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A Virtual Reality Movie

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A Virtual Reality Movie

A Major Qualifying Project

Submitted to the Faculty of

Worcester Polytechnic Institute

In partial fulfillment of the requirements for the

Degree in Bachelor of Science

In

Interactive Media and Game Development

By

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Date: 4/28/16

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Professor Joseph Farbrook, Advisor

Abstract

The goal of this project is to create a virtual reality movie that could be delivered to users through Google's play store and the IOS store. This movie was written by the team and developed using Adobe Fuse, Autodesk Maya, and Unity3D Software. Using these tools we created characters, animated them in multiple scenes, and incorporated a virtual reality camera. This was then loaded onto a smart-phone to be put into a virtual reality viewing device such as Google Cardboard

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Chapter 1: Introduction

1.1 MQP Background

Our Major Qualifying project at WPI was a virtual reality movie for the Google cardboard virtual reality viewer. We choose to do this as a project due to the apparent role that virtual reality will play in both film and games in the near future. Just in the past few years' alone virtual reality has become a huge part of the games industry with companies such as Sony, Oculus, and Google creating platforms to deliver virtual reality to their customers. It was our goal as a group to create a virtual reality movie and explore this new technology while learning how it differs from traditional media.

Our team was initially four members. We began with three artists and one programmer. Due to the project being a film, we believed there would be less tech requirements than an actual game, so one programmer would be sufficient. When researching projects, we anticipated a great deal of animation and level design and believed that three artists would be the proper amount. Unfortunately before the project even began, an artist left the team and so we began as a three-person team, which we believed to still be manageable. The team proceeded as a three-person team for the early parts of the project. As a group we researched the virtual reality projects that had been done in the past. As we moved further along in the project and began to create the actual movie it became clear that work was not being done by all members of the group and once again the group lost a member leaving us with a two-person team.

From that point on we continued to work, though at a limited rate. We turned the scope of the project down a degree, and continued to work on the movie. The MQP ended up running past three terms because of the lack of a third member and we continued to work on it during D-Term.

Member Bios

Jonathan Decelle- Artist

Job on MQP

Animation, Writing, Voice Acting, Sound Editing

Max Kinney- Programmer

Job on MQP

Tech, Writing, Voice Acting, Room Design and Setup

1.2 Virtual Reality History

The concept of an immersive medium has been around for years even before the modern idea of Virtual Reality was around. For the sake of this project, we only researched more modern examples of virtual reality. The term virtual reality was coined by visual programming lab, or VPL, founded by Jaron Lanier[1]. The company also sold the first virtual reality equipment in the form of goggles and gloves.

The next piece of history we looked at was *Lawnmower Man[1]. Lawnmower Man* was a film that introduced the general public to the idea of virtual reality. In the film, a scientist has a mentally disabled person play virtual reality games as a form of therapy. The film used actual virtual reality technology from the VPL research labs.

The first Virtual reality devices to be developed for game systems were the VR head set for the Sega Genesis, and the Nintendo Virtual Boy. Sega's VR glasses were developed and shown at CES in 1993, but due to technical development difficulties never made it to market and was a huge loss for Sega. The Nintendo Virtual boy was released in 1995 and was advertised as the first portable console that could display 3D graphics. The Virtual Boy ended up being a failure for a number of reasons including lack of software, lack of color in the graphics, and difficulty of use.

In the years after these relatively large commercial failures at attempting virtual reality, the industry has revisited the idea of virtual reality with new advances in technology. Companies such as Google, Sony, and Oculus[2] have begun a push for more Virtual reality and with that numerous other developers have begun to create software. We looked at a number of different games and movies that used virtual reality, specifically on smart phones as it would be the platform that we would be using.

We first looked at the software on Google's own platform, Google Cardboard. Cardboard has a number of games and movies. One of the first and most interesting

[1] "History of Virtual Reality - Virtual Reality." Virtual Reality Society. N.p., 25 Dec. 2015. Web. 26 Apr. 2016.
[2] Team, Oculus. "Oculus Rift Pre-Orders Now Open." Blog -. Oculus, 6 Jan. 2016. Web. 26 Apr. 2016.

experiences was Sisters[34], a movie where the player sits in the middle of a room and events unfold around the player. Sisters attempts to use virtual reality to add another layer to the horror genre.

Our group also looked at VRSE, a company that produces high quality virtual reality films. They have done a virtual reality filming of Saturday Night Live, Concerts, and other large events.

[3] "Sisters - Android Apps on Google Play." Sisters - Android Apps on Google Play. Otherworld, 31 Mar. 2016. Web.
[4] Apr. 2016.

Other Virtual Reality software we looked at includes Glitcher VR, a program that allows the user to look through the camera in a virtual reality setting and use filters on the camera to affect what the user sees, such as Color Inversion, Predator Vision and a super 8 footage filter.

When we began the project we initially believed we would use the Oculus Rift as a

Figure 3: Google Cardboard Viewer

development platform. At the time when the group was formed in the spring of 2015 it was the most prominent device for virtual reality. After we returned from summer break, a number of advancements had been made and Google was making a push in the development of VR with Google Cardboard.

After reevaluating what we wanted from our project, we decided that developing a movie that could run on a phone through Cardboard we be a better option. We came to this decision for a number of reasons. At the start of the project, WPI did not have any Oculus development kits to begin working with. This, combined with the fact that Oculus does not have a huge install base, lead us towards Cardboard where it would be available to anyone with

a phone. We wanted our movie to reach as many people as possible, which led us to our final decisions to develop for smart phone.

