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The Exploration of Video Game Technology in Architecture

This work and its defense approved by:

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Voluntary Movement in Architectural Representation
The Exploration of Video Game Technology in Architecture

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by

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Abstract

Architecture has just recently started to explore the emerging potential of real-time rendering (video game) technology. This thesis argues that such technology provides for an improved sense of “being there,” compared with previous architectural three-dimensional representation methods. Current methods typically put individuals in the role of spectators who passively examine the space in the represented architecture. The new interactive medium enables individuals to be more actively involved with the representational environment, which in turn makes for a better understanding of its spatial, experiential effects. The sort of viewer involvement specific to this research is the ability to actively and voluntarily traverse the virtual environment in a manner similar to the voluntary movement capability of real-life presence.

In order to demonstrate the potential of an architectural representation method that allows for voluntary movement through space, this thesis will investigate current philosophical and practical discourse, as well as directly experiment with the technology by building a demonstration. Recent theoretical and philosophical discussions of digital technology and real-time rendering raise a variety of arguments, both positive and skeptical, about how we may encounter physically non-existent environments. Several philosophical bases for the discourse will be investigated, such as Merleau-Ponty’s theory of the perception of space. Merleau-Ponty tries to restore the cognitive role of the body against a philosophical tradition begun with Descartes that emphasizes the mind, arguing that in order to learn, the physical body has to be present. Learning requires “an active body coping with things.” (Dreyfus, 2001, p. 57) This account shows that a body, or a self, who is able to cope voluntarily with things is required for spatial perception, which is exactly what this technology offers as an enhancement over passive modes of representation. While real-time rendering technology cannot entirely substitute for
the presence of a real-life body, this mode of representation will provide a fuller, more engaged understanding of a represented space, considerably superior to any previous three-dimensional architectural representation.

Keywords

Architectural representation, real-time rendering technology, voluntary movement, virtual reality, video game
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Dedication

To my Parents, Flore and Emil.
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1 Introduction

Architects depend on visualization technology to allow for clients or the general public to learn and appreciate their visual ideas. From hand-drawn graphics on paper, plan drawings, scale models, literature, diagrams, perspective drawings, all the way to today’s state-of-the-art digital technology, the need to visualize ideas pushes the development of ever greater visualization tools. The emerging new media technology that allows for voluntary movement in virtual space, however, is an advancement that changes the direction of architectural representation.

Unlike the need for visualization with other art forms, architecture is considered unique, since architectural design utilizes a space or environment that is both artistic and inhabitable. Being inhabitable means that architectural design spatially surrounds every aspect of an individual’s life – functionally, emotionally, habitually, cognitively, psychologically, spiritually, and so on. The inhabitability of architectural design brings forward the significance of both private and shared existential space. The design’s apparent spatial enclosure is not always the same as the individual’s private existential space. Its existence is based on the fact that every human activity operates spatially (Norberg-Schulz, 1980, p. 223). According to Norberg-Schulz, private existential space is constituted during mental development through interaction between the individual and his environment. The result is an image which consists of three-dimensional relations between meaningful objects, which will not be visible without the ability to interact within the space. Norberg-Schulz continues that the basic understanding of the meaning of spatial experience is already established and acts as a context for what is actually being
experienced (Norberg-Schulz, 1980, p. 223). Similarly, according to Michael Benedikt, architecture of real qualities should be found useful and beautiful, like a tree (Benedikt, 1987, p. 52). Architecture in reality should be understood in its own existence, and be experienced as it is. It should therefore be able to be immediately understood as it is while one experiences it, not when involuntarily given an imposed understanding by a second or third party. As Ortega y Gasset, Merleau-Ponty, and the existentialists and phenomenologists of this past century have pointed out, just being alive is enough to guarantee the world’s meaningfulness (Benedikt, 1987, p. 10). When one is learning about architecture in person, one is “always already” embedded in the “experience” of it, “interacting” and giving “feedback” with his/her surrounding enclosure. While visualizations have focused on the visual aspects of design ideas, these humanistic aspects have not been effectively embedded in the representation.

The need to consider other means of representing architecture arises from the visual representation’s failure to provide comprehensive architectural representation. To remedy this problem, architects have used alternatives such as literature to expand the passive visual-centric architectural representation.

Moving forward from manually hand-drawn images after the verge of the digital era, architects started using three-dimensional digital simulation software to represent their designs. Architects have used computer graphics technology with which any kind of three-dimensional object can be rendered easily without the usual perspectival chores of hand-drawn rendering, but at the same time requires large amounts of time to render the final image.

Recently, the growing popularity of three-dimensional video games has accelerated the development of its underlying technology, real-time software graphics simulation technology, or real-time rendering technology. Since its inception, real-time rendering technology has attempted to create software that is able to render simulated images instantly, or at least at a
rate of two images per second, to allow for real-time interactivity with the computer user. Early attempts required a great geometrical reduction of the three-dimensional model to allow for this immediacy, hence making the simulated image look very bland and unexciting. However, advancements in computer processing capabilities have allowed the software to render more realistic simulated images in much less time, and therefore to make real-time rendering with better quality increasingly possible.

Realizing the broad opportunities for experimentation in architectural representation, this study will examine this new and emerging technology. The prospects of this technology are greatly promising; despite its limitations, the technology has succeeded giving video game players a sense of “being there” in the virtual video game world. This sense of “being there” is one of the most compelling learning opportunities for architectural representation. At the present time, implementations of this technology in the field of architecture have been limited.

Pertinent to real-time rendering and real-time interaction is what is considered as virtual reality. Virtual reality has been of major interest to the Information Technology (IT) world for some time, and has been considered as the future of digital representation. Architects have in turn become familiar with fly-through systems that allow people to explore the details of a virtual object by moving rapidly through a series of computer generated images, and with systems where users put on gloves and goggles to manipulate virtual objects that seem to be actually there (Sakamura, 1999, p. 6). Though there has been much experimentation, an established “industry standard” has not yet been reached in the application of navigation

Figure 1 – DOOM (id Software, 1993)
technology to architectural representations, for public or client audiences. The complexity and the effort necessary to build comprehensive virtual reality experiences with such a method are overwhelmingly difficult and expensive, therefore making it impractical in many ways.

Video games have very broad public penetration and are economically successful, while having most of the properties and features of virtual reality. Very few comprehensive virtual reality implementations have actually reached common public use. Video game technology is not as comprehensive in terms of the number of devices attached to the user’s body; however it has been successful in conveying a strong sense of being inside a virtual world. It is much more feasible, therefore, to use this technology as a more generally available method of representing architectural design.

![Image](image_url)

**Figure 2 – Half Life 2 (Valve Corporation, 2008)**

Video games have a fairly long history dating back to the late 20th century (Whyte, 2002, pp. 8-15). The first commercialized video game consoles beginning with the Atari console in the 1980s and up to the latest iteration of high-performance consoles such as the Microsoft Xbox 360® and Sony Playstation 3®, represent significant technological advancements. Video games
have also been implemented in personal computers, which have gained popularity because of their flexibility and modifiability. They have progressed from two-dimensional (2D) monochrome or four-colored simplistic game mechanics to become powerful immersions of personal experiences in photo-realistic three-dimensional (3D) spaces with lifelike artificial intelligence made possible by advancements in computer hardware (Whyte, 2002, pp. 8-11).

Unlike console machines, personal computers are both consoles (the device or platform where the video game program is intended to run) and development machines (the tool to develop the video game program). Originally built for military workstations in the 1960s, personal computers (PC) have now found their niche as entertainment centers, where individuals do their everyday activities, such as watching movies, reading electronic books, listening to music and playing games, in addition to business purposes. Moreover, PCs come in various sizes, from desktop and workstation PCs to mobile PCs which people use when traveling, to PCs that fit in a shirt-pocket. With such pervasive availability, this medium promises a great opportunity as a strong platform for the development of a standardized, public-reachable form of real-time rendering applications.

Despite the promising features of these technologies, this thesis will also examine numerous accounts which are skeptical, or even outright reject them. Hubert L. Dreyfus, Professor of Philosophy at the University of California at Berkeley, has been very skeptical as to the promise of teleconferencing, which lies in the domain of virtual reality. He argues that whatever is not real (virtual or otherwise) will not be in any way comparable (and thus not represent-able) with what is real. He uses examples that defeat the compelling promise of having electronically mediated human activities (Dreyfus, 2001, pp. 50-72). As practicing architects and theorists, Alberto Perez-Gomez, Juhani Pallasmaa and Dalibor Vesely also have skeptical views of digital representation techniques which are considered as “shifting the
inclination toward the visual (while ignoring other aspects),” “inhuman,” and “deceiving perspectival hinge.” Perhaps controversially, this project will examine and refute such accounts.

This project will explore the aforementioned technological medium and its capacity to portray architecture, in the context of contemporary technology. Additionally, this thesis will examine a selection of well-developed video game titles in regard to their portrayed architecture, as well as some well-known real-time architectural visualization projects.

The goals of this thesis can be described in the following points:

1. To prove that computer-game visualization can successfully deliver architectural representation.
2. To demonstrate the effectiveness of interactive visualizations in portraying the embedded, experiential dimension of spatial perception.
3. Provide guideline for best practices of the new media in architecture.
4. Evaluate currently available commercial and non-commercial game-engines (real-time rendering software).
5. Build a simple, virtual-space experiment which uses most of the important aspects of human-space interpretation and interaction.
2 Media Technologies Revisited

This chapter will examine the historical backgrounds and compare different varieties and case studies of media technologies available for architectural representation. This chapter will also explain the fundamentals of why real-time rendering technology is considered an important leap towards better architectural representation.

2.1 Evolution of Media

Media technologies have evolved quite distinctively, resulting in better or at least different media by which artists may unleash their freedom and creativity, while again providing better and/or different accessibility for disparate audiences. This development does not only affect the product, but also the design itself and its process, as well as the way we look at architecture and its practice.

2.1.1 The Perspective and Scale Drawing

Since the 15th century, perspective and scale drawing have changed the profession of architecture. They separated the process of constructing buildings from the design process, establishing the position of the Architect as distinct to that of the Master Builder. Because of this distinction, architects started to be separated from the physical building, therefore focusing more on the image of representation.
Thanks to perspective renderings, architectural designs could be visualized before their construction. According to Dalibor Vesely, the emergence of pictorial perspective cannot be attributed as a breakthrough by few individuals, but rather to a series of cultural shifts that took place in Europe over the course of a hundred years (Vesely, 2004, p. 110). The fifteenth-century introduction to perspective was laid out in Leon Battista Alberti’s “Della Pittura” (1435). The use of perspective made it possible to see an accurate, two-dimensional graphic representation of what the eye perceives.

Filippo Brunelleschi (1377-1446) was the first to prove perspective’s accuracy by relating a painting representing an object to the object itself. In order to do this, he held a painted perspectival representation of the Florentine Baptistery of the Church of San Giovanni (pictured) before his face, cut a hole in the painting, and viewed it by holding a mirror in front of him (Vesely, 2004, p. 131). The result was that the perspectival image matched the actual object. Brunelleschi’s experiment held true according to certain given conditions, such as the position of the observer and the experiment’s manipulation of the viewpoint, and his technique was limited to monocular vision.
The law of perspective was reaffirmed later in the 19th century, however, by the introduction of photography. The accuracy of a photograph was considered objective, unlike perspective painting which depends upon the skill of the painter.

2.1.2 Computer-Aided Design

Computer-Aided Design (CAD) came about through the development of computers in the 1960s. The development of CAD software revolutionized the production of working drawings by making it possible to edit and revise without redrawing. It also established the change from traditional hand drawings into computer-generated images. Most architects today, in fact, use CAD software to produce technical drawings. While there were no changes to the basic underlying technique of perspective, the development of computing technology allows computers to instantly calculate and simulate masses and volumes with perspectival accuracy. Earlier CAD software, however, lacked photorealistic qualities; therefore hand-drawn images or paintings were still commonly used, especially for public relations and marketing purposes.

The product of this technology is still two-dimensional images, mostly printed on paper; however the design process has shifted towards the use of electronic screens. Architects now sit in front of machines, interacting with the electronic input devices, instead of drawing with pen and paper on drawing boards.

2.1.3 Computer Graphics (Animation) or CGI (Computer Generated Imagery)

Later on, the popularity of CAD spearheaded developments into more advanced representational techniques following advancements in computer technology. Another variable came to light thanks to digital simulation: photorealism. In addition to perspective calculations,
photorealistic computer-generated images require calculations of many other variables, such as shadows, illumination, material reflectivity, refractivity, and many more. These simulations apply the laws of physical phenomena and implement them in the software running on powerful computers. The result is an image that can either be a substitute for, or be superimposed upon photographs.

This technology also made way for synthetically generated computer images which integrate with or alter “real world” visual and spatial information using traditional video cameras or film, producing surreal or impossible scenes, as in movies or documentaries. It also allows for the possibility to produce full-length feature films solely through computer graphics. All of these can be made easily because of advancements in intuitive graphical user interfaces between the individual and the computer. These movies are created with professional software, but can be played back with software players that are available to anyone. Architects began using them, therefore, for one very apparent reason: the opportunity to allow their clients to walk through their facility before any brick is laid.

Using computer-generated imagery (CGI) visualization methods to represent architectural designs finally bestows design ideas with a more faithful, life-like appearance. This method, however, still has a number of shortcomings:

1. The tendency to focus only on certain aspects of the building while ignoring other aspects that may be in need of critical attention;

2. The tendency to tamper with and manipulate produced images to “enhance” the effect and to hide any unobvious flaws/mistakes in gaining design approval.

3. Even though CGI visualizations in movies and animations feature realistic images, they are, in a way, inefficient for use in architectural visualization since architecture not only
involves what is seen by the eyes, but also what is “seen” by (and felt and interacted with) the body. That is, the ability to voluntarily move about in the built space.

2.1.4 Three-Dimensional Interactive Media

While watching a walk-through movie of the interior of a building may be a very compelling experience, it is certainly different from “walking through” the actual building. A more suitable comparison for this involuntary experience would be watching a film of a “rollercoaster ride,” as distinct from riding a rollercoaster. As computers’ capability to receive input instructions and the speed of processing increased, so did the demand for the creation of interactive visual experiences, not merely passive ones.

While electronic three-dimensional interactive media technologies were available commercially as early as the 1990s, their technological uses were more oriented toward professional development. Although visual quality was crude from the standpoint of the press, professionals already dubbed the technology to be immersive and convincing (Gross, 1994, p. 56). Interactive media technology quickly gained popularity with the common public through the entertainment industry. Used extensively, especially in the video game industry, it made possible both faster computational capabilities and advanced “geometry-simplification” algorithms, which developed rapidly because of the constant demand for improvement and for gaining a competitive niche in the market.

Interactive media technology uses the same method as computer graphics animation techniques but it renders the animation in real-time at thirty frames per second or more, while simultaneously allowing the software to receive control feedbacks which can interactively alter the animation. The result is comprehensive real-time interaction and feedback between the audience and the images being continuously produced, which also can be combined with
scripted multi-point aural simulation, and psychological visual effects such as stereoscopic images, weather effects, changes in color and physics simulation. Therefore, it can be said that this medium attempts to simulate the free will of bodily movement in a dynamic environment, which opens up new possibilities for the understanding of space, and allows for an experience that is not available in previous passive three dimensional representations.

While not essentially a medium that possesses a physical form, the practical substrate for this technology is the computer hardware and its peripherals. The active nature of the technology, which requires a specific hardware at this time, becomes a limiting factor. In the future, however, as computers become even more pervasive, computer hardware in a much more diminutive form will be as common and as cheap as light bulbs, for example.

Meanwhile, the peripherally bound nature of the medium adds an unintuitive connection between the user and his machine. Passive modes of architectural representation naturally stimulate the human visual and auditory senses, closely resembling the presentation of its real-life objects. These interactive peripherals, on the other hand, hardly resemble real-life counterpart actions; to effectively immerse himself into the representation, an individual needs to learn the skill to master the peripherals, which is a non-intuitive barrier.

