Infinite Regress:

The Blurring of an Architectural Game-Space

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Abstract

Architecture and gaming have always been unconnected. Architecture uses a vast array of tools as a means to an end, to show information. The computer gaming industry however, creates virtual worlds for its experiential potential. While this disjunction is explicit I believe that the gaming industry presents architecture with a medium from which to expand its expression. I explore the redundant nature of the space created when two or more spatial conditions are imbedded/layered within each other. By investigating the separate industries of architecture and gaming, I hope to blur and possibly alleviate the distinctions between the tools that architects and game designers use. With growth in gaming technologies and superior compatibility, architects should have the capacity to work between these two worlds. With such technologies architects or designers can further enhance their design by experiencing their designs through a virtual, immersive and interactive real-time environments.

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Chapter One

1.1 Introduction

Where realistic environments, interaction and immersivity are concerned, game worlds have begun to encroach on the realm of architecture – blurring distinctions between physical and virtual experience. Moreover, as a function of the drive for realism, more and more game spaces are presented perceptively in “first person,” as one would experience an actual built environment. When you factor in the real-time interaction between individuals supported by Internet-based gaming, game environments have the potential to perform key functions we associate with architecture, namely the creation of meaningful *places* to stage and support social exchange. Finally, when these virtual places are connected back into the real via real-time digital video feeds, virtual environments can function as thresholds or portals back into the real.

1.2 Thesis Statement

Despite the increasing degree of overlap between gaming and architecture, architects are mostly ignorant of developments in the gaming industry – often willfully so. That being said, architects use a vast array of digital tools as a means to an end, namely to model buildings that are intended to be constructed. While the digital model is also a means to an end for a game developer, the end is different. For the architect the virtual model is (only) a representation, whereas a game developer creates virtual worlds to support inhabitation and experience. While architects may legitimately believe that the real trumps the virtual, the existence of the real may not obviate the usefulness of the virtual version. Indeed the digital model can perform a different function once the building modeled has been designed and constructed. In this respect the digital model can transcend its function as a mere tool or means to an end – expanding and enhancing the experience of the actual building.

It is the overlap and redundancy between the real (as represented by architecture) and the sophisticated virtual environment (as manifested in contemporary computer games) that I propose to explore in this thesis -- both from the perspective of the design professional and of the user/player. Using a number of spaces, scenarios and digital media, I intend to explore the ambiguous, provisional and redundant nature of space created when real and virtual spaces are embedded/layered within each other. In so doing, I also hope to encourage a dialogue between architects and game developers, to promote awareness and use of new technologies among architects, and to expand the definition of architecture. This thesis explores the potential of redundancy, overlap and blurring between the realms the real and the virtual, of gaming and architecture.

In recent years game companies have encouraged the gaming public to participate in the creation of levels (game environments) by placing their level builders in the public domain. While researching this thesis I've come across several studies assessing the potentials of game engines for architectural modeling.[1] While I, too, use a level builder (Quake 3 Arena) to model an actual building (the School of Architecture at Carleton University), the thrust of the thesis is more theoretical than practical. Again, I wish to go beyond the use of the model or level as an architectural design/presentation tool.

1.3 Structure of the thesis

The thesis comprises both written and design work – design being used as a form of research. I begin by introducing computer-based games in Chapter 2, looking at key developments, categories and technologies. In Chapter 3 I look at the use of digital tools by architects – the ways their means and ends differ from those of game developers. Chapter 4 examines “crossover environments” – digital environments that, whether by their function or the technologies they incorporate, challenge distinctions between the real and the virtual.

Chapter 5 describes the design portion of the thesis – explorations into embedding the virtual within the real. This includes the use of real-time video feeds into virtual spaces, the incorporation of photography, the use of QuickTime VR panoramas, etc. The aim is to discover new spaces, merge/blur the virtual and the real, expand the definition of space in the realm of architectural, and to displace and redefine the experience of the viewing subject within redundant and parallel spaces.

Architects, as noted, are comparatively conservative when it comes to conceptualizing the potentials of virtual environments. While they use many of the same tools as game developers, the digital models they create remain provisional and defer to the real environments they represent. Generally digital models are abandoned once the architectural design moves into the construction documents phase. More often than not buildings are modeled as objects (to assess their impact on the city or adjacent environment) rather than as spaces to be explored or navigated. Interactivity is, for a variety of reasons, not a priority for architects, who generally use the model to generate rendered stills or pre-rendered fly-throughs.

At the same time, sophisticated computer games have begun to transcend their function as entertainment and have become spaces for interaction. In this sense game environments increasingly resemble the environments architects create. Massively Multiplayer Online Role-Playing Game (MMORPGs) bring thousands of people together for interaction, via characters. When players interact, play may halt altogether, transforming the game into a "chat room" or vehicle for communication. Such game environments are tantamount to real world spaces both in their function and in their qualities (sound, light and shadow, physical constraints, and architectural detail).

When virtual environments are examined outside their function as design and presentation tools and/or gaming levels, they take on a different, potentially redundant quality. The design portion of this thesis attempts to blur the distinction between architecture and game design by embedding virtual versions of real environments within those environments then feeding the real back in the virtual. Existing simultaneously within real and virtual versions of the same environment, the viewing subject is displaced – watching himself watch himself through various layers of mediation – simultaneously positioned in the roles of person, player and character. Such redundancy and "feedback" is facilitated by technologies such as web cams that permit the virtual to come in contact with real space.

Leveraging gaming technologies to bridge between the real and the virtual would allow architects to examine their work in new ways. Real-time feeds into photorealistic and immersive virtual worlds can vastly expand the quantity and quality of spaces that architects design – breaking down boundaries, blurring distinctions, and opening up new possibilities. As the future brings more options for how and where we interact as human beings and as the line between the real and the virtual continues to erode, architecture's role can significantly transform to allow humans to interact in a broader choice of settings – whether real, virtual or indeterminate.

Chapter 2: Background One – Games

> *"Gaming is now a bigger and more profitable enterprise than the film and television industries combined ($6.3 billion in video games sold worldwide in 1999, and online gaming is a $250 million industry)."*[2]

2.1 Introduction

A game is an entertaining and participatory activity for one or more persons. Academics Katie Salen and Eric Zimmerman note that games are "capable of addressing the most profound themes of human existence in a manner unlike any other form of communication."[3] Games confirm our desires, evoke pleasures, anxieties, release, wonder and knowledge. Whether open-ended, procedural and/or collaborative, games provide a framework that structures choices and responds to the actions of the player(s). The rules of the game also structure interaction between players – who play both against the game and each other. Games can challenge our problem-solving skills, enhance physical coordination, and help to nurture relationships.

To help games appeal to the imagination, especially computer games, a narrative is often employed. A narrative is a story or a tale communicated via word of mouth or written text. Early version computer games of Dungeons and Dragons were text-based. The narrative would structure the choices presented to players and provides a context within which to make decisions. In the case of Dungeons and Dragons the narrative is different for every player. This kind of game is called a role (or roll) playing game because players select a character and play in turns.

Games may be categorized in a variety of ways: single vs. multiple player, card games, board games, role playing, adventure, action, strategy, simulation, sports, god games, educational, puzzle, online, single player, etc. Given the digital focus of this thesis, however, we will look specifically at categories and characteristics of computer games. One of the major goals for which computer game companies strive is realism. Realistic environments can enhance the immersive experience of games by more effectively evoking feelings of fright, shock, anxiety, etc. Similarly, many computer games support "pure playability" by fantasy-based visuals. In this form, the most important value is entertainment through imagination. Rather than creating highly realistic environments, these games deploy abstraction and color to foster imagination and problem solving.

Early in their development computer games only *represented* reality through diagrammatic symbols (e.g., the arcade console games of the 1970s). As computer gaming developed, however, realism improved in all genres and highly detailed three-dimensional models replaced 8-bit sprites (2D, flat, animated images). Today, layered-image backgrounds have been supplanted by richly detailed, three-dimensional cities and landscapes.

The drive for realism has characterized computer gaming from its inception and has, to some degree, become synonymous with the industry. Arguably realism is implicit in the medium -- as is the assumption that *greater realism equals more immersivity*. Equally important considerations such as playability, music, narrative, challenge and character development appear secondary to graphical output. Rather than encouraging players to decipher symbolism within a game, they are increasingly presented with photo-realistic environments.

To better understand relevant parallels between architecture and game development, this chapter will outline key themes, many technical. I will define *games* and trace the evolution of computer gaming using categories such as spatial depth, point of view, level of immersion, and realism. I'll also discuss current technologies, tools and benchmarks in the gaming industry, including photographic image mapping and real-time video feeds. Tracing a chronology of digital gaming will help us better understand the hyper-realism that characterizes the industry today (in the form of first-person navigation and highly detailed massive-multiplayer environments). The term *immersive fallacy* describes the phenomenon of empathetic transposition between the individual player and a character within in the game. Analogous to the concept of "suspension of disbelief" in films, it describes the level of immersion and absorption into the action and the degree to which one forgets that he is playing and/or is different than the character. Realism, first-person viewpoints, perspectival space and technological innovation all serve the *immersive fallacy* in game design.

Understanding the state of gaming technologies, in turn, will inform our assessment of the use of digital modeling in architecture and will set the stage for the experiments described in Chapter 4.

2.2 Space and Immersivity in Computer Games

Although games can be categorized in a numbers of ways, it is perhaps most relevant to categorize computer games with respect to their immersive qualities. The representation of space (boundaries, depth and perspective) has a direct impact on the degree of immersion. While it is certainly not the only factor, it is an important one – and is particularly relevant to the relationship between gaming and architecture.

When discussing space and the movement (of objects, characters, etc.) though space, it is important to differentiate pre-rendered scenes from scenes that are rendered on the fly. Free movement though perspectival space is extremely computation-intensive. Until quite recently there was an inverse relationship between freedom of movement and the sophistication of the scene. A hybrid model (used extensively in the *Myst* series) is movement thorough linked, pre-rendered QuickTimeVirtualReality (QTVR) panoramas. Unlike first-person shooter (FPS) games like *Quake* and *Far Cry*, the *Myst* player "jumps" from panorama to panorama, each of which is rendered in great detail. Although the viewer is stationary in each panorama, his viewpoint can rotate 360 degrees in all directions. In recent versions of *Myst*, these panoramas include video clips of characters moving though the space while the player looks around.

With faster processors, more efficient texture mapping and better rendering algorithms, it is now possible to support both full movement through perspectival space and high levels of detail. The *Myst* cousin *Uru* is an example of such a game – extremely rich in detail (all of which the player must scrutinize for clues to the unfolding drama) but supporting real-time rendering and fluid movement in both first and third person (see section 2.3 below).

Text-only Space (no pictorial dimension)

Text-space, which is a form of immersion, was introduced in the 1970s with games such as Dungeons and Dragons. In this form, the player simply had to read and interpret a text within a character/computer interactive system, and imagine a world while being guided through the text.

Contained 2-dimensional space

Following text-based games, graphical games such as *Pong* and *Space Invaders* used pixels to draw graphics as representations of objects. In *Pong*, for example, a spot represented a ball and vertical bands of pixels represent paddles. The interaction between the spot and bands obeyed the laws of simple physics – allowing the player to relate the play to tennis or ping-pong. From their inception graphical games deployed symbolism and metaphor; graphics were imputed with a metaphorical value to foster an immersive relationship to play. The associational metaphor enabled the user to suspend disbelief and intuitively relate the game world to the real world. Metaphors included gravity, grade, danger, friend, foe, objects, ice and so on. Without the use of real world metaphors game-play would be vague and ambiguous. To encourage immersion in the game, players needed to relate the digital events to real world experience.

Wrap-around space

This graphical interface of games like *Asteroids* and *Pacman* warped space by permitting objects to disappear off the edge of the screen only to reappear directly opposite to where they vanished. This gave the impression that the game space was continuous and permitted the subconscious to extrapolate and travel through an invisible space. Such continuity of space is understandable in the game environment yet impossible in real scenarios.

Spaces that scroll along one axis

Games such as *Defender, Super Mario Brothers,* and *Atari's football game* used scrolling to give the impression of continuous movement through a two dimensional space. The *Super Mario Bros* series featured horizontal movement while games such as *Spy Hunter* privileged vertical movement. Continuous horizontal movement was common in animations such as the *Flintstones* where characters stayed within one plane and background repeated behind them as they moved left and right.

Scrolling along two axes

Gauntlet and *Simcity* permit scrolling along both the x and y axis in a two dimensional plane.

