Fusing Art and Technology: Designing an Immersive Storytelling Attraction in Virtual Reality

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Fusing Art and Technology: Designing an Immersive Storytelling Attraction in Virtual Reality

A Dissertation
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Fine Arts
Digital Production Arts

by
Alexander Jameson Young
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Abstract

Journey to Proxima Centauri: Terror of the Mnar is a 3D Virtual Reality experience that fuses many elements in order to create a brand-new interactive attraction. Diving into a game birthed by the implementation of HTC Vive technology and Unreal Engine 4, the user finds themself in a virtual world where they experience an exploration-focused adventure through the icy caverns of an ancient temple. Unlike its predecessors, this virtual experience transitions into a vehicle-based attraction halfway through the game with the user moving into a real-world motion simulator without removing their VR headset.
## Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title Page</td>
<td>i</td>
</tr>
<tr>
<td>Abstract</td>
<td>ii</td>
</tr>
<tr>
<td>List of Figures</td>
<td>iv</td>
</tr>
<tr>
<td>1 Artist Statement</td>
<td>1</td>
</tr>
<tr>
<td>2 Background</td>
<td>3</td>
</tr>
<tr>
<td>2.1 What is Journey to Proxima Centauri?</td>
<td>4</td>
</tr>
<tr>
<td>3 Research and Influences</td>
<td>6</td>
</tr>
<tr>
<td>3.1 Classic Horror Author, H.P. Lovecraft</td>
<td>6</td>
</tr>
<tr>
<td>3.2 Disney Imagineering</td>
<td>8</td>
</tr>
<tr>
<td>3.3 P.T.</td>
<td>13</td>
</tr>
<tr>
<td>3.4 Resident Evil 7: Biohazard</td>
<td>16</td>
</tr>
<tr>
<td>3.5 Tying it All Together: Building the Immersive World</td>
<td>17</td>
</tr>
<tr>
<td>4 Methodology</td>
<td>19</td>
</tr>
<tr>
<td>4.1 <em>Axag</em>, the Monster</td>
<td>20</td>
</tr>
<tr>
<td>4.2 Environment</td>
<td>26</td>
</tr>
<tr>
<td>4.3 Industry vs Nature</td>
<td>34</td>
</tr>
<tr>
<td>4.4 The Ride Vehicle</td>
<td>37</td>
</tr>
<tr>
<td>4.5 Android</td>
<td>39</td>
</tr>
<tr>
<td>4.6 Technical Design</td>
<td>44</td>
</tr>
<tr>
<td>5 Conclusions and Discussion</td>
<td>48</td>
</tr>
<tr>
<td>Bibliography</td>
<td>50</td>
</tr>
</tbody>
</table>
List of Figures