1.3 Virtual Reality versus Traditional Media

Virtual Reality presents a number of challenges not found in traditional media. When a player has a 360-degree field of view, there is more for the animators and artists to think about to ensure that the entire scene is ready to be viewed at any point during the movie. What this means is that opposed to traditional media, where you can use camera angles to limit the amount of animating that needs to be done in a VR movie, all parts must be animated. This makes animation for a virtual reality movie much more time consuming because the producer is unable to take those short cuts.

Another aspect and potential problem with virtual reality we had to address is the real world area around the user. In most cases it is unlikely that the user is standing in an empty room and will have 360 degrees of freedom to move around. During our own viewing sessions, we came to believe that most players would be sitting in a chair and the space behind them would often go unchecked, as it is uncomfortable to turn the body all the way around. We discovered this while playing through games like Sisters where we found it difficult to see what was going on behind us. Given the trouble we had ourselves, we decided to try and focus most on the things going on inside the movie in front of the player.

One of the challenges we had to address with the movie was how to focus the players view onto what we wanted them to look at. Since players have full freedom to look anywhere in the space they are in, it is impossible to make them look where you want them too. Instead we could only take steps to encourage the player to look. We will analyze the steps we took to do this further in the animation section of the paper.

VR presents another interesting problem: who the viewer is. In most media the player does not have a single perspective. First person movies do exist (Hardcore Henry[5]) is a good example, but they are not common. With this perspective we have to help the player establish

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[5] "Hardcore Henry 2016." HARDCORE HENRY. STX Entertainment, 2016. Web. 27 Apr. 2016.

who they are. If the player has trouble figuring out who they are, they can become confused which can detract from the overall experience of the movie.

When looking closely at our own experiences with viewing virtual reality movies, more issues arose that are also found with traditional media, but to a more extreme degree. An example of this would be simple fatigue from viewing the movie. The cardboard models that we decided to use do not come with straps or any form of gear to hold the device in the place while the view follows along. This means that the user can grow tired if viewing for an extended period of time. This combined with the fact that we only had a few months to work on the project led us to decide on an approximately 5 minute length for the movie. Another issue that can potentially arise with traditional media, but is far more prevalent with virtual reality is the issue of nausea. Sudden jerky movement and or quick cuts can lead the viewer to become "carsick". Moreover, certain movements could cause the player to feel as though they were actually moving, in the world and possibly fall in the real world.

Chapter 2: Process

2.1 Research

The first step we took when planning out our VR movie, was to research the other VR media that was already released. We looked at as much virtual reality media as we could, most of which is already discussed in the previous section. We wanted to see what kind of interesting things were going on in the field of VR and for content ideas.

2.2 Brainstorming

Our initial process after we did a good deal of research about the current state of virtual reality was to begin brainstorming ideas for what we could do in our movie. We came up with many ideas many of which were similar to the examples of VR we had seen in our research. We tried to brainstorm multiple genres and not focus too much on any one genre of film.

We quickly began trimming our ideas down to a reasonable amount. After cutting many of our ideas, we were left a movie about a police chase where the player would switch between

different officers in a large store while they track down a fugitive, and a murder mystery movie in an old house similar to Clue. At first we moved forward with the Police Chase idea, but quickly abandoned it after having difficulty writing major plot points and figuring how to incorporate VR into it. After the elimination of this idea as a possibility, we decided to go with the murder mystery and began writing it.

One of the major ideas we had during our brainstorming sessions was the idea of misdirection. Given the power that the viewer is given by being able to look in a full 360 degree view, we wanted to try to deceive them through some form of misdirection. We thought that since players have so much control they might feel as though parts of the movie would not be able to slip by them. We believed this would be an interesting idea and would work well with one of our other ideas; having multiple plays through from different views. We wanted players to go through on their first play to have an idea of what was happening, but realize after playing through again that they were missing a major piece of the story. We wanted the players to have a reason to go through the story more than once, so we felt the need to give them some sort of motivation to do so.

2.3 Writing

After settling down on a single idea, there was a great deal of work to be done to get our ideas about the movie onto paper. We had decided how long we wanted the move to be so we began to start developing a story we thought would fit into that time span. Our initial ideas were very ambitious and likely would have taken far too long to accomplish. We wanted the player to follow 6 different characters and switch between pairs of characters freely just by the using the magnet that is a part of the Google cardboard viewer. We then wanted certain transitions to happen depending on who the character was following at the time of transition, but this would have created an incredible amount of work and was quickly scrapped after discussion with our advisor.

When discussing our ideas, we quickly moved towards the idea of a dark comedy. We wanted to write a funny story with dry comedy and funny characters. When creating our characters, we drew inspiration from clue again and wanted to give the characters a fun

naming-theme. All the characters' names are silly plays on the names of soda. For example, one of the characters, Dr. Pibb is a mix of Dr. Pepper and Mr. Pibb; two similar sodas, while another character is named Tabitha; a play on the soda, Tab. We also named the victim of the story Edward Namel, which when abbreviating his first name leads to his name being "Enamel", making the joke that these soda named characters killed the (tooth) Enamel. We wanted the characters to each have distinct personalities that would interact with each other in different ways. We always planned on having characters leave in pairs so we wanted to create personalities that would work well together. This was one of our biggest focuses when writing the characters; how their conversations would go while they were split off in pairs.