2.1.5 The Future Medium

Better electronic display technologies are constantly being developed, the latest being electronic displays that are as flexible as a piece of cloth, and can be embedded in almost anything. This allows for the all-pervasive use of digital content that can be viewed on even the most mundane objects, such as water bottles and soda cans.

Another iteration of future display technology being developed is the Virtual Retinal Display (VRD). In 1991, the University of Washington’s Human Interface Technology Lab
(HIT) invented this concept, and began development in 1993. The VRD projects a modulated beam of light directly onto the retina of the eye producing a rasterized image. The viewer has the illusion of seeing the source image as if he stands two feet away in front of a 14” monitor. In reality, the image is on the retina of its eye and not on a screen. This technology allows for the possibility of building a virtually large or fully inclusive stereoscopic display capability with small, lightweight, glasses-mountable equipment (Naval Postgraduate School, 1999).

2.2 Learning from Video Games

This representational technology is currently popular in the video/computer gaming industry. According to the Merriam-Webster Online Dictionary (2006), the word “game” means “activity engaged in for diversion or amusement” and the word “video” means “the visual portion of television.” Interpreting these meanings as early descriptions of the enactment of the video game, the term video game thereby means an activity used for amusement via the television set. This description explicitly matches console gaming platforms, such as Atari, 3DO, Sega, Nintendo, Sony Playstation, and Microsoft Xbox. They are independent dedicated computers that are specifically designed to run commercially available video game software sold in proprietary cartridges or compact discs. These dedicated machines plug in directly to any household television set; hence the origin of the device’s naming convention. For the purpose of this study, a video game can be defined as a computer-controlled virtual universe that players interact with it in order to achieve a certain goal, or a set of goals (Wikipedia Contributor, 2006). The two most important concepts to consider are:

- The video game is a simulation of a universe that can also be dubbed ‘virtual universe’ or “virtual world”;
• The video game, as a game, requires the player’s intervention into or interaction with the simulated universe to achieve a certain predetermined goal(s).

In the early days of video games, the visual quality could not match or even come anywhere near to that of CGI visualizations because of technological limitations at the time, which required geometrical simplification to allow for applicable real-time rendering capabilities. However, computational speed doubles every two years (Intel Corporation, 2005), thus providing a constant definite improvement over time.

The video game industry has developed significantly over the course of only twenty years in the public entertainment domain, in recent years competing with the Hollywood movie industry, which emerged in the early 1900s. Instead of being advertised as video games, contemporary video games sometimes are advertised as “cinematic,” thereby suggesting a cinema-like experience. In reality, this claim is questionable, and its usage is understood as a marketing tool despite the fundamental difference between video games and films. The comparison, however, expresses the video gaming industry’s move toward providing increasingly realistic environments, visually on par with the photographic standards of the cinema, which is the ultimate standard for mass entertainment.

Previously, video games were associated with blocky pixilated images, symbolic graphics and animations, and unexciting computer beep sounds. By inserting the word “cinematic” into their advertisements, the video game industry tried to put that outdated image to rest. At the current stage, typical real-time rendering hardware can render fifty or more
frames-per-second\(^1\) with a visual quality comparable to advanced CGI animations of the late nineties, which at the time could take hours to generate only a single frame image.

### 2.2.1 Categorizing Video Games

Video games, as a broad term, come in many flavors. There are various types and modes of video game play, or in other words, the “game play.” In association with architectural representation, the game play type referenced in this project should utilize three-dimensional/spatial environments and character impersonation. Because this type of video game tries to provide the experience of being in a particular spatial scenario, scenes must be spatially interesting and believable, which is the same goal as any architectural representation. It is apparent that a video game cannot literally put a player into the synthetic environment because of the mediated nature of the technology. The video game, therefore, puts the player into the role of a given character with which the player is able to orient himself and interact within the environment, hence the usage of the term *impersonation*. The uses of impersonation in video games have several modes, the most popular of which are first person shooter games, third person action games, and top-down/large-scale strategic games.

In a first person shooter game, a player assumes the role of a character as if he is looking through the character’s eyes, viewing the video game environment from a first person perspective. The experience of the game environment is meant to be very personal; the player naturally sees the representation and interacts with it while receiving graphical and/or aural feedback, as in reality. For example, when the player runs, the view on screen will bob around; when the player looks up to the sky and stares at the sun, the view will simulate temporary blindness by rendering a bright white screen that fades out slowly; when a hard surface moves

\(^1\) This performance is hardware specification dependent.
closer to the view on-screen and apparently strikes the player, the view will shake, simulating a hard object hitting the player’s head. While the player is not experiencing any of these phenomena in reality, such visual effects give meaningful and intuitive feedback because of their close relationship to real-life personal experiences.

In a third person action game, the player also assumes the role of the central character in a game, but instead of viewing the environment from the point of view of the character’s eye, the viewing perspective is usually behind the shoulder of the character. Therefore, the player can observe the situation in a more strategic point-of-view. This gives the advantage of having the ability to more closely observe the character’s bodily actions within the environment, although the player has a less personal approach to the environment. This mode may be beneficial in applications such as room or furniture ergonomics presentations.

The top-down/large-scale strategic point of view, or “god mode,” greatly benefits large-scale planning scenarios, such as the well-known Sim City franchise video game. Unlike the previous two modes, this particular mode offers none of the personal experience within the game environment, and thus offers a reduced impersonation level (with exceptions, such as strategic officer-on-duty simulation).

### 2.2.2 Playing Video Games

All video games rely on representation technologies (graphical, auditory, etc.) to provide feedback to the level of interaction provided. For example, a simple game of table tennis requires the player to observe the movement of the ball and strike accordingly. In more complex games, such as first person shooter games, the player needs to observe the game environment through the graphical display, while controlling the movement of the character.
and shooting at targets simultaneously. In short, the level of interaction is much more complex and at a much faster pace.

In most video games of this type, the player will see the representation of a hand holding a weapon on the video display, for example, a crowbar. While this is technically a representation of the hand of the character, since the player is currently taking the role of the character, it is therefore understood that the hand on display is the represented hand of the player. When we press the appropriate button on the game controller for the function *attack*, we will see on the display an animation of the hand whipping the crowbar to hit a nearby object. Observing the screen, the player will develop the involuntary habit to press the same button when he/she intends to use the tool. Depending on how the creator of the video game intended things, the game control scheme may provide additional usages for the hand-held crowbar, such as prying open an object, door, window, or to reach an object which is otherwise unreachable.

When we compare actions in the video game environment to the real world, i.e. when we hold a real crowbar with our own hands, we surely have much more flexibility and freedom in how we want to use it. In such types of video games, the player’s freedom is indeed limited to the creativity of the video game programmer, as each possible function needs to be carefully planned and programmed. Also in video games, players have the obstruction of the mediatory control system, such as remembering which button to press to perform a particular function. Looking at these facts,
developing a habit for this control scheme and becoming a skilled player is the only way to maximize immersive interaction in the virtual world.

A game like Namco’s famous Pac-Man represents a virtual universe of its own. The universe is set inside two dimensional walls, and the avatar\(^2\) – the Pac-Man – needs to traverse the “corridors” to finish eating all the “foods” spread throughout the walls (the white dots) while avoiding the four colorful ghosts, or antagonists. Although graphically far from what we perceive in the real world, the interaction between the player and the two-dimensional, symbolical environment makes it possible to understand this game as a universe in itself. The mechanics of this interaction can be explained in the following example:

The avatar bumps into walls in the Pac-Man game, looking for a way out through the openings in the walls. This is a basic law of movement restrictions that mimics the real world. The antagonists in the game are also similarly restricted by the walls, so when they chase the avatar, players try to avoid them by taking advantage of the blocking properties of the walls. In dangerous or life-threatening situations, we normally try to avoid or run away from the source of danger. The same instinct applies to this game. Players will want to run for their — limited quantity of — life when they are being chased by the antagonists.

In this case, therefore, it is not the graphical representation that makes the game meaningful to the player, but the interaction of the player with the game environment.

\(^2\) An avatar is a digital representation of the player, or a character whom the player assumes control in the game/virtual world. The avatar is the center of the virtual world, as everything else simulates or happens around the avatar only, with the exception of multiplayer games in which multiple avatars are controlled by multiple players. In such situations, the virtual world revolves around each player in their respective inter-connected software/machine. The word “Avatar” comes from *Avatāra* (Sanskrit) which means “descent,” become mortal, to imply incarnations of Hindu gods (Levine, 2007).
2.2.3 Early Forms of Video Games

The famous video game *Pac-Man* uses television sets connected to a game console machine, or orthographic view, to visualize the virtual world. In this case, the player understands that the virtual world visually exists, but he or she does not see a direct correlation with any real-life reference since the visualization is highly stylized and symbolic. However, this does not pose a problem for this particular game because personal, first person perspective view was not *Pac-Man*’s main purpose, regardless of computer graphics rendering capabilities and limitations at the time.

In the 1990s, the term virtual reality reached the general public. This is around the same time when computing technology first became capable of simulating real-time three-dimensional images. Video games followed suit in taking advantage of this capability, resulting in the creation of early three-dimensional games. One example is “Wolfenstein 3D,” an adaptation of the original 1981 two-dimensional “Castle Wolfenstein” game, which popularized the first person shooter genre. The game company, id Software, continues to produce high-quality, extraordinary first person shooter video games up to the present day.
“First person” denotes the perspectival view of the graphical representation, and “shooter” denotes the aiming pose of the avatar, usually represented by the appearance of a hand holding a weapon and a crosshair in the middle of the viewing screen to make aiming easier. This configuration has remained popular even to this day. Compared to the Pac-Man game, the mechanisms for interaction have changed dramatically. In the top orthographic view, the player controls two-dimensional or lateral movements, which are referred on the screen as up, down, left, and right. Three-dimensional game movements need to be more comprehensive, even though in most three-dimensional games, the ground of the gravity-bound earth is still generally two-dimensional, with the exception of the possibility of different ground heights or levels. Flight simulators and outer-space simulators are exceptions that need to be pointed out, in which cases the avatar’s body travels freely in all three-dimensional directions. In addition to moving forward (toward the screen), backward (further from the screen), left or right (rotate the head or body to either direction), jump upwards and fall/dive downwards, players will also have “strafe” left or right (move the body to the left or right while maintaining straight view to the front). Later in the progression of first person video games, as the two-dimensional motion controller input device called mouse became popular, the “mouselook” interface was introduced. The mouse look enables players to swiftly navigate the virtual world by moving the screen’s point of view, achieved by dragging the mouse with their hand, mimicking the movement of the head/eye, while the other hand stays on the secondary control input device — typically a keyboard — to move the body. This interaction scheme not only enhances control in the virtual world, but also has the potential to immerse the player into the system as in real-world situations where head and body movements are independent.
2.2.4 The Platformer Evolution: Prince of Persia

Prince of Persia is a popular game franchise that was first released in 1989 by the software company Broderbund. Originally made for the 8-bit Apple II computers, it later ported into Amiga, Apple Macintosh, PC DOS, and other console machines such as Sega Mega Drive and Sega Genesis. The game itself was considered a great leap forward in the quality of video game animation. The game creator, Jordan Mechner, studied his brother David running and jumping in white clothes to ensure that all the game movements looked accurate in a process called rotoscoping – a method of projecting live action images onto a screen where the projection image is then traced frame-by-frame to create an animation (Ubisoft, 2001).

Figure 7 – Prince of Persia (Noureddine, 2002)

The use of the rotoscoping method in animation creation proved to be a powerful magnet for attracting interest. The two-dimensional, symbolic representations of the Persian Castle corridor environments in Prince of Persia seemingly become alive with the fluid, realistic

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3 In computer science, porting is the adaptation of a piece of software so that it will function in a different computing environment (e.g., different CPU, operating system, or third party library) to that for which it was originally written.

4 Disk Operating System (DOS) is an early Personal Computer’s operating system developed by International Business Machines Corporation (IBM) and (later) Microsoft Corporation. It dominated the PC market from 1981 to 1995.
movements of the symbolic representation of a character (the avatar, the prince), who reacts to and provides feedback animation to the player’s control. What is meant by “symbolic” in this case is that it tries to look like the object being represented in a limited graphics capability (low resolution, sixteen color capability only). Stone walls, glazed tiles, carved stucco, and other materials usually used in Persian (modern day Iran) architecture are depicted “symbolically,” as shown in the screenshot above. Even though the three-color (skin tone, hair and clothes) pixilated avatar does not do justice to, for example, a photograph or a movie of a Persian prince, the seemingly realistic interactive movement of the avatar produces its own level of immersion. While not immersive by any photo-realistic standards, the symbolic objects and good color choices, in addition to the avatar’s fluid and logical movement capabilities, immerse the player in a way that makes it easy to imagine what could happen in reality. Some simple examples to illustrate this concept would be:

1. The avatar runs past the platform and falls into the gap, realistically bouncing between walls until finally hitting the ground and losing his life. The game, therefore, simulates gravity, friction, and bounce.

2. When the avatar is running in one direction, a sudden command for change in direction will make the avatar appear to be trying to change his running direction, slipping in the process, thereby following the laws of inertia. These logical and believable game mechanics help the player imagine realistic events even with symbolical representation.

The establishment of the PC version of Prince of Persia proved to be a significant step toward establishing the game as a PC landmark, largely because of PC’s broad penetration as a general commodity in any household. This shows how the game’s improved animated
feedback can help players immerse themselves even in the case of graphically simplified symbolical games.

**Three-Dimensional Generation**

The franchise tried to upgrade the idea for the three-dimensional generation in 1999 by debuting Prince of Persia 3D, but it was released and perceived as a great failure (Alvi, 2003). In 2003, however, game company Ubisoft Montreal, under the supervision of the original creator, Jordan Mechner, produced “Prince of Persia: The Sands of Time.” As opposed to the 1999 version, this game with its heightened sense of spatial representation, became a successful three-dimensional implementation of the same idea.

![Figure 8 – The Sands of Time Location (Ubisoft, 2003)](image)

The concept of the game remains basically the same in the newer version. It’s a platformer type of game, where the avatar runs, jumps, hangs over, climbs, and manipulates platforms, levels and floors in order to create a sense of adventure and free movement.
throughout the game space. While in the previous installment, Prince of Persia is highly symbolical, in this version, the game’s three-dimensional environment, with faithful polygon models and detailed skins/materials, comes closer to photo-realism. Real-time shadows and fog add additional atmospheric effects to the environment.

Most games basically serve a purpose/goal or a challenge, whether it involves a quest to achieve a certain position, win a particular deal, or defeat a set of rules, artificial intelligence, or fellow player(s) in multiplayer-games. Prince of Persia is driven by linear story-telling and narrative aspects, which are even more emphasized in the latest installments.

Not all games need to tell stories, however. Games such as Tetris, Pong, Blix, or Snood are simple graphic games that do not lend themselves very well to narrative exposition (Wardrip-Fruin, Noah; Harrigan, Pat; et.al., 2003, p. 119). Furthermore, the experience of playing games can never be simply reduced to the experience of a story. As a matter of fact, the interactivity of games often contradicts narration. In some cases, the player assumes the role of the decision-maker as to how the story will unfold, while in other cases it is the author of the story who does so.

In the Prince of Persia games, however, the harmonious hybrid between voluntary interactivity and narrative storytelling is recognized, creating what can be called “interactive cinema;” giving the sense of freedom, yet still software-directed. This provides the possibility
for the product to be realized, since a fully functional “I will do whatever I want” kind of virtual world is still somewhat a utopian perspective.

Prince of Persia presents the time-honored story of a prince coming to rescue a princess (the damsel in distress, or DID), who must battle through the Castle of Persia. The prince must confront the antagonist non player character (NPC) character by name of the evil wizard Jaffar – who intended to marry the Princess (the DID) himself – and his band of Persian guards, which are spread all over the castle, guarding their posts patiently. The princess, of course, refused to marry Jaffar, so he put a time limit for her to rethink her decision before Jaffar would put an end to her life. The Prince must rescue the princess before the time is up. The story is as simple as that.