3.1 Cover of Astounding Stories, which first published *At The Mountains of Madness* .................................................. 7
3.2 A hotel lobby scene from the Hollywood Tower of Terror ride at Disney Hollywood Studios .................................................. 8
3.3 The preshow video for Mission: Space at Walt Disney’s EPCOT .......... 10
3.4 A scene from the queue line for Flight of Passage at Disney’s Animal Kingdom ................................................................. 11
3.5 Hideo Kojima’s P.T. .................................................................................................................................................. 13
3.6 Visualization of playspace available to the user ........................................... 14
3.7 P.T. Level Design [Eisenmann, 2014] ...................................................... 15
3.8 Resident Evil 7: Biohazard ........................................................................ 16
3.9 The Immersive Worlds Handbook ................................................................ 17
4.1 Axag .................................................................................................................. 20
4.2 Concept art of the creature, based off of concepts by Nick de Spain . 21
4.3 Human and gorilla skeleton, compared ...................................................... 22
4.4 Lizard with dewlap [Alberta p, 2008] ......................................................... 23
4.5 The armadillo girdled lizard uses its spikes as a defense mechanism, curling up like an armadillo when threatened. ......................... 24
4.6 The player spots the monster’s shadow looming ....................................... 25
4.7 The Mezzanine, the first room of the game ............................................... 27
4.8 The lower floor of the Mezzanine ............................................................... 28
4.9 The Abandoned Equipment Room ............................................................ 29
4.10 The Abandoned Equipment Room ............................................................ 30
4.11 Scene from Pirates of the Caribbean ride at Walt Disney World’s Magic Kingdom ................................................................. 31
4.12 The Trophy Room, Work in Progress ...................................................... 32
4.13 The Crystal Garden ..................................................................................... 33
4.14 Some pieces of the industrial equipment used by the humans ............ 34
4.15 The broken down androids ........................................................................ 35
4.16 The monster’s trophy room ...................................................................... 36
4.17 My original blueprints for the vehicle ..................................................... 37
4.18 Final vehicle design, model by Philip Hatfield, surface by Cassidy Lamm 38
4.19 The Time Rover vehicle from Walt Disney’s Animal Kingdom          [Walt Disney Company, 2018b] ......................................................... 39
<table>
<thead>
<tr>
<th>Section Number</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.20</td>
<td>The Engineer as he appears in the game</td>
<td>40</td>
</tr>
<tr>
<td>4.21</td>
<td>Original Concept Art for the Engineer</td>
<td>41</td>
</tr>
<tr>
<td>4.22</td>
<td>Remodeled Engineer</td>
<td>42</td>
</tr>
<tr>
<td>4.23</td>
<td>Surfaced Engineer</td>
<td>43</td>
</tr>
<tr>
<td>4.24</td>
<td>Maximum area of movement</td>
<td>44</td>
</tr>
<tr>
<td>4.25</td>
<td>Teleportation in a VR game</td>
<td>45</td>
</tr>
<tr>
<td>4.26</td>
<td>Upper floor of the Mezzanine, with elevator in the corner</td>
<td>46</td>
</tr>
<tr>
<td>4.27</td>
<td>One of the rocks used for terrain building</td>
<td>47</td>
</tr>
</tbody>
</table>
Journey to Proxima Centauri is a tale that pits the user against nature and the complex relationship between an android and its creators. In the game, the player comes face-to-face with the the ancient presence that destroyed an entire crew of explorers that came before them, and they become trapped in a raw, untouched cavern full of danger and the unknown. Creating an immersive experience of a large scale required the hard work of a team of at least 18 individuals and took about a full year to bring to fruition. As co-founder of the project, I took on the role of not only visual lead, but also the modeling lead, programmer, designer, and a team leader. The artistic and technical considerations to be made for this project were numerous and often difficult, but necessary to ensure the success of the production.

Originally coming from a much more technical background, I have always had a stronger passion for art. Growing up with video games and witnessing their evolution from 16-bit to the beautiful, art-driven titles that exist today pushed me to pursue creating my own fantastical worlds. This project has been an opportunity to put that passion to use. Creating a beautiful environment, engaging characters, a thrilling story, and seamlessly tying it all together in the Unreal Engine was a complex
task that involved months of research and work.

In the following text, I would like to discuss the research, my design process, and the challenges I have faced in greater depth to fully illustrate the work that has gone into this project, bred from the fusion of art and technology.
Chapter 2

Background

All my life I’ve wanted to make video games - to be a part of an immersive experience and to transport myself and others to a new world. I started playing video games at the age of 4 with my family’s Super Nintendo, moving on to the Nintendo 64, the Nintendo GameCube and so on. I enjoyed Nintendo games the most because I found them to be creative, unique, and fun. Those were the types of games I wanted to make.

To me, some of the most impressive games are titles such as Final Fantasy and Xenoblade, with their gigantic worlds, beautiful environments, and fun characters. Playing in these worlds, I felt something I couldn’t feel by watching a movie or reading a book. I was in a different land and could even see myself there. I could interact with the environment and characters; I could make decisions that changed the course of my story; and I could experience a beautiful, magical world unfold before me. These were the games that inspired me to want to make games myself.

During my time as an undergrad, I was very much a technical student. I majored in Computer Science, and the focus of my studies was programming. I learned how to use coding languages such as C/C++, Java, and various video game
APIs such as Unity and Cocos2dx. Despite laying down a strong coding foundation and learning the tools to make video games at an intermediate level, there was still something missing. I quickly realized near the end of my time as an undergrad that I yearned for the more creative side of production. When I started my graduate studies in the Digital Production Arts program at Clemson University, I made it a goal to increase my artistic abilities and to start carving out my path towards becoming a 3D artist. With the help of my mentor, Mr. Insun Kwon, I began to practice the art of digital sculpting and surfacing. Despite much difficulty, I began to feel like I was easing into the path toward where I belong in the CG industry.