To write the story we met as a group and started 'spit-balling' ideas. We had the basic idea of the story: a group of people come across a dead body during a party and must decide what to do from there. Working off this, we brainstormed character identities to try and create a diverse cast of characters that would have interesting funny interactions with each other. Once we felt we had created a solid cast of characters, we began to write our general idea for the plot. To do this we took the start and the finish and wrote the general happenings in those scenes, and used those to help create the scenes in-between. We then began to plot out the middle scenes where our characters would separate into smaller groups and got our ideas down for those scenes. After some discussion with our advisor and some changes made to our ideas, we once again got together and started planning out who would say what. We bounced lines for characters off each other until we agreed on lines that we thought would be funny, progress the plot, and make sense for the character to say. We did this for every scene until we felt we had a good script, which turned into our first draft. We brought this first draft to our advisor and together worked to fix plot line holes in the script. We did this a number of times over the next 2 weeks until we felt we had a script good enough to be finalized.

2.4 Story

Our story takes place inside a mansion in a gated community. The guests are attending a party thrown by the owner of the house, Edward Namel. Edward is one of the oldest members of the community, but is planning on moving out and finding another house. He is holding this

party to decide who he will allow to buy the house. The 6 other members of the community are in attendance of this party in an attempt to get the property. All of the members want to buy the property because the more property you own in the community, the more decision making power you have. Before it can be decided who will be able to buy the property, the host mysteriously drops dead in the middle of the party, and this is where our movie begins.

The story begins with all six characters positioned in a circle around the host, who lays dead on the floor. The characters are as follows

John Dew – John's name is a play on the soda Mountain Dew, He is a level-headed young man that joined the community a few years ago. He is in a secret relationship with another resident of the community, Tabitha.

Tabitha – Tabatha is a young extremely successful business-woman who recently joined the community. She is ambitious and wants to take a larger part in the community by acquiring Edward's home. She is ruthless when trying to get what she wants and does not pull any punches.

Ruth – Ruth is another older member of the community, having lived there for over twenty years. She is a widow, whose husband passed away over ten years ago. She appears to have a tough exterior, but cares greatly for her friends and would do anything for them.

Dr. Pibb – Pibb is another younger member of the community. He is an extremely skilled surgeon. His skill has given him a great deal of confidence, if not some cockiness. He is not well liked by a number of the community members.

Mr. Pepper – an old man who has lived in the community for almost 20 years. He has a very rough exterior and is quick to anger, but means well.

Ms. Sierra – The youngest person to attend the party and not actually a member of the community. She is standing in for her father who is away on business. She lives a pampered life and is extremely skittish when their host mysteriously passes away.

The characters are all dumfounded by what has just happened. No one knows what is going on and it's all they can do to keep calm. While they are trying to wrap their heads around what happened, some begin to realize why they were here in the first place: the house. After some discussion they decide that the only way to figure out who gets to buy the house is to give the option to whoever finds the deed in the house. After the group agrees on this set of rules, they decide to split off into pairs to keep themselves protected from a possible killer.

As they split up, they all head to different rooms to look for the dead, though they have different motives while they are looking. Pibb and Pepper split off and head to the house office, John and Tabitha head to the Library, and Ruth and Sierra go to the Kitchen. After a brief amount of time searching the rooms, discoveries are made and the groups all return to the room they started in. The group discusses what happened again and an argument breaks out, before more revelations occur and the story comes to a close.

A full version of the script and story can be found attached to the end of the paper.

2.5 Recording and Sound

Given the story we developed, we had to do voice work for the characters in the story. Luckily for us, the ATC at WPI provides recording equipment to students that is of a reasonably high quality. Initially we were given poor quality equipment that led to sub-par recordings we would later re-record when we made some small changes to the script. After returning to the ATC and mentioning that the device was for an IMGD MQP, I was given a far superior audio recording device which left us with better tracks to use. WPI does have a dedicated IMGD audio recording room, but obtaining access to it was quite difficult as there is no system in place for reserving the room, and contacting those in charge of the IMGD program yielded no responses. We were able to gain access once through a friend of one of our group mates, but after that member of the team left, we were no longer able to get access and had to resort to using other places that may not produce as good of an environment for recording. We were able to use library tech suites to record. While sonically not perfect, they did provide a quiet environment that outside noise would not interrupt.

With the mix of our characters, we needed to record both male and female voices. Initially we thought we could record all of the voices just in our all-male group, but after having difficulty creating reasonable quality voices for the female characters, we decided to bring in some friends to help us record the other voices. None of the people recording voices have had much experience, if any with voice acting, so the overall quality of the performances were not too high. There is much room for improvement in that area, with more experienced actors and actresses.

After getting the recordings they were imported into Reaper (a free audio editing program installed on all the computers in the IMGD lab). Reaper was very easy to use and allowed us to edit together all the best recordings we had into one .wav file. Using Reaper, we were also able to edit the sound of the tracks using Reaper's built in EQ, Pitch, and ReaFir. ReaFir was the most used tool as it allowed us to remove any unwanted noise that was picked up during the recording.

