Virtual Cinema:

Exploring Cinematic Concepts in a Virtual Environment

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1. INTRODUCTION:

The space is called ActiveRoom. At first glance, it appears on the outside to be just a normal room – relatively cubic with blue-colored walls and an inviting green-copper door. I enter the space, and am confronted by an empty corridor with a wood-paneled dividing wall to my right. Just a regular everyday space, I think to myself. Upon proceeding down the corridor and around a bend, however, I come across the first unusual sight – a room divider stands propped up in the corner, just like the ones people used to use to change their clothes behind in old-fashioned movies, but this divider is textured differently. In fact, instead of fabric, the divider appears to be made out of a living movie! Every aspect of the divider's surface projects a film in normal playback, just as if the movie was a part of the furniture's construction!

After continuing to explore the room, I come across other such oddities. There's a lamp shade showing a movie of a car-chase! There's a trashcan showing leaves blowing in the wind! The picture hanging on the wall, which first appeared to be just a normal oil painting, upon closer inspection actually turns out to be a movie of a waterfall in a lush tropical landscape!

Just as my body begins to slip further into the immersive nature of this strange cinematic experience, I grudgingly remember that this is all just a dream. A dream? Well, no, not a dream. But none of it, not the movies, not the furniture, not even the room itself, is real…

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The purpose of this essay is to explore ideas around creating a cinematic experience in a virtual environment. I begin by surveying and discussing existing Virtuality Reality (VR) technologies to analyze their potential for implementing a form of interactive cinema that would exist in a virtual environment. The final section of this essay discusses an example of a virtual environment (VE) model, implemented in Muse, a 3D browser, for a virtual cinema experience.

2. VIRTUAL REALITY – A HISTORICAL PERSPECTIVE:

Many believe that Morton Heilig was the first person to attempt to create what we now call virtual reality (Packer & Jordan, Eds., 2001), and in 1955 he wrote a paper called "The Cinema of the Future," which outlined a framework for simulating a multi-sensory cinematic experience. Heilig's goal was to present to the audience the illusion and sensation of a first-person experience such that they truly felt immersed in the media (Heilig, 1955). His "Sensorama" machine attempted to stimulate all five senses in the following breakdown: Sight = 70%, Hearing = 20%, Smell = 5%, Touch = 4% and Taste = 1% (Heilig, 1955). While his devices never became popular successes, his work was an inspiration to future virtual reality engineers.

In 1963, a twenty-two year old graduate student at MIT named Ivan Sutherland astonished colleagues with his work in interactive computer graphics. Sutherland was a visionary, and in 1966, still several years before the introduction of the personal computer, he implemented the first head-mounted display (Packer & Jordan, Eds., 2001). According to Sutherland, the ultimate computer-generated display is "*a room within which the computer can control the existence of matter*" (Sutherland, 1965), but short of this, he was a pioneer in advancing the immersive properties of virtual reality technology.

Heilig and Sutherland, along with many others, have helped to bring about a keen interest in virtual reality, both in cultural and academic circles. It seems that society has tremendous zeal for the idea of full sensory immersion – to explore an alternate world outside of one's own body. But what is virtual reality, besides, perhaps, an oxymoron? Much of the contemporary notion of virtual reality comes from the work of Scott Fisher in the early 1980's, whose work was influenced by Heilig, Sutherland and many other predecessors (Packer & Jordan, Eds., 2001), but a concrete definition is hard to come by. The term virtual reality was actually coined by Jaron Lanier in the mid 1980's, who went on to create VPL Research Inc., out of which came such trademark VR equipment as the DataGlove, DataSuit, and the Eye Phones (Bacard, 1993). Many researchers believe that **virtual environment** is a better phrase (Vince, 1998), but most people would agree that computers are inextricably involved.

> *"Virtual Reality: a medium composed of highly interactive computer simulations that sense the user's position and replace or augment the feedback of one or more senses – giving the feeling of being immersed, or being present in the simulation."*
>
> (Sherman & Craig, 1995)

Howard Rheingold defines virtual reality as an experience where the participant is "*surrounded by a three dimensional computer-generated representation, and is able to move around in the virtual world and see it from different angles, to reach into it, grab it, and reshape it*" (Rheingold, 1991). Both of these definitions speak to the fact that virtual reality is an immersive experience, one in which the user can interact with the computer-generated environment in real-time. In the quest to produce an effective and satisfying virtual reality space, many interesting and complex technologies have emerged over the last few decades.

3. VIRTUAL REALITY – HARDWARE:

A variety of different machines and devices have been developed over the years in the advancement of virtual reality technology. Since Ivan Sutherland created the first head-mounted display (HMD) back in 1963, a number of companies have developed similar versions in an attempt to design the ultimate VR experience. HMD's were the first devices to be used in commercial VR applications, such as virtual reality arcade games (Vince, 1998, pg. 26). A typical HMD contains two LCD elements mounted on a helmet that fits over the participant's head. The LCD screens are quite close to the eyes in order to enhance the sense of immersion by blocking out the outside world. The horizontal field of view is usually around 60^{o} for each eye, with a vertical field of view of 45^{o} (Vince, 1998, pg. 84).