When I started this project, I knew exactly what I wanted to do: further my artistic skills and show what I have learned this far by creating a beautiful, 3D experience. For better or worse, I also knew what I had to do: harness the technical skills that I already had to create the framework for this experience. Together with my co-creator of this project, Paul DeBaun, we formulated a team of many creative minds and started work on a 3D experience in virtual reality that would take the user on a unique journey. They would take on the role of a soldier sent to uncover the mystery behind a frozen temple. The player would not only explore the temple by feet, but would also ride in an excavation vehicle to travel deeper into the temple. As the project grew, our scope became a massive undertaking. We stayed focused, and through many hard hours of planning and work, we have created an incredible experience, known as Journey to Proxima Centauri: Terror of the Mnar.

2.1 What is Journey to Proxima Centauri?

Journey to Proxima Centauri is a Virtual Reality experience that places the user in an HTC Vive Headset and a playspace that takes up the space of a medium-
sized room. A 2’x4’ motion simulator takes up one corner of this room, and is used by the player during the game to move to new areas of the environment. Before entering the game, the user watches a pre-show video, offering background story and exposition for the mission they are about to undertake as well as safety information to keep in mind during the game. Once in the game, the user descends into the caverns of the temple via an elevator, and their commanding officer instructs them to begin investigating the environment.

There were several goals I had in mind while working on this game. I wanted players to experience a beautiful, immersive environment. I wanted them to feel like they were truly a part of the story. These are just a few of the goals I had to consider during the design and implementation phases of the game. Later in the Methodology section of this text, I discuss the steps I took to tackle these challenges.
Chapter 3

Research and Influences

In this chapter I discuss the research that went into this project as well as influences that inspired me during its design and implementation.

3.1 Classic Horror Author, H.P. Lovecraft

Several influences affected my design decisions on Journey to Proxima Centauri. The virtual experience takes place on an ice-covered planet that was once home to an ancient alien civilization known as the Mnar. Some great catastrophe brought about the end of their race, leaving only a desolate, frozen planet. One of my inspirations for the frozen environment was At the Mountains of Madness, a science fiction-horror novella written by author H.P. Lovecraft in 1931 [Lovecraft, 1936]. The story is a first-person narrative of a geologist that led an expedition to Antarctica where he and his team encountered ancient, alien horrors. The icy wasteland and its treacherous mountains are the source of great strife for the explorers, and most of the expedition team does not make it home alive. While the icy planet of Proxima Centauri isn’t quite as terrifying as the “Mountains of Madness,” I drew lots of
inspiration from the desolate atmosphere.

Figure 3.1: Cover of Astounding Stories, which first published *At The Mountains of Madness*

There’s something about a desolate, icy wasteland that appealed to me when creating Proxima Centauri. There is a sense of isolation that comes from being in a place where other humans do not dare to go. As the lone adventurer in this place, you feel surrounded by mystery and danger with foreboding hints that perhaps you are not alone in this place. There are common thematic patterns that occur in Lovecraft’s work that I also wanted to share with players. One of them is the human fear of the cosmic unknown - a fear of what could be lurking out there in the depths of space - possibly some terrible creatures that could wipe out humanity in an instant. I wanted
users to think about these emotions during the game, which I explain more about how I implemented this in the Methodology section.

3.2 Disney Imagineering

The game as a whole is heavily modeled after a theme park attraction. In particular, the game was modeled after a variety of attraction known as the “dark ride,” which is “an industry term for any amusement park or theme park ride that uses vehicles to send passengers into an indoor environment and through a series of scenes.” [Levine, 2018] While doing research, I looked at what I believe are some of the most successful dark rides, which are those featured at Walt Disney Theme Parks. The talented team of individuals that works on these attractions is known as the Imagineers, who the Walt Disney Company itself describes as “the unique, creative force behind Walt Disney Parks and Resorts that dreams up, designs and builds all Disney theme parks, resorts, attractions, cruise ships, real estate developments, and regional entertainment venues world-

Figure 3.2: A hotel lobby scene from the Hollywood Tower of Terror ride at Disney Hollywood Studios
Most Disney dark rides (as well as their other attractions) are known for sequencing together two elements to create the complete experience: the queue and the ride.