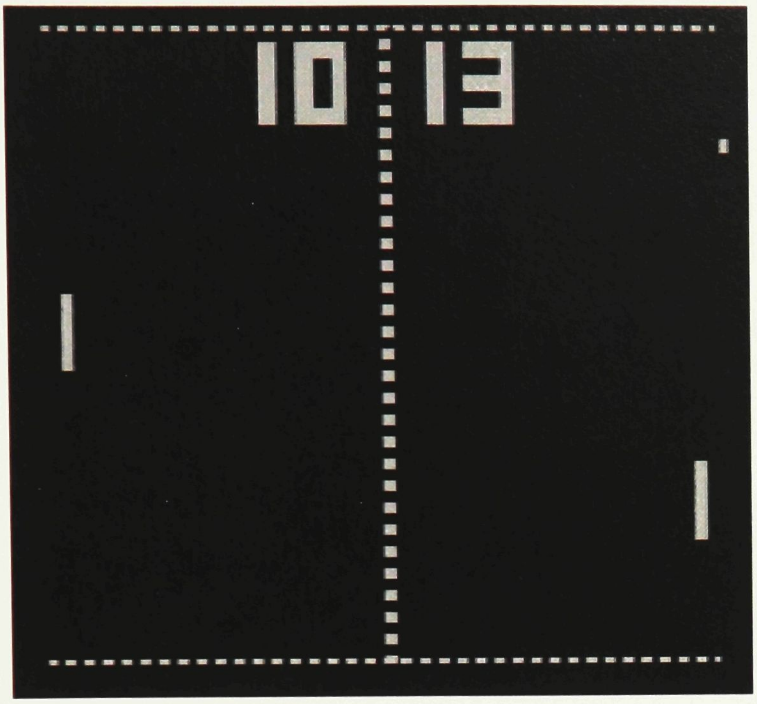

Fig. 1 Pong. From: Atari games (5 Feb 2005)
<http://www.ordiworld.com/jargon/fig/pong.gif>

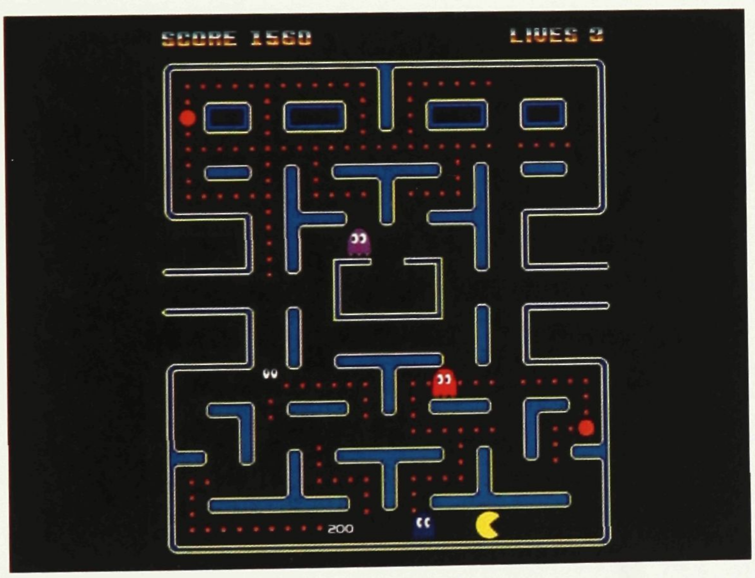

Fig. 2 Pacman. From: Quest 3d.com (5 Feb 2005)
<http://www.quest3d.com/images3/entertainment/screenshots/pacman.jpg>

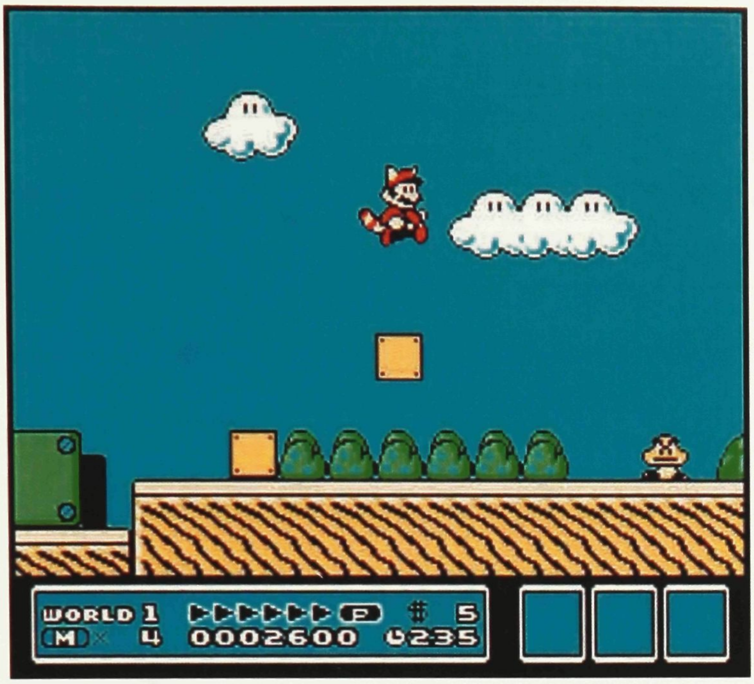

Fig. 3 Super Mario Bros. 3 From: WomenGamers.com (5 Feb 2005)
<http://www.womengamers.com/images/articles/editorials/classic/smb3NES.jpg>

Fig. 4 Simcity. From: www.apocageddon.pwp.blueyonder.co.uk (5 Feb 2005)
<http://www.apocageddon.pwp.blueyonder.co.uk/express/web/scc%20arial.jpg>

Adjacent spaces displayed in one room at a time

Games like *Berzerk* take place in multiple rooms where the user is able to imagine that his/her character is invisible to other game features. If the user's character is hidden from view from the enemy, the user will not be *seen,* therefore not engaged. The user will have to maneuver to stay hidden and/or accomplish desired tasks.

Scrolling with multiple background layers

Double Dragon used scrolling to simulate a deep and dense background. The depth effect was created by the gradation of movement of the various layers of background images. The background of the first level of *Double Dragon* contains an image of a city that imputes a character and feel to the game.

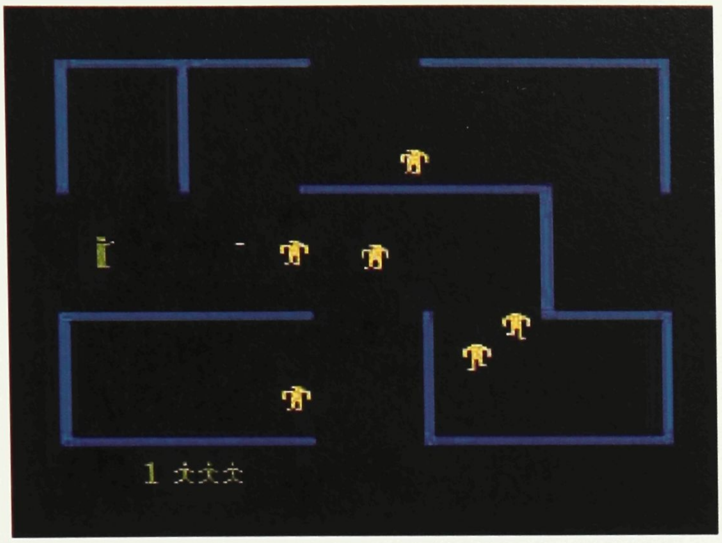

Fig. 5 Berzerk From: Digitpress.com (5 Feb 2005)
<http://www.digitpress.com/dpsightz/atari5200/berzerk.jpg>

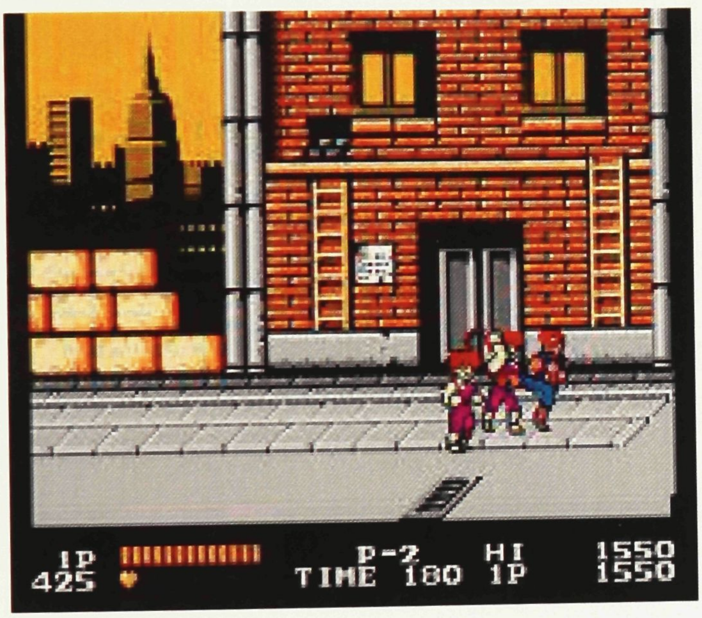

Fig. 6 Double Dragon From: VideoGameCritic.net (5 Feb 2005)
<http://www.videogamecritic.net/images/nes/double_dragon.jpg>

Limited 3-dimensional space – the use of perspective in the scene

The spaces used in *Tempest* and *Night Driver* were made to simulate a 3 dimensional environment. By using vector lines and/or rules of perspective, a simple perspectival scene was implied.

Two spaces on one screen or two separate screens

Multiplayer games such as *Spy vs. Spy* were characterized by having players control their character while attempting to find others by searching through a labyrinth of rooms. The location of one's character and environment (as well as those of the enemy) had to be envisioned before one could become an effective, intuitive player; hence, the game required players to quickly master mental mapping skills.

Early 3d space – one horizontal plane

Wolfenstein 3D is one of the earliest "3D" first person shooter games. The player is in the first person view mode and must explore a series of dungeons in an immersive world. Drawing on these advances gaming technology, the game *Doom* presented a two-and-a-half dimensional (2.5d) game. The floor level changed heights and characters could be engaged from above or below.

Fig. 7 Tempest. From: Appolo.com (5 Feb 2005)
<http://www.appolo.com/projects/tempest3/tempest6.JPG>

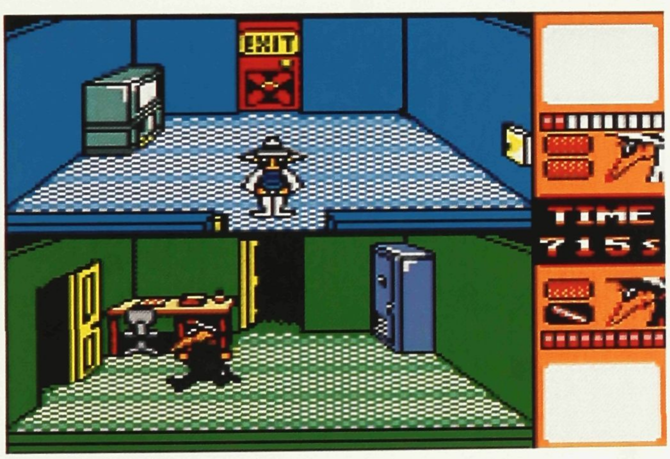

Fig. 8 Spy vs. Spy. From: dmgive.com (5 Feb 2005)
<http://www.dmgice.com/news/nov99/svsgba.gif>

Full 3d Space – horizontal/vertical movement

Quake, *FarCry* and most current first-person shooter games (*Doom3*, *Half-Life2*, etc.) use full, three-dimensional space. In this game space, a player is allowed full freedom of movement. One can walk along the ground plane or look and shoot anywhere that the game allows. Players also have the ability to fly or jump in the environment since the plane of movement is no longer limited to the ground and the scene is rendered on the fly.

Mapped space – pre-rendered panoramas

Instead of real-time, on-the-fly rendering, mapped space games such as *Myst* present a slower-paced game with pre-rendered environments. Every animation is pre-recorded and every viewpoint is pre-calculated. In this mode, the computer does not need to run a game engine that will calculate its visuals in real-time. It needs only to store the information that is needed for each particular scene. This way the *animation* is smoother and realistic, unfortunately at the expense of repealing fast-paced (inter)action.

Fig.9 Screenshot of Doom. From: dmgice.com (5 Feb 2005)
< http://www.dmgice.com/news/nov99/svsgba.gif >

Fig.10 Screenshot of Quake. From: Quake3bits.com (5 Feb 2005)
<http://quake3bits.com/htm/maps/chartres.htm>

Fig. 11 Screenshot of Myst IV. From: Qualitywallpapers.x-stence.com (5 Feb 2005)
http://qualitywallpapers.x-stence.com/Games/Myst%20III.jpg

2.3 Viewpoints: First-Person, Third-Person, and Overhead Views

First-person viewing means that the view on the monitor is the view that the character in the game will see. It is the most immersive viewpoint as it permits players to project themselves into their characters. Most gun-oriented or shooting games utilize this mode (thus the moniker "first person shooter"). Game developers with an artistic bent are able to create frightening "horror-film" experiences when they know the positions from which the character will be looking. Since the first-person view imputes an empathetic and experiential aspect to a game it can also serve as a useful tool for architectural spatial explorations. Depending on the circumstance, the digital building model should not only be used to output still images or pre-rendered animations, but accommodate a viewer's unrestricted movement within the scene.

Third person viewing implies that the player controls a character, whom he watches on the screen. In recent games like *Uru* players must create a character (or *avatar*) that they control throughout the game. It can be a fantasy-based character or one that resembles the person controlling the character. The case of Uru, this character is watched "over the shoulder" from behind.

Fig. 12 Screenshot of Half-life2. From: http://pc.gamespy.com (5 Feb 2005) < http://media.pc.gamespy.com/media/492/492830/img_2466501.html>

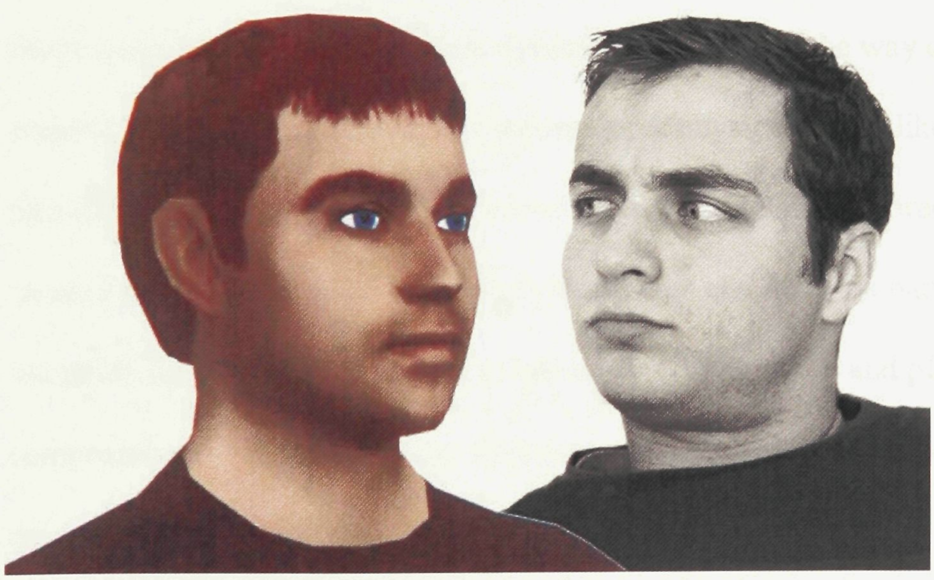

Fig. 13 A character of likeness is created in Uru, from the Myst series.