Players cannot change the course of the story in the game. The prince must confront all the Castle’s guards and explore the castle’s interior and exterior walls finding his way to the princess, finally dealing with Jaffar and rescuing the Princess. He obviously cannot, for example, decide to explore the other part of the castle, collect treasury, or find another princess who may be easier to rescue. This pre-scripted linear storyline is just like a scenario or a play in a theatrical production, or a

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Figure 10 – Warrior Within Location (Ubisoft, 2004)

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5 NPC = Non Player Character, that is, computer controlled or scripted characters, with or without artificial intelligence.
narrative, in this regard. However, at some point players are also given a choice on how to overcome an obstacle or which corridors to follow, and in some parts of the game, players can choose which way to go in game space “intersections,” in which each path leads to the same goal but through a number of differences in the spatial experience.

As in most similar games, the unfolding story and the actions of the avatar come through as the main aspects of the game. Especially apparent in the newer installments, such as the Prince of Persia Trilogy⁶, the sheer amount of polygons are mostly concentrated on the character action models, such as the Prince, his comrade Arabic King daughter Farah, and all other sorts of characters and villains. The environmental elements use less demanding polygons and fewer details, but this does not imply that environmental design is worthless. The characters are always situated inside the shell of virtual environmental surroundings which pave the way for the actions to occur and for the story to unfold. In the same way as real-world

architecture and interior design, the game space environment is also built to function, and not merely to serve as background. There is a whole discourse in itself about Game Level Design in which the art of designing game environments (referred as “levels” in games) is discussed.

In the case of three-dimensional computer gaming, the environment sets the boundary rules. Even though players may feel that they can roam freely, the environment governs the limitations of where players can or cannot explore. Depending on the creativity of the game designer, game limits can be realized, for example, by a pile of rocks blocking a corridor, a broken bridge preventing the avatar from crossing to the other side, or a band of respawning7 antagonist characters (enemies) patrolling the area and in itself cutting off the possibility for the avatar to pass through freely. There are hints of continuity or the remote possibility to overcome these restrictions, such as when players can visually peek through a hole in a pile of rocks blocking a corridor, or view the buildings on the other side of a broken bridge. These give players the impression of a vast game space without explicitly telling them that they cannot continue to explore further.

The environment is also where the avatar lives at that moment of time. His goals are to explore the environment and find ways or paths to progress. The early Prince of Persia games were simple stories and platforms that could be navigated in a representation of a two-dimensional cross-sectioned world: left, right, up, and down. The latest installment of the game tries to mimic exactly how real-world environments would be experienced. Looking at how the Prince of Persia franchise succeeded its early establishment, the latest Prince of Persia game-space maintains the idea of the platformer game by using environmental elements as a means of

7 Respawn is a term in video games that means the regeneration of a video game entity. A respawning location usually indicates a Cartesian location where the entity, usually the villains, reappears or regenerates after the prior generation has been eliminated. This creates the behavior of self-replenishing villains that can be used to block progression toward the respawning area as the “mortal” avatar would never able to survive infinite attacks.
progressing through the game. Instead of traversing through and jumping up or down between floors and platforms, however, the avatar is equipped with new abilities which are, among other things the ability to: climb walls, traverse sideways, slide through small gaps, swim or dive in the water, jump between poles/columns, swing around with ropes, etc. These abilities basically allow the player to do anything, and to interact with, and make use of the environment for his own purposes. Although all these actions are pre-scripted and/or pre-determined, and it can be obvious at times to observe that some sort of “path” is already set up for the avatar to follow, players will still have to interpret for themselves, and at some point successfully create the sense of exploring and investigating the game-space for ways of, for example, reaching a higher spot by jumping between poles, or rescuing Farah by swinging across the platforms with ropes to reach her. At this point, players will have to investigate the environment around the avatar to understand how to reach a particular goal by searching for clues and signs such as climbable columns, doors, or stairs which could lead to the goal, or how to make use of the wall to jump upwards or downwards.

The game space NPC characters add even more variety and depth to the spatial experience by providing something to interact with (to talk to, or to kill, in this game context). For example in the Trilogy, Prince’s comrade Farah, a computer artificial-intelligence (AI)
controlled character, helps him get through obstacles or kill enemies with her bow and arrows. Sometimes they also interact with each other by means of cinematic cutscenes⁸ and conversations. While these are scripted and players are relieved of their control on these situations, they help narrate the story and also help keep them on the story’s track after each couple of minutes of gameplay.

In the same way as the environmental elements, NPC characters also help set up the atmosphere of the spatial experience by adding artificial life to the environment. The avatar can interact with them, talk to them, give help or demand help, and so on. Antagonist NPCs provide the avatar with AI villains who are scripted to attack or impede the Prince’s path.

All of these environmental descriptions in the Prince of Persia game franchise match up with real-world architecture with respect to a number of aspects. First, Steen Eiler Rasmussen argued that architectural buildings are produced like motion pictures without famous performers; a sort of documentary film with ordinary people playing all the parts, and architects have some sort of organizational function (Rasmussen, 1959, p. 14). As discussed earlier, the game environment is similar in that the game-space is conceived as some sort of

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⁸ A cut scene or cutscene is an often cinematic scene that occurs as a sudden break of style or context before returning to the normal flow of a work.
story (a movie or motion picture). The game-space itself is a “built environment,” though not in the real-world meaning of the world “built,” but in the same sense that it is “artificial” and provides service or function to the dweller. The avatar and the NPCs are the dwellers and the users of the virtually built environment, and they make use of it extensively, as the environment’s main purpose is to move the story along by facilitating the avatars’ explorations and by providing a setting in which the NPCs can operate as scripted by the programmer.

The game environment serves as an example of experiential architecture, as Rasmussen described:

“It is not enough to see architecture; you must experience it. You must observe how it was designed for a special purpose and how it was attuned to the entire concept and rhythm of a specific era. You must dwell in the rooms, feel how they close about you, observe how you are naturally led from one to the other (Rasmussen, 1959, p. 33).”

The architectural environments in Prince of Persia resemble an Arabic/Iranian/Persian style, even though not very carefully modeled. But in the context of this game example it is well conceived to serve as a ground for the story and actions, and as we can understand in this context, the architectural details are not the main purpose of the production of the game. However, the opportunity remains strong to shift attention from the details of the actions and characters to the environment, to better serve architectural purposes. In the case of its function, the game environment serves Rasmussen’s description very well. Players experience and investigate how the environment is created for a special purpose and also can feel attuned to the Persian/Arabic concepts of form, structure, and materials. Players indeed dwell in the rooms and explore their surroundings, finding clues from one room to the other.
2.2.5 A Personal Nightmare: F.E.A.R.

F.E.A.R. (First Encounter Assault Recon) is a three-dimensional first person shooter game “which combines creepy horror with kinetic and visceral action” (Ocampo, 2005, p. 3). The game received many positive reviews for its visual quality and sound effects, and was dubbed to have its own “haptic” effects that enhance the player’s sense of reality.

F.E.A.R.’s outstanding graphical quality is demonstrated in the creepy horror theme, which requires a very good mystical, atmospheric and environmental experience. Creepy environments, as we usually see in horror movies, are usually composed of dark, gloomy, silent spaces, with a lot of shadows. This gloomy, silent environment creates a whole new set of challenges in many aspects of the space-simulation, lighting, auditory, and surreal dimensions such as ghosts, for example, making them feel more dramatic to the player.

Simulating such a world is quite a serious challenge for the computer, requiring high-end hardware specification and a newer-generation console machine to run, depending on the game version.

Because of its theme, F.E.A.R. lets players traverse indoor spaces, secluded rooms, narrow passages, and tight building shafts alike, infested with villains, the cloned soldiers. The cloned soldiers are endowed with artificial intelligence and can react realistically to the player’s avatar’s approach. If the avatar, for example, bumps into something and makes a noise, any nearby cloned soldiers will hear and react accordingly (i.e. hunt the avatar down if they see him directly or try to come closer to examine the source of noise if they did not see the avatar.

Figure 14 – F.E.A.R. Artificial Intelligence (Ocampo, 2005)
directly). The gloomy, silent environment is also particularly favorable to concealment, as the avatar can hide behind shadows to remain unseen. In this setting, it is natural for the player to keep hiding and avoid being seen before the player is ready to strike. This requires an understanding of the space around the avatar to pinpoint locations where he can effectively strike the opponent without being hurt too badly or losing. Sometimes the avatar needs to change his body position to better see and understand the environment, for example, by climbing plumbing pipes in the building and crawling in shadows from a height above the floor. This way he avoids being seen, and at the same time gets a better understanding of the space from a higher point of view. If possible, the avatar can also walk around and visit subsequent rooms while hiding behind the windows to see the situation better from different perspectives.

The creepy theme, however, adds another expected problem: fear. Dark places are good for hiding but are also prone to promote a sense of fear. Ghosts can appear at any time in various places, and can distract players from their intention to study the situation. Early in the game, the player is introduced with a horror storyline in which the ghost in the form of a little girl makes repeated appearances to scare the player.

Figure 15 – F.E.A.R. Illusion (Ocampo, 2005)

9 “Being hurt” and “lose” relate to statistically kept numerical properties of the avatar’s physical condition. Most video games quantify the amount of fitness/health by percent; 100% equals to pristine health and 0% equals to death. Losing, or death, is mostly the end of the game except for a number of video games where “resurrection” is possible. Most games incorporate “checkpoints” after which if the avatar dies, will return to the latest checkpoint, to avoid replaying the progress from the very beginning. Some games also include an option to save the state of the game, allowing spontaneous return to that state at a later time.
While in most cases being scared is a very subjective reaction, this game, on the other hand, provides ample effects to scare most players, and this psychological “obstacle” adds to the spatial experience of the game. Most of the time players feel that somebody or something is always watching them, and this “The Ring”\textsuperscript{10}-style ghost always appears at unexpected moments, making players constantly aware and ready for the next apparition.

The theme of the game demands a realistic, natural response from the environment, thanks to the artificial physics system which governs objects in the game. When the avatar bumps into a steel shelf loaded with boxes and empty cans, for example, the shelf wobbles, making noise, and its contents fall apart on the floor, while the cans bounce around making even more noise. This mundane behavior makes possible the contrast between the natural and the unnatural. When everything behaves like it normally does, the player can more easily gain awareness of unnatural phenomena, such as an empty can that floats in mid-air, or ghosts that walk through doors.

\textsuperscript{10}“The Ring” is a Japanese horror movie from which F.E.A.R. horror inspiration was taken.
Part of the realistic setting is self-existence. In most first-person shooter games, the emphasis is placed on the environment. F.E.A.R. is among the first of its genre to provide an important aspect of gameplay: self-existence. It is true that players can interact with the virtual-universe in most games, but in most cases it is hard to tell whether they physically exist in the game or whether they are just wandering around like restless spirits. In F.E.A.R. players do not see just the hands and the weapon, but also their “virtual” feet when they look down, and a projected shadow of their “virtual” body when they stand behind a light source. While this aspect of the simulation is often neglected, this provides a sense of existence in the game, especially in games with a gloomy theme like F.E.A.R. Body shadows will not only provide for a realistic visual feedback, but will also trigger enemies to chase for.

This degree of realism, while certainly still artificial, gives a heightened feeling over the natural behavior of the environment and allows the player to evaluate the environment to create an effective strategy to achieve the goal – in the case of F.E.A.R., – of getting through a room tightly guarded by clone soldiers.

2.2.6 The Simulation of Life: TES IV – Oblivion

The Elder Scrolls IV: Oblivion can be considered as another leading first-person shooter type of video game, although it belongs more to the category of a role-playing game. A role-playing game (RPG) is basically one where the player takes the role of a character in a story, and collaboratively creates and follows pre-programmed stories.

The game has huge, lavishly detailed worlds that offer tremendous amounts of action and adventure. As an RPG, it has an open-ended goal, which means players can virtually do whatever they want, within the limits of the game world. There is a main linear story to follow, but other non-essential stories, so called “side quests,” can be followed to allow for more
experience, reward, or simply the satisfaction of doing some deeds or getting a piece of information. The avatar usually develops as he/she progresses through the game. He/she becomes more powerful, smarter, quicker, older, or enhances other statistical parameters which will affect how the avatar will perform in the virtual world. With higher statistical “strength,” for example, the avatar can do more damage to his/her opponent and can carry more inventories. While statistical numbers mean less excitement in terms of spatial experience, the developing body strength and swiftness throughout the game gives the player the ability to cover more distance in less time. Over time, in fact, it creates an awareness of the performance of the “virtual body” for the player.

The game has both exterior and interior environments, and does a very good job in giving a sense of freedom and the seamless transition between the two. The body, however, is not represented in the game’s first-person view. Oblivion has an additional, different method to display the avatar’s existence in the world – using a third-person perspective view. With this view, the player will have a better sense of what their avatar looks like. This is an unrealistic method, but creates a better implementation of self-existence in regards to understanding the avatar’s contextual existence. The third-person perspective in the
game observes the avatar and his/her environment from behind while maintaining the same scope of view as its first-person counterpart.

The game also establishes independent head-body movement, and this is very apparent in the case of the avatar riding a horse. In the case of horseback riding, the movements and direction of the horse are independent from that of the avatar. This creates the sense of natural “sightseeing” when usually our eyes and/or head look around while walking in one direction.

2.2.7 Living in Another World: Second Life

Second Life signifies literally what it offers us: a second life, outside our real life. Technically speaking, Second Life is a three-dimensional virtual world which is entirely built and owned by its “residents.” It was created by Linden Lab, a San Francisco-based company founded in 1999 with expertise in three-dimensional shared environment graphics, physics and networking. This computer game is available to anyone with decent computer equipment and a high-speed internet connection. Inside the virtual world, there are various real-world equivalents of social, economical and political structures. Even though everything is synthetic
and may seem to be only casually oriented – after all, it is only a computer game – the economy is real; the game has its own currency and exchange rate against real-world currencies around the globe. This means that the game could be one’s source of living in the real world. The game attracts people interested in having fun, in social gathering, or in the businesses.

Since any of its residents are able to make changes and build properties in the world, the game is therefore internet-based. Digital data about the world is kept inside servers\textsuperscript{11} and has to be transferred from the servers into the player’s own computer each time the player visits a particular place. Because this is done dynamically, players may see the world constructing itself bit by bit before it is fully realized. Graphics quality is mostly functional, and tends to be at the lower end of current standards. Players can make their own avatar, a representation of themselves, to look like anything they want it to, whether it really resembles themselves, or something else, even non-human. Spatial measures are more or less faithfully represented, with some real-world governing laws such as gravity, the earth’s rotation,\textsuperscript{12} solidity,\textsuperscript{13} and so on. Other things such as death, sickness, and injury do not exist, and players do not need transportation means in the game because they can instantly teleport themselves to their destination or levitate above the ground and \textit{fly} across distant places. These are only a few of the characteristics that make the Second Life built environment a potentially fascinating subject of study. This review is going to look at the way Second Life architects waver between designing around these particular characteristics, and embracing replicas of real-life architecture, as in a virtual Las Vegas.

\begin{itemize}
\item\textsuperscript{11} Computers serving the software through network/internet.
\item\textsuperscript{12} Such as day (bright) and night (dark) scenes.
\item\textsuperscript{13} The existence of solid objects by which player cannot walk through.
\end{itemize}
The Built Environment

One of the most interesting aspects of the game is that residents can own land and build on it. Land value also reflects its real-world counterpart of land business dealings: prices increase as nearby businesses or landmarks are developing. Architecture is functional at best, but some well-off residents can build or order houses from “architects” that can design and build for them. A number of emerging “architecture and design firms” are listed in the developer section of the Second Life’s website. Some architecture in the game, in fact, refers to real-life building. Octal Khan (real name: Wagner James Au), owns a house in Shamrock (not a real world site) which resembles his real-life house in Los Angeles, designed by Gregory Ain (Au, 2006). In life he didn’t build his own house, but in Second Life he does, fully referencing it to the original plan of Gregory Ain’s work. The result, according to him, is an architecture that he likes to share with friends and visitors and discuss with people of similar architectural and design interests.

