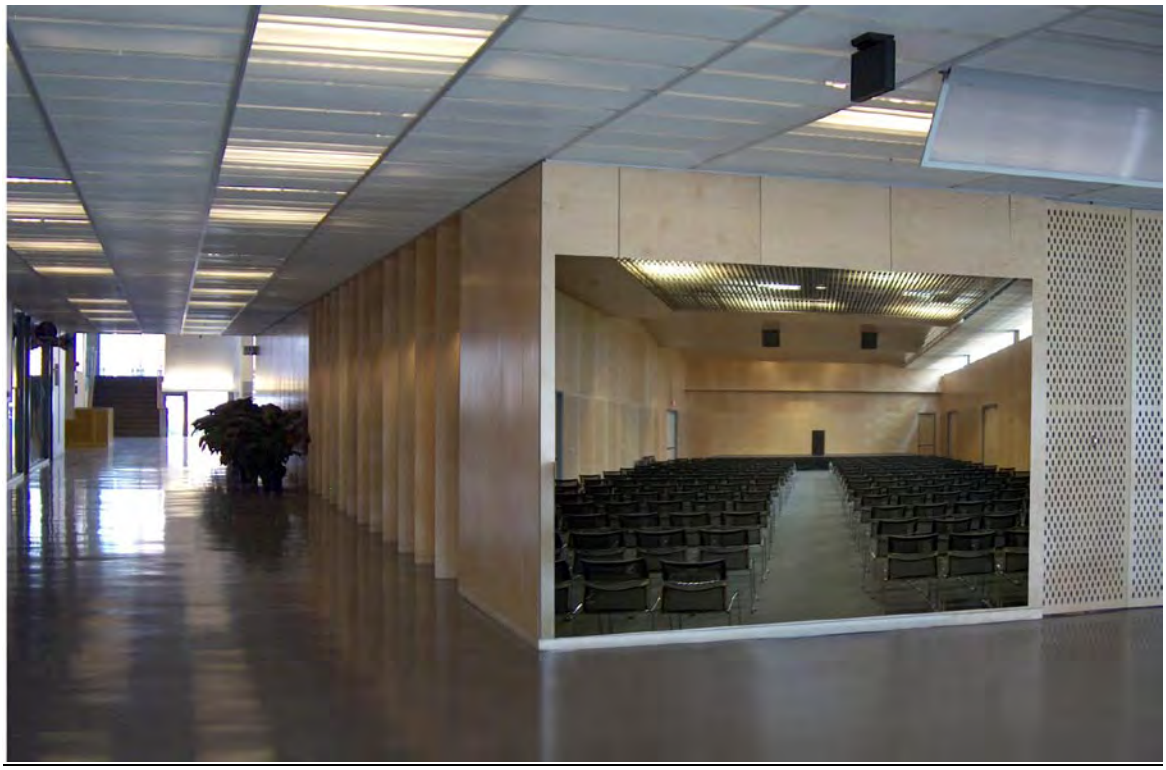



JLG

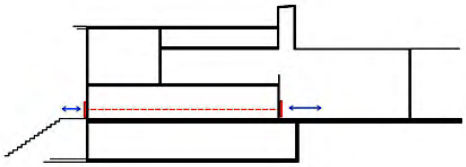
Linear Planar (parallel): This condition highlights a different case as the bypass has now been set in a linear orientation through the building. As the user looks through the portal, they are actually perceiving and interacting with a space directly through the building. This is illustrated further in the accompanying images, but essentially it is as though the portal is a direct vectoral bypass of space (as though the structure has been removed between these two points. This is different qualitatively from the non-linear bypass because the user knows that what they are seeing is actually directly in front of them. The line of sight passes directly through the vertical plane.

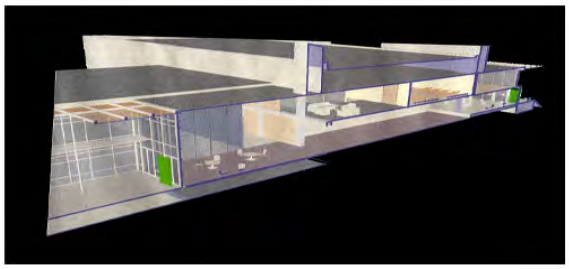






Linear Sectional (parallel): This final condition is similar to the Linear Planar condition where the direct line of sight is through a horizontal plane as opposed to a vertical plane. This allows the user to effectively see through the building to the other side and causally links those spaces.