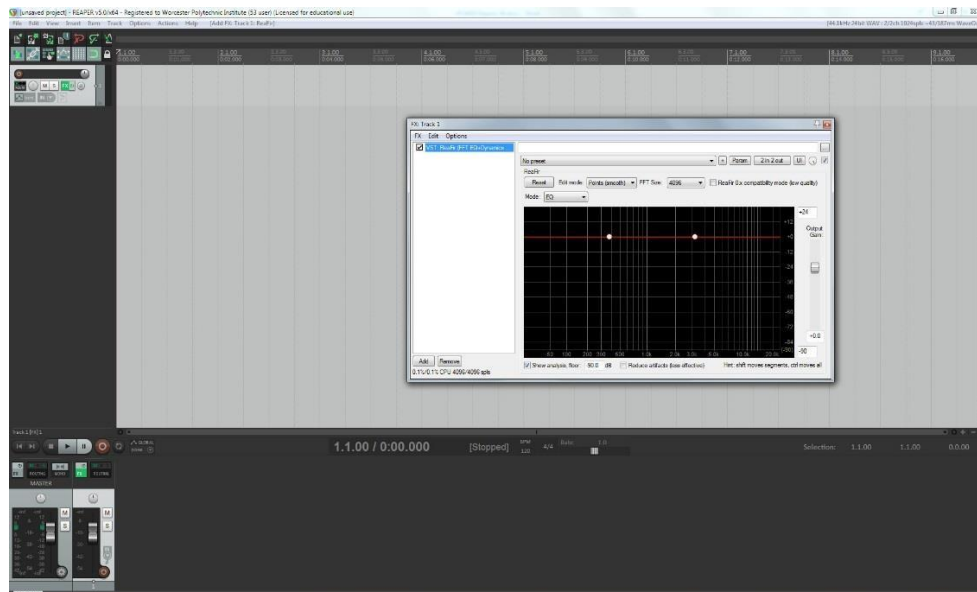*Figure 4: Reaper with the ReaFir menu open*

At the beginning of the project there was also plans to interact and work with a student from the Berkley College of Music, and to have him do music for our movie. Initially both parties were very excited to be working together, but as the project progressed and difficulties arose inside the group communication between both parties lapsed and nothing ever came of it.

Originally we planned to have a number of sound affects in addition to dialogue, but due to time constraints were unable to incorporate them into the movie.

When we had a full size team we also planned on incorporating more noise such as footsteps, object sounds, and other audio that would have helped bring the scenes to life. Unfortunately, the change in group size cut down on the amount we could produce as a team and forced us to cut certain parts of the film; sound being one of the first things.

2.6 Animation

Given that this project is an animated movie, the bulk of the work to be done was animating the characters in the movie. With a virtual reality movie, this is even more difficult than it would normally be. A difficulty is that the player can see the whole scene at almost all times, so special care must be taken to make sure that the player can never see pieces that are unanimated. There are times where animation can be avoided, such as if a character's back is turned and they are speaking.
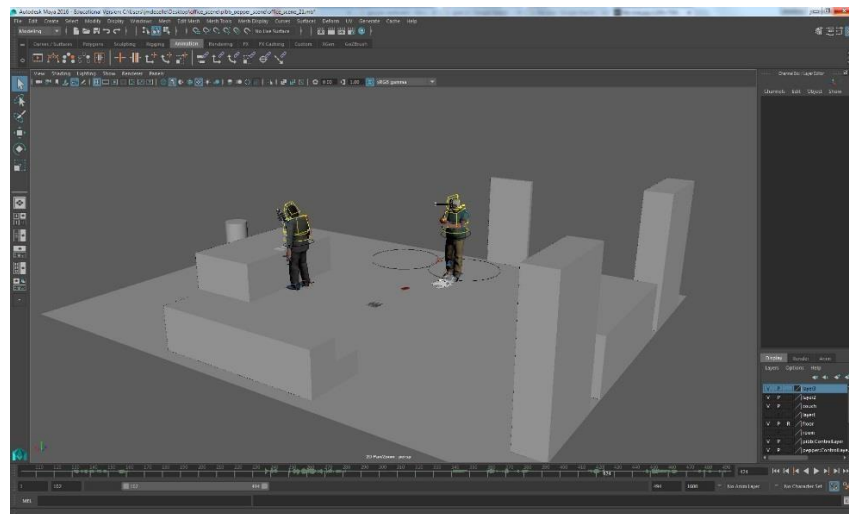
Figure 5: An example animation scene in Maya

In normal media a good camera angle can cut down tremendously on what actually has to be animated. This greatly reduces the actual time that one must spend animating. Ultimately we ended up with around 5 minutes of animation spread across five scenes. The amount of animation for each character ranges from 2 in 3 of the scenes, to 6 in the first and last scene.

Animating 6 characters at the same time was by far the most difficult, as all characters should be reacting to each other's actions.

One of the biggest difficulties this project faced was the large quantity of animation, done by only one animator, with limited experience in biped animation. Because of this, animation research had to be done to improve my skills as an animator. I did research on traditional biped animation and facial animation to improve my skills to a reasonable point, where I could get work done in a timely manner.

During the process of animation we ran into multiple hiccups that cost the group some time. Initially with our three-person team, we all planned to do voice work and early on recorded initial voice overs so that we could begin syncing animations with the characters were working on. Later when we dropped a member of our team we realized that we would need to re-record the sections that used his voice, as he had not completed all the voice work for the character. Unfortunately the re-recordings were not exactly the same length or cadence, so many of the animations had to be redone and moved around to fit the new recording length and speed.

2.7 Pipeline

For our project we had a very simple pipeline, but it was far from perfect. We began with the creation of our characters. To create our characters, we used Adobe Fuse. Fuse is a program that allows you piece together characters from a list of pre-existing assets. This makes creating biped human characters fast and easy. Doing this we were able to create six different characters in just a few hours. They characters made in Fuse were then put through an auto rigging program, which rigged the characters with bones and with facial controllers which used blend shapes. Initially we were worried that blend shapes may not work on smart phones and we would have to find a way to rig the faces, but after some tests we found that blend shapes worked fine. Ultimately this process saved us a huge amount of time as modeling and rigging a character from scratch can end up taking hundreds of hours.