Figure 19 – Environments in Second Life (Linden Research, Inc., 2008)
The emulation of real-life architecture doesn’t stop here. Second Life contains a replica of an entire city: Dublin in SL (Dublin in Second Life), which is a reproduction of a part of real-life Dublin, Ireland, with all its Irish bars, shops, music, and friendly people (DublinSL, 2006). Places of interest are modeled and embedded with pictures of real-life Dublin, allowing players to learn about Dublin before they even set their real-foot over there. Reality is, however, bent to fit virtual space. Take for example the Irish Bar in the Dublin in SL area. When players visit here, they will arrive at a predefined point, and from there one can see a representation of part of O’Connell Street in Dublin – slightly distorted/modified to fit – along with a number of points of interest, such as the Bank of Ireland, Bewley’s Coffee House, Famine Statue, and many more. These points of interest do not exactly resemble their real-life counterparts, but are close enough that people can learn about and experience them.

Even further from real-life imitation is the architecture that attempts to build around the standards of this particular world. There are two such sets of standards: some that arise from technical limitations, and some that arise from the specific governing laws that make up Second Life. One small caveat, for example, is the problem of the internet data streaming nature of the program. When a player arrives for the first time in Dublin, his/her body levitates several feet above an empty ground on which the Dublin “stage” is slowly realized, on a polygon-by-polygon and texture-by-texture basis. Most of the time, the player can witness how the buildings are formed, both inside and out, before it is fully realized. This way, building designs are mostly transparent to the players, and walls are not built to conceal things but rather to limit movement. The sense of security is also very different in Second Life. For example, players as business owners are not afraid of their merchandise being stolen. The security scheme is set through scripts and programs that strictly control who, when, and how any player can interact.
with an object. Therefore architecture in Second Life never aims for security in the sense of its real-world counterpart.

Some other forms of architecture in Second Life specifically adapt based upon how the world is functioning within. For example, near the Welcome District there is a store which is built many stories high and does not include stairs of any sort as a way for people to go to different floors. While this building is certainly impossible to use properly in the real-world, the fact that players can levitate or fly in the game made this form of architecture functionally possible.

**Living in Second Life**

The Second Life built environment is not only about technical or physical limitations. The everyday “second life” is likely quite different, for better or for worse, than our real lives.
So how do players really live in Second Life? Take, for example, the Irish Bar in Dublin in SL. Players of different backgrounds gather together in their avatar forms, to virtually sit down, relax, dance, talk and so on, making somewhat effective use of the environment. Some of the players actually come from real-world Dublin, and some are just visitors. Each avatar has his or her own appearance and outfit, much like the real world. Players become interested in each other based on appearances, even with blocky polygons and blurry textures. Then people start to talk, and if one avatar chats, other avatars around him/her can read what he/she said from a certain radius. People in the form of avatars often absolutely separate their second life from what they call “first life” (real life). When one asks, “What do you do?” The answer usually refers to what one does inside the virtual world. For example, “I build and create things for sale on this street,” or “I run a bar in that area,” and so on. When they work, they really work on something. For example, when one sells guitars, inside the game they actually construct something and build things, and – because this is a computer program – write and put scripts (pieces of programming code that give attributes or functions to the object) into the object so that when finished, they can put the object on display for other avatars to buy. In this way, avatars earn money to spend anywhere they prefer. Still in the virtual world, avatars can get married, buy a house, and live happily ever after.

2.2.8 Video Gaming Technology Implementations in Architectural Visualization

While video games possess architectural elements, they are not specifically made for architectural visualization. Video gaming technology’s promising features have induced architecture firms to experiment with this technology since early versions of first person shooter video games. Several attempts have been made to utilize video gaming technology in architectural visualization, such as the Computer Research and Teaching Laboratory at West
Cambridge, United Kingdom, by Cambridge University and Microsoft. Paul Richen, director of the university’s Martin Centre for Architectural and Urban Studies has said: “The best way to learn about a building is to run around in it, and in a computer game that’s just what you do.” (BBC NEWS, 2000). The visualization project was built with the same game engine\textsuperscript{14} that powered Quake II, a popular first person shooter video game by id Software. The visualization product allowed London architect Geoff Cohen of RMJM Architects to take the sponsor, Microsoft’s Bill Gates, in Seattle, and anyone who cares to join in, on a virtual tour of the building, using the video game’s multiplayer over-the-internet capability (BBC NEWS, 2000).

There were some problems worth noting in the implementation, however. The most significant problem was the difficulty of technical conversion from a drawing into a “game.” The video game’s pre-programmed mechanics were causing additional problems. The point of the video game is to go around blasting objects with a collection of fearsome weaponry. Although visualization developers wanted to leave the video game mechanics intact, the idea was quickly denied by the head of the department. However, stripping all the weapons out of the game was not the end of the problems. The remaining problems can be attributed to the skill of the user. The developers found out that many people keep falling off the landings of the stairs, because people with no prior experience of playing first person shooter video games found it awkward to move around in such small and intricate U-shaped stairs in the game (BBC NEWS, 2000). The developers ended up adding hand rails, which is actually a required detail, which helped people navigate the stairs. The elevators posed a problem as well, because of the missing elevator door. People were being “killed” upon entering the elevator, as the above head car would descend and hit them “on the head” (BBC NEWS, 2000).

\textsuperscript{14} Game engine is the underlying “middleware” that runs a set video game of contents. Different video game titles can have the same engine, licensed from the developer. See chapter 4.
Architectural mega-firm HKS has also turned to video game technology. The company licensed the Unreal Engine 3, a powerful visualization middleware that was developed for the popular Unreal Tournament video games (Veila, 2007). Compared to the now-antiquated Quake II engine, the Unreal Engine 3 is a major step forward in visual quality as well as ease of development. The same game engine has been used in the production of other best seller video games such as Gears of War and Mass Effect. HKS is using the technology for architectural models, generating additional revenues of $65,000 to $150,000 per project (Veila, 2007). Pat Carmichael, the company’s advanced technology manager has said that the firm’s long-standing challenges were that clients often have trouble translating two-dimensional images into accurate ideas of what a building or interior space might look like in reality. The worst situation is when a client sees a finished building and says, “That’s not what I expected.” (Veila, 2007)

Carmichael began experimenting with video gaming technology when he felt that visualization techniques, then consisting of a series of still images which took hours to render or animations that cost hundreds of thousands of dollar to produce were in grave need of an...
alternative. He found the potential of video gaming technology clear; clients can control the
point of view with a joystick or keyboard, walking in and around buildings and structures as
they would a finished building, all rendered or drawn with animations running at thirty frames
per second, some three thousand times faster with much less cost (Veila, 2007).

The firm, on the other hand, does not consider that this technology is ready to displace
other methods just yet. Even though modern game engines have been developed as a
middleware that is relatively easy to use, designers will still take years to accrue the artistic
experience to make the most out of the technology. Ian Kinman, president of the New York
Society of Renderers and founder of Animation + Images thinks that the software used for
architecture, films, and games will continue to blend, although “it remains to be seen if games
technology can really become a widely used architectural tool.” Kinman added, “so far, there is
not a project HKS is working on that couldn’t also be done in other ways.” (Veila, 2007)

Quest3D, one of the first real-time three-dimensional software packages available for
general purpose projects, includes architecture, product design, virtual reality training,
entertainment and multimedia (Ratcliffe, 2007). Although not in the very latest cutting edge
manner, such as Unreal Engine 3 or CryEngine 2, Quest3D provides ample features with much
lower licensing costs. As time goes by, there will be more and more competitive products with
more powerful features as the technology becomes mainstream.
2.3 Summary

Real-time rendering technology is an expected progression from off-line rendering, which only needed sufficient computing power. Ever increasing computing speed has made it possible for real-time rendering technology to continue developing rapidly ever since.

The video game reviews show in great detail that architecture is a significant element of dwelling in virtual space. The first three modern video games, Prince of Persia, F.E.A.R. and Oblivion describe the importance of virtual architecture as a vehicle to progress through the narration, unlike in cinema where architecture is often treated as a mere background. Players involvement with the environment enables them to experience the virtual space – not just witness it – similar to real-world environmental relations. There is also a progression toward incorporating more types of bodily interactions with the environment, providing a stronger, intuitive relationship between the body and the environment.

The fourth video game, Second Life, is an online social game that has to limit its bandwidth, therefore providing much less visual and functional qualities than the other reviewed video games. However, Second Life effectively simulates comprehensive social life where architecture is “by players, for players,” which means the environment is built by the players, for players’ social, cultural, economical and political purposes. In short, it simulates life, hence its name “Second Life.”

The potentials of video game technology have appealed to architects for quite some time, and yet this technology is still rarely implemented. Even though it could help clients to understanding designs more thoroughly, architects remain reluctant because of the difficulty in adopting the technology into their work flow. Clients also impede this acceptance, because
projects utilizing this technology would require them to familiarize themselves with the relatively unintuitive control schemes or mediating devices common to game technology.
Theoretical Challenge

“Most architects seldom read at all: they only look at seductive pictures and absorb slogans.” (Salingaros, 2004, p. 19)

Ever since the beginning of the distinction of the architectural profession in the 15th century, perspective and scale drawings on a two-dimensional medium have been the prevailing language of design exchange between architects and builders, clients, the public, sponsors and other related entities. The variety of these drawings and their compatibility between members of this exchange group are often forgotten. The professional group, architects and builders, benefit from their experience with the mature language of construction documents, construction processes, results evaluation, as well as their own experience in the professional field, making communication effectively accurate. Communication between this exchange group and the other, average people, gives a wider variety of results.

Common people generally have difficulties accurately visualizing the structures represented in construction documents. This problem has been alleviated, however, with the introduction of increasingly photo-realistic rendered images, either hand-drawn or computer-generated. Photorealistic images allow non-professionals to more easily visualize design ideas by just looking at the representation.

Yet these three-dimensional images are static, which is why they are inadequate representations of the world of architectural experience, which is active and dynamic. For this reason, film and animation walkthroughs have recently become a popular means of architectural representation, seeking to replace static photorealism. The moving picture
represents an active and dynamic world with great clarity. However, one more element is still missing in all these advancements: the presence of our own body. From a purely visual point-of-view, the presence of our own body in the representation is not important. Yet this should be a crucial element in architectural representations since we are not only looking at the design with our eyes, but we are supposed to live or dwell in the design. According to Martin Heidegger, architecture, or a building is meant to be a dwelling, where people perform activities, as well as being on earth, to dwell: “Building is really dwelling. Dwelling is the manner in which mortals are on the earth.” (Heidegger, p. 146) To have a better understanding of the represented architecture, we need to be able to host activities in it, and understand our functioning, feeling bodies moving and interacting in it. We need to represent our dwelling, just like we represent abstract visual properties of a space.

3.1 Background Question

Aristotle considers each mode of representation – verbal, visual and musical – as being natural to human beings (Vukcevich, 2002), while Plato considers representations to be a second degree copy, an imitation of the world which is in turn an imitation of ideas or forms, which are “models” of everything that it is. As such, representations and those who dwell in them cannot be further from the truth (Plato, 2003).

With architectural representation however, the argument is reversed. An architectural representation is the only way to give the design a contemporary presence, through which design qualities can be examined without sacrificing the labor and cost of construction before the proposition can be brought into existence.
Since their inception in Classical Greece, representations have worked differently for architects. Tracing back to the Classical era, representations, in the form of artifacts\(^{15}\) (Pérez-Gómez, 1997, p. 7) were regarded as very important aspects of architecture, but not in a technological sense. The relationship between ideas and built architecture was mostly an equivocal, subjective, belief‐ridden affair. Around the 16\(^{th}\) century, this affair becomes technologically inclined in a more logical and objective sense. It is expected that technological development aimed at providing better accuracy in geometrical representation will help artists create objective graphical representations of its subjects. This holds especially true in modern architecture, where a one‐to‐one correspondence between graphical representation and the resulting building is increasingly demanded. Technological advancement has made it much easier for architects to create descriptive drawings, increasing graphical accuracy. Media variety is much broader as well, ranging from paper to video displays, which accommodate moving/changing image or video. Using the same principles of perspective, faster, more advanced computers generate accurate and believable representations of what the eye should see with ever‐increasing realism.

This increasing visual prowess came, however, at a cost. Architects became increasingly conscious of how their designs would perform when drawn, photographed, or, more recently, digitally represented, to the point where the quality of habitation became a secondary concern. Maybe the most famous example in recent times is that of Le Corbusier, who, long before the advent of digital manipulation, tried to "improve" the appearance of his buildings by modifying, manipulating and removing parts of the photograph by airbrush (Colomina, 1987, p. 12). Attached is a manipulated photograph of his built design, La Villa Schwob (1916), published in his magazine L'Esprit Nouveau. (Colomina, 1987, p. 13) The manipulated photo is purged of

\(^{15}\) Artifacts = mediator between idea and architectural space (Pérez-Gómez, 1997, p. 7).
any organic growth or distracting objects, as well as references to the original site, so as to completely focus the view on the formal qualities of the building (Colomina, 1987, p. 12).

This phenomenon, sometimes identified as occularcentrism (Pallasmaa, 2005, p. 15) plagued architecture from the Renaissance to all the way to the Modernist movement. Several authors place the origin of occularcentrism at the advent of the use of perspective as an illusionistic mode of representation (Vesely, 2004, p. 173) (Bertol, 1996, p. 89). According to Vesely, the use of illusionistic perspective constitutes the end of the process of acquiring an ever higher degree of the representation’s independence from reality (Vesely, 2004, p. 167). Perspective’s new dominant role is apparent in Bramante’s visual manipulation of the setting to create a theatrical illusion of indeterminate depth (Vesely, 2004, p. 172). Other examples are the Teatro Olimpico by Andrea Palladio in Vicenza, Italy and Palazzo Spada by Bartolomeo Baronino, in Rome (Bertol, 1996, p. 89). The theater has fake hallways made of wood and stucco, giving the illusion of spacious hallways, behind the theater, that end in vanishing points. The palace, which houses a grand art collection, the Galleria Spada, has a trompe-l’oeil perspective in the arcaded courtyard designed by Francesco Borromini.

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16 Some authors, like Juhani Pallasmaa place the beginning of occularcentrism in Ancient Greece. "Already in classical Greek thought", according to Pallasmaa, "certainty was based on vision and visibility." The primacy of the sight among the five senses is equally well exemplified in Renaissance thought (Pallasmaa, 2005, p. 15).
Juhani Pallasmaa observes that this trend has caused the architecture and urban settings of our time to make us feel like outsiders, in comparison with the emotional engagement of natural and historical settings. Pallasmaa argues that the problem of visual primacy is their poverty in the field of peripheral vision.\^17 Unconscious peripheral perception transforms retinal *gestalt* (form) into spatial and bodily experiences. Peripheral vision integrates us with space, while focused vision pushes us out of the space, making us mere spectators (Pallasmaa, 2005, p. 13).

Pallasmaa also argues that, while the computer is regarded as a tool to liberate human fantasy and facilitates efficient design work, it tends to flatten our magnificent, multi-sensory, simultaneous and synchronic capacities of imagination by turning the design process into a passive, visual manipulation – a retinal journey. The computer creates a distance between the maker and the object (Pallasmaa, 2005, p. 13).

On the other hand, Alberto Pérez-Gómez downplays the influence that occularcentrism has had on architecture. He argues that while it is apparent that buildings possess experiential qualities which are lost with visual-oriented representation, the focus towards the visual is not entirely dependent on the architect’s idea. While there is an “intimate complicity between the architectural meaning and the *modus operandi* of the architect,” it should be granted that the meaning of an architectural work will always include the influences of the context, function and culture, in addition to the architect’s idea (Pérez-Gómez, 1997, p. 8), and our own subjective presence.