The overhead or "god" mode displays game characters from above – whether in plan (map), plan perspective, or at a slight angle with respect to the ground plane. *Simcity*, *Civilization* and *Age of Empire* are all examples of overhead games. These games focus on the large-scale interaction of buildings and cities in a constructed environment, rather than on individual characters.

2.4 Gaming Technology and Terminology

In this section I will introduce key terms, tools, techniques and technologies used in computer game design. Topics include polygons, real-time versus pre-rendered environments, bump and normal mapping, dynamics, in-game physics, game engines, and architectural implications.

Game Engines

A game engine is the piece of computer software that controls most facets of the game. Game engine components include dynamics that control the way objects move, and the manner in which the environment incorporates physical forces like gravity, mass and friction, and various modes like swimming, driving vehicles, parachuting, etc. *Multi-faceted* games incorporate multiple dynamic movements. If a particular game becomes too multi-faceted, the depth of the simulation will go down and play may be compromised. Meaningful play is said to stem from players making knowledgeable decisions with limited options.

Fig. 14 Screenshot of Age of Empire 3. From: GameSpy.com (5 Feb 2005) <http://media.pc.gamespy.com/media/721/721644/img_3070836.html>

Fig. 15 Screenshot of Half Life 2. From: GameSpy.com (5 Feb 2005) <http://media.pc.gamespy.com/media/492/492830/img_2466481.html>

Polygons

Polygons are two-dimensional shapes with three or more sides. They are the building blocks of scenes and characters. In the gaming industry, polygons normally refer to triangles because triangular shapes are efficient to calculate and are, by construction, always planar. When designing games, programmers attempt to optimize the number of polygons used in a scene (a combination of the environment, objects and characters). Too many polygons means computation-intensive rendering resulting in low frame rates and a breakdown in response times. Sluggish response times compromise interactivity and work against the *immersive fallacy*.

Texture and image mapping

Texture and image mapping refers to polygons having an image overlaid onto them. Otherwise polygons would remain single colors, only changed by an altered position to the light source(s).

Real-time light and shadow mapping

Real-time shadow mapping (as the name implies) is used in predominately in real-time gaming. It is one thing to render in real time a digitized model; to scale, move and rotate a player around a dynamically rendered environment. It is quite another to light the scene with complex real-time lighting algorithms that reflect reality. Real-time shadows dynamically calculate shadows on surfaces in a realistic fashion, following the rules of optics. New games present fresh real-time lighting ideas in realistic ways (e.g., light sources that sway and cast shadows that distort as they move, adding drama or suspense to a scene.

Normal Mapping and other technologies

Bump mapping, a technique similar to *normal* mapping, adds a displacement or height value to a surface map. This bump map is a flat greyscale image in which white represents high bumps and black depressions. When rendered bump mapped surfaces not only have color/pattern but appear to have raised surface detail. Bump mapping can create beautiful details on surfaces when rendered in still image format. However, when it is used in animations, pre-rendered bump maps imply lighting from one direction only, making real-time lighting on a moving figure quite unrealistic.

By contrast, *normal* mapping simulates shadows in all three Cartesian directions. Rather than a grayscale image mapped to the surface, normal mapping uses a three-colored palette (one for each direction in a three-dimensional virtual space). The resulting real-time rendering creates highly realistic, polygon efficient models/objects/environments for gaming. Normal mapping allows game designers to create highly detailed low-polygon models or meshes that have the appearance of a high-polygon model.

> *Similar to bump-mapping, normal-mapping encodes both the height of a pixel and the direction a pixel faces in a normal bitmap (standard bump maps just encode the height.) Using this normal map, a 3D engine can add detail to a low-poly model.*[4]

A wire frame shows a large number of polygons to produce a scene. Texturing and lighting will produce amazing results.

Dynamics and in-game physics

Until quite recently games had limited physics built into their real-time engine, limiting what a user could do in the environment. "The ability to effect the environment that is so proudly foreground is essentially limited to being able to inflict damage upon it, rather then to have truly multiple choice."[5] In-game physics, however, are absolutely integral to current first-person shooter games. In-game physics and dynamics mean that games have the ability to reproduce real time gravity effects on objects allowing objects to move in realistic ways. Each object is imputed, for example, properties such as mass, friction and buoyancy. Moreover players now have the opportunity to use these various objects in the game environment in order to complete certain objectives of the game. These real-time physical properties make environments more dynamic and believable. As game theorist Barry Atkins states, a deformable environment "is part of a basic strategy of 'immersion'. The concept that one might somewhat 'forget' that one is playing because there is no collapse into illogical lack of cause and effect."[6] This means that the objects change and react as the user interacts with them

In the game *Half Life 2*, for example, one must climb onto a platform and control a powerful electromagnet in order to pass a certain level. The objective is to transport the character's vehicle to another location. When a player experiences the interactive fun that comes with lifting and dropping the vehicle, the experience on the rig becomes an exciting portion of the game.

Artificial intelligence

Artificial Intelligence, or AI, is the ability of computer software to mimic, through programming code, a genre of behavior that may be considered intelligent. Games use AI technologies to program the user's characters and to give the human players a challenge. In the past, characters were programmed by simple code which produced simple and often predictable outcomes. Players could quickly and easily learn the patterns and overcome the challenges. Today AI-programmed characters receive certain characteristics such as speed, aim accuracy and physical fortitude as the game progresses.

The Internet's influence on the gaming industry

As theorist Katie Salen notes, "meaningful play emerges from the interaction between players and the system of the game, as well as from the context in which the game is played."[7] Today, meaningful play can also emerge from a multiplayer community environment. A game is played when players 'play' or make choices. The choices are actions usually followed by outcomes. Thus, this meaningful play resides in the relationships between these players, actions and events (outcomes) and their integration into the larger context of the game.

The gaming industry has leveraged increased speeds of communication over the Internet to accommodate physically disparate payers within the same game environment. In the 1970s and up to the early 1990s, primitive, text-based MUD (Multi-User Dungeon) games came alive only in the player's imagination. Now, by using the Internet to connect to a common server, multitudes of players can interact in a detail-rich virtual world —the design of which encourages players to challenge and inspire each other, fostering bonds and relationships. Now the story-telling space has become a social space where the actions of other players can influence the setting. Tellingly, "*Game experience may change during online play*" is written on the packaging of game titles such as *Half-Life 2*. Augmented by artificial intelligence, online games foster a new kind of shared virtual consciousness.

When virtual spaces become social spaces we have the opportunity to (re)design our bodies and revisit social conventions. Are these bodies metaphors for cyber-existence? Can they be considered metaphors at all? Consider what the components or characteristics of our physical bodies tell others about our culture, nationality, lifestyle, fashion awareness, job title, age, experience, status, sex, size, blood type, etc. Are these same characteristics important in the cyber world? If not, why are they important in the real world? Is cyberspace potentially a more equal ground for human discussion and human evolution? Is it a place devoid of discrimination or is it just different?

Virtual social spaces suggest a dualism between physical and non-physical realms. This kind of dualism existed in the Middle Ages supported by religious beliefs in a world beyond the physical, outside of the material domain. "This non-physical space metaphorically paralleled the material world, but it was not contained within physical space."[8] Medieval spiritual space was a separate and unique part of reality yet, to the extent that God was imminent in corporeal reality, shared characteristics with it.

Similarly, today's virtual social spaces are not entirely separate from our reality. Online gaming communities, for example, have meta-game aspects -- forces that bring the two worlds together. Gerhard Spiller states that we are "beginning to see that those organizations once called metaphorically alive are truly alive, but animated by a life of a larger scope and wider definition. [He] call[s] this greater life 'hyperlife'."[9] A kind of hyperlife is said to exist in the busy organization of a post office, a city like New York, in *Simcity*, in the Aids virus, as well as in online gaming communities. This hyper-life's diverse dimensions will be explored in Chapter 5 where associations will be fashioned from reality, from game spaces and from other places, between and beyond.

Massively Multiplayer Online Role Playing Games (MMORPGs)

As suggested above, Massively Multiplayer Online Role Playing Games (MMORPGs) are growing in popularity. In the past multiplayer games were restricted to a single level/map with a limited number of players. First-person shooter games such as *Quake* and *Half-Life* featured small levels with quick action that accommodate games lasting between 5 and 30 minutes. MMORPGs have recently broken records for the number of users that were online, playing the game at one time.

As an example we might briefly consider *World of Warcraft* (*WOW*) which went online in November, 2004. In this game format, each player chooses his own character and develops individual characteristics. According to developer of the game (Blizzard) and gamerseurope.com, *World of Warcraft* is the fastest-growing massively multiplayer online role playing game and has shattered all previous concurrency records in by supporting over 200,000 simultaneous players during the holiday period.

Fig. 16 World of Warcraft Screenshot. From GameSpy.com (5 Feb 2005)
<http://media.pc.gamespy.com/media/016/016985/img_2806170.html>

Fig. 17 World of Warcraft Screenshot. From GameSpy.com (5 Feb 2005)
<http://media.pc.gamespy.com/media/016/016985/img_2523287.html>

2.5 Conclusion

With that said we must still question why the gaming industry is so driven toward realism and why realism and immersion seem to be synonymous. Perhaps this realism is a call for a hidden architecture. The clever abstraction and symbolic representation of early computer games has given way to a reality factor – supported by the techniques and technologies described above. Will users bore of hyper-realism of a game and find it redundant? Perhaps, in reaction to architecturally rich virtual spaces, the real would become less real than the game, thus reversing the theoretical positions of the real and virtual. What impact might this have on architecture or the ways in which architects define what they do?

With the knowledge of the tools and techniques of gaming we are well positioned to make connections with the tools used by the Architecture, Engineering and Construction (AEC) industry. Parallel items can be noted when considering connections between the goals and aspirations of architecture and the gaming industry.

Chapter 3: Background 2 -- Architecture

> *"Since the dawn of CAD, the AEC community has sought the uber-intelligent building model – a single database that contains geometric information about a building's physical form, data on its components and their behavior, as well as cost, erection schedules and other non-design information.*[10]

3.1 Introduction

This chapter briefly describes digital tools used by architects – by way of better understanding how their use of digital technologies differs from that of game developers. Implicit in this discussion is the belief that architects would benefit from a better knowledge of the tools and techniques of the gaming industry – to expand both what they do and the ways they go about it. In particular, I believe that gaming engines have the potential to significantly enhance the design palette of the architect. To test (on a very preliminary level) this hypothesis, I produced a three-dimensional model of the School of Architecture building at Carleton University and used an engine from the popular game *Quake* to permit users to move through the space. The model accommodated real-time movement through a series of rooms containing diverse material and lighting conditions. This experiment is discussed further in Chapter 5.

To the extent that architects (or their clients) would benefit from the ability to immerse themselves in the designed space during its conceptual or schematic development, a tool such as this would be increasingly useful as the technology improves. With improvements in technology users will have the ability to make virtual environments increasingly realistic. Should we reach the point where users cannot or do not differentiate between the virtual and the real, we will have crossed a threshold into a new way of thinking about our designed world. Until recently visual realism and interactivity were mutually exclusive in the digital realm – the more polygons the model contained, the less interactive it was. Realistic visualization required scenes to be pre-rendered, limiting their ability to support real-time interactivity. Current technologies, however, accommodate both high levels of detail and interactivity, providing the means to bridge the experiential disjuncture between the real and virtual worlds.

With this in mind, a parallel yet diverging line of inquiry explores the impact of highly realistic virtual environments on the definition of architecture itself. When working with real-time technologies, a potential conflict arises when either the architect or game developer creates a space whose function and experiential qualities allow it to replace the real -- the digital version being in some way superior to the real. Chapter 4 will further explore these "crossover" environments while Chapter 5 will present the reader with some unique spaces and scenarios.

3.2 Digital Tools in the AEC industry

Numerous Computer Aided Design (CAD) programs are in use in the architectural profession today. The most common is AutoDesk's *AutoCAD*, used primarily for drafted (2-dimensional) drawing. While most CAD programs accommodate both 2 and 3-dimensional drawing, drafting and modeling are discreet undertakings and represent relatively independent data sets.

In *Hybrid Space: New Forms in Digital Architecture*, however, Peter Zellner states that "buildings [will no longer] need the plan/section/elevation convention, but rather [will be] fully formed in 3d modeling, profiling, prototyping and manufacturing software."[11] Zellner believes that detail-rich models will enable the next generation of designers, consultants, clients, contractors and fabricators to articulate the design and to interactively explore the building before it is built. Thomas Mayne, founder of Morphosis, agrees with Zellner. He contends that "in the future there will no longer be a need to draw plans; everything will be done in three-dimensional model format."[12] This idea is more radical than it sounds given the efficiency and effectiveness two-dimensional drawings as abstractions of data. Zellner and Mayne envision that orthographic projections will be generated, as needed, as views or sections through models. Presentation, working, shop and construction drawings would be derived from a single, multi-layered, virtual model that could be shared between users. Given the predilection for complexity in architecture today (to some degree fueled by the availability of digital tools), intricate calculations are required for building systems and architectural components. Digital visualization facilitates communication between the architects, engineers, fabricators and those constructing the building.

BIM -- Building Information Modeling

The use of technology to visualize the process of construction is known as *Building Information Modeling* (BIM), which is structured on the premise that a building is created as a total package in the form of a digital, three-dimensional model. This model functions beyond the design and construction phase of the building; it is used to control building systems once the building is finished and facilitates life-cycle maintenance.

As noted, BIM software aspires to a "uber" level of integration. It can incorporate simulations and programs that calculate unseen forces that an architect should know about in order to operate more effectively. Individual computer software packages track only a fraction of the total information involved in the construction and operation of a building. The vision of BIM is that the integration of these systems into a single package will allow architects to move to the next level of design -- where technical, code-related, and long-term maintenance issues can inform the design process from its inception. By joining individual subsets of information, designers will have access to all interpretations of the building, many of which normally come from structural, mechanical, and electrical engineers.