Once we had designed all the characters, it was time bring them into Maya. We started this by importing the characters into the scene and building a room around them. To create the scenes they were in we gathered reference of rooms like the ones were planning on modeling and took view aspects of them that we believed fit in with the ambience and theme of the scene. To start we used simple gray models as placeholders before the scene would be brought into unity. This allowed us to position character movement and actions so we could get an idea of what they would be interacting with.

The scene would then be imported into unity through the built in 'export to FBX function in Maya. From there we brought the scene into Unity and brought it to a reasonable scale. Once the scene was in Unity we then used assets that we found in the Unity store to quickly populate the room, replacing the gray models we used in Maya Using the Unity assets saved us a great deal of time that we otherwise would have had to spend modeling and texturing.

Once the rooms were built and the animations imported we could push the files from the computer and try to get them working on phone. This process involved checking to make sure that all scenes imported properly as they would often come into strange bugs that required is to go back into Unity to try and solve. We often had to debug what we ended up pushing to phone, which we will discuss more in the next section.

2.8 Push to Phone

Moving our project from the computer to the phone ended up being one of the most difficult tasks we faced during this project. We ran into multiple roadblocks when transfer our project from the computer to the phone such as black screens, lack of gyroscopic movement on the camera, and animations not carrying over. To fix these problems we often had to go back to Unity to look for what could be causing problems.

One of the problems we believed we were having when pushing to phone was the stress the movie was putting on the phone. We believed that was one of the causes for the movie not running properly on phone. We had to do a number of tests to make sure that we could have six animated characters going in the scene at the same time.

Certain camera's had different problems when pushing to phone. We were unable to get the Dive Camera to function properly on phone and the solutions we found online and on their own discussion boards did not yield successful results in fixing the issue. The issue with the camera limited us to only being able to push the movie onto Android phones. The Cardboard camera gave us issues with a double vision effect when looking through the viewer, but we were able to solve the issue for the final build.

One of the biggest issues we found when pushing our movie onto a smart phone, was difficulty finding documentation on how to fix issues on the phone. Given the large number of phones with different specs, operating systems and software it was difficult to find solutions that would fix the problems we were having on our specific phone. We also did not have an IPhone that we ourselves could test our movie on, to see how it functioned on IOS.

2.9 Resources

Early on in the project we did research about the current state of VR. We had many helpful resources that gave us an idea about what kinds of games and movies were being made, and where VR was going to be headed in the future. We looked at a number of sources ranging from actual VR apps to websites such as the Virtual Reality Society[67], which gave us information not only about the history of virtual reality but looked at what was to come in the future. We were also to look at a number of tech based website to learn more about the technology used by these virtual reality products.

To improve the quality of animation being done I used a number of sources to learn more about animation and how to make character movement look realistic. One useful resource was a video on the walk cycle done by Kyle Balda, found on YouTube[6]. This video helped me get the basics movements of the walk cycle in a quick easy to digest tutorial. It

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[6] "History of Virtual Reality - Virtual Reality." Virtual Reality Society. N.p., 25 Dec. 2015. Web. 26 Apr. 2016.
[7] dmasterclass. "Kyle Balda." YouTube. YouTube, 5 Dec. 2011. Web. 26 Apr. 2016.

greatly improved the quality of the walk cycle, which was evident over time, as the walk cycles improved.

When learning how to do facial animation we used the Preston Blaire Phoneme[8] series as an informational piece. The guide details the basic phonemes that we use when speaking and was invaluable to doing the facial animation of the characters. The guide gives details of how the phonemes work and mix together which helped me work with little to no previous experience in facial animation.

Another resource which was invaluable during the project is the Maya plug in Pose2shelf. Pose2shelf is a Maya script that allows the user to save the position of highlighted objects. This means that you can go back and forth between saved positions which made facial animation possible. Using Pose2shelf we were able to save facial poses for phonemes and use them at will, which was essential to facial animation.

Chapter 3: Post Mortem

3.1 What Worked

During our project we had a number of ups and downs. There were a few things we tried to do that worked well, and many things that did not work. In this section we will talk about what worked for us and in the next section we will go over what did not work.

Adobe Fuse – Adobe Fuse is a program created by adobe that saved us an immense amount of time when creating the characters, we would use for the movie. The characters we created were easily rigged using Mixamo's auto-rig program. If we had tried to model and rig six characters without the use of Fuse it would have been nearly impossible in the time frame that we had.

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[8] Preston, Blair. "Home Page Preston Blair Phoneme Series." Preston Blair Phoneme Series. Gary Martin, n.d. Web. 27 Apr. 2016.

Reaper – Using Reaper as a sound editing program made cutting the voice recordings we took easy and fast. The program allowed us edit the clips together to make a coherent track and remove unwanted background noise simply using the built in tools of Reaper.

Google Drive – Google Drive was the way our group shared and stored our files. It provided us with plenty of storage and an easy way to share data. There were some issues with difficulty uploading certain files to the Google Drive, but these did not occur often and overall Google Drive was a useful, efficient tool for file sharing.

Unity Store – The unity store provided us with numerous models that we used to fill our rooms. The assets were cheap and of a high enough quality that fit perfectly into our scenes.

3.2 What Didn't Work

During the development of the movie we ran into a number of roadblocks and problems that set us back in terms of schedule and gave us problems. Some programs did not work as well as we wanted to and we had to either abandon or simply push through and continue to work with them.