The trend in visual primacy brings up a question in regard to interactive media in architectural representation: Can interactive media in architectural representation reverse the trend from visual to experiential architecture?

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\^17 Peripheral vision is a part of vision that occurs outside the very center of gaze.
3.2 Theoretical Issues Explored

3.2.1 Subjectivity and Belief

We have discussed earlier the realistic, immersive experience the virtual world offers through the use of interactive media technology. Realistic, immersive character, however, is in the eye of the beholder. It seems that the surreal and amusing nature of interactive media works very well with casual subjects, fiction, and the relaxing entertainment industry. It does not seem to work very well in the professional field, where one-to-one relationships, absolute accuracy and true believability between a professional product and its representation are generally anticipated (Pérez-Gómez, 1997, p. 5). Judging from the number of negative interactive media critics, a lot of people are generally skeptical about whether this technology can even come close to representing a useful truth.

Obviously, the representation will not be the same as the actual object. A photograph of a building is not the building itself. It’s just a depiction of a real object; we could not even dwell in it. However, by looking at the photograph, we recognize the visual essence of the building. We know what it looks like from a certain angle, therefore the moment we visit the building, we will recognize it immediately. Following this process, it can be said that, subjectively, we could see the essence of truth through representation. Practically speaking, the subjective essence of truth may be all that we need to proceed. Once the essence of truth is recognized, it is followed by a justification of the truth itself. Assuming this happens repeatedly, over time we will subjectively start to think that the mode of representation carries truth by itself. In other words, we make the assumption that the representation contains the truth – a process we call believing. We develop the belief that a photograph tells the truth about what is being represented. Because in our eyes, it always does, until we realize that a means of manipulating the truth in
photographs exists, which starts to challenge this newfound belief. Especially with computer generated images, which could have photo-realistic depictions without depending on any real-life set up.

The validity of architectural representation depends on this notion. This notion of belief actually stands for any other form of architectural representation, or any form of architectural work, for that matter. Kant describes belief as “subjectively sufficient, but is recognized as being objectively insufficient.” (Kant, 1887, p. 498) Let us take an example of one fictional architecture firm, which had, say, twenty clients, all of them happy. Statistically, the firm’s success rate of satisfying their clients, therefore, is one hundred percent. This statistic easily appeals to the firm’s next potential client. The truth is, though, that there is no guarantee this next client will end up with a happy face. However, assumptions based on track records form the basis of the subjective truth, as in pragmatically belief (Kant, 1887, p. 499).

Interactive media actually suffers from this predisposition. The current state of interactive media development requires a steep learning curve, which makes it harder for the non-skilled to form ground for belief. However, clients always have the decisive moment, whatever assumptions they have, to decide and point out at least what they like or dislike. So they believe the architect can fulfill their requirements, as they likewise believe in their own ability to decide on and approve of the design. Let’s suppose the requirements were set and it’s time for the architect to show off his design using interactive media. Interactive media require the voluntary participation of the client. No matter how many interactive media-literate clients we can find, there will always be ones that scratch their heads and clumsily interact with the media. Those with this problem will be more absorbed with the mediator peripheral instead of the content, which therefore defeats the purpose of an interactive representation.

Several ways to overcome this problem are as follows:
1. Develop strict standards for an interactive media control-scheme using standard peripherals, such as US standardized computer keyboards. As computers become more pervasive and interactive media become an everyday occurrence, the number of interactive media-illiterate will decline. The video game industry already somewhat standardizes their control-scheme, allowing players to master gameplay control quickly, or even instantly between different video games in the same genre. An example of this is the use of directional and W-A-S-D keys on the keyboard. This solution is the most feasible; however, it can only go that far.

2. Develop better peripherals for three-dimensional navigation that are intuitive and naturally easy to use. The video game industry has adopted this path as well, by creating joysticks, gamepads, steering wheels, etc. New peripherals, are always compelling; however, unique, non-standardized peripherals are difficult to implement universally, and thus are less feasible than standardized equipment.

3.2.2 Space and Place

The architectural experience that interactive media mainly tries to represent is the experience of being in the “place,” and/or being in the “space.” Aristotle made the distinction between space and place (topos): space was the sum total of all places occupied by the bodies, while place was that part of the space whose limits coincide with the limits of the occupying body (Jammer, 1993). Tuan describes space experientially, as something that gives the feeling of openness, infinity, and freedom, while place is a center of human living activities (Tuan, 1977, p. 4). In the digital, three-dimensional virtual world, space and place are elements created to provide enclosure to a body – a virtual body, in this case. Their portrayal is limited only by the capabilities and capacities of the computer hardware and every associated peripheral. They are
elements, meaning they exist only for that sole purpose and for that particular session. Space and place in the virtual world are temporary. They do not have real-world persistence. They exist as long as the computer runs the software. In other words, the existence of the virtual world depends on the continuity of the microprocessor’s calculations. We cannot explore space in the virtual world with total freedom; we can only explore whatever we or someone else has built into the software. If we assume that the programmer could not totally enclose the virtual world space with a place, the participant would fall into the infinite abyss of nothingness. With real-world definitions in mind, everything we can experience in the virtual world is, indeed, a place, with boundaries and parameters. There is no “space” in the virtual world, as of the present day.

3.2.3 Virtual Reality Revisited

Virtual reality is very closely related to the “virtual world;” a term that has been used in this paper. The term actually has various meanings, some of which stem from underlying technologies, while others have a more conceptual background. Virtual reality is sometimes used synonymously with “artificial reality,” or “simulated reality.” This meaning is different from that of the “virtual world” discussed earlier. The term virtual reality\(^\text{18}\) (or simply VR) is a contradiction in terms. In one way, it can be said that virtual reality tries to be almost real, without actually being real. The virtual reality in itself is not real, therefore it is not considered as something real, but resembles and/or replaces the essence of one or more aspects of the real. Practically, however, virtual reality could include aspects of the real.

Virtual reality is in essence immersive (Grau, 2003, p. 15). While similar to simulation, in general the word simulation does not have to be immersive, and refers primarily to the

\(^{18}\) The term virtual reality was first popularized by Jaron Lanier in the 1980s (GBN, 2004).
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factual, or what is possible under the laws of nature. Immersion in most cases is mentally absorbing, characterized by diminishing the critical distance between what is shown and increasing the emotional involvement in what is happening (Grau, 2003, p. 13). According to Janet H. Murray, immersion, the experience of being transported into a simulated place, “is a metaphorical term derived from the physical experience of being submerged in water.” (Murray, 1997, p. 98) Immersion does not relate only to electronic interactive media, however. Narration has been creating worlds that are “more real than reality,” which alerted Plato to distrust the poets as threats to the Republic (Murray, 1997, p. 98). Electronic interactive media, then, enables us to act out our fantasies.

During our everyday internet voyages, we inevitably will come across something on the web that is called “virtual.” Using one of the major internet search engine websites, an internet search with the keyword “virtual” produces results such as “The Virtual Tourist,” “Virtual Reference Desk,” “Virtual Library,” “Virtual Religion,” and so on. Several e-commerce websites refer themselves as “virtual stores.” In this sense, being virtual carries the meaning of a store which is not a “real store,” as most people are accustomed to, i.e. a building that houses merchandise. The store is a computer screen where the shopper visually browses through merchandise. Naturally, this store experience is completely different; in a virtual store, shoppers cannot manipulate or try out the merchandise directly, but only can look at representational images. However, there is a certain “reality” to the virtual store. First and foremost, the store still fundamentally retains the same purpose as a regular store. The transactions are real, as is the merchandise that the shopper buys. A few days later, the merchandise arrives at the customer’s address. In this case, the shopper’s knowledge of the reality of commercial business keeps him/her aware that he/she is still interacting with
something real. In this case, virtual reality is used as a method of representing merchandise for reasons of convenience, and it serves its purpose well.

According to Jennifer Whyte (2002), the use of the term “virtual reality” can direct attention to either the VR medium or the VR system. When the term is used to refer to the VR medium, there is a focus on the virtual environment and the model created within the computer. In contrast, when it is used to refer to the VR system, the focus is on the hardware and software (Whyte, 2002, p. 3). As a medium, virtual reality has three defining characteristics.

1. Interactive – users can interact with models
2. Spatial – models are represented in three spatial dimensions
3. Real-time – feedback from actions is given without noticeable pause

If we compare these three characteristics to the definition of video games that was offered earlier, we can see that virtual reality and video games are almost interchangeable terms. We can at least assume that virtual reality is one of the aspects of first-person shooter games, among others.

In relation to virtual reality systems, virtual reality can be defined as follows (Whyte, 2002, pp. 4-5):

1. Immersive systems totally surround the user, supposedly providing an unmediated experience. They do this through specialist hardware such as head-mounted and large wall-mounted displays. They require high-end computing power to provide a highly realistic environment.

2. Non-immersive systems typically use more generic hardware. The same software techniques are used but the system does not totally immerse the viewer. Sometimes described as window-on-a-world systems, they allow the user to become immersed into...
the virtual reality through a screen or display that does not take up their total field of view.

3. Augmented reality systems overlay virtual and real world imagery allowing the user to interact with both the virtual and real world, for example through the use of mixed video and computer images. Such systems reduce the amount of geometry that it is necessary to build in the virtual world.

Following Whyte’s categorization system, video games fall into the second category, which is considered non-immersive. Immersion can be understood as physical immersion or skill-based immersion. Physical immersion is what Whyte described in the first point of virtual reality systems, where physical equipment surrounds the player with a multitude of sensory-stimulating properties (visual, auditory, tactile, etc.). Immersion can also be achieved, arguably, through skilled players who become united with the non-immersive control system, reaching the same result as immersive virtual reality.

3.2.4 Voluntary Movement

The interactive medium’s benefit clearly lies in its interactive component. Interactivity makes the representation of voluntary bodily movement throughout the virtual world possible. This opens up possibilities for gaining a better understanding of space, against static or involuntary\(^{19}\) three-dimensional representations. This is exactly where architecture can benefit from video game technology. Static or involuntary architectural representation methods typically regard clients or users as spectators that passively attempt to understand and learn about architecture. The interactive medium, on the other hand, enables clients or users to be

\(^{19}\) Involuntary 3D representation includes static and motion (film/animation) images where the viewer is passive.
more actively involved with the environment, which makes for a better understanding of architectural experience.

The effect of voluntary movement is described by the distinction between images of distant and close proximity. According to Adolf von Hildebrand (1893), when a viewer stands far away from the object of perception, he gets an overall two-dimensional view of the distant image. As the viewer moves closer to the object, he loses the overall picture and is able to get only partial glimpses of it. The perceived image is not purely visual but also tactile. The closer image, therefore, conforms better to the reality of the object because a matching occurs between the movement of the eyes tracing the object and the object’s real form (Hildebrand, 1893).

The ability to act within an immersive context is closely related to the sense of agency, which is “the satisfying power to take meaningful action and see the results of our decisions and choices.” (Murray, 1997, p. 126) For example, in a video game the player expects to feel agency when he presses on a button and his avatar in the game reacts accordingly. The sense of agency is important to supporting immersion, especially where player’s command is explicitly influential. Yet the ability to move around a virtual world in itself may not give the feeling of agency. However, as we discussed earlier, any virtual world is a place that is pre-programmed to contain the avatar; the more reactive the place, the more agency the player feels. For example, the movement of the avatar’s body pushes and smacks the bushes and grass on the ground, or the movement of the avatar’s feet in a shallow river creates gushes of water and its rippling water sound.

3.2.5 The Matrix’s Solution to Mediated Virtual Reality

*The Matrix* (1999) is a science fiction film written and directed by the Wachowski brothers. The film describes a future in which the reality perceived by human beings is actually
a computer simulation called the Matrix, created by conscious artificial intelligence machines. It came about as a result of war between humans and machines. The machines end up overpowering the humans, and the humans subsequently rebel by trying to shut down the machines’ energy source (as electronics) by clouding the sky and depriving them of their main source of energy: the sun. This leads the machines to use of human bodies as an energy source. The Matrix led humans to believe that they were living in a normal manner, while their bodily energy was actually being maintained and harvested.

While this scenario is clearly a fiction, such a notion of virtual reality, if possible, would be the perfect form of interactive media. The movie also derives philosophical ideas from sources such as Plato’s allegory of the cave and Descartes’ evil genius. The evil genius presents the complete illusion of an external world in existence, including other people, where in fact, according to Descartes, no such external world exists (Descartes, 1996). The evil genius in the movie is replaced by sentient machines, deceiving human beings with their virtual reality software, the Matrix.

The current breeds of interactive media use microprocessor-equipped machines capable of simulating a limited virtual world. As mentioned earlier, however, the interactivity provided is bridged by computer peripherals, the mediator device; hence the experience is mediated. Unless highly skilled to subjectively overcome the mediation, immersion is almost impossible. We were faced by the challenge to create a better, more intuitive mediator device. However, mediated virtual reality can only go that far.

The diagram below explains the experiential relationship between human beings and the world through physical processes.

![Figure 23 – Human and World Diagram (Author)](image-url)
In the diagram above, the mind and body are different, separate entities. Descartes views the pineal gland as the principal seat of the mind.\textsuperscript{20} Neuroscientists testify that brains produce the mind. The relationship between brain and mind remains debatable, but since it is established that the mind and brain are very closely related, this thesis symbolizes the relationship with a diamond shape that remains directly connected throughout subsequent diagrams. The brain and the sense system are elements of the body, hence the same coloring. All are parts of the nervous system, with the brain as part of the central nervous system and the sense system as part of the peripheral nervous system, through which stimuli are received/sent. The world interacts physically with the sense system, giving and receiving stimuli. Through this simplified series of physical events, the mind experiences the world.\textsuperscript{21}

Comparing this diagram to the next, which explains how human beings experience the virtual world, it is apparent that the mediator (the computer peripheral/control scheme) becomes a barrier for any possible experience provided by body/real-world relationship.

![Figure 24 – Human and Mediated Virtual World Diagram (Author)](image)

People skilled in using the mediating device can achieve greater immersion in the virtual world because the mediating device has become an extension of the body.

![Figure 25 – Skilled Human and Mediated Virtual World Diagram (Author)](image)

\textsuperscript{20} Descartes originally said “…pineal gland as the principal seat of the soul.” However, Descartes does not regard mind to be different from soul (Carter, 1991, p. 207).

\textsuperscript{21} Whether this process should be described as “the mind experiences the world directly” or “the mind experiences the world through the body” remains a philosophical debate that will be discussed in the following subchapters.
This relationship however, remains strictly subjective. Everything comes back to the mind; it’s the mind which decides whether this sense system/mediator relationship is comparable to the sense system by itself. The two certainly are physically different, but the subjective differences can be reduced through the body’s acquired skill.

The ultimate relationship to the virtual world remains the direct body-virtual world relationship, described in the Matrix scenario. The Matrix scenario illustrates the possibility of the future of an unmediated virtual reality, under certain conditions. Assuming that the conditions are met, the relationship diagram is as follows:

![Figure 26 – Human and Virtual World (direct connection) Diagram (Author)](image)

Unmediated virtual reality requires that the mind, body and computer become directly connected. This connection, however, presents a technological and philosophical debate. Technologically, this is currently not possible, until advanced research in “nervous-system – microprocessors” and “electro-chemical – electronic signals” verified the possibility of effective and sustainable direct connections between them. There is some hint, however, that this technology may become possible in the future. US researchers have carried out technological trials for bionic eye implants (Fildes, 2007). These early cybernetic experiments demonstrate sustainable and effective one-way communication between electronic and electro-chemical signals. A small video camera mounted on a normal spectacle captures visual information. A small handheld computer worn on a belt converts the signal into electrical signals, which are then sent back to the glasses to be transmitted wirelessly to a receiver under the surface of the eye. Finally, the implant receives signals from a receiver and stimulates the retina, which then sends visual information to the brain. Patients with *retinitis pigmentosa* or macular
degeneration\textsuperscript{22} benefit greatly from this technology, even though the visual feedback that they see from their eyes does not come anywhere close to a normal eye, they are able to see light, shapes, and movements. The first generation of the bionic eye can only process sixteen pixels or electrodes\textsuperscript{23}, and has been in use for more than five years by the earliest patient. The newer generation can provide sixty electrodes, which should provide much better visual information.