GIS – Geographical Information Systems

GIS, or Geographic Information Systems, is a powerful mapping system that combines a vast array of data in a map format. The system includes information on sewage, subway, cabling networks, high-rise buildings, crime patterns between jurisdictions, emergency routes and other connecting fabrics. GIS systems allow designers to connect proposed buildings into the larger infrastructural context. They feed into and expand the effectiveness of the Building Information Model.

Computer Simulations – structural performance, acoustics, environmental factors, movement and lighting

Engineers use a variety of simulation tools to aid in complex calculations. Advanced visualization in structural engineering includes *Progressive Collapse Analysis* (helpful for calculating the safest entry and exit points of a building) and *Buckling Analysis* (which visualizes the maximum safety of structures). Similarly, *Piping Systems* can help the architect to understand just how much plumbing is required. Together these tools facilitate visualization, integration and installation of HVAC systems.

Acoustics is the study of the physical properties of sound -- whose characteristics can be measured, quantified and charted. Using sophisticated software, architects and acoustical engineers can better control sound, considering the impact of a building's volume, shape, and materiality on acoustic performance. While, in the past, physical models were needed to test acoustics, "until now, there has been no guarantee that the new space will have any aural relationship to the reference space."[13] Today digital sound 'particles' – representations of the total energy produced by the sound source – are sent in all directions. Acoustic simulations show how sound energy flows, helping to identify echoes and improve the effectiveness of absorption placement. "Auralization is the ability to render accurately the sound of a space, whether built or not, while immersed in a controlled listening environment."[14] We now have the technology to actually hear an un-built space, and create amazing sounding spaces.

Water streaming and wind simulations can also benefit the design of virtually any building. Wind simulation algorithms permit designers to predict and mitigate harsh, windy conditions in urban areas. Similarly, large bodies of water can be studied to determine the environmental impact of a building on the water's edge, and various scales of currents can be studied to predict their impact on shorelines.

It is now also possible to simulate the movement of individuals through space. This software works by placing objects in space and using visualization techniques to interpret movement around them. Such simulations can be useful in determining the placement of emergency exits and in the design of urban public spaces. Vehicular simulations are at the forefront of highway and transportation hub design.

Lighting simulation is a component of most major 3D modeling programs -- whether as simple shade and shadow or sophisticated ray tracing and radiosity algorithms. To accurately simulate lighting, proper empirical data must be inputted into the digital model. Glare on surfaces can be calculated before the project is finished permitting, for example, materials to be modified to avoid problems.

Among the other forces affecting the design of architecture which can now be simulated are glare studies in airports, budget organization, material specification, lighting patterns, shadows, radiant heat and hot spots studies, water runoff, thermal drifts on the inside and outside of a building, etc.

3.3 Game Engines

As noted above, game engines could be a useful tool for the AEC industry – should the Building Information Model be adopted. Their multi-faceted properties would enable designers to interact with, examine and present design proposals in innovative ways. In addition to fly-throughs and eye-level walk-throughs, engines such as Ubisoft/Crytek's *FarCry* engine support movement through the scene in various vehicles. The night mission portion of *FarCry* requires players to don infrared glasses to detect heat-spots of enemies. It's not difficult to imagine how such a function could be adapted to permit design professionals to switch from a normal to a "temperature detection view" -- to observe air flows, thermal and material properties (acoustic information, light/radiance), electrical work, plumbing, HVAC systems, and structural stress levels (variable colors). Modern games also feature vast multiplayer options/modes, permitting disparate individuals to inhabit the same virtual space at the same time. Consulting engineers might, for example, congregate in the digital space with the architect to point out and discuss areas of interest.

Current game engines operate using parameters that coordinate game operations; these parameters include gravity, physics, AI, and the behavior of objects within the environment. If programmed with information relevant to architectural projects, these digital environments would follow virtual physics and permit forces, information, etc. to be realistically demonstrated.

Because of the improvements in inputting/importing models from *AutoCAD*, *3DStudio*, *Maya* and other modeling programs used by architects, game engines could be deployed at an early stage in the design process. The designer could inhabit the schematic model to assess the proportions of spaces, the influence of light quality/quantity, potential program layouts, etc. As basic decisions were made, detailed information such as color/material, lighting, etc. could be added and the model could be shared by way of soliciting feedback from others involved in the design or construction process.

Because of their familiarity with 3D design programs such as Maya and 3dStudioMax – many of which are used by game developers -- I believe architects could easily make the transition to the use of game environments. In this fashion, architects can be considered to be level builders.

3.4 Conclusion

Using the scenarios presented above I've attempted to make a case for the use of gaming tools in the making of architecture. These tools would allow architects to simulate various forces/decisions and provide them with an interactive way of addressing results, using *causality* as a means. The combination of architectural and gaming tools, coupled with the ability to undertake simulations in interactive, highly realistic environments, would change not only the way architects work, but their understanding of architecture itself. Vast multi-player virtual spaces may begin to look and act "real" – becoming indistinguishable from the real as our concept of the real changes. Roles may also change.

Architects currently use virtual models as a means to an end, namely to produce a work of architecture. Even in this capacity the enhanced digital model would generate additional synergy between the user (the designer) and the work. When the model transcends its function as mere model, however, it can augment the function of the building – whether used independently (in place of) or in addition to (in parallel with) the building itself. At the limit, depending on its ability to support functions in a meaningful way, the existence of a quality-rich virtual environment may obviate the need for the building itself, redefining architecture in the process.

The goal of gamers, in this same instance, is also event oriented. Events and interaction between users make the gaming environment similar to real-world environments. But rather than literal realization (with all of its advantages and limitations), the game is focused on a virtual materialization that fosters immersion and accommodates interaction with the environment, the parameters of the game, and with other users. These observations lead me to explore the varying degrees of interaction between the real world and the gaming world. Using a variety of media, I can investigate new spatial conditions that equate, merge and separate the real and the (gaming) virtual. The following chapter will focus on the immersive aspects of these tools -- envisioning things from a user's perspective, namely from the inside of a model and creating buildings within an experiential realm.

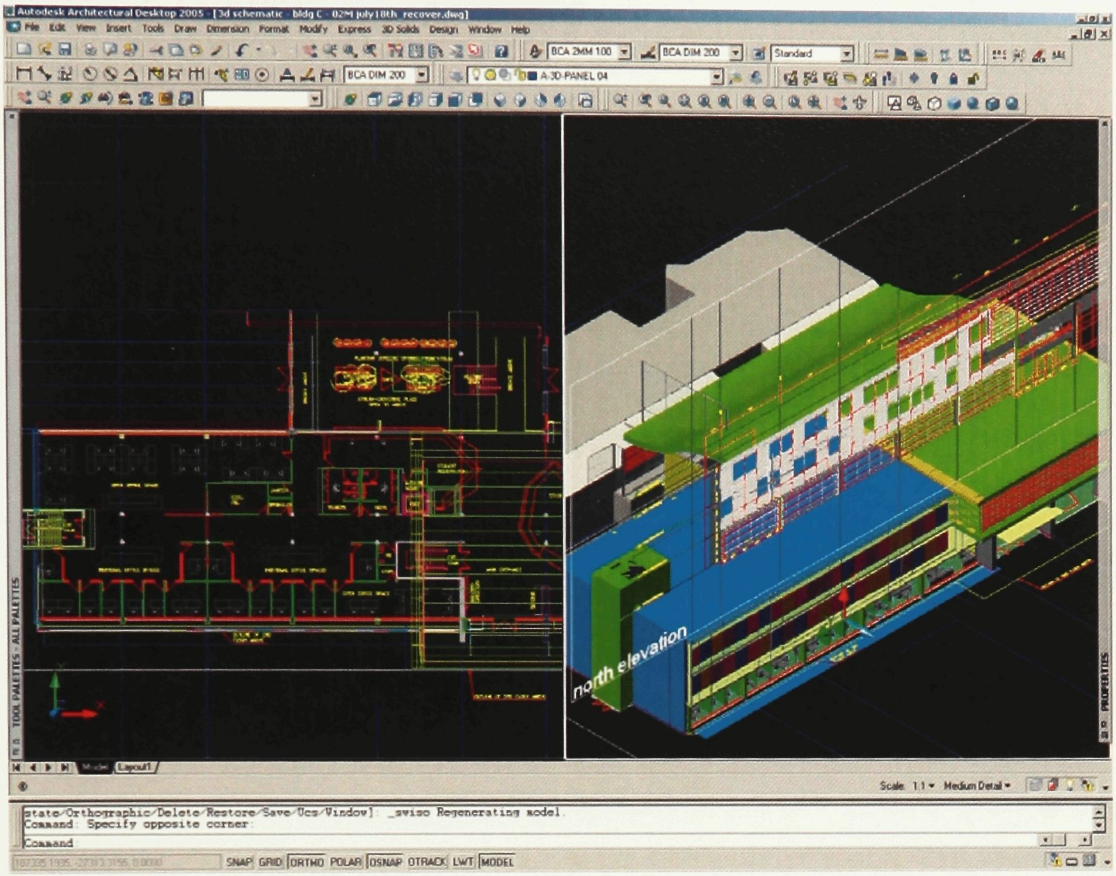

Fig. 18 Screenshot from Autodesk's AutoCad. Using 3d modeling to examine buildings as a whole.

Chapter 4: Crossover Environments

4.1 Introduction

This chapter will explore immersion and social interaction within virtual spaces – beyond their use as gaming environments and/or design-related tools. In order to test some of the observations I make in this chapter, it was necessary to experiment with various media. These experiments are described in Chapter 5.

Gaming author Eugene Provenzo observes that *"When you play a video game, you enter into the world of the programmers who made it. You have to do more than identify with a character on the screen. You must act for it. Identification through action has a special kind of hold. For many people, what is being pursued in a game is not just a high score, but an altered state."*[15] This altered state depends on the game's ability to alter a player's perception, to entice them into spaces and places beyond the norm, to make them forget that they are playing. Paraphrasing Katie Salen, in *Rules of Play,* interactivity is something to be experienced, rather than observed.

Level designers do not directly design play but design the context and structure to accommodate play . A level is a skeleton with obstacles, vantage points, and so on. While, in the single player games, the level is not exactly arbitrary, play requires the addition of rules, opposing characters, etc.. In a multiplayer mode, play results primarily from interaction between players, detaching it even further from the environment. In a similar fashion, architects do not design experience but rather the surroundings that accommodate various functions and experiences. Both level builders and architects design "spaces of possibility" in which meanings can emerge. However "purpose built," these spaces might be, they inevitably transcend the functions and uses for which they are designed.

On this basis, we can distinguish a game from the interactive virtual environment in which it is staged. Games will always attempt to challenge the player; there will be goals to reach, opposing forces with which to grapple, and criteria against which to evaluate actions and outcomes. In support of game-related interaction, today's virtual environments accommodate multiple players in immersive, detail-rich spaces. In an appropriately designed environment, however, users can develop their own rules of interaction, whether in addition to or in place of the rules of the game. I believe architects should pay attention to such environments. Beyond their usefulness for the design and life-cycle maintenance of a building (as discussed in Chapter 3), digital spaces can encroach on and overlap with the "real world."

4.2 Meta-Communication

Interaction and exchange between players that transcends the more literal aspects of the game may be termed as "meta-communication." Online games, for example, are fascinating for the deep and meaningful relationships they promote between characters, players and persons, cultures and communities. On-line games are occasions for open narrative, self-narrative, self-discovery, and immersion into new kinds of experiences. The following terms describe some known relationships between the self, the virtual and the beyond.

Immersion and Interactivity

Immersion and interactivity go hand in hand with game experience. As Barry Atkins notes, interaction must exist between computer and human user for a game to be truly immersive. *Cause and effect* contribute to the experience; without it, states Atkins, there is no learning, no knowing:

> *"The essential characteristic of what is termed interactivity in relation to the computer game is that is must watch the reader. We act. It reacts. We act again. It reacts again. It rewards our attention with attention of its own. This might be presented to us in 'real-time' but we are locked in a complex dialogue or dance with the machine that amounts to a sequence of exchange that goes both ways. Even not to act is an act, and signifies. And in that dialogue of absence and action rests the fundamental claim to interactivity of the computer game. […] The text we read watches us over time, it presents the illusion of 'knowing' us as we come to 'know' it, of 'reading' us as we 'read' it."*[16]

Immersive Fallacy & Immediacy

In Chapter 2, I introduced the concept of *Immersive Fallacy* – analogous to the concept of "suspension of disbelief" in film. As Salen and Zimmerman state, "The immersive fallacy is the idea that the pleasure of a media experience lies in its ability to sensually transport the participant into an illusory simulated reality,"[17]

Immediacy is the ability to authentically reproduce the world and create an alternative reality. While on some level every medium aspires to bring us closer to a more immediate and authentic experience, for every medium there is a different point where "immediacy leads to hypermediacy."[18] Take the example of using a webcam to communicate via live video to someone in another part of the world. The context in which we view the video image (within a web page, etc.) will have an impact on how immediate or artificial the experience will seem.

> *"Immersive fallacy would assert that a player has an immersive relationship with the character, that to play the character is to become the character. In the immersive fallacy's ideal game, the player would identify completely with the character, the game's frame would drop away, and the player would lose him or herself totally with the game character."*[19]

Today's top immersive games shuffle the player's awareness between person, player and character. Salen and Zimmerman explain: *"The phenomenon of meta-communication implies that game players are aware of the frame of a game and that a player's state of mind embodies a kind of double-consciousness that both accepts and refutes that frame."*[20] This play with double-consciousness asserts that the player is immersed within the character of the game while at the same time being aware that he or she is controlling a puppet, a tool or object. The player both knows and "forgets" the artificial nature of the game, being both player and character simultaneously.