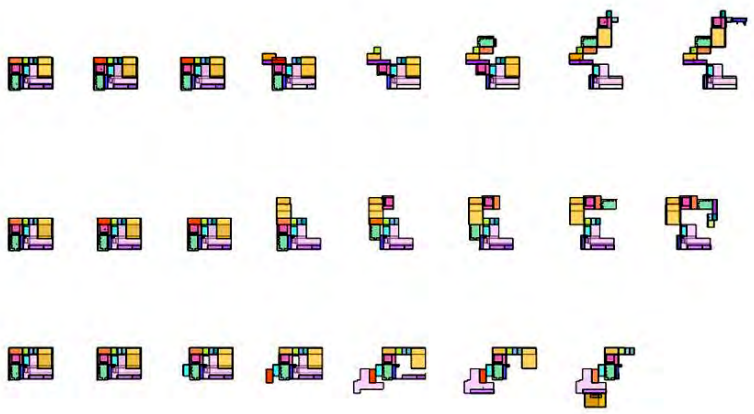

Harry Potter
$18.89


EXIT

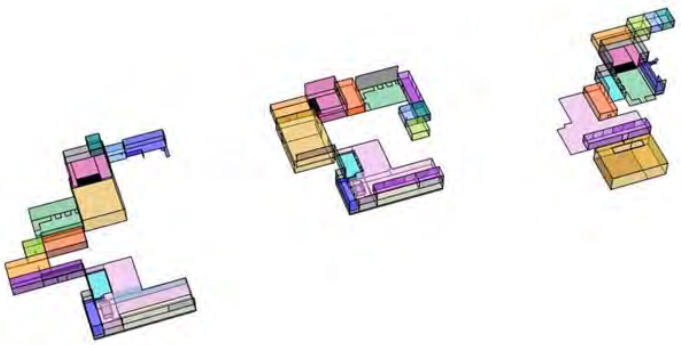
Operational Mechanics and Causal Links of the Transarchitectural Form

At this point, we must then establish the causal link between the virtual and the physical. To accomplish this, I linked the portal (previously explained as connecting non-adjacent physical spaces) with portals located in the virtually reconstructed UC center. These portals exist in the same locations as those in physical space, and as the causal link is established between the virtual and the physical, one has a direct effect on the other. In this case, the shifting topography of the virtual UC is linked to the portals established in the physical UC. In other words, as the discreet spaces of the virtual UC begin to shift and rearrange, so the portals in the physical UC correspondingly shift to link physical points of the UC (through the new media technology). This establishes the causal link between the virtual and the physical ends of the Transarchitecture. We can see that as one end of the topography changes (shifts in relation to the virtual visitor) we see a direct effect in causal links between locations in physical space (portals connecting parts of the UC).

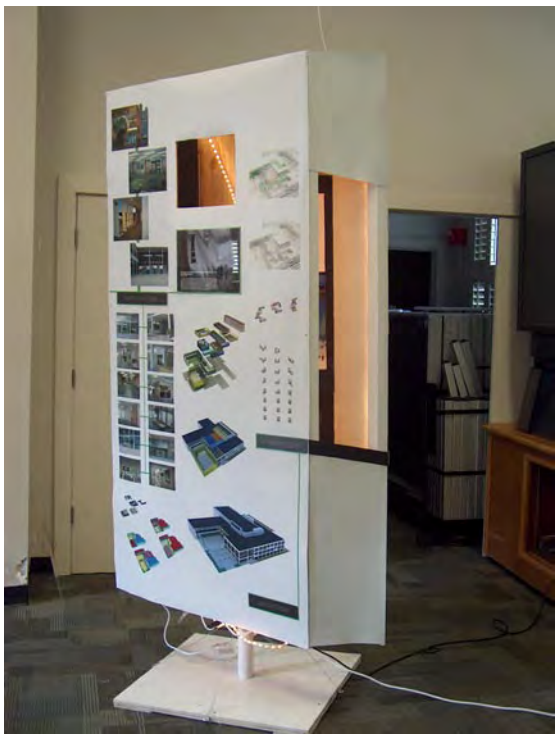
These portals do not follow the traditional notions of the Mixed Reality experience, as they do not literally and perceptually link virtual and physical spaces. In this case, the relationship is indirect where we see events in the virtual having a direct effect on events in the physical. In this example, a strange phenomenon has happened where the MRB has actually been split in two (one representing virtual connection between spaces and one representing physical connection between spaces). I would argue that this allows for a different type of Mixed Reality experience where instead an individual is experiencing a reshuffled physical space based on that physical space reconstituting itself in the realm of the virtual. In effect, the single experience of the Mixed Reality has now been split into two separate experiences which are connected through a causal link. The result is the ability for a user to visit the UC in virtual space or physical space to allow the experience to extend across the Transarchitectural topography.