I spent a week at Walt Disney World in Orlando, Florida researching the rides and discovering what elements made them successful. One of the biggest things that stuck out to me was that despite spending long amounts of time in the queue (the line that guests wait in before boarding the ride vehicles), I was never bored because there was always something to look at or do. The queue’s set design not only provides an immersive ambiance, but also tells a story. The queue for The Twilight Zone Tower of Terror ride at Disney’s Hollywood Studios (See Figure 3.2) takes the guests to a dilapidated hotel from the 1930s. The guests discover by looking at the old, dusty furniture and cobweb-covered antiques that this hotel hasn’t been maintained for many years. Once the guests reach the main elevator, they come face-to-face with an “Out of Order” sign, and a bellhop ushers them into an old library, where they are shown a video that explains what happened to the hotel on a stormy night. The building was struck by lightning, and five people who were in the elevator vanished. After the preshow, the guests are directed into the boiler room, where they will then enter the maintenance elevator for the actual ride.

Journey to Proxima Centauri pulls inspiration from this model of using a preshow and immersive set design as well. Before the player begins the game, they view a preshow, during which their commanding officer tells the player the game’s backstory and prepares them for their mission. Inspiration for our pre-show specifically came from a couple of Disney’s other ride queues such as the Mission: Space ride at Walt Disney’s EPCOT. [Inside the Magic, 2017]
During the pre-show for this Disney attraction, the guest is briefed on their training mission where they will learn to be an astronaut with a team of other trainees (other park guests) by piloting a space craft (See Figure 3.3). The idea of the pre-show video is to provide guests with an exciting video that adds several flourishes to their experience. It gets them in the proper mind-set to board the ride, where they will be a part of an out-of-this-world experience. It also adds a point of interest to the queue line, as although the guest is not yet on the true ride, they feel like they have already begun their adventure.

As researcher David Maister notes, “Once we are being served, our transaction with the service organization may be efficient, courteous and complete: but the bitter taste of how long it took to get attention pollutes the overall judgments that we make about the quality of service.” [Maister, 1985] Although the pre-show is not the main attraction, it acts as an addition to the queue that makes waiting to board the ride much more bearable. Because Journey to Proxima Centauri was built with the intention of many people experiencing it over the course of a day, the preshow was an important addition that also drastically reduced the amount of time that each person would spend in the game if all of the material in the pre-show was instead active play material. Due to the specific hardware (the motion simulator) necessary for this experience, something had to be done to allow more users to enjoy it. By breaking up the story’s prelude into its own video that can be watched outside of the VR headset, the game can accommodate many more people over the course of a day.
Once users put on the headset and are transported to Proxima Centauri, they begin their true adventure. When the idea for the game was first discussed, my co-creator and I had different ideas about what it should be. I wanted to build an adventure experience where the user would walk around and investigate a virtual world. My co-creator wanted to build a virtual ride experience that used a motion simulator to move the player instead of letting them walk on their own. After discussing and compromising, we decided to try something new that had not been done before. We combined the adventure and the ride into a hybrid experience, where the player would start their journey on foot, find a vehicle, and then step aboard without removing the VR headset.

When designing the adventure portion of the ride, I made it a point to continue using what I had learned from my Disney World research trip, taking careful note of what made the queue lines for the Disney Park Attractions exciting, besides the pre-show videos.