Imagine a game that encourages players to constantly switch frames, questioning the inside and the outside, perhaps simultaneously. The immersive fallacy suggests that one's pleasure with a medium relates to the degree to which the medium transports the player into an illusory environment. Historically, these illusory worlds were created as paintings, photographs, moving pictures, color moving pictures (with sound), video (delivered via television), and most recently as immersive games like *Quake*. Is this progression inevitable? Will it continue, or are we approaching end of the line with respect to realism? Although the drive for increased realism seems to characterize the gaming industry, it doesn't necessarily take into consideration the meta-communicative nature of play. Indeed, immersion is not only a question of the "reality effect," nor is there a simple relationship between player/character, player/game, game/outside world.

The virtual as a threshold into the real

The next level in gaming (and/or interactive digital environments) may be to appropriate and incorporate the real – the presence of which would add yet another layer to the person/player/character relationship. A player could exit the digital realm into the real through a device such as a webcam. A character within the game environment could encounter a familiar image (whether on a screen, in a frame or in some other way mapped to a surface). As the character approaches, it becomes evident that what he/she is seeing is a real-time web feed of him/herself *qua player* playing the game. As a result, the character's vision completes a reversal in the loop by entering the physical person. Similarly, the player inhabits a virtual character to observe him/herself. This genre of inversion of the person/player/character relationship has not yet been explored in the gaming industry. As a research and theoretical proposition, however, this spilt could be quite interesting -- as it transcends familiar modes of game play and introduces a new viewpoint.

An example of the meta-game is in the title Far Cry. Here the clock on the wall shows the actual time. Realizing that game time can exist in the exact time as your own can be quite uncanny.

Disembodied consciousness/Virtual bodies

Human consciousness has always been characterized by dualism and dualities. The duality between body and mind is key into understanding immersion within digital environments, as is our ability to experience things empirically while simultaneously reflecting on that experience. We are always concurrently subjects and objects of our own consciousness.

As players we project ourselves into the game. Through thought, dreaming and all means of artistic creation we, as humans, attempt to transcend our physical existence and to project ourselves into a virtual or conceptual realm. Moreover we are always trying to resolve the physical and conceptual realms, to move transcendentally toward the conceptual without abandoning our empirical grounding in reality. Sophisticated digital environments permit us to transport our disembodied consciousness into a virtual realm where we can regain a *body*. Individuals become players, players become characters and, through characters, we inhabit new bodies. While only consciousness is required to immerse ourselves in the game, the body is recreated to permit the consciousness to act and to interact. The person/ player/ character relationship transcends its already-complex definition and aspires to additional dimensions of location and being. The virtual body is capable of being in two or more places simultaneously, of seeing more than one thing at time.

Sentient environments

Supported by in-game physics and artificial intelligence, sophisticated game environments can be said to have a consciousness of their own. They are “aware” of and respond to the position/actions of the players/characters. Cues to this *consciousness* may come from the surroundings as when the sun location and time of day adjust to the location and time of day at which the game is being played. Game environments may be darker at night (e.g., *Uru*) forcing us either to reset the date, time and location parameters of the operating system or to wait until daylight to accomplish a task. Another example can emerge from a currency within a game and its *value* throughout the virtual terrain. This occurs because a meta-game occurs within the game, interacting with the players, their characters and the environments that they come into contact with. In *SimCity* the environment has an explicit consciousness of its own. Here, invisible forces, values, cultures, and languages envelop the inhabitants, whether or not they are aware of it. While it is more difficult for an architect to design the same level of *consciousness* into a building, lighting and HVAC systems can be designed to recognize users, adjust to time of day, etc. Moreover, the BIM paradigm suggests that there is a parallel, digital version of the building that is used as a means by which to interact with building systems.

Parallel and hybrid worlds

When considering possible manifestations of layering, combinations, and overlaps between the real and the virtual, it is helpful to remind ourselves that redundancy has always existed. This section identifies and classifies examples of such overlaps, involving different levels of technology. Classifications range from "non-parallel and non-interactive" to "parallel and interactive." The goal is to better position the crossover environment (e.g., the MMORPG) within a history of artistic and technological endeavors. Neither the categories nor the examples are intended to be definitive.

Category 1: Non-parallel; non-interactive

A painting on the wall

A painting on a wall is an example of a non-parallel, non-interactive environment. Within the painting an image is presented to the viewer through the virtual viewpoint of the painting's frame. More often than not, the scene depicted is different than the setting in which the painting is displayed. Interactivity is limited to the act of looking, interpreting and/or reflecting on the image. Conceptually projecting oneself into the scene does not normally have an impact on the painting, although the scene is staged for the viewer's benefit and thus anticipates the act of viewing.

An LCD surface

Images (moving or still) displayed on a LCD or computer monitor are not necessarily interactive or linked with the real world. Like the painting on a wall, the environment from which we look is normally different from the environment at or into which we look. Not until the digital (LCD) and the real (captured by a video camera) are linked, do the environments become parallel.

A television or book in crowded room

Television programming depicts events and stages stories that captivate the attention of the viewer, drawing them into the narrative. Similarly, books bring non-parallel worlds to life in the reader's imagination. Stories and events may run concurrently with events happening in the reader/viewer's environment, dividing their attention between real and the virtual. To the extent that these narratives are self-contained and are not changed by being watch or read, we can classify them as non-interactive.

Category 2: Parallel and non-interactive

A mirror on a wall

Mirrors present us with parallel and reversed worlds. While we can use the mirror to see into our own world we can not alter the reflected version except by changing the real one. Using two or more mirrors, one can create a kind of infinite regress, overlapping reality and reflections with reflections.

Category 3: Non-parallel; interactive

A phone call in crowded room

Telephony virtually links its participants together, facilitating interaction through voice. The (virtual realm) in which communication occurs is, by and large, independent of the spaces that the individual parties occupy. Via telephony, parties can be two 'places' at one time.

Massively-multiplayer environments

MMORPG environments accommodate interaction both with the environment and with other players. By and large, however, they are non-parallel because the virtual environments in which players meet are independent from the physical environments that individual players occupy.

Category 4: Parallel; interactive

Parallel environments accommodate more than just simple communication between two parties. They overlay and intersect with the physical space that each of the participants occupy. By appropriating reality (via video feeds, etc.), they blur the distinction between real and virtual and challenge concepts of time and space.

Video conferencing

Video conferencing allows multiple users to communicate through voice and image. Signals from each user overlap and create a hybrid 'physical' setting. Even though users occupy separate locations they are able to come together and share their virtual identity and presence with one another.

Doug Back's gallery installation[21]

Doug Back's gallery piece, *Small Artist Pushing Technology,* is comprised of a rotating camera atop a monitor on a pedestal in the middle of an empty gallery. The video feed is played back on the monitor in such a way as to give the appearance of a real-time feed. Viewers position themselves in front of the monitor and wait for the camera to rotate to their location in order to see themselves on the screen. The video feed, however, randomly changes from real-time to delayed feed. Thus periodically the viewer is presented with an empty room (i.e., the absence of self) when the camera is pointing at them. The feeling can be quite unsettling. One must then think twice the relationship between the real and the virtual environment (the one of the screen) and one's assumption about the veracity of video images.

Supercity and Karlskrona2

Superflex is a company that carries out experiments within the design and architecture fields. Supercity, which was designed by Superflex, is a virtual city designed as a research experiment and used over the Internet as a local network. The primary project, Karlskrona2, was a virtual city that was created for the real city's citizens. The project's website describes it as follows:

The [KARLSKRONA]2 project is to create a digital copy of the city karlskrona in Sweden, to be called Karlskrona2. this copy will be accessible to the citizens of the city via the Internet, where digital representations of themselves (avatars) and the streets and buildings of the city centre will create a virtual version of the structure and personal relationships in Karlskrona (the real city).

Karlskrona2 will initially be an exact replica of the city but as the virtual citizens meet and interact things will change, buildings will redefine their function, social hierarchies will alter, laws will be reconstituted and renewed. The virtual Karlskrona will be visible to the real city through a large-scale video projection in the main square. Here citizens can gather in real space to follow the activities of their avatars and consider the divergences between Karlskrona and Karlskrona2

The project is designed as a research experiment, using the Internet as a local network rather than a global communication tool. Karlskrona2 is a "free space", in the sense of not having to obey the legal, economic or social rules of Karlskrona. At the same time, it is inhabited by at least part of the same community of individuals as the real city, bringing the challenge of virtual reality into the lives of neighbours and friends.

To what extent will be a fulfillment of individual or collective fantasies? To what extent will it conform to the pattern of Karlskrona? What new possibilities does the Internet's "free space" offer to an existing community? [22]

Endeavors like Karlskrona2 present opportunities to study many social phenomena. Real-world class hierarchies have been broken down in this virtual landscape, giving rise to new virtual classes and positions. In its virtual form, alterative societies were permitted to form both in relation to and independent of the "real" city.

Karlskrona is an excellent example of an overlapping parallel environment. Although a screen was set up in the main square to display the virtual version of the city, however, no real-time video connections were made between the real and the virtual. This one could see the virtual while in the real but one could not use the virtual as a means of (re)accessing the real.

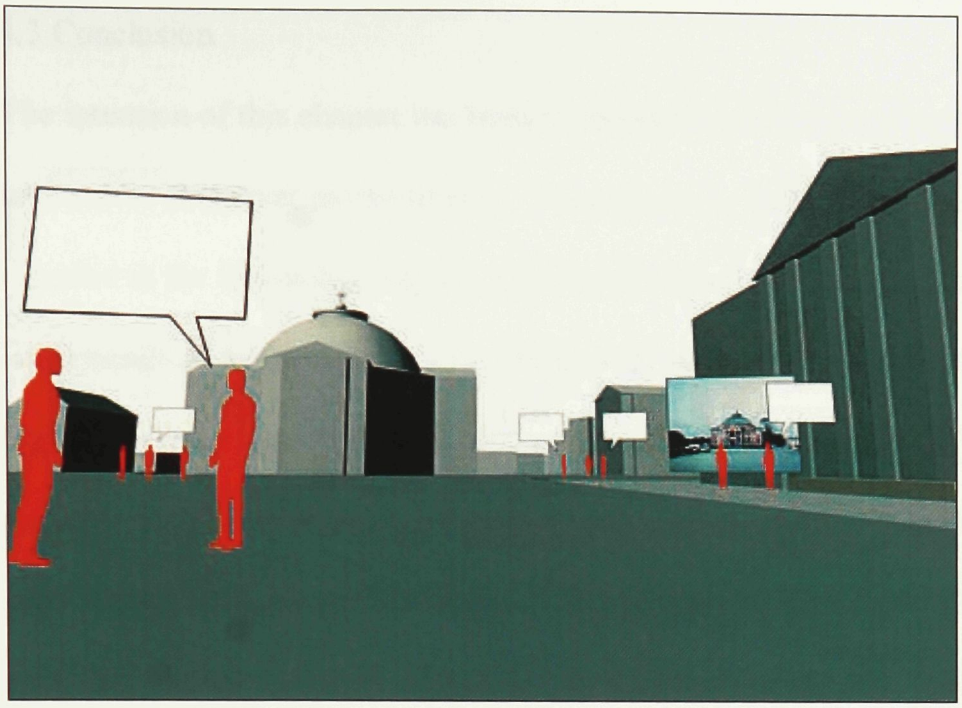

Fig. 19 Karlskrona2 From: <http://www.superflex.dk/> (5 Feb 2005)
<http://www.superflex.dk/karlskrona204>

Fig. 20 Karlskrona2 From: <http://www.superflex.dk/> (5 Feb 2005)
<http://www.superflex.dk/karlskrona203>

4.3 Conclusion

The intention of this chapter has been to introduce categories, examples and terminology to describe crossover environments. These form the basis of the experimentation I describe in the following chapter. By way of setting the context, it is important to understand the numerous ways in which we project ourselves into virtual spaces and how we routinely occupy both virtual and real realms simultaneously. We also need to consider the ways and degrees to which crossover spaces promote immersion and overlap with the physical spaces we occupy. The Meta-game, immersive fallacy and immediacy each describe the influence of gaming environments on people. From a phenomenological standpoint, these immersive *worlds* are as real as the physical. After all, communication and interaction take many forms and employ many media. Perhaps the *sentient* nature of a virtual space can reflect, shape and augment a community's consciousness – virtual versions can promote a stronger engagement with and appreciation of their physical counterparts. Perhaps, too, architecture can overcome its adversarial relationship to virtual space by using and appropriating it to enhance and extend the meaning of the built environment. Indeed, architects should have a stake in resolving the virtual with the real.

Chapter 5: Experimentation

5.1 Introduction

In this chapter I describe the various media and technologies with which I have experimented -- by way of exploring possibilities of overlap between the real and the virtual. As I am interested in embedding the real into the virtual (and vice versa), I looked particularly at photography, QTVR panoramas, and real-time QTVR-type video feeds. I hope to demonstrate how the use of these media can strengthen connections between the worlds of architecture and the gaming industry. While each medium can be used effectively on its own, using media together allows them to reinforce each other. These experiments focus on immersion and on the displacement of the subjective self.

Photography is the de facto technique for capturing images of the real world. Photographic media play an important role in architectural projects, as, for example, when demonstrating how proposed buildings fit into the surroundings. Photography is also used for site examination, documentation, and presentations. Panoramic photography captures images in a wide format – extending the frame in the horizontal direction. While photography an essentially two-dimensional medium, panoramic images can be digitally adjusted or stitched together to form a virtual space around the viewer. Apple's Quicktime player has been the forerunner of this technology and works both with photographs and digital models. Saving a digital model in QTVR (Quicktime Virtual Reality) flattens out a *360* view into a long image, then overlays the image to form an interactive virtual box when viewed within a QTVR player. Using QTVR technology, environments are taken from 3D capture to 2D map to 3D virtual box which is viewed interactively on a 2D screen. Interactivity, too, is an additional dimension.