Cardboard – Using Google's own Cardboard camera proved to be problematic later in the development cycle. We eventually realized that we would need a different camera to get the movie to properly run on IOS devices. We attempted to fix this problem by switching camera's but ultimately could not get the second camera to work and had to settle with only getting the project to work on Android.

DIVE - The DIVE Camera[9] was used to allow us to put our project on both Android and IOS devices. While the camera worked well on the computer it would not function properly on our smart phone.

Unity – We decided to use Unity as our development platform. We did this because it has a good deal of documentation on the Internet and we believed it would be easy to find answers for any our problems. This ended up not being the case and our tech side had a lot of problems

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[9] "Durovis Dive." Durovis - News. Durovis, n.d. Web. 27 Apr. 2016.

that took a good deal of time to solve. It is hard to say if Unreal 4 would have been a better development platform but Unity was not as easy to work with as we had hoped it would be.

3.3 What Went Wrong

This project had a great deal of difficulties. It is obvious considering that it was a project meant for 4 people that ended with 2, so it never became all that it could be. I believe this is due to a lack of coordination as a group and the shortcomings of some of the team members. As a group we did not necessarily have all the skills required to make a quality animated movie. During the second term of the project the work done by members was clearly uneven, and due to this we were forced to drop a group member who did not pull his own weight. This put a heavier load on myself as an animator, and at the same time made us lessen our goals. We had a far more ambitious project at the beginning that became far simpler as we had to face the difficulties of the project.

Communication – As a group we had a great deal of trouble communicating with each other. While we did not have trouble finding times that we could meet, we did not talk enough. As a group we mostly used email to communicate, which would often lead to late responses as members either missed emails or did not check their email frequently enough. There were times where we would end up not meeting at all, and come to group meetings having no idea what each other had accomplished, if anything. This made it difficult to plan and ensure that proper amounts of work were done in a meeting. Often we would arrive at meetings having no idea what other members of the group had accomplished, which was unacceptable. The difficulties we faced with communication also cost us what could have been an exciting opportunity to work with a student from Berkley College of Music.

Experience- One of the other shortcomings of our group was simply that our skills did not match up well with the skills that were needed for the project. For our artists, animation was the bulk of the art work and our artists had more of a basis in 3D modeling, texturing, and concept art. Because of this, a good amount of time was spent researching animation and learning how to properly animate characters before we could even start working on the project itself.

Cut Back- The problems listed above contributed to the cut back in the size of the team, but we cannot talk about the project and the issues it faced without discussing cutting a member of the team. Initially this project was meant to be a 4 person project with three artists and one tech member. At the very start of the project a teammate dropped, which in reality was not an issue because all ideas were scaled down to work with three people. However, losing a group member about halfway through the project was disastrous. Also considering this team member produced almost no tangible work meant that the project was essentially a 2-person effort from the start. This caused us to scale down the project immensely. Our original plans were far more ambitious and would have included small scenes between every major scene to give the characters more exposition. Instead we were forced to use fade-to- black transitions to save time.

We also felt as though overall animation quality likely suffered. Having two animators working together would have allowed a split in the work which we feel would have led to overall better animation as more time could have been focused into each scene. Having two animators would also have allowed the two to check over each other's work to ensure there were not any strange issues or weird motions that would be missed by a single animator.

The group made a small attempt to outsource some animation help by making a quick advertisement in the Animation II class for an Independent study credit, but no students were interested.

Chapter 4: What to do for the Future

4.1 Changes that would have improved the experience

The project experience for the Virtual Reality movie could definitely been improved on all sides. More structure would have greatly improved the project and helped group members produce more and higher quality work. Having more rigid meeting times outside of advisor meetings would have ensured that the team kept in contact more often and that team members were held accountable for the work they should be doing. There were also times where cooperation yielded better results than working alone. Some problems that plagued the

project for weeks were quickly solved when another team member was brought in to help work on the problem.

Another way the group could have been more structured would have been to create written agendas for group meetings. These written agendas would have allowed to the group to more easily communicate with the advisor and help hold the group accountable for what they wanted to accomplish on a week-by- week basis.

Another problem that our group seemed to have was uneven amounts of work for group members at certain times. During the project there were often times where some group members would have a great deal of work while others would be left with less work or close to none at all. I believe finding some sort of work for the group members that had lesser loads would greatly improve the overall experience on the project. Maybe finding the tech based group member during the preparation phase would have allowed the team to work more efficiently so that slowdowns would not occur later down the line.

Just given the developments that we have seen in the past year for VR we believe in the future it would be better to move onto more dedicated VR equipment. While we believe that at the start of the project choosing to use VR on a phone was the best choice, the quick advancement in the field has made the large amount of new VR platforms more enticing. The phone was a limiting factor in our project, often giving us trouble over what we could bring onto it and limiting us creatively, due to the low specs provided by phones today.

4.2 New Developments in VR

While we worked on the Virtual Reality movie, the field of VR kept improving and making advances. Many game developers have put resources towards developing their own virtual reality platforms. Oculus has continued to make Virtual Reality Products, Sony has created its own virtual reality device, Microsoft is working on VR, and numerous other companies including Samsung and Amazon. All these companies have made strides in pushing VR forward and it shows.