The binocular omni-oriented monitor (BOOM) display is a device which fits over the participant's eyes, but which is supported by a counterbalanced arm to eliminate the heavy and cumbersome helmets that are typical of HMD's. The user can be either sitting or standing, and the 3D perspective in the virtual environment is calculated by the movement of the arm's joint angles (Vince, 1998, pg. 86).

I do not believe that either a HMD or BOOM system would be appropriate for implementing a virtual cinema environment. First of all, the displays are too small and at too low a resolution, and I would be worried that the quality of the movies would not be high enough to produce a satisfying experience. They also require the user to wear a device which can be cumbersome and which can severely limit one's movement.

At SIGGRAPH '92, a VR device was exhibited by the University of Illinois at Chicago called the CAVE (Cave Automatic Virtual Environment). It was initially designed as a scientific visualization system by the Electronic Visualization Lab (EVL) at UIC, but has since been used for many other applications, immersive entertainment among them. The CAVE is a 10x10x10 ft. cube made up of three rear-projection screens for walls and a top-down projection screen for the floor. The projectors are hooked up to high-end graphics computers, such as an SGI Onyx2 Infinite Reality, which generate the 3D graphics in real-time for a 1280x512 stereo display at 120 Hz (Cruz-Neira, 1993). For interactivity, the user's head and hand are tracked with electromagnetic sensors, or a 3D-wand can be used. The alternate left and right eye displays – needed to produce the pop-up 3D effects – are synchronized with light-weight LCD stereo shutter glasses.

The CAVE has limited potential for a cinematic virtual environment, as I will explain below, but it does bring up some interesting concepts around VR that could be applicable to a virtual cinema space. The benefits of the CAVE are that it achieves a large angle of view, has high resolution (HDTV to twice HDTV) color images, and can accommodate multiple people at the same time (although with only person controlling the interactivity) (Cruz-Neira, 1993). Having the large-scale projection walls of the CAVE means that the projection plane does not rotate with the viewer; this reduces errors from rotational tracking noise and latency typical of wearable devices such as HMD's and BOOM's (Cruz-Neira, 1993). This type of hardware set-up would, I believe, be much more accommodating for a virtual cinema experience than an HMD or BOOM, for it offers the higher resolution, larger angle of view, and smaller latency needed for effective movie projections. The CAVE is also a floor-to-ceiling display, which greatly improves one's immersion into the manufactured environment.

The CAVE was not designed with movies in mind, however, and the system is ultimately more useful for creating pure 3D computer-generated graphics than as a virtual cinema space. The primary roadblock is that the CAVE employs a stereoscopic display (rendering each frame from a left eye and right eye perspective) to create the illusion of pop-out 3D, which would not work for film clips embedded in the 3D graphic space. This is not to say that 3D movies are not effective, because there are many examples of beautifully constructed stereoscopic movies (IMAX's Cirque du Soleil 3D, for example), but we must remember that the CAVE uses 3D graphics generated in real-time (rendered on the fly), meaning that the computer has to redraw the scene every 1/60th of a second in order to maintain the frame rate at 30 frames/sec. This is vastly different from 3D film or video, where one can spend minutes or even hours rendering a single frame. It would thus be impractical, at least with today's computers, to include complex, data heavy movie clips in a stereoscopic display.

However, without using a stereoscopic display, the CAVE could still be a useful environment for projecting a virtual cinema presentation. Instead of the SGI computers, regular high-end desktop computers could even be used. Are we not, then, in this case, just creating a fancy projection space? On one level, yes… but the difference between this set-up and a regular projection space is that the CAVE still offers a floor-to-ceiling projection surface and the option of using a 3D mouse for interactivity and navigation. In any case, the CAVE could be considered more of a specification for creating a VR environment using existing technology than the creation and implementation of a new technology. As such, I believe that an effective virtual cinema experience could be created by borrowing some of the concepts of the CAVE, but that a unique hardware/software environment is still needed that is specific to multiple movie projections in a 3D space.

4. VIRTUAL CINEMA:

When I use the phrase *virtual cinema* in this essay, I am referencing an informal term that comes with a high level of abstraction and interpretation. This is done on purpose, even though virtual cinema could mean so many things, because it is an effective phrase to begin a discussion on the inclusion of movies and movie clips in a VR environment.

For the context of my research, I am interested in exploring concepts around a 3D space where movies are displayed on non-traditional surfaces. Imagine a room containing multiple movies where, instead of being projected on flat screens, the movies are displayed on the furniture in the room as if the very fabric of the furnishings was made from movie clips. This is a room that you can explore, as well, containing a maze-like structure for you to travel through. The different movies work together to tell a narrative, and each one has it own uniqueness, imbued from the structure that it has physically wrapped itself around. The premise here is that movie viewing becomes an active experience, with the audience having to actively seek out the movie clips, and where the films take on textural and spatial properties to help convey the narrative.