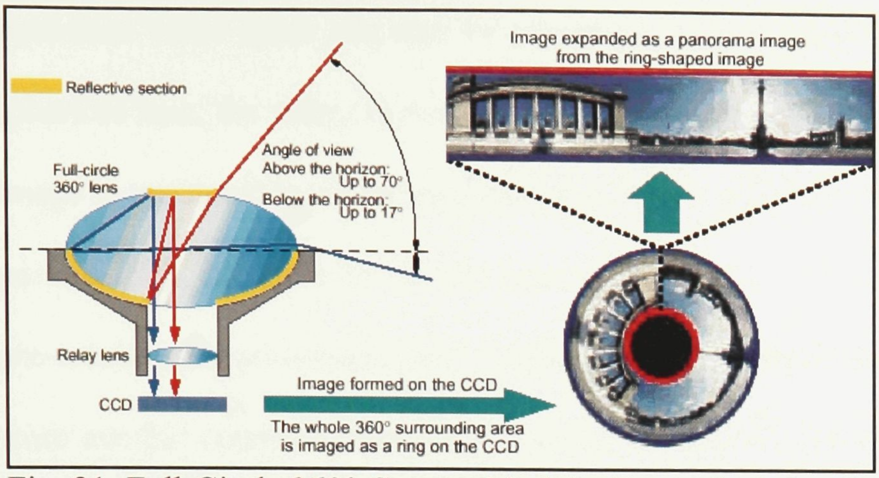

Fig. 21 Full-Circle 360° Camera Module From: Sony.net (5 Feb 2005)
<http://www.sony.net/Products/SC-HP/cx_news/vol34/featuring2.html>

Fig. 22 Partial Panorama created by merging many photographs together.

Real-time video feeds can also be channeled though a QTVR-like interface. Using a spherical lens, the video camera captures a 360 degree view of a scene. The distorted image is translated by either hardware or software into a scrollable, cylindrical image that permits us to interact with the real time video output. This live feed does not have to be pre-animated or pre-loaded since it captures what is already there. Imagine a live telecast from another country viewed in this form; because the viewpoint is not constrained, the viewer is free to explore the scene in all directions (the viewer is stationary but the view is not). Moreover, combining live (real-time) video feed with pre-rendered, hyper-realistic elements in a virtual environment allows us to blur the real and the virtual. The layering of the real, corporeal world with the virtual world represents tremendous possibilities for rich social spaces.

We have already noted that pre-rendered QTVR panoramas are used in games such as *Myst IV*. The game immersion is smooth and the interactivity with surrounding objects and characters is seamless. The surrounding space is pre-rendered, pre-animated and it appears as if you're surrounded by a movie, engulfed in the action. In this particular game, the object of the game is closely scrutinizing and manipulation the environment to discover the object of the game. QTVRs, as noted, would not be as effective in a first person shooter game.

5.2 Theory and Terminology

Information and Noise

As a discipline *Information Theory* studies the movement of information in a system, how it is transferred and received. Information can be said to be divorced from meaning as it is a measure of uncertainty in a situation. For example, if a situation is completely predictable, there is no information present. "It is a concept bound only to the quantification of stimuli or signals in a situation."[23] In this respect, information will always have an inherent noise. In many devices this noise is seen as a negative element. In the game domain, noise is not necessarily negative. "Sometimes entire games are premised on the notion of putting noise into a channel of communication."[24] Simple games like charades will have an innate noise, which is part of the game. This noise muffles the information that is being presented and, in turn, challenge the players.

Redundancy

Where noise affects the successful transmission of a signal, there exists a counterbalance called *redundancy*. Redundancy refers to the idea in information theory that information can be successfully transmitted even if some of it is lost. This occurs because redundant patterns compensate for gaps within the information. In the communication systems such as spoken language, more information than we need is transmitted. According to Warren Weaver, an information theorist, the redundancy of the English language is about 50 percent. He states that "half of the letters or words we choose in writing or speaking are under our free choice, and about half (although we are not ordinarily aware of it) are really controlled by the statistical structure of the language."[25] We could therefore eliminate half of the words we use and still transmit the necessary information, in the English language. Noise and redundancy are both integral to the way games transmit information. Redundancy is particularly important in games filled with "modular, interlocking informational elements;"[26] the game becomes more flexible, allowing many of its parts to be filled in. The system of redundancy found in language also applies to media such as the Internet (a somewhat text-based interface), through which it also makes its way into computer games.

Like games, works of architecture include *noise* and *redundancy*. This is explicit during the design stages when "modular, interlocking" elements are pieced together in a variety of permutations. Even in the final design, however, building codes require redundancy of functional elements like doors, exit stairs, elevators and windows. Similarly, *noise* can create interesting spatial conditions, such as accidental, unintentional or uncalculated spaces. To some extent noise describes the degree to which the whole is greater than the sum of its parts.

Convergence

Games are becoming increasingly comprehensive, featuring *real-to-life* environments in interactive, virtual three-dimensional space. In parallel with computer performance, gaming developers are pushing software to new limits. As performance-related impediments are overcome, software can emerge as a powerful tool for the architecture profession, in many facets of the discipline.

Convergence, as I envision it, involves the overlap and interpenetration of real and virtual spaces and being; in the context of this thesis, this means that integration of built and digital versions of the same architectural space. Using a webcam to pull the real into the virtual version of a space, permits the viewer to engage the real space on which the game space is modeled -- as in my experiments with the School of Architecture building. If the player logs into the virtual space from within the real space, video feedback can permit the player's character to confront the player as character. Through the eyes of the character in the virtual space, the player sees him/herself playing.

Contemporary games have not yet incorporated visual input from the real via devices such as webcams, although, as noted in Chapter 2, computer games frequently leverage the date/time and location settings of the user's operating system to synchronize the game with the user's environment. Games such as *Myst* and *Uru* also incorporate pre-recorded video footage into the digital environment, permitting players to engage with "real" characters as they navigate around. Sound, too, greatly enhances game environments, promoting deeper immersion and facilitating interaction between users. Today, five and seven-speaker surround systems make spatial recognition even more realistic and environments more immersive. In the game *Half-life 2*, the person/player/character relationship is fluid. This game includes the ability to view a computer screen as an object within the game. Made to look like a television signal in real-time, the screen displays what the camera in another part of the level is seeing, often a space visited before. Often these areas will be populated with enemies, giving the player something else to stress about. This technique projects the character's vision into another space, making it difficult at times to determine where the character is located. In most cases, one must recall and recreate the recently visited space in one's mind in order to recognize the position and direction of the enemy soldiers. In a (human user) multiplayer mode, being the voyeur for too long may have fatal implications, virtually speaking of course.

5.3 Experiments, Scenarios and Case Studies

In this section I will present several scenarios suggesting how gaming technologies and architecture might converge, merging the tools of visualization, experience and construction. Virtual environments resulting from such a convergence could be redundant, complimentary to, or be substitutions for built spaces. By and large the social spaces of MMORPGs accommodate individuals who would otherwise never be able (to afford) to meet. As both occasions and venues, MMORPGs do not present a direct threat to architecture. Beyond MMORPGs, however, I also envision *redundant* spaces in which the physical and virtual more directly overlap. The phenomenon of overlap also refers to the over-lapping and layering of being, body and consciousness -- scattered between the real and the virtual.

Quake III Arena - School of Architecture real-time model

To explore the convergence of information, noise and redundancy I constructed a digital model of the School of Architecture building at Carleton University using the *Quake III Arena* level builder. I then placed an interface/computer/window to provide access to this model with a room (the Hub) inside the School. This allowed "players" to enter the virtual version of the School from within the School itself. I also placed a webcam at the computer to allow users to see themselves on a screen in the game, which ultimately, created an infinite regress. The computer hosting the interactive model was also setup as a public Internet server to permit people outside the School to log in and explore the virtual model. This allowed students and staff (physically in the School) to interact with alumni (outside the School) as they explored the School together, using their virtual bodies.

The *Quake* experiment permitted users to experience the meta-game in a multi-layered environment. As noted, while in the virtual world, players have the opportunity to see a screen in the game that has a live stream of the real world via a webcam situated in the Hub. The user sits at a computer in the Hub, looking at a virtual self looking back at him/herself sitting at a computer in the Hub. The relationship between player/character, player/game, game/outside world continually oscillates. Embedding a real-time video stream into the virtual 3D model blurs the context in which the player views him/herself.

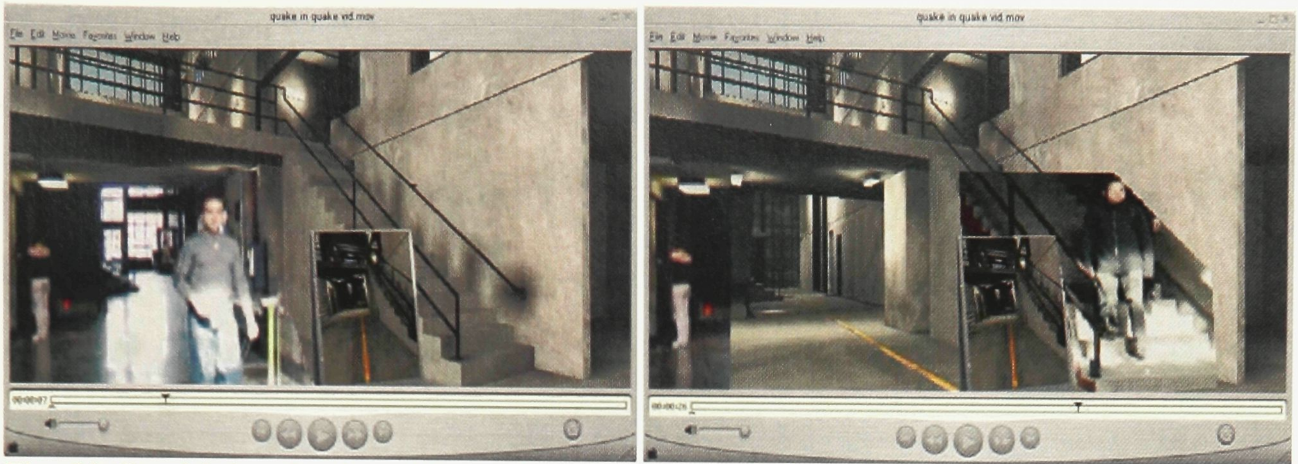

Fig. 23 Combining Quake with *windows* into the real via webcam.

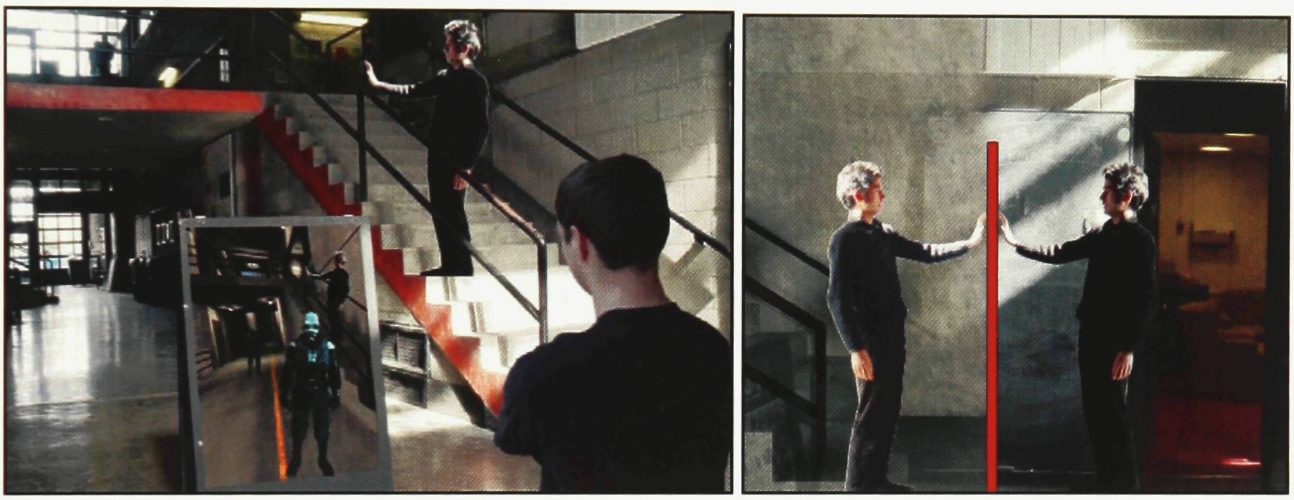

Fig. 24 Real looking into a virtual screen, seeing a virtual representation of a real person, captured in real space, projecting that into the virtual.

The QTVR medium

QTVR is used extensively on tourism and automobile manufacturers' websites to show products and places in a more meaningful ways. Historians and architects are also beginning to use this technology to describe their work – both built and digitally modeled/reconstructed. Embedding real-time video into a digital environment using QTVR, however, results in a conceptually confusing convergence of the real and the virtual, rife with possibilities!

I quickly explored convergence between a 3D model and panoramic photography in the central "street" of the Architecture Building. Various inputs and outputs can be placed in such *virtual* spaces; slippages occur and redundancies abound. The images below illustrate the potentials layering and juxtaposition of various elements. Perhaps, as in Doug Back installation, time could be become the ambiguous frame. At times these worlds could be overlaid and become synonymous with one other, only experienced with reference to the game reality, the virtual game reality.

The combined images could be a 3D model or game space, with the other being potentially a real time feed from cameras in the real space. Now imagine playing the game where at various points in the level one would encounter a window though which one saw a real-time, real-world feed. Like Karlskrona2, the line between the real and the virtual would be transgressed. What were once distinct realms would unite, and overlapping elements would reinforce the redundant aspects in both.

Embedding a real QTVR image within a digital image is one form of overlap. The digital presents real-time movements of characters with the real as a still image. Only the area in which characters cross the QTVR does the real give way to the digital. A person in the real world could walk around the environment and with the use of spatial locators, while their virtual self repeats those movements in the virtual world. The virtual level or map would determine where the user could or could not move, as would the real world's physical boundaries. The QTVR of the real would relay this information so that no irregular or physically-impossible events occurred.