One development for portable VR that occurred in the early stages of our project was the collaboration between Oculus and Samsung to release the consumer version of Gear VR. Released in late November of 2015, Gear VR is a high quality device used in collaboration with a proper Samsung Galaxy device. The device houses the phone and also a touchpad and back button on the side. This device is of a much higher quality than the simple Google Cardboard being made of sturdy plastic and having a head strap. This is reflected in its price as it retails for $99.

Figure 6: Gear VR from Samsung

More major than Gear VR during the duration of this project, Oculus released publicly their main VR platform, the Oculus Rift on March 28th 2016. The Oculus Rift was our early choice for development but due to the late release and WPI not acquiring development kits until later in the year, we stayed away from it. The Oculus Rift, being a dedicated platform for virtual reality has more power behind it and dedicated features not seen on Gear VR or Google Cardboard such as Controllers, higher resolution displays, and drastically increased processing power as it uses a computer. With Oculus Rift units being shipped around the world and its install base growing, it is definitely possible that using the Oculus Rift in the future could be the superior choice.

HTC has also entered the virtual reality arena recently, in conjunction with Valve through the HTC Vive. The Vive is similar to the rift in a number of ways; same resolution and connectivity to computers, but differs in its tracking method. The rift uses 360 degree head tracking while the Vive uses a laser positioning system and over 70 sensors to delivers its virtual reality experience. The Vive also makes use of the Steam store as a platform for delivering software to players. The Vive is currently priced at $800, making it far more expensive than the $600 Oculus Rift, though the Vive does come with 2 motion controllers, which the Oculus Rift currently does not.[10]

Figure 7: The Htc Vive with Controllers

Also during the time that we developed our movie, Sony has continued to make strides with their VR platform originally titled Project Morpheus. While it was announced as early as 2014, they have made a great deal of progress during the duration of the project and have confirmed a release in October of 2016. Sony has an innate advantage by connecting their VR platform to the PlayStation 4, which already has a large install base of around 36 million around the world. Sony is also incorporating some of their old technologies into their new VR system.

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[10] Staff, Digital Trends. "Spec Comparison: The Rift Is Less Expensive than the Vive, but Is It a Better Value?" Digital Trends. N.p., 5 Apr. 2016. Web. 26 Apr. 2016.

Sony's VR can make use of the Dual Shock controller, the PlayStation Move, and the PlayStation Camera. The Camera can track lights on the headset while the wands from the PlayStation can be used liked hands.[11]

[11] Stein, Scott, and Sean Hollister. "PlayStation VR Made Us Smile, and It's Because of the Games." CNET. CNET, 16 Mar. 2016. Web. 26 Apr. 2016.

MQP Script

First Scene

Scene opens fading from black floating above your own corpse a group of people standing around it. View is eye level and all characters are around. All characters are staring down at the body to show the player where to look.

Mr. Pepper "what the hell happened?" Ruth

"I don't know. I just found him like this"

Ms. Sierra "Is he… dead?

Dr. Pibb kneels down and checks for a pulse

Dr. Pibb "yea he's definitely dead"

John "Who could have done this?" *He looks about, settling on Mr.Pepper as they begin to speak*

Mr. Pepper "It had to be the damn commies" *His voice is firm and confident as he gives a nod, still staring at the body, hands planted firmly on his hips, slouching.*

Tabitha With arms crossed she rolls her eyes at Pepper "The cold war ended like 20 years ago old man"

Ms. Sierra "Well what are we gonna do? We have to get out of here!" She is panicked, fiddling near constantly with her hands*, eyes darting about instead of focusing on the speaker*

Dr. Pibb *standing and shaking his head, he looks at each of the other individuals as he speaks* "No, no, we're only at this party because we all wanted to buy the house. And now that Edward can't choose someone, we have to."

Mr. Pepper *eyes finally break away from the body, looking to the Dr and nodding* "I agree, let's make a game out of it, whoever finds the deed gets to buy the house!"

Ms. Sierra "But there is a killer on the loose!" Looking thoroughly concerned, she covers her mouth with one hand.

John: Turning to face sierra "Well if you want to leave than you can go by yourself"

Ms. Sierra: "Well on second thought" *her hand drops and she looks to the floor at her feet*

Dr. Pibb "Its fine. We'll look in pairs and if anyone doesn't come back, we'll know who it is."

John "Then I'll look with Tabitha"

Mr. Pepper "Hmph big surprise there" *The statement is more under his breath, earning a glance from John.*

Ruth "I'll take Sierra" She smiles and looks to the girl before ushering her along towards the door.

Mr. Pepper "I guess that just leaves you and me Dr. Pibb"

Exit all characters through different doors

Mr. Pepper and Dr. Pibb Transition

Pibb and Pepper head down the hall

Dr. Pibb "Why don't we go check the office"

Mr. Pepper "You think the deed's there?"

Dr. Pibb "Let's just say I've got a hunch"

Enter office

Mr. Pepper and Dr. Pibb Office Scene

the two enter, with pepper pausing as they step in, examining the mess as Pepper walks right, ignoring it.

Mr. Pepper "Wow, someone really did a number on this room."

Dr. Pibb "Maybe… Or maybe Edward just wasn't the tidiest of people" *He comments while moving towards the desk, not looking at pepper.*

Mr. Pepper "I mean it looks like a hurricane came through here."

Dr. Pibb "Hmmm more like a tropical storm. Let's start looking. I'll take the area around the desk you look at those bookshelves."

Dr. Pibb immediately starts opening a hidden safe in the desk, Mr Pepper searches along the bookshelves

Mr. Pepper "What do you think happened to the good host?"

Dr. Pibb "Who knows? Murder, brain aneurysm? Could have been anything. Let's just find this deed.