![Figure 3.4: A scene from the queue line for Flight of Passage at Disney’s Animal Kingdom](image)
Time and time again, what wowed me the most was the beautiful scenes that lit up the queue lines. It felt like I was on a movie set every time I waited in line for a ride. Better yet, it felt like I was in another world. I had truly entered the setting where the ride took place. One of my favorite examples of this is the queue for Flight of Passage, a ride based on James Cameron’s *Avatar*. There are several scenes that make up the queue for this attraction, such as a lush landscape from the planet of Pandora (See Figure 3.4), an underground research facility, and a laboratory with beautiful, animated displays. Even though scenes like this are merely the queues for Disney rides, and not the actual rides, they greatly inspired me when designing the environments for the exploration portion of *Journey to Proxima Centauri*. I will discuss these design aspects in more detail in the Methodology section of this text, as well as more examples of the Imagineering feats that inspired *Journey to Proxima Centauri*. 
3.3 P.T.

One of my main goals when creating this game was to keep the player immersed at all times. However, due to the limited amount of playspace offered by the HTC Vive’s Lighthouse system, the maximum size of square footage a player can walk around is 11 feet 7 inches x 11 feet 7 inches. This restriction, combined with the requirement for the motion simulator to take up a 2 feet x 4 feet space, forces the player to have a small area of foot-based locomotion at all times (see Figure 3.6).
In many other VR games, the designers overcome this issue by allowing the player to teleport within the space using their controller(s). This is something I wanted to avoid, however, as I believe the use of teleportation, while useful in its allowance for bigger virtual spaces, detracts from the user’s experience. It pulls players away from the virtual world, reminding them that this is only a game, and that they have the power to teleport with an electronic controller.

Surely, I thought, there must be a way to take advantage of the available real-world playspace without having to sacrifice virtual trekkable terrain. I found my solution in a game called P.T., by game designer Hideo Kojima [Kojima Productions, 2014] (See figure 3.5). In this horror game, the player finds themself in a dark, creepy house. The main playable space within the game is two hallways, connected at a corner (See Figure 3.7).
Despite having such a small level, the designers’ creative use of the limited space makes the horror game very immersive and haunting. At nearly any time the player manages to enter through “Door 2,” they find themselves warped back to “Door 1.” Each time they make this loop through the level however, they will notice differences in the level that make it seem that something strange is going on in this house. The player does not become bored with the space, and the developer is able to successfully reuse the virtual space.

Inspired by these techniques, I made many design decisions that enabled our team to reuse our limited real-world playspace in ways that would allow us to expand our virtual world exponentially. I will discuss this in more depth in the Methodology chapter.
3.4 Resident Evil 7: Biohazard

Another inspiration was the recent Playstation 4 title, Resident Evil 7 [Capcom, 2017] (See Figure 3.8). This game is arguably best played in Playstation VR, where the player is be totally immersed in a horrific world. In the game, the player takes on the role of Ethan Winters as he searches a macabre plantation for his missing wife.

![Resident Evil 7: Biohazard](image)

Figure 3.8: Resident Evil 7: Biohazard

The game makes brilliant use of atmosphere and story to make the player feel immersed. As you navigate the plantation, you come across horrific imagery and gruesomely animated characters and enemies that set the mood for a truly terrifying experience. My early plans for *Journey to Proxima Centauri* initially called for a much more horrific experience, similar to this one, but after compromising with my co-creator, a much more family-friendly game was created. In order to implement my ideas for the sort of tension you experience in games like Resident Evil 7, I had to be much more subtle. One of the considerations to make when adding the element of
fear into the game was that players would at certain points be entering and leaving the motion simulator during moments of tension. If the player felt rushed or anxious during these times, the risk for injury might become greater if they attempted to swiftly move in or out of the vehicle. In designing the game’s monster, I had to be careful in regards to its place in the story, ensuring that players feel tension at the right moments without putting them in real-life danger.

3.5 Tying it All Together: Building the Immersive World

In creating a virtual world that is heavily inspired by the attractions found at Walt Disney Theme Parks, I had to be particular about engaging the same mindset used when creating an immersive real-life experience, but with the benefits and
drawbacks of having the user in a Head-Mounted Display. Another book that I found especially useful in engaging this mindset was *The Immersive Worlds Handbook: Designing Theme Parks and Consumer Spaces* by Scott A. Lukas [S. Lukas, 2012] (See Figure 3.9). In his book Lukas details the many elements one must consider when designing an immersive space, such as atmosphere, authenticity, and story.