In this scenario the digital presents real-time movements of characters, like in a game, while the virtual camera captures the surrounding area. The real is a live feed animated image. This kind of mode presents real-time feeds to both worlds. A camera would capture the position of the real players and project them into the digital game world. In the absence of support, the real players would not be able to interact with invisible game players -- the real players would only appear as walking ghosts in the virtual game world. In order to see the layering of these opposites, one would need a portal or virtual looking glass. As with *Karlskrona2,* the virtual city would be visible to real onlookers though a digital interface. A physical screen in the real world would give individuals a glimpse of the virtual world. Here, the transition of real to virtual is instantaneous, onlookers and the *looked-upon* will have a plane of transfer, which they are unable to completely cross.

Fig. 25 Real photography and stitching

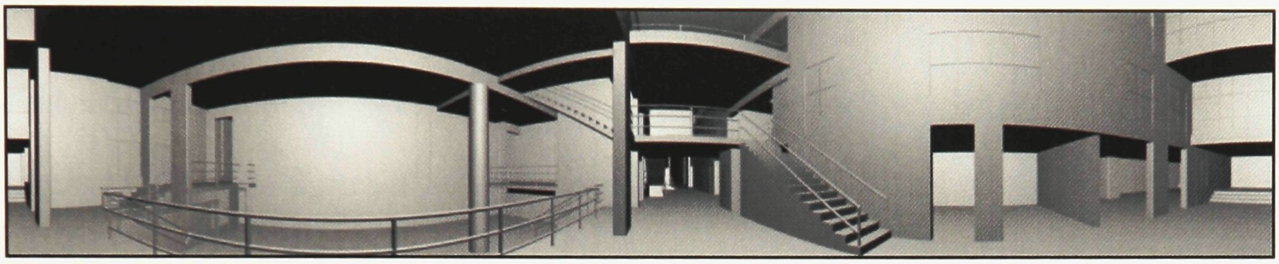

Fig. 26 Digital panorama

Fig. 27 Combining real photography and digital panorama

TDR – virtual transformation

This study led me to an exploration of the space of the Technical Data Room (TDR), also in the School of Architecture at Carleton. In this scenario, I first photographed the space then created a virtual model of the space using a game engine.

Technical Data Room – School of Architecture - Panorama photography – many photos stitched together to form horizontal "panorama". Similarly to Fig. 25.

Technical Data Room – School of Architecture - Digital panorama

The above images demonstrate a layering and overlapping of images to form a sense of cohesion between the photographs and the model. Wherever applicable, the user or programmer can manipulate the scene to determine where "tears" or changes of layer should occur. Real or virtual, what is important will determine how the media should be manipulated.

Fig. 28 School of Architecture & digital model played within the Quake game.

Fig. 29 School of Architecture model as seen through the character within Quake.

While the original model of the School created in *Quake* (see above) was a massing study of a more extensive space, I built a separate model of the TDR using Ubisoft's *FarCry* editor in order to explore the space in greater detail. The objective of the second TDR exercise was to become familiar with the software and to test the use of a game engine to explore blurring, embedding, subjectivity, and distinctions between the real and the virtual. In this scenario, game players enter the *game mode* in real-time, allowing for instant reaction and change based on cause and effect.

Real, Virtual and the Intermediate

Now, with the above as a preamble on multi-viewing environments, we can further explore new kinds of spatial conditions involving the real, the virtual, and spaces in between. One of these conditions involves the user being within the Game space, watching others watch him or her in a multiplayer environment. This kind of interaction occurs when a player projects him/herself into a digital character -- who may be designed to resemble the player to strengthen the bond between player and character. In the first-person mode the character would come into contact with other (human) users. An immersive field captures the characters without consideration for person context interaction, i.e., purely character to character. In the third-person mode, players can see their character and thus, project their individual characteristics into the character. Another level of imagination and visualization occurs when one can see another body mimicking what the mind thinks, rather than control through the body.

As discussed with respect to *HalfLife2,* one can watch a digital monitor within a game space and see the real-time positions of others in a different room or places. Such views or portals between virtual spaces add yet another dimension to the already complex laying of real and virtual. One can also be within a game space, watching a digital monitor, seeing oneself, watching the monitor, digitally or virtually. Such uncanny experiences prompt one to rethink the relationship between position, location and identity. Being neither singular nor unique, the concept of location becomes devalued, spawning parallel identities and subjectivities. But we have to question the parallel-ness of these split subjects. Are they in any way equal with respect to the character and the player? Or do they have a split-character. For a few seconds, while watching the monitor, you become aware of another cohesive layer of existence. One can think about it, by stretching the person/player/character relationship into a void where character extends itself by becoming a player and controlling another character or a pseudo character. Imagine a pair of virtual hands controlling what you are controlling, even though those hands are controlling what appears above them - a computer game. Who is controlling this game; you or the hands that you're controlling?

A user immersed in a game space watches a digital monitor and sees him/herself watching the monitor through a webcam. This experience may be even more bizarre since, rather than involving your virtual figure, the person/player/character relationship reverses and loops back to the player. Again, the person is playing a game and the player becomes the character. The character moves about the virtual space, and discovers a virtual monitor or screen where, with the touch of a button, the view zooms in to reveal a real-time video feed of a webcam showing the player in real space. The players character confronts the player as a character, playing. Who's in control? Who is doing the looking?

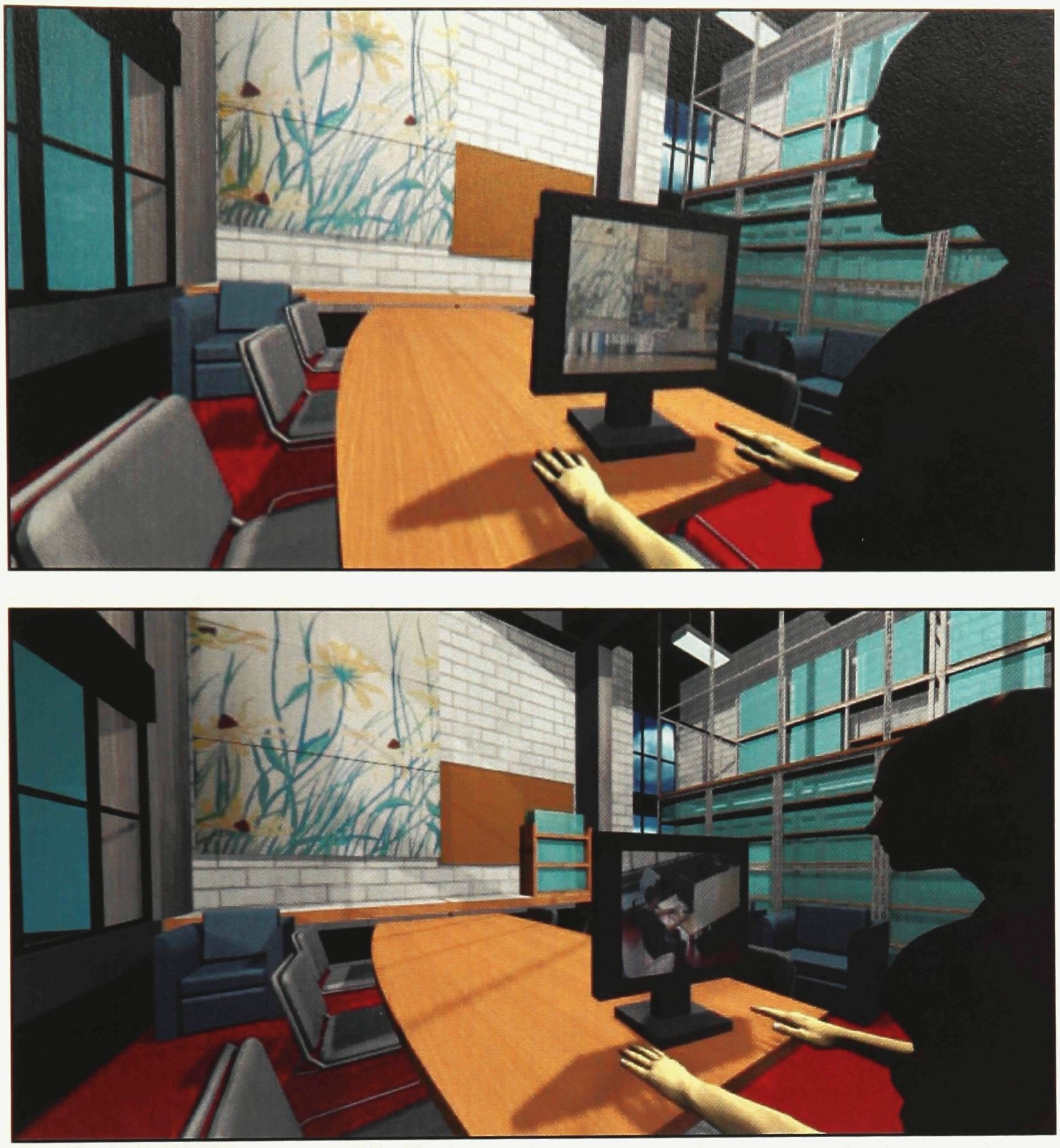

Fig. 30 Merging the real within a virtual context.

Fig. 31 Real and Virtual. Interchangeable?

Another scenario involves watching a digital monitor within a game space on which you see yourself watching looking into a monitor on which sits a webcam (obviously) that can be controlled by the character in the game. This transcends beyond the physical-less limit of the previous mode where one would only look through a webcam. In this capacity the character, controlled by the player, has the ability to move objects within the real, most importantly the webcam. The character will be able to control what it sees, to interact with the real. This might be considered to be an overly complex or redundant interface: real world into virtual, through game (character) controlling the real. Why not use a simple real-time monitor to control a robot-like device in real-time? Well, it depends on the goal of the interaction. Perhaps the potential of one's imagination is better tapped in an imaginative world like cyberspace or game-space. Perhaps one would make different choices as a character (within a virtual environment) than one might make in the real world -- free of the effects of gravity, oxygen, friction, mass, etc.

Another scenario involves a game in which a digital canvas displays a live feed image of, for example, the School of Architecture (e.g., the TDR or Pit). Rather than looking at an in-game monitor -- a virtual representation of a monitor -- the viewer here is presented with a screen. In both its position and what it displays, the screen presents the viewer with the real image of what they would expect to see within the virtual world. The screen introduces us to a different kind of view of the space -- one that is fragmented and/or artistically composed. Multiple cameras focused on a particular object or event, for instance, could present a cubist-like version of the space. Reversing the scenario where multiple characters view a single object, this scenario permits the player *qua* viewer to see the same scene from multiple viewpoints simultaneously.

Surrounding projection

Along the same lines, imagine that a live-feed image of yourself is projected onto this digital canvas within the game environment. The uncanny feeling that one might experience when seeing oneself on a computer screen inside a game is amplified by the scale of screen within the digital space -- surrounding and immersing the character in an overwhelming way. The screen displays the person as the same scale as the character, permitting the character to develop a more intense relationship with the image. In this form, subtleties such as facial features can be leveraged and experienced by others in the virtual space. The focus is on the immersive aspect.

Similarly, a large-scale digital canvas could be placed in (or projected onto a surface within) a real space and produce different effects. This screen could be located, for instance, in the central street of the Carleton Architecture Building and images could be projected to correspond to the viewpoint of the viewer. When looking into this digital window, then, one might see digital characters located within the digital level/map. These might appear as custom characters, representing alumni, professors and virtual visitors to the architecture school space. Given the scale and position of the screen and the fact that the viewpoints of the real and virtual are calibrated to correspond, these virtual beings would appear to be present in real space and time. When the image of the real, in turn, is projected onto a similar screen in the virtual world (as if from the opposite side) this screen becomes a life-size threshold between the real and virtual versions of the same world. Characters on both sides of the screen have an idea of who (and how many) are watching them. This fascinating intersection of parallel realities suggests a number of theoretical and technical ways to use the screen as an interactive medium. Touch screens, for example, could be used to support such explorations given that they accommodate drawing, painting, pointing, and expressing feelings.

Imagine being in real space and observing a 360 canvas on which is projected a QTVR image. This is yet another opportunity for exploration. This event involves a physically overpowering structure – a version of the old cycloramas. A virtual structure like this, created in the TDR of the Architecture building, explores how one might interact with such a screen. Surrounding the person is the digital model, including real-time characters imbedded into the curvature of the screen. Rather than looking into a screen, which is showing a selected portion of virtual space, this curved screen displays a near 360 degree real-time moving image (video feed) of another location and time. The video will not lie, but rather display what is there and surrounding the viewer with another place in the world.

As previously noted, the impression of a three-dimensional space can be created on a two-dimensional surface using a two-dimensional receptor (camera) and a two dimensional projector (e.g., a monitor). What would happen if the receptor and the projector worked in a three dimensional system? Rather than capturing an image this projector would be generating one, using the same idea as the spherical lens except that here the input and output would be inverted. A spherical input and output device would create a sort of surrounding real-time sphere of infinity. There would be no *proper* perspective in the traditional notion. The meeting of lines, parallel lines, and various layered images and spaces would be quite surreal. Depending on the viewer's position and on the position of the capturing device, the view could change and create something unexplainable.

Another interesting situation presents itself when someone in one space (e.g., the Architecture building) sees a real-time feed from another place in the world (e.g., a studio in Spain) projected onto a screen. Within the same space as the screen, a camera shows the people in Spain an image (of their image in the space?) of the Architecture building. In this fashion an infinite space can be presented to both parties if they both have the same equipment. Essentially, this equipment consists of a spherical projection screen, a 360 degree-lens camera to capture the broadcasting people, and an opposite spherical lens to project the incoming images onto the spherical screen.

People inside the sphere will see themselves on the canvas in the other location. This is because the image that is broadcasted will be seen again, repeating itself. This phenomenon is similar to that of feedback that musicians may encounter during concerts. When musicians place their microphones too close to the speakers, a loop of sound will eventually produce a screeching noise. The users of these surrounding screens will experience something similar. Users will not be able to overcome this infinite regress unless they make the canvas that they are watching invisible so that the viewers on the *other side* cannot see themselves on the screen. The screen must be eliminated or made virtual. A way to make the canvas invisible would be to create the same kind of canvas in VR. The redundancy that is produced is a direct feedback. Similarly, when an individual points a camera into the monitor where it is sending signals, the image overlaps and the image of an infinite space appears in the monitor. When examining this phenomenon closely there may be a slight, almost unnoticeable lag within the overlaying "windows". This is due to the speed of transmission and reception and equipment.