Possible Spatial Recombinations: 3 Iterations



Possible Recombinations: Totals



Final Review Summary

Review discussion primarily revolved around practical use for such a system and the level of investigation. Comments suggested that the project would benefit from a more refined level of analysis, as well as a new proposal for how my findings may alter the way designers consider physical spatial constraints. The specific suggestion is to pursue a 5 Points format to outline the way the virtual can change the way architects and users think about space. The reviewers feel a strong connection between the theory and the manifestation of the work, but more attention is needed in the area of formal investigation, and the ability for the MRB to be more carefully integrated into space. This is in line with the timeline of the investigation, as I found it necessary to first outline the scope of the intervention and form new definitions about spatial interaction.

Reviewers also noted that while it was necessary to investigate existing form (the UC) as it traverses the physical/virtual divide, they also feel that the next natural step is a proposal for new structure. This will begin to examine the conditions I have outlined in this project as they apply to new architectural space. For example, if the advent of new media systems and hybrid spaces allows the architectural occupant to inhabit multiple spaces at once, how can we use this information to begin to design space that does not respect traditional spatial boundaries? Is this the dissolution of architecture or simply the refolding of architecture into itself? I agree with the initial comments and assertions and I feel that what I have produced will be crucial in achieving the next step of proposal and description of a new spatial type (the Transarchitectural form).

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Listing of Virtual Projects Examined During the Course of Research

Dancing with a Virtual Dervish
Marcos Novak

TransTerraFirma
Marcos Novak

Wand 5
part of Media Space-Media in Space, Space in Media in Friedrichsstr

Chapel Hill Walkthrough
University N.C. Chapel Hill, Sitterson Hall

VSDSS System
Virtual Space Division Support System
Nomura, Japan 1992

Aurora
Dautenhahn, 1999

Cybercity Walker
Mixed Reality Systems Laboratory Inc.

Alphaworld
1995 Activeworlds universe

Spatial Model of Interaction
Benford and Fahlen 1993

Transit
Klaus Filip and Nicolaj Kirisits

Osmose and Ephemere
1995, 1998

Synthecology
Electronic Visualization Laboratory and University of Illinois at Chicago, Art Institute of Chicago and Columbia college Chicago, and Applied Interactive Organization

3PointD
Destroy Television
Electric Sheep Company

Cyclone.soc
Gavin Baily and Tom Corby, UK, 2005

Shi Ka Ku No Mu Ko U Beyond/Invalid Sight

Object B
Exonemo, Japan 2006

MaSS Market as Speed Spectra
MaSS Dev, Japan, 2006

Vexations c.i.p. Composition In Progress
MOHRI Yuko and Migara Soichiro, Japan 2005

Evolving Sonic Environment

Virtual Laguna Beach
MTV and Makena Technologies

Lonlygirl15

Four Eyed Monsters

Lifelog Program
DARPA

PMOG
Justin Hall

WorkSpace Unlimited
Implant
Voornit Kunstencentrum in Ghent, Belgium in street window
Extension
Devmap
V2 Institute for Unstable Media in Rotterdam
Blind Love

Second Life Landscape Initiative
Ars Virtua

FoAM
TGarden
txOom
TRG Transreality Generators

Virtual Ecosystem
Laukosargas Svarog

Please Touch

Perfect Time
Hideaki Ogawa

Embodied Conversational Agent
Justine Cassell

Virtusphere

Virtual Air Guitar Project

Digital Street Corner
Fred Forest, Art Basel Miami Beach 2005

Objects of Virtual Desire

Fugue

C.A.V.E System

Panscope 360 degrees

Cognitive Agents in 3D

CyberPRINT - Interfacing virtual and physical spaces through the body

Residual Data Cloud

Starchild

Flatworld
Par 2001-?

Immersive Television

Mersea Circles

Super-i

Life Clipper

CityCluster

Imaging Place