Another example is a technological trial developed by Scottish company Touch Bionics. The company developed an electronic prosthetic hand, and fitted it to a man in Scotland (Walsh, 2006). The prosthetic hand features fully articulated joints powered by individual motors, with sensors that could pick up myoelectric signals from arm muscles to make a full range of movements. While these advancements are considered a technological leap, they are still nowhere near any comprehensive communication between the nervous system and the computer.

Philosophically, the discourse that allows for mediated virtual reality has been heavily debated among renowned philosophers for centuries. The problem hinges on an old philosophical debate about the way the mind and body interact. Some people claim that mental phenomena, such as pain and happiness are essentially subjective (\textit{qualia}), and as such irreducible to any set of physical events (Chalmers, 2002). At the other end of the dualism spectrum, people claim that mental events are just our way of speaking about events which are essentially bodily, and that consequently, the mind does not hold its own among the stimuli of the physical world. This lingering linguistic dualism is bound to disappear as people become more educated about the functioning of their own minds and the brain.

\textsuperscript{22} Both diseases cause the retinal cells which process light at the back of the eye to gradually die (Fildes, 2007).
\textsuperscript{23} The number of electrodes corresponds to the number of pixels of a video camera. Electrodes need to be very small in size to correspond to the size of the retina (in the two digits of \textmu m range).
3.3 Philosophical Interactive Media Critics

Interactive media technology discourse appears to attract scientists, professionals, and philosophers alike. A number of important debates by different thinkers and writers in the domain of architecture, representation, and virtual reality are presented in this chapter. The relatively young topic has created contradictions and confusion, mainly because of its subjective interpretation and indeterminate standard of conduct. This is evident in the various arguments that appear to be both partially supporting and denying the simulation of embodiment in interactive media, some calling it “idealized,” while others describe it as “visionary.”

3.3.1 Role of the Body (Merleau-Ponty)

Through his Phenomenology of Perception of 2005, Maurice Merleau-Ponty (1908 – 1961) identified the cognitive potential of the body as an alternative against Descartes’ famous dictum “Cogito ergo sum” (I think, therefore I am). For Descartes, the mind is much more clearly and distinctly known to us than the body: knowledge of the existence of our own body, together with the knowledge of external objects, comes in third place, after knowledge of the mind and of the existence of God are established (Descartes, 1996). Descartes uses a simple example to illustrate his concept: the Wax Argument. A piece of solid wax, whose properties we can sense, will feel different once it melts. However, wax is still wax, as far as we understand with our mind. Based on this example, therefore, the knowledge about the wax lies exclusively in the mind. Descartes believes that the world outside our mind does not exist; hence, it carries no significance.
Maurice Merleau-Ponty attempts to break this dichotomy with a new account on the body-mind relationship. The body is not a mere object or physical entity, and the knowledge of one’s own bodily existence and spatiality is different than that of external objects. He therefore underlines the fact that there is an inseparable connection between consciousness and the body.

“(…) the position of my hand is not determined discursively by the angle it makes with my forearm, and my forearm with my upper arm, and my upper arm with my trunk, and my trunk with the ground. I know indubitably where my pipe is, and thereby I know where my hand and my body is, as primitive man in the desert is always able to take his bearings immediately without having to cast his mind back, and add up distances covered and deviations made since setting off.” (Merleau Ponty– p. 115)

According to Merleau-Ponty, knowledge “resides” in the body as well as in our mind. When driving a car, the knowledge that rotating the steering wheel to the right will make the car turn right may be no longer in our mind. All we think about when we drive is to turn right, and the hand automatically rotates the steering wheel to the right. Hence, simply understanding how things work does not give us the full knowledge of them. In order to fully understand and acquire skills, we need to experience our environment together with the body.

The term “experience” comes from Latin word experientia, which is a translation of the Greek word ἐμπειρισμός (empirismos), which is translated into English as empiric. Classical Greek and Roman usage of the word refers to a physician whose skill derives
from practical experience, as opposed to instruction in theory (Sini, 2004). The term, therefore, means something that is derived from experience and observation, rather than theory. Thus, experience can be described generally as knowledge or skills acquired through observation of, direct involvement in, or exposure to events. What is derived from this observation, however, is generally not quantifiable. It’s the process of the whole mind-body combination and body-subject actions which enables our understanding as we perform certain tasks.

Likewise, I do not learn how to co-ordinate the various parts of my body in order to perform a task, but I only learn about my various body parts insofar as they come together to perform certain tasks. This applies to both those body parts that I can see, but also to those parts that are hidden from me, but which I can nonetheless visualize (Merleau-Ponty, 2005, pp. 172-173).

Not only is knowledge of one’s own body privileged as compared to knowledge of the external world, but the body itself takes on a cognitive role. This doesn’t mean, however, that the body is somehow severed from the external world, in which cognition participates.

My whole body for me is not an assemblage of organs juxtaposed in space. I am in undivided possession of it and I know where each of my limbs is through a body image in which all are included (Merleau-Ponty, 2005, p. 113).

The idea that Merleau-Ponty brought about did not consist only in restoring the cognitive role of the body, but also in breaking the mind-body and mind-world dualism.

Recent video games have made huge progress in mimicking the real world interaction of body movement and the environment. Although the requirement for “an active body coping with things” (Dreyfus, 2001, p. 57) seems to be the ideal argument for the effectiveness of video game technology in architectural representation, as discussed earlier, voluntary movement in video game technology is still a far cry from real bodily involvement. Insofar as players are able to overcome the mediating peripherals, voluntary movement of the body is of special importance:

By considering the body in movement, we can see better how it inhabits space (and, moreover, time) because movement is not limited to submitting passively to space and time, it
actively assumes them, it takes them up in their basic significance which is obscured in the commonplaceness of established situations (Merleau-Ponty, 2005, p. 117).

Experience also suggests events that are perceived immediately but mentally unprocessed (or processed afterwards), such as reflexes, or instincts, which are the characteristics of real-time interactive media.

In early three-dimensional video games, such as Wolfenstein 3D, the three-dimensional display movement is unrealistically smooth; it looks like a camera on a shock-absorbing wearable tripod in movie productions. In recent games, the manner in which the point of view wobbles when the avatar is running, the shock effect of being hurt by a villain, the tendency to tilt toward the direction of travel, and other visual effects conveying body movement provide for a more believable experience. The significance of bodily interaction with the environment in order to provide the player with a sense of reality is displayed in Figure 28, which ridicules a mishap in the video game Half-Life 2 (© Valve Corporation).

The comic strip tells the story of a game character made with in-game modification.
software. While the story does not generally orient itself as being inside a video game, this issue (#007 and #008) of the comic interestingly parodies the mechanics of the video game. Strip number five and six tell us: “Hey, cool! I can pick up things in this game!… I mean world. It’s a little odd that I don’t have to use my hands though.” (Livingston, 2005)

In the game, the button “E” on the keyboard is the bind for the functions of picking and releasing objects. However when a player picks up the can, the onscreen view does not show any body limb holding it. Any object that is “picked-up” appears to be floating in the air. It is interesting to point out that this phenomenon in the mechanics of the game does not generally hinder players’ performance and/or experience, but exists nonetheless. Newer video games such as F.E.A.R. discussed in the previous chapter, do show body limbs and shadows, which provides an enhanced impression that the player is really occupying the game-space. These simple gestures of representation carry the significance of what Merleau-Ponty describes as body image: “… the body image is… a way of stating that my body is in-the-world.” (Merleau-Ponty, 2005, p. 115)

Because of the subjective nature of three-dimensional interactive media, the question that follows is whether video games may somehow constitute a compromise between real bodily interaction and disembodied virtual reality.

3.3.2 Telepresence and Distance Learning (Hubert L. Dreyfus)

Dreyfus constantly questions the dominance of everyday computer and internet use. He talks about telepresence and distance learning in his book On the Internet (Dreyfus, 2001). While telepresence is not real-time three-dimensional simulation, the reality it tries to remotely interact with mimics how mediated virtual reality works; therefore his account is useable in this regard. Dreyfus starts by rejecting the Cartesian claim that we are never in touch with reality,
and that all our experience of the world is indirect (Dreyfus, 2001, p. 53) and also the Pragmatist claims of William James and John Dewey that what gives us a sense of being in touch with reality is the ability to control things in the world (Dreyfus, 2001, p. 54). According to Dreyfus, controlling a robot with delayed feedback would not give us a sense of reality. It is the ability to control things in real-time (as in laparoscopic surgery, (Dreyfus, 2001, p. 55)) that gives a sense of reality. Even in this case, claims Dreyfus, distance can undermine our sense of really being present, "leaving us with a vague sense that we are not in touch with reality" (Dreyfus, 2001, p. 55). He also suggests that the increasing disembodiment that comes with “living in cyberspace” might be fatal for our capacity of understanding the world around and, ultimately, for our capacity of leading meaningful lives:

“(...) if we manage to live our lives in cyberspace, we would lose a lot more than face-to-face conversations, verbal promises, and the memory power Plato saw we were endangered by writing. We would lose our only reliable way of finding relevant information, the capacity for skill acquisition, a sense of reality, and the possibility of leading meaningful lives – the last three of which are constitutive of us as human beings.” (Dreyfus, 2001, p. 93)

Dreyfus argues that what gives us a sense of reality is being exposed to risky situations, which is precisely what telepresence is trying to avoid. He goes on to describe, following Merleau-Ponty, that the thing which gives us a sense of being in touch with the world is the necessity of getting an optimal grip on the world, i.e. finding "the best distance for taking in both the thing as a whole and its different parts” (e.g. a picture in a gallery). The body seeks and finds this optimum. The ability of coping with things is not directed to anything in particular, but to things in general, to whatever comes along (Dreyfus, 2001, p. 57).

24 “Living in cyberspace,” even though it could be related to almost anything in digital space, relates also to “living in” a virtual world as in a real-time three-dimensional representation.
The most challenging case of telepresence, according to Dreyfus, is live, interactive, video distance learning. Showing that one cannot acquire expertise\(^{25}\) in this case amounts to successfully refuting the possibility of the distance learning education system. What is lost in the case of interactive, video distance learning, according to Dreyfus, is "the possibility of controlling one's body movement so as to get a better grip on the world," or "a sense of context" (e.g. the shared mood in the classroom) (Dreyfus, 2001, p. 60). The distant apprentice will not learn how to respond to the overall scene by being drawn to zoom into what is significant (Dreyfus, 2001, p. 64). Dreyfus gives the example of a doctor performing surgery with a camera mounted to his head, so that his students can watch him perform and learn from the video produced by the camera. While watching the video, the camera automatically points to the surgical procedures, handled by doctor, thereby depriving the learner of bodily involvement in a risky real environment where he has to interpret the scene himself and learn from his mistakes (Dreyfus, 2001, p. 65). The disembodied learning experience, therefore, is not enough to enable students to master a surgical procedure. Additionally, Dreyfus does not think that watching films is privileged in that respect, as "football players can only learn up to a point by watching game movies" (Dreyfus, 2001, p. 64). Finally, he appeals to intuition to show how unlikely it is that simulated bodily contact can produce the same sense of intimacy as flesh-and-blood human contact (Dreyfus, 2001, p. 70). The conclusion is that remote control, while being less risky and more efficient (at least \textit{prima facie}) etc., cannot replace real life interaction.

Dreyfus' arguments make a lot of sense considering the current state of technological development. However, what Dreyfus pointed out are the limitations of a mediated mode of interactivity, in which the distance learning context clearly exemplifies unskilled participants' problems in coping with the technology.

\(^{25}\) See Dreyfus' skill scale in "How Far is Distance Learning from Education" (Dreyfus, 2001, pp. 27-49).
Telepresence presents a much more difficult challenge in comparison with mediated virtual reality. Telepresence tries to mediate reality, meaning the underlying technology has to encode real-world data, transport it to a distant location, and then decode it back into a real-world output device, in real-time. Technology from the telephone to the most advanced teleconferencing system can be used as a practical example. The problem of this process is, clearly, disembodiment.

Interactive media uses a similar process, but for a different purpose in the case of video games. Video games use similar technologies and methods, but it does not try to make a relationship with real-world reality. Video game worlds sustain their own “reality” in their own game spaces. Furthermore, video games provide their own “embodiment” in the form of the avatar. A player identifies himself with his avatar. What happens to the avatar in the virtual world, the player experiences as happening to himself (Balkin, 2004, p. 2047). Therefore, video games and their gameplay may offer the potential for “virtual” embodiment.

3.3.3 The Art Argument (Martin Heidegger)

Considering architectural representation as a form of art, we may investigate Martin Heidegger’s (1889 – 1976) “The Origin of the Work of Art” (Heidegger, pp. 15-86). While architects consider accurate one-to-one relationships between an object and its representation as truthful, Heidegger argues that art shouldn’t be treated in relation with truth in this sense.

Heidegger starts with older notions of works of art, architectural and sculptural works, which can be seen installed in public places; art works from different periods housed in collections and exhibitions. In itself, these are things; they have a thingly character, just like a rifle or a hat that are hung on the wall (Heidegger, pp. 18-19). What then, if anything, makes artworks different than other things that we can see around us? According to the traditional
understanding of the work of art, the art work carries something else over the thingly element, which constitutes its artistic nature. The thingly element says something other than the mere thing itself; that is the allegory of something. The allegory is brought together with the thing, to form a symbol (Heidegger, pp. 19-20).

Heidegger argues that something is a work of art not because it is an allegory of something else, or because it is a thing which possesses special artistic characteristics, or raises lofty sentiments. Something is a work of art because it reveals a truth.

"Truth happens in the temple’s standing where it is. This does not mean that something is correctly represented and rendered here, but that what is a whole is brought into unconcealedness and held therein." (Heidegger, p. 54)

The work of art tells the truth about something; in his example, a pair of peasant shoes in Van Gogh’s painting (Heidegger, p. 32). Using common knowledge of a society, assuming that everyone already knows about shoes, Heidegger deciphers the painting’s truthfulness by describing how the shoes serve the peasant woman in her toilsome laboring. As such they “belong to the earth,” and “are protected in the world of the peasant woman” (Heidegger, p. 32). The worn interior of the shoes is a testimony to the “toilsome tread of the worker.” “The stiffly rugged heaviness” speaks to “the accumulated tenacity of her slow trudge.” “On the leather lie the dampness and richness of the soil.” “Under the sole slides the loneliness of the field path as evening falls.” Their usefulness comes across even more the less aware the woman is about them. The woman reaches for them in the morning without noticing or reflecting.

Heidegger calls this reliability. Reliability is what gives the equipment its character. Reliability is what allows the peasant woman, according to Heidegger, to answer “the silent call of the earth,” and to be “sure of her world.” “World and earth exist for her (...) in the equipment.” (Heidegger, pp. 34-35) Finally Heidegger said,

“...above all, the work did not, as it might seem at first, serve merely for a better visualizing of what a piece of equipment is. Rather, the equipmentality of equipment first
genuinely arrives at its appearance through the work and only in the work. ... Van Gogh’s painting is the disclosure of what the equipment, the pair of peasant shoes, is in truth.” (Heidegger, p. 35)

The truth in a work of art, therefore, lies in its capacity for setting itself to work, revealing or bringing forth into our attention, the deeper meanings and relationships among things in our world, and on the earth (Heidegger, p. 35). In this regard, an architectural representation as a work of art does not necessarily have to “factually correspond” to some reality, as long the entities therein are able to reveal compelling insights about the “world” of the participant.