After looking through the safe for around twenty five seconds Dr.Pibb finds nothing of use, except a shrine to Sir Nicholas Cage, Pibb stands up, scratching his head

Dr. Pibb "Well it appears my hunch was wrong I don't see anything."

Mr. Pepper "Well we've only been looking for like 30 seconds!"

Dr. Pibb "Look I can admit when I'm wrong, let's move on"

Mr. Pepper "Whatever you say Pibb."

Mr. Pepper and Dr. Pibb file out of the room

John and Tab Transition

As Mr. Pepper and Dr. Pibb leave the room Tabitha and Jon are walking down the hall. As they pass they nod to each other and the camera separates from the player's character and follows the character they pass instead.

Tabitha – "Jo…"

John Cutting Tabitha off "wait we'll talk in a second"

Silence

Characters enter library

John and Tab Library Scene

The two characters enter the room. And stand facing each other as they start talking.

Tabitha "You know they're going find out about us, maybe we should just tell them."

John "There's no way that they'll find out"

Tabitha "Didn't you hear Mr. Pepper before? He probably already knows."

John "That old man? He's senile"

John turns around and heads to the book shelf and begins to look through the books, while Tabitha follows and continues talking to him.

Tabitha "But what if they do!? They might figure out our plan."

John "Who cares if they do? They won't be able to stop us, we have two seats already, and more money together than anyone of them.

Tabitha "I don't want there to be any chance that we don't get this house, if we have control of three properties we can control all the decisions in the community.

John "Well, if we can just find the deed we can settle this"

Tabitha "Fine let's go look somewhere else"

Both characters exit

Ruth and Sierra Transition

As John and Tabitha exit Ruth and Sierra are also walking by

00: Ruth "Calm down Sierra, everything will be fine"

07: Sierra "You don't know that"

Ruth and Sierra go into the kitchen

Ruth and Sierra Kitchen Scene

Characters enter

Sierra is standing around while Ruth starts to move around the kitchen

Sierra "Why are we in the kitchen? This is no time for a snack"

Ruth "I'm not looking for a snack, I want to find out who killed Edward"

Sierra "Why do you care so much about this guy, you barely knew him?"

Ruth "Actually, he was a good friend of mine, one of the few people I could actually stand."

Ruth goes to the fridge and begins searching it.

Sierra "What about me?"

Ruth "Less and less with every word."

Sierra "What could you possibly be looking for in the fridge?"

Ruth "Clues…"

Ruth moves to a cabinet and searches it

Ms. Sierra "Don't keep me in the dark!"

Ruth "Alright found what I need. Let's go"

Ruth pulls something out of the cabinet and puts it in her pocket

Ms. Sierra "But what did you find!"

Ruth "Don't worry, you'll find out soon"

Ruth and sierra exit into the hall way through the door they came in and head towards the room from the first scene

Final Scene

Ruth and Sierra are first to enter, Ruth kneels down and checks Edwards's body once more. Ruth sets up by the table at the head of the room.

John and Tabitha walk in and return to their positions from the start.

Pibb and Pepper walk in and return to their original positions.

All the characters stand in a circle around the body like at the start of the movie

Ruth "I've got some news everyone might want to hear. Edward Namel, was poisoned."

Dr. Pibb "And how exactly do you know that?"

Ruth "I found this in his kitchen"

Ruth holds out a small vial with a cyanide label on it

Dr. Pibb "Oh, so you just happened to find this in the kitchen and are now accusing us? You're the one holding the bottle."

Ruth "Just one second! He was a good friend of mine and…."

Tabitha cuts Ruth off

Tabitha "But you're a Doctor right Pibb? You'd have access to cyanide"

Dr. Pibb "Me and everyone else here, you know how easy it is to get cyanide?"

John "No I don't actually, please tell me."

Dr. Pibb "Well, uh that didn't come off right"

Mr. Pepper "Take it easy on the good doctor, he's a good man, and this is no proof, any of us could have still done this."

Tabitha "Yeah you're right, even a crazy old man!"

Mr. Pepper points his finger at Tabitha

Mr. Pepper "Call me crazy one more time and I swear, I'll" –

Cut off by John

John "Oh, you'll what? Murder her?"

Ms. Sierra "Guys, I think I found something"

Ms. Sierra interrupts reaching down and grabbing a piece of paper from Edward Namel's body.

Ms. Sierra looks at the note and exclaims

Ms. Sierra: "Yeah this guy killed himself"

She folds up the note and puts it in her pocket, also on the note is the location of the deed the player will only see this detail of information if they are playing through the eyes of Sierra

Everyone else "Wait, seriously?"

John "Hah, well I guess he's not going to heaven."

The house falls away and fire breaks out, the player is in hell, haunting music begins to player, maybe a deep voiced laugh begins from a distance

Cast – All members of the cast live in the same gated community and are interested in buying the house

Mr.Pepper – An older man with wrinkles a look of disdain. He has white hair and a white beard that covers up much of his face. He is very old fashioned and seems to think we are still at war with the communists.

Dr. Pibb – A young doctor with a thriving practice. He appears to be very arrogant and condescending.

John –A young business man who is up and coming in a large corporation.

Tabitha – Part of a rival to John's business firm. Very strong willed.

Ruth- An older woman whose husband passed away many years ago. She has a hard tough exterior, but is very caring in the inside.

Sierra – An heiress and "princess" to an extremely rich father. Lives in community as a vacation home and is only at the party because her father asked her to.

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