5. MUSE:

I decided to prototype my ideas in virtual cinema using Muse software and one screen of a RAVE system (a RAVE is similar to a CAVE, but has less projection walls). The Muse Client is a 3D browser that allows for multimedia and multi-user integration. It uses a 3D environment within which everything, from applications to interface elements, are 3D objects.

The 3D objects I used for my Muse site were created in 3DS Max 4.0, a 3D authoring software tool. I constructed a cubic room with a few wall partitions to create a maze-like feel, and added some 3D furniture models, such as a room divider, a lamp, a wall clock, and a table. To each of the furniture models I added a UVW map, and then applied a material texture. The type of material applied was not important, as it was to later be replaced by a QuickTime movie. Appling a texture in 3DS Max did have the advantage of being able to adjust the UVW tiling properties to ensure that the QuickTime movie would display properly.

Using a MAXscript plug-in that comes with the Muse SDK, I exported my 3DS Max file to the Muse format. This saves a number of the files used by the Muse browser into one ZIP file. Within this ZIP folder is a file called *main.mtcl*, which contains the mTCL code used by the Muse browser for integrating interactivity into the environment (mTCL is a programming language). To the *main.mtcl* file I added lines of mTCL code that resemble the following:

```
set myVideo [extern [mediaNode #auto -mediaUrl "$::CWD/MyMovie.mov"]]
lappend ::mcc::objList $myVideo
set myScreen [$sceneIter getNamedChild $sceneNode "Furniture"]
$myVideo loop 0
$myVideo attachAboveNode $myScreen
```

The *MyMovie.mov* in the above code refers to the filename of the QuickTime movie that will be applied as a texture map to the 3D object named *Furniture*. In order for this above code to work, the movie file must be added to the ZIP file. Now, upon viewing the environment in the Muse browser, the *Furniture* object has the movie *MyMovie.mov* wrapped around it in a texture map, the properties of which are defined by the UVW mapping previously applied in 3DS Max.

6. ACTIVE ROOM:

Using the procedure described above I was able to show a wall clock with a movie of a waterfall replacing the clock’s back-plate, such that when looking at the clock it appeared that one was looking through a window or portal to a tranquil nature scene. To the lamp I applied a movie of cars driving over the Lion’s Gate Bridge in rush-hour traffic. To the trashcan I applied a movie of branches swaying. And to the table I applied a movie of a first-person perspective of driving through Stanley Park in a car.

I named this project ActiveRoom, and presented it on one screen of a RAVE system. The RAVE screen allowed for a large, almost floor-to-ceiling display, which increased one’s sense of immersion in the 3D space. Not having a 3D mouse, I relied on the computer keyboard to navigate. I created 14 cameras in my 3DS Max file which I converted to anchors, such that I could navigate ActiveRoom either by using the arrow keys on the keyboard or by moving from one camera view to another using Muse's viewpoint browser tools.

I believe that ActiveRoom was successful at showing a virtual cinema prototype environment. The movie clips I used were not designed to work together in a collaborative narrative, so I am not able to comment on ActiveRoom's effectiveness as a storytelling tool, but I think that it offers some interesting possibilities for expanded cinema. There are three main drawbacks to the Muse environment which I believe detracted from the immersive experience of ActiveRoom. The first problem, which could probably be overcome with some tweaking, is that the light levels in Muse tend to be significantly lower than the levels portrayed in 3DS Max. As such, when ActiveRoom was projected onto the RAVE screen, some of the room's details were lost. I also would have liked to have been able to remove or fade the Muse browser's borders. The fact that ActiveRoom was being projected from the floor up was lost because of the bright blue border that exists at the bottom of the Muse Client. The last drawback is that I was unable to include sound in ActiveRoom. Upon attempting to run one MP3 in the background, I found that the sound skipped every two seconds to the point of being unbearable to listen to. This is probably a memory problem, as the sound played fine with no movies playing, although it could still be a problem with the Muse Client being able to handle QuickTime movies and sound simultaneously.

7. CONCLUSION:

It is my hope that I may be able to continue to explore the possibilities of Muse and its effectiveness as a tool for creating virtual cinema spaces. ActiveRoom is a good example of how movies can be extracted from their traditional flat screens and displayed on 3D objects. ActiveRoom is also good example of how an audience can become part of a movie's narrative construction by having to search and explore a 3D space for the film projections. There is a good deal of potential here for further audience reception analysis in this type of movie environment. Lastly, ActiveRoom is also interesting as a computer model for a physical, real-world creation of this type of cinematic installation, for it allows one to begin to explore ideas around how the cinematic experience is affected by multiple movies being displayed on non-traditional surfaces.

Looking to the future of virtual cinema, I imagine a good tool would be something similar to Muse, but which is optimized for integrating movies and sound. Stereoscopic displays can produce an increased sense of immersion, so it would also be interesting to look at developing a tool where the 3D objects are presented in stereovision, but where the movies are not.

Cinema is still coming to terms with the effects that computers will have on its art form. It will be interesting to see where ideas of expanded cinema will take us over the next few years. In any case, it seems plausible that a 3D virtual cinema environment is something that researchers and commercial entrepreneurs alike will soon be exploring in earnest.

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