3.3.4 The Cinesthetic Subject (Vivian Sobchack)

Vivian Sobchack is a cinema and media theorist and cultural critic. She is skeptical about digital technology, reckoning that, while cinema allows for lived, embodied participation, experience with digital technology is dispersed and insubstantial. Vivian Sobchack argues that our bodies “feel” what is shown in the movies (Sobchack, 2000). She used Merleau-Ponty’s description of intercommunication between the senses and real-world objects:

“One sees the hardness and brittleness of glass, and when, with tinkling sound, it breaks, this sound is conveyed by the visible glass…” (Sobchack, 2000)

Reading the passage, Sobchack recalls that she physically “cannot fully touch Ada’s\textsuperscript{26} leg through her stocking or Stewart’s\textsuperscript{27} sensitized nude body on the screen of The Piano... cannot taste the exact flavors of the pork noodles she saw in loving close-up in Tampopo...” (Sobchack, 2000). She argues that she still has a partially fulfilled sensory experience that cannot be reduced either to the satisfaction of merely two of her senses or through cognitive thinking and conscious thought. She explains her reasoning as follows: first, it is her lived body posture

\textsuperscript{26} A character in the Academy Award winning movie “The Piano” (1993).
\textsuperscript{27} idem
sitting in readiness, focusing on the screen, which makes for the potential of a multi-sensory experience. Secondly, she has to be engaged by what she sees, marking it not merely in her attention, but also in her bodily tension and comportment. Insofar as she cannot literally touch, smell or taste the particular onscreen figure soliciting her sensual desire, her body seeking to fulfill this solicitation will reverse its direction to locate a sensual grasp on her own subjective lived body (Sobchack, 2000).

However, she pointed out that the interactivity of Quicktime movies (generally speaking, a digital movie played on a computer) hinders the feeling of being in a “real-time” and “live-action” cinema where the movie “streams” the future (Sobchack, 1999).

From these accounts, we recognize the power of involuntary immersion. It is interesting to note that a person’s environment can have a huge impact on her experience with representation. Watching the same movie using Quicktime media would indeed have much less impact. The interactivity of a Quicktime movie (the ability to pause/rewind/fast-forward) reduces the suspense, immediacy and spontaneity of otherwise uncontrollable cinema. Rarely does one have an environment setup for Quicktime movies that mimicks that of a movie theater. At this time, Quicktime movies themselves cannot compete with large-scale, widescreen, high-resolution films that a cinema can provide. Compare the mood of watching a movie at home to a movie theater seat. From the very beginning, we enter the dark theater room and see only glimpses of what composes the theater against the primacy of the contrasting screen. In this setup, movie-goers can do nothing but focus on the screen, which helps immersion.

The question that follows, then: How will interactive media affect this cinematic immersion?
Sobchack pointed out earlier that interactivity in Quicktime movies actually killed the immersion. One of Sobchack’s observations on immersion conditions is engagedness. Based on her descriptions, her ability to be engaged by what she sees on-screen indicates an interest in the significant essence of the film. If the movie is not interesting, we would doubt that immersion is going to happen. Therefore, the storyline, the actors, the images, or whatever essence that engages us in the movie, governs our immersion. In the same tone as Sobchack, Ken Perlin argues that reading a Harry Potter book is to experience his agency, as he navigates the various challenges that life presents him with. Therefore after putting the book aside, Perlin can easily sustain the pleasant fiction that there is an actual Harry Potter somewhere (Wardrip-Fruin, Noah; Harrigan, Pat; et.al., 2003, pp. 14-15). Perlin adds that while playing Tomb Raider (© Eidos Interactive Ltd.), we don’t think of Lara Croft the same way as Harry Potter. While the game contains an interesting story as well, the whole experience of following the story depends on the player portraying Lara Croft. When the player stops playing, Lara Croft disappears as well. The story depends on the player to progress (Wardrip-Fruin, Noah; Harrigan, Pat; et.al., 2003, p. 15).

In this regard, passive modes of architectural representation may as well become more “engaging” than interactive three-dimensional representation, especially in cases where the architect telling the design concept is “more interesting” than the client’s own willingness or ability to walk-through the building. It again comes back to the issue of belief, the mediated nature of interactive media technology, and how to direct these issues so that they will appeal to a more general use of three-dimensional interactive media technology.
3.4 Summary

The question of whether interactive media in architectural representation can reverse the trend from visual to experiential architecture can be answered in a number of aspects.

First, architectural representation is a unique case. Aristotle considers representation to be a copy of nature, while Plato considers representation to be a secondary copy. Architectural representation, however, evades both these definitions, because architectural representation precedes whatever it represents. The representation, however, still references something in the context of the real world. Therefore, it has at least a copy of the context from the real world, because the design is going to be built in its context.28 As clients, we often understand the real world context cognitively, together with our bodies, which help us relate a representation to its real-world context. To make an ideal comparison with its context, therefore, architectural representation should be the embodiment of a design idea.

Second, the importance of the body in understanding space is apparent. Merleau-Ponty tried to restore the cognitive role of the body, as well as the body in which knowledge/skill resides. Dreyfus and Sobchack do not find any embodiment to be possible with interactive, mediated, electronic representation. This is largely because of their sceptical view that nothing can be fully represented faithfully and accurately. They also emphasize the problem of mediation, neglecting the significance of belief and skill. Nonetheless, Heidegger argues that, as an art work, an architectural representation does not have to be objectively accurate to be truthful, as far as the representation is able be experienced as true.

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28 Some exceptions apply, such as in the case of Modernist Architecture (such as Le Corbusier’s case mentioned earlier) where context is not regarded.
Finally, the architectural experience that interactive media is expected to represent is the experience of place. The technology can better represent voluntary movement through space, which opens up the possibility of a better understanding of place. Three-dimensional interactive media is more experiential than previous media because people possess a body with which they voluntarily move about. To become the body, however, depends on the degree of immersion. The degree of immersion depends on belief, skill level, as well as the mode of representation and interaction.
Chapter 4: The Technical Exploration

“Computers are useless. They can only give you answers.” (Pablo Picasso)

This chapter will describe the process of an experiment with three-dimensional real-time-rendering interactive media technology, from this point forward referred to as 3DRTR. Different real-time rendering hardware and software technologies will be discussed and evaluated for the purpose of architectural representation. The subject of this 3DRTR experiment will be the architecture of the Toraja community from South Sulawesi, Indonesia, a proposed UNESCO World Cultural Heritage Site (Adams, 2004, p. 433). Finally, the chapter will evaluate the architectural visualization and draw conclusions about its performance.

4.1 How 3DRTR Technology Works (Technical)

Technically, 3DRTR interactive media is a computer software program that simulates a virtual world, providing a virtual self-presence experience. It runs on a system of hardware microprocessors which process data to display output and receive feedback from the participant.

The system hardware consists of several processing units that communicate with the participant through mediatory input/output peripheral devices, such as a liquid crystal display (LCD), keyboard, mouse, or joystick. Computer displays as an output device are a very intuitive implementation of a graphical interface that produces a raster color graphic comparable to that of a photograph or painting. This has been an especially intuitive device
since the advent of graphical user interface; prior to this, the user needed to learn the computer’s language and symbols in a process similar to learning how to read. Input devices require more design and ergonomics challenges to provide for the most intuitive experience. However, even the most intuitive input device still requires training in order for one to master it.

The software is an application that runs on top of a system software. Different hardware machines run different system software, on which different application software are needed as well. For example, an application, like Adobe Photoshop that runs on the Apple Macintosh OS X (also known as “Adobe Photoshop for Mac”), will not run on the Microsoft Windows operating system. Windows users will need a specific Adobe Photoshop software program developed for Microsoft Windows (“Adobe Photoshop for Windows”) to run the application. The 3DRTR software as an application is bound to the same limitation.

4.1.1 The Hardware

3DRTR typically runs on most popular personal computer operating systems: Microsoft Windows, Apple Macintosh, and Linux. Personal computers are general purpose machines, built according to specific needs, using standardized hardware connections and ports for configuration versatility. Hardware configurations for 3DRTR software, however, generally require high-performance components and processing units that are not required for general purpose applications. 3DRTR software is considered as one of the most complex category of software.

3DRTR as video games however, also runs on console machines, such as Sony Playstation 3, Microsoft Xbox 360 and Nintendo Wii (the most popular consoles at the end of 2007). A console machine is a computer hardware that is specifically made for the purpose of
running video game software. It accepts specific media formats, such as proprietary cartridges, specially formatted compact discs, DVDs, or Blu-Ray Discs. The machines have the same basic concept as any computer, but with proprietary system software that runs proprietary media formats that are usually not readable by mainstream personal computers. Because of this specialized use, console machines do not suffer from the specification requirements of personal computers. Every console machine of the same generation has exactly the same hardware specification, eliminating the need to upgrade or adapt system hardware to the software. This way, console machines are generally more affordable than high-performance personal computers. Console machines most commonly use televisions for output display, although recent models can use almost any type of newer monitor/display technology. Different consoles use different controllers, however, generally called gamepads or joysticks, although the button assignments and arrangements typically differ.

Both personal computers and console machines have similar technical concepts. A primary processing unit, or CPU (Central Processing Unit), typically performs most of the calculations while a GPU (Graphical Processing Unit) performs the graphical operations. Graphical operations need a separate processing unit because of their specific type of calculations. Each processing unit is supported by data storage sets called RAM (Random Access Memory). The GPU as a specialized processing unit usually employs much higher...
performing RAM than the general purpose CPU. The different elements are interconnected together through a system bus. The capabilities of each component (generally their processing/transfer speed and amount of storage capacity) governs the resulting overall performance.

![Typical Gaming Desktop PC (Hewlett Packard, 2007)](image)

The customizability of personal computers allows for specially-configured hardware for extreme 3DRTR uses. For example, while current generation personal computers (ca.2008) are typically equipped with dual-core processors, which allow for more efficient multi-tasking performance\textsuperscript{29}, 3DRTR specialized computers could be equipped with quad-core CPUs to

\textsuperscript{29} Modern operating systems allow for multi-tasking of different software tasks. Single-core CPUs create the illusion of parallelism by switching attention from different tasks frequently, although effectively only able to
process the multi-threaded\textsuperscript{30} software. With as many as two to three GPU cards installed, performance is effectively doubled or tripled. Because of the multiplicities of components, however, overheating becomes a major concern. Water-cooling systems creating better heat-dissipation, similar to radiator cooling system in transportation engines, were therefore invented to remedy this issue.

While specialized hardware may not be feasible for mainstream use, the capabilities of hardware components continue to increase, as size and power consumption continue to decrease. In the future we will see mainstream computers become much faster than the fastest computer today, and it will be small enough to fit in a shirt pocket.

4.1.2 The Software

3DRTR software produces synthetic computer graphics fast enough for the viewer to interact with the virtual environment without noticeable delay. While this speed depends largely on the hardware specification, efficient software architecture also contributes to the 3DRTR software’s rendering speed capabilities.

While 3DRTR includes numerous methods and operations, such as synthesizing three-dimensional geometry, simulating lighting and textures, and rasterizing final images, it also

\footnote{Calculation-demanding software can be programmed to have multiple tasks or processes, taking advantage of multi-core CPUs.}
performs efficiency operations, such as level-of-detail operations (LOD)\textsuperscript{31}, hidden surface removal (HSD)\textsuperscript{32}, and clipping\textsuperscript{33} methods.

Other than geometrical operations, 3DRTR software also possesses physics simulation capabilities, such as the laws of gravity, inertia, friction, etc. Objects behave differently, when picked up and thrown, for example. A small cardboard box will bend and eventually break apart when thrown away, while an empty barrel will instead bounce around and roll. Ragdoll physics methods are also implemented with characters and animals in 3DRTR, where, for example, a character that falls off a cliff will have body limbs bouncing around with joints bending in realistic directions.

Lighting simulation has also developed to include HDR (High Dynamic Range) imaging techniques which correctly represent a wider range of exposure, from pure sunlight to shadows. With a regular photographic technique, the camera exposure has to be set at a certain level. Current display technology is likewise unable to display the full range of exposure.

\begin{footnotesize}

31 Level of Detail (LOD) method reduces the number of polygons of an object as the viewer moves further away from it. This allows the computer to preserve its computing power as far away objects do not need detailed features unlike close proximity objects.

32 Hidden Surface Removal (HSD) is a category of methods to hide geometry or surfaces that are not normally visible, such as a model whose backside is not visible. This method also reduces processing overhead by skipping calculations of objects that are behind another object.

33 Clipping operations clip objects that are not inside the viewing window.

\end{footnotesize}
HDR-enabled 3DRTR simulates overpowering sunlight in interior areas by introducing the over-glow or bloom effect. This effect creates a glow on the overly-bright area, allowing more details to be seen in the rest of the image. Graphics processing company nVidia summarizes its products’ HDR rendering capability (Green & Cebenoyan, 2004) as follows:

- Bright things can be really bright
- Dark things can be really dark
- Details can be seen on both

This allows for better lighting between outdoor and indoor areas in the virtual world. Software capabilities for realistic virtual world representations are always increasing, along with the hardware technology.

4.1.3 3DRTR Engine

The software suite that possesses 3DRTR capabilities is often called an “engine,” or in the context of video games, a “game engine.” Because of the developmental pace of rendering capabilities, 3DRTR engines usually include features that currently available hardware cannot fully utilize (unless with hardware setup that is too expensive at the time). Every time a new
3DRTR engine is released, it is usually considered next-gen (next generation), which can only be fully utilized in the future when the necessary hardware becomes affordable.

There are hundreds of commercial or professional 3DRTR engine packages, such as Dassault Systemes Virtools, Truevision3D, Quest3D, as well as engines that are developed for video games, such as Crytek CryEngine, Valve Corporation Source Engine, Unreal Engine, id Software Doom 3 Engine, and many more. While commercial packages typically demand high royalty fees, most video game engine companies allow for the possibility of non-profit modification by video game owners.

Different engines have different features and usability. While most of them require special skills in three-dimensional object modeling, computer programming, sound editing, choreography, and concept art, for a more thorough design and better 3DRTR application, one or the other can be more suitable depending on a user’s existing skills. For example, modders\(^\text{34}\) familiar with 3D Studio Max can more easily adapt to the Crytek CryEngine’s Sandbox Editor software, the main editing application for the engine’s video game provided free-of-charge on the game disc.

### 4.1.4 The Mediator Device

As discussed earlier, a mediator device is the largest hindrance for immersion in 3DRTR applications. As a regular keyboard and mouse combo is the required standard on every personal computer, this mediator device is the most widely used.

\(^{34}\) Modder: a term for a person who modifies a video game.
Other, more specialized mediator peripherals allow for better spatial navigation. One of them is the Space Explorer by 3Dconnexion. The three-dimensional controller, usually referred to as “6DOF” (Six Degrees of Freedom), allows for more intuitive three-dimensional movements. The knob on the center of the device can be moved in a manner similar to a joystick in game consoles. The movement possibilities are much more diverse, however. Instead of just tilting around on its axis (like a joystick), the knob can be dragged sideways and pulled up or down, as illustrated in the next picture. This allows for considerable ease in navigating a three-dimensional space as compared to a mouse, for example, that only tracks sideways movement.

Another three-dimensional controller is the MX Air™ mouse by Logitech Inc. The mouse works and looks like an ordinary mouse, but as soon as the user lift it up, it becomes a motion detector. Using gyroscope accelerometer technology, the mouse “on air” will be able to detect hand movements in three-dimensional space. Most users get accustomed to this device quickly because of the intuitiveness of the motion controls.
While these devices are still mediators with a potential to hinder full immersion, their intuitiveness offers easier adaptation with the mediator.

4.2 The Experiment

The experiment will select a candidate 3DRTR technology for use in depicting an architectural subject. Because of the author’s familiarity with 3D Studio Max and the low cost of modifying the video game title “Crysis,” powered by Crytek CryEngine 2, the experiment will use this video game engine. The Toraja village in the heart of Sulawesi, Indonesia, which features lush tropical forests and outdoor scenery, has been chosen as the subject matter because of the video game’s existing setting in the tropical area. The existing tropical setting can be retained or only slightly modified to provide for the backdrop of the Toraja houses and rice barns, modeled in 3D Studio Max and imported into the video game.