Surrounding virtual projection using VR goggles.

In a variation on the preceding scenario, users could wear VR goggles rather than seeing images projected on to a 360 degree screen. Participants would wear translucent or opaque VR goggles or a headset that would virtually surround them with a sphere of the real-time video feed of the distant space. In this capacity, the distant viewers can actually see the opposite space via the spherical lens real-time camera without interruption from an opaque sphere. Both parties could project themselves into the adjacent world through this virtual medium. Their presence would transcend the physical, being transmitted into the other realm in a digital format.

The situation suggests the potential incorporation of movement. The VR goggle wearer might be given the opportunity to move the camera viewpoint along, for instance, a track. Participants in the distant place may follow the moving camera, as if being led. Similarly, a distant virtual user may walk with a crowd of people in another location, experiencing the space in real time as if he were actually moving though it.

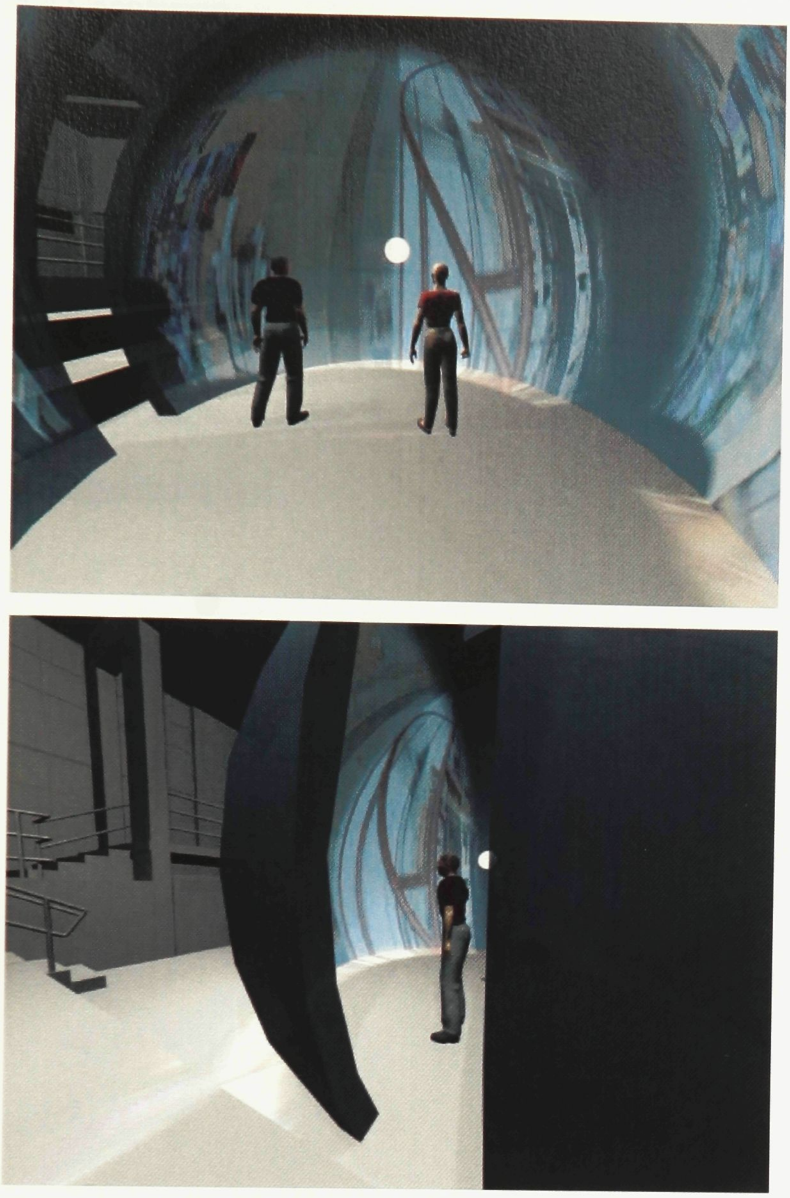

Fig. 32 A real 360 surround screen, projecting one's presence into another.

Fig. 33 A virtual 360 surround screen.

5.4 Conclusion

In this chapter I've attempted to describe a realm of possibilities for extending the real into the virtual (and *vice versa*) through the use of real-time video feeds. The details have been left to the imagination of the reader, for it is only though experience that the implications of these scenarios can be truly appreciated. Given architecture's stake in the real, this technology has the potential to challenge and expand our understanding of architectural space.

Chapter 6: Conclusion

There are many innovations in the gaming industry of which the architecture community may not be aware. Beyond the opportunities that new tools and techniques might represent (e.g., in the presentation of projects to clients), these innovations continue to redefine the boundary between and definitions of the real and the virtual. This thesis envisions a fluid and complementary relationship between real environments and their virtual counterparts. One way to explore/exploit such redundancies is to embed real-time video feeds into highly realistic, interactive, multi-user, virtual versions of the same environment, permitting subjects (players) to move fluidly between parallel and interconnected realms. Such environments would have profound implications on our understanding and experience of subjectivity.

Chapter 2 explored key aspects of the gaming industry. Various game spaces were described to present a chronological (re)definition of immersion in games. Among the newer technologies identified were real-time lighting, normal mapping, physics, Artificial Intelligence, immersion, interactivity and internet online gaming. Chapter 2 also explored the logic behind games, explaining what makes them attractive to players, describing the various viewpoints that one can assume within an immersive environment, and discussing the many similarities between the game level and the digital architectural model. While architectural models are used primarily to generate perspectival views, we can imagine major overlaps between the architectural digital model and the game – once the model is inserted into the game environment and the viewer becomes a kind of a player. Once immersed in the scene, information becomes experience; by contrast traditional forms of architectural representation privilege information over experience.

The distinction between information and experience is one of the major differences that this thesis hopes to help to overcome.

Furthermore, in the case of Massively-Multiplayer Online Role Playing Games (MMORPGs), gaming events include social interaction. Multiplayer environments now have the potential to incorporate webcams and voice over IP (sound) to present a more multidimensional immersion than is available though telephones and chat rooms today. Instead of facilitating interaction within a virtual cyber "nowhere," game environments support interaction in an experiential "somewhere" — a veritable place. This place is created by a virtual architecture in concert with characters that inhabit it. While the aspect of *place* is intricate by definition, complex to describe, and best experienced in person. Online multiplayer environments come in only a few "flavors," the most popular being the detailed digital three-dimensional world in which character interaction is shaped through text and the movements (dances, gestures, attacks) of the characters. In the last chapter of the thesis I explored alternative spatial conditions that could be supported within a gaming environment; perhaps even incorporated into architectural visualization.

Many of the media explored, especially photography, are visual. To perceive space, users require tools that support the use of their senses. As noted, Immanuel Kant's writings address the idea that the only way that humans perceive the natural world and its phenomena is empirically, through the senses. The limiting aspects of our bodily senses, cannot, however apprehend an unlimited world of matter and knowledge.

> *"What is delivered to our consciousness is the product of our bodily apparatus, and takes the forms it does because of the nature of that apparatus: there cannot be visual representation without eyes, or aural representation without ears; there cannot be thoughts or ideas without brains. But sights, sounds, ideas and so on, are not the objects external to us, they are representations of these objects. They exist only in the human apparatus that produces them."*[27]

With this in mind, I investigated tools that might expand the ways architects work as well as the spaces on and with which they work. Some of these tools help them engage invisible forces and phenomena (e.g., infrared light, sound visualization, various types of crop coloring in satellite images etc.). Chapter 3 comments on visualization tools used in the AEC industry.

Chapter 4 described various modes of being -- real, virtual, between and beyond. Combining real and theoretical phenomena, I attempted to describe that which is best understood through experience. Using the concept of meta-communication and the person/player/character relationships that typifies the gaming industry, I identified categories and characteristics of gaming spaces and suggested how they might be used in the formulation of a theoretical gaming design tool. The power of contemporary game engines has improved significantly in recent years. Using a game engine alongside current architectural tools suggests interesting possibilities.

Chapter 5 outlined the design experimentation I undertook as a part of this research. The scenarios presented promote a technological marriage between gaming and architectural visualization. By utilizing *Quake*, *Quicktime*, *FarCry,* and real-time video feeds, I explored how hybrid environments might challenge modes of being (real, virtual, and in between), allow us to leverage the redundant nature of overlapping spaces, objects, entities, and to extend our concepts of subjectivity. Using the game engine to support various modes of immersion and interaction, I was able integrate gaming environments with architectural models -- taking the digital architectural model well beyond its current, limited use for presentations purposes. These varying spatial conditions suggest new kinds of interactions that redefine concepts like presence and reality.

The current focus in the gaming industry is on making products increasingly realistic. Game developers would find it difficult to market games with *fake*-looking models due to gamers' expectations regarding realism, in-game dynamics and physics, real sounds and natural effects (fog, rain). A hidden architecture emerges in the gaming world when real-world's rules (passage of time, lighting, gravity, friction, etc.) are re-enacted in the virtual. For some people (players), this strong virtual realism creates a reality more realistic than the realities they inhabit. For them, the virtual is a more authentic experience than real life.

In the gaming industry, the imagination is often limited to trying to imitate the real. Rather than games reaching beyond the imaginable, they take on a subdued role in replicating the real in the digital format, presenting us with a virtual experience based solely on the real.

> *"C.S. Peirce, defines the virtual as follows: "A virtual X (where X is a common noun) is something, not an X, which has the efficiency (virtus) of an X." His definition does not adhere to either of the OED definitions strictly, as it indicates an "external form or embodiment," which does not reference itself and which stands in for something else ("a virtual (as opposed to actual) thing"), but in such a way as to be as effective in terms of <u>representation</u> as the actual thing."*[28]

> *"The farthest extension of the modern usage of virtuality is manifest in Baudrillard's notion of the collapse of the distinction between the real and the virtual. For Baudrillard, the enormous circulation of images that marks the last half of the 20th century (and is marked by* <u>*television*</u> *more than any other technology) introduces an ontological confusion in terms of the image that is not present even for Peirce; for Baudrillard, the virtual does not indicate a difference across orders, but indeed the complete collapse of orders, so that the real and the virtual become indistinguishable (on an ontological level). For Baudrillard, images have lost their ability to be virtual because a real referent can no longer be distinguished - what once was designated as virtual is now more present than reality itself (or reality is so imbricated with these images that the difference becomes moot). Against virtuality, Baudrillard posits the* <u>*hyper-real*</u>*."*[29]

Perhaps the gaming industry is striving for the hyper-real, motivated by a television-like concept of the authentic – the logical conclusion of which (as noted) would be increased incorporation of real-time video feeds. The virtual can however relate to the real in other than a mimetic fashion. The virtual has the power to distinguish itself from (transform, transcend) the real, by presenting a different set of rules (physics, friction, colors, light patterns, time systems, etc.) -- an infinite world of possibility emerging from (but not mimetically bound by) the real.

In terms of the impact of new techniques and technologies on architecture, new design software may take environmentally responsive architecture to new heights. Where building form is concerned orthogonal designs may give way to forms associated with nature. Perhaps new designs will take into consideration the function of a particular space and shape its geometry according to the dynamics already existing in adjacent spaces or the natural world. Newly developed materials or ways of assembling, can only be assembled using the computer; Frank Gehry's museum at Bilbao is an example of organic form, the use of new materials (titanium), and computer-based fabrication of building components. New materials and assemblages may become so complex that they can only be visualized and realized with the use of the computer, and will require gaming technologies to test functions, forces, etc.

Sentient virtual environments immerse players within rich spaces, leveraging cause-and-effect interaction to deepen engagement. Real world architecture is becoming sentient as well. Room lighting and temperature controls deploy sensors to automatically adjust to the presence and preferences of inhabitants. Perhaps walls, windows, doors and the systems of a building will become similarly automated in such a way as to respond to individual users' needs and desires. Building overhangs may automatically enlarge and change position according to the position of the sun and the user in the space. A fully conscious physical space would create a new kind of causality between spaces and inhabitants, and allow architects to conceptualize form in a more dynamic and organic way.

We've observed that architects use a vast array of digital tools as a means to an end, namely to model buildings that are intended to be constructed. For the architect, the virtual model is primarily a representation. Architectural design focuses on creating spaces that are appropriate their context, budget and to the functions they accommodate; form often tells about function and vice versa. More often than not, architects design spaces that accommodate events and social gatherings. This thesis has gone to great lengths to emphasize that contemporary game designers now also design social spaces that foster events and support shifting scenarios. Similar to the real, game environments promote responses to stimuli such as color of a space, material of walls, shapes of particular space and so on – they are neither functionally nor architecturally neutral.

Game and architecture design relate because they both promote the use of space for events supporting inhabitation and experience. Whether or not architects support what is happening in the game industry (or indeed are even aware of it), overlap between the disciplines is happening.

We observed that the digital model can perform a different function once the building is designed and constructed - extending and enhancing the experience of the actual building. With a diverse palette of virtual possibilities, a digital architecture can be explored in another way. Time and space can be adjusted, and buildings systems opened and analyzed in a new way. Anything that cannot be allowed or possible in the real world, could potentially be accommodated in the virtual. Like the real architecture, virtual architecture should be designed to inspire, support human activity and interaction, increase our range of experience, enhance relationships, promote a deeper understanding and appreciation of the built environment, and augment the quality of life; virtual or real.

I hope that the knowledge gained from this thesis will encourage students and design professionals to expand the tools they use to include gaming, photography and video. Exploring the subversive potential of new media will surely present, perhaps by accident, a new way of seeing ourselves, and of understanding and appreciating spaces, places, and the world around us. The kinds of visuals and experiences that gaming brings to non-gaming scenarios are astonishing. The incorporation of gaming into the architectural process has the potential to transform the way architects work – and transform architecture in the process. Whatever else they might be, the new tools and techniques represent a word of possibilities.

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