The CryEngine2 software is a very powerful 3DRTR application with next-generation features. The French architectural and urban design visualization company IMAGTP has licensed CryEngine2 for use with their product visualizations (IMAGTP, 2007). Ringling College of Art and Design in Sarasota, Florida, was the first institution to license CryEngine2 for educational purposes. The College’s Computer Animation Department Head Jim McCampbell has said: “No other game engine comes close to offering the visual fidelity of the CryEngine2, which can produce the kind of high quality near-photorealistic output in real time that until now required expensive render farms days, or even weeks, to generate.” (Ringling College of Art and Design, 2007) At this time, the software requires quite hefty hardware requirements, but that will become mainstream in just a few months as computer hardware manufacturers battle for the competitive market.
4.2.1 About Toraja

The sight of the Toraja houses is well known from the brochures of tour operators. The upward turning roofs and intricately carved decorations make for striking images that attract visitors from all over the world. Their grandiose burial ceremonies make for moving film documentaries that leave a lasting impression on audiences (Volkman, 1990, p. 94). While images and movies of their elaborate rituals have struck a cord with viewers in the Western world, these media have not managed to convey a deeper understanding of the Torajan people’s lifestyle.

Figure 36 – Torajan rituals (CES-GMU; HU; CUT; WALDA; CEPI, 2000)

Short of a trip to the actual place, the Torajans’ way of life remains largely a mystery. Experiencing the accidental landscape, putting in the effort necessary to reach their top of the mountain burial places, and not least, sacrificing the dozens of buffalos that tradition requires for burials of the deceased, remains a foreign experience to most, excepting the local people and the few that have the privilege of visiting.
It is, paradoxically, literature, not still images, that has been more powerful in conveying a sense of place of the Torajan land. This description, from Harry Wilcox’s “White Stranger: Six Moons in Celebes,” is a powerful testimony to the impact that Torajan burial places had on early visitors (Volkman, 1990, p. 97):

When I rose to go and turned up the unkind path of rock I passed the resting-place of some of Pong Ratebambam’s most recent ancestors. This was a small pavilion with an ample atap (roof) in the shade of which sat three life-size wooden dolls, the images of former dwellers in the compound whose mortal remains moldered in coffins behind them. Their white eyes stared vividly at me and their stiff wooden fingers were held out as though in greeting. Their sarongs were in rags and fixed to the railing of their gallery were the horns of a great bull, which I already realized were the supreme symbol of magical strength to the villagers of La’bo. I passed the place without venturing on too close a scrutiny which might, I feared, have been construed as a lack of respect (Wilcox, 1949, p. 49).

What this first-person narration shares with the interactive media is a sense of actively participating in the narration, as opposed to the more passive attitude associated with other media technologies. In this chapter, we will provide a 3DRTR virtual recreation of the Torajan way of life, which will allow people with access to the virtual environment a chance to immerse themselves, according to their particular interpretations, in the way of life of the Torajans.

4.2.2 The Tongkonan (Toraja House) of the Torajans

The Toraja people inhabit the Latimojong Rock Mountain range and Mount Reute Kambola in South Sulawesi. The inhabitants of the Toraja land, or Tana Toraja, are said to have migrated around 2500-1500 BC from Indo-china and arrived on the island by boat. Boat symbolism is sometimes associated with the traditional Torajan house architecture which features a distinctive upward bending roof (Kis-Jovak, Nooy-Palm, Schefold, & Schulz-Dornburg, 1988).
Gaudenz Domenig (1990), however, disputes the idea that the shape of Torajan houses is reminiscent of the boat that the Indo-Chinese ancestors of the Torajans were said to have used when they set foot on the island some two thousand years ago. According to Domenig, ship symbolism was coined by foreign observers and is not supported by the ethnographic evidence; the parts of the projecting gables, in areas where similar architecture is encountered (e.g. Savu island), carry names like “neck,” “snout,” “cheeks,” and “breath,” all suggestive of a bull head (Domenig, 1990, p. 314), which is an equally powerful element in Torajan mythology. This interpretation is supported by a 1770 picture made on the occasion of captain’s Cook visit to Savu, in which bull horns can be seen at the end of the gables. In Savu, however, ship symbolism is expressed in the lower part of the house. Similarly, according to Domenig, Torajan houses bear signs of buffalo or bird heads growing out of the roof (Domenig, 1990, p. 314). Evidence that suggests otherwise is derived, according to Domenig, from a faulty translation of a Torajan ritual chant (Domenig, 1990, p. 315).
The touristic appeal of the Toraja community also resonates with the Indonesian government. In a bid to exploit the wave of international interest in Torajan architecture, the national government decided to make the traditional Torajan house, or the Tongkonan, the effigy image on the 5000 Rupiah paper bill. Such recognition on the part of the Indonesian government is rare for a group that is otherwise politically marginalized (Adams, 1998, pp. 345-6). The political recognition that follows the inclusion of the Tongkonan among the national Indonesian icons came at a cost, however. The Indonesian government, seeking to preserve the traditional Torajan house, demanded that all new houses built in Tana Toraja bear elements of traditional houses. This government intervention had twisted effects as far as conservation is concerned. The Tongkonan, once a symbol of status among its inhabitants, lost most of its traditional significance once it became accessible and mandatory for everyone. The Tongkonan ceased to be a marker of social identity in order to become associated with Torajan ethnic identity (Adams, 1998, pp. 337-8) (Volkman, 1990, p. 96).

As lived-in architecture, the Tongkonan was increasingly replaced in modern times with concrete or bamboo houses that are built in the immediate vicinity of the Tongkonan. One of the reasons for this development is, of course, the increasing appreciation for the Tongkonan as a touristic attraction. Another reason is the increasing time that the Torajans spend indoors,
under the influence of the Western lifestyle. As a dwelling place, the Tongkonan is far from comfortable (Volkman, 1990, p. 96). The “dark, windowless, confining interiors” served more as a refuge, a protective space, rather than a living space. The Tongkonan was basically “a fortress with a bold façade” (Volkman, 1990, p. 96).

4.2.3 The Spatial Arrangement

The Tongkonan is the primary element of a Torajan village, referred to as Tondok. The Tondok is mainly comprised of a large open space for the purposes of Torajan daily living. Most of the household functions were performed outside: working, cooking, and tending to the animals. The Tongkonan is also a symbol of identity, representing the descendants of a founding ancestor. Its decorations and carvings express family nobility in the community. Only noble and/or rich people could afford to build and maintain it. Tongkonan is always built facing north, to commemorate the direction of where they came from.

Torajans orient themselves upwards as well, to refer to God, or Puang Matua. Puang Matua was originally a pagan god, but during the period of Dutch colonialization Christian missionaries converted Puang Matua into the Judeo-Christian God. This upward orientation is illustrated by the upward pointing of the Tongkonan’s roof. In front of the Tongkonan is usually a row of rice barns called Alang, which is a smaller version similar to Tongkonan architecture.
Apart from keeping rice away from pests, during important rituals and social meetings, important persons and community leaders sit on the platform underneath the rice barn. The number of Alangs built also symbolizes the family’s wealth (CES-GMU; HU; CUT; WALDA; CEPI, 2000).

The members of Torajan communities are mostly agricultural workers. They raise farm animals and cultivate rice. The Torajan work ethic is very strong. Starting low and reaching for the top is the mentality that the Torajans appreciate. At the bottom of the economic hierarchy people raise chicken and pigs, then water buffalos, and, finally, towards the top of the hierarchy, they get to own their own rice fields (CES-GMU; HU; CUT; WALDA; CEPI, 2000). The rice fields are usually located around the perimeter. The animals (i.e. water buffalos) were once held in the space under the Tongkonan, but in recent times they have been kept in special
enclosures apart from the houses for health reasons. Chickens and dogs roam free in the open spaces.

*Tongkonans* and *Alangs* are arranged spatially according to the following rules (see figure 41):

A. A *Tongkonan’s* central axis is never aligned with the axis of *Alang*. This is believed to symbolize the concept of human life that should not collide with or obstruct each other.

B. Windows or openings on a *Tongkonan* cannot be directly aligned with windows or openings of any nearby *Tongkonan*.

![Figure 41 – Landscape Arrangement (Author)](image)

*Tondoks* usually border bamboo forests, which serve as a source of materials for building and maintaining the *Tongkonan* and *Alang*, as well for other more general uses. The vicinity is also usually bordered by rice fields and the *rante*, an open space dedicated for animal slaughtering rituals. There is considerable distance between *Tondoks*, as each family typically occupies their own set of aforementioned landscape elements. It is also believed that in the
Voluntary Movement in Architectural Representation

Past, natural elements such as forests and rice fields helped protect each family’s interests by providing a cover or barrier (CES-GMU; HU; CUT; WALDA; CEPI, 2000).

Figure 42 – Spatial Arrangement (Author)

4.2.4 The Virtual Tondok

Because of the video game engine’s existing tropical area contents, only the models of the Tongkonan and Alang were created and imported. CryEngine2’s close relationship with popular three-dimensional modeling software makes it easy for the process to be carried out. However, as with any 3DRTR application, general rules, such as a polygon count of the models that needs to be minimized in order to increase computing efficiency, should be considered.

The existing terrain model includes an elevated ground site originally made for a military base; terrain which a Tondok would similarly require. To the north of the site is a river,
while rice fields lie to the east, and forest to the south. A number of minor modifications to the existing environment were carried out, such as:

Figure 43 – Tondok site in the game (Author & Crytek)

1. Removal of unneeded objects. The Tondok occupies a virtual space that was previously used as an enemy military base. All traces of military objects were removed, and replaced by a designated ritual space rante.

2. Adaptation of terrain level. The site occupied by the Tongkonans was originally too steep. The use of terrain tools fixed this problem. The same tool was also used to level the ground underneath each of the imported objects.

3. Re-arrangement of vegetation. Obtrusive vegetation elements are now re-arranged to allow for the imported objects to sit appropriately in-between, underneath, or around the vegetation.

4. Reuse of animated objects. Several appropriate animated objects were salvaged. Birds flying over the roof, chickens walking and pecking around on the ground, and colorful
butterflies around the bushes are now integral landscape elements. These objects include sound effects as well; for example, the chicken clucks, and the bird sings.

![Image](image.jpg)

Figure 44 – Approaching Tondok (Author & Crytek)

The result obviously cannot be justified in this document because the paper medium can only present still images; source files can be downloaded from the following website link:


The packaged container file includes instruction on how to install and use the content. Users, however, need to own the video game “Crysis” to install; the computer hardware specification recommended by the game developer should also be considered to achieve the best experience. The experience of using this 3DRTR software application is described in a series of screenshot images as follows:

As the player approaches the site, a hint of Torajan settlement becomes visible. Volkman describes what she considers the touristic gaze:
Voluntary Movement in Architectural Representation

“... such houses are striking features of the Toraja landscape. Even from a distance the eye is caught by their densely layered, arching roofs; their stilted, almost ungainly silhouettes; and their brightly painted red, black, and yellow surfaces.” (Volkman, 1990, p. 95)

As the player walks closer to the site, details of the buildings start to show, emerging from the contrasting lush vegetation that dances quietly according to the direction of the wind. Birds fly around the curving edge of the roof, while chickens wander around clucking, and frogs jump.

Figure 45 – Approaching Tondok, closer (Author & Crytek)

At the center of the village, the player can look around the environment which displays the following images. The version of the 3DRTR on a computer screen will feature a dynamic virtual world that is “alive”: trees, grass, and plants wobble according to wind direction; wind direction changes according to the time of day; the clouds as well as the sun are moving according to weather and time of day; animals wander around, seemingly busy. While moving around, the player will be able to see his own body, as well as his own shadows on objects. The player will be able to interact with objects, such as picking up a rock and throwing it.
Figure 46 – Looking around Tondok 1 (Author & Crytek)

Figure 47 – Looking around Tondok 2 (Author & Crytek)
Figure 48 – Looking around Tondok 3 (Author & Crytek)

Figure 49 – Sitting on one of the Alangs’ platform (Author & Crytek)
4.3 Summary

The experiment shows the potential of using 3DRTR software for architectural visualization. The ability to move freely in the virtual world represents exactly what we are able to do in the real world. While immersion depends on each player, the near-photorealistic dynamic display that this technology provides allows players to immerse themselves more easily. The problem of mediating peripheral devices will always be a hindrance for first-time users; however, more frequent usage will quickly enable them to overcome this flaw because of 3DRTR’s relatively intuitive nature.

The virtual Tondok is an example of a low budget project done in a relatively short time, supported by user-friendly editing tools. The CryEngine2 is able to render multiple duplicates of the Tongkonans and Alangs, as well as provide highly detailed landscape scenery that spans many miles away in real-time, which is outstanding.

While relatively easy to use, the modification of a video game is still a rather complicated process for professional use in general architecture, and therefore still not widely practiced, despite its potential. Until software developers create specialized 3DRTR applications for architectural visualization, this technology will remain in the hands of a certain group of 3DRTR enthusiasts with specialized computer skills.
Interactive media is the most appropriate method of spatial representation for architecture, in addition to currently prevalent architectural representation methods. Architecture is built for many purposes; however, it always has to “interact” with human beings. We live an active life in it, and the built environment “reacts” to every step we take.

When we examine a photograph of a built space, we can physically see its graphical qualities. However, we simply cannot interact with it. We might find ourselves asking “I wonder what it feels like to wander around the room…” When we put down the photograph and visit the site, we can prove it in reality. Obviously this is not possible with a design that does not exist, or is not yet built, even when we generate a photo-realistic simulated photograph.

For this purpose, therefore, we have examined a walkthrough animation of an architectural design. The advancement of three-dimensional simulation technology has made the animation so realistic that it is virtually indistinguishable from real video camera footage. We sit in our seats while watching this incredible movie and start pondering, “Why does the camera have to point at the window, I would like to see the hearth from that position…” While professionals may be able to easily recognize spatial qualities just by examining architectural drawings or sketches, inexperienced clients, on the other hand, may have problems “imagining” even the most realistic architectural rendering. Images may look beautiful, but looks can be deceiving; it may not explain other important experiential qualities.
No architectural design can virtually be created equal, hence the importance of treating each new design with careful experiential design considerations.

Especially as clients, we will want to be ourselves, and create a meaningful interaction, simply because it is our very own individual persons that are going to inhabit the proposed design. We will want to try to interact with the proposed design: walk in it, sit down in it, open doors and windows, arrange furniture, and so on with the client as the first-person subject initiating whatever he/she wants, at no time bound to the camera’s will.

Interactive media can alleviate this problem. This particular brand of media adds interactivity, a more personal dimension of representation, in addition to the widely used visual and auditory elements. This may not add to the experiential senses (three more remaining: taste, smell, and touch), but the personal dimension gives the sense of “being your own self.” Here the representation can “interact” by giving us the freedom to direct the point-of-view, which is equivalent to moving freely in space with our own body. This allows us to interact with an unbuilt design, as if with the real thing.

The problem of the mediating devices will always be present, a hindrance for the common, non-3DRTR oriented audiences. This problem, however, will slowly minimize itself as 3DRTR gains popularity and simplicity of operation.

By building the game-engine experiment, a running prototype of the program has been attained that proves the feasibility and significance of the new media in representing architecture, and provides basic functional demonstrations of the targeted final result. The thesis project can be continued further to study the effective use of the new media in more detail and depth, for example, by adding considerations of human behavior, human perception, an understanding of view-space relationships, and so on.
The work resulting from this project can be used and re-used as a template for further experiments, which, with more detailed models, can increasingly concentrate on the spatial and interpretational aspects, as well as the role of new interactive media in both representing and creating architectural, cultural, and anthropological experiences.
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