Lukas offers many design choices to consider when creating a new space, such as giving a space a meaning and communicating that to guests; using techniques such as perspective to force a guest to experience the environment in a specific way; creating emotion in the environment that entices the guest to feel a certain way, such as inducing awe at some epic structure or landscape; and several others. I found this book to be incredibly useful as I researched, designed, and implemented the elements that make up *Journey to Proxima Centauri*, and in the Methodology section, I provide more detail about how I implemented these ideas.
Chapter 4

Methodology

In this chapter, I explain my approach to solving the challenges I faced during the creation of *Journey to Proxima Centauri*. I will show examples, breakdown my design approach, and give an inside look at how I tackled the issues.

From the beginning I took the initiative as Art Lead. My choices helped shape the game into the experience users see and feel. I also oversaw the rest of the artistic team, including our concept artist and prop modelers, to make sure that their work reflected the look that I desired for our game.
4.1 *Axag, the Monster*

![Axag Image]

Figure 4.1: Axag

In the game, the user encounters a large, reptilian, icy creature known as the Axag. This creature is a manifestation of the energy that lives within the mysterious temple, tasked with defending the energy source from being harmed or taken. The design for the monster lends itself to the look and feel of the environment. One of my design choices in creating the icy temple was that as the player digs further into its depths, they would find that the temperature rises. At the core of the temple, they find a great pit of lava that turns out to be their final obstacle in escaping.
The monster resembles the design of the environment in that its exterior is frozen solid, its hands frozen shut into fists, and icy crystals jut out of its skin in all directions. Conversely, its body’s core is extremely hot, so much so that the thinner parts of the Axag’s skin, such as the thin layers over the breast and scapula, show a hot, emissive glow.

Figure 4.2: Concept art of the creature, based off of concepts by Nick de Spain

The design was heavily inspired by works drawn by artist Nick de Spain [de Spain, 2016]. His work heavily features monsters reminiscent of Japanese kaiju (怪獣, lit. strange beast). I was also inspired by gorillas and reptilian creatures.
The gorilla’s skeleton features much longer and bulkier arms and hands than the human’s (See Figure 4.3). The gorilla is designed this way so it can walk on all fours, supporting its large upper body’s weight as it moves. The Axag, too, features large, muscular arm muscles to support the weight of its thick upper body. The creature moves mostly on all fours, pounding its frozen-shut fists into the ground as it moves.

The Axag’s hind legs are of a different structure, more like those of a digitigrade such as a lion or bird. Walking on its toes, it has two powerful joints at the ankle and knee surrounded by masses of muscle to propel it through the environment with
swift strides and long jumps. The creature was given such muscular fore and hind limbs to give it not only an intimidating appearance, but also the ability to chase the user through the environment during the game’s vehicle-based chase scenes, creating tense and exciting situations for the player.

When modeling the monster, it was important to ensure proper topology for the sake of animation. I found the community at polycount to have a very useful wiki with information on creating efficient edge flow for joints and other character features [polycount, 2015]. Using these resources, I learned about following the path of my creature’s musculature within the edge flow to ensure proper deformations. I also learned how to converge edgeflows into the pits of joints to make sure that when the joint opens, volume of the limb is not sacrificed. Techniques like these ensured the monster would move realistically in the animation phase with less work from the rigger.

![Lizard with dewlap](image)

**Figure 4.4: Lizard with dewlap [Alberta p, 2008]**

Other features of the creature are reminiscent of reptiles, such as dinosaurs and lizards. On the Axag’s neck are thick, hanging sacks of skin, like the dewlap one might find on a lizard such as the one in Figure 4.4. On its head is a carapace-like horn, and jutting out all over its body are sharp crystals, creating a silhouette similar
to other spiked lizards (See Figure 4.5).

![Figure 4.5: The armadillo girdled lizard uses its spikes as a defense mechanism, curling up like an armadillo when threatened.](image)

Speaking of the creature’s crystalline spikes, the decision to insert these into the monster was not just to improve the dynamism of the silhouette. It also reflects the creature’s place in this world, and how it is tied to the environment. The temple is covered in these same crystals, and they represent the energy flowing through its walls. This energy not only creates the energy of this planet, but ties all of its structures and now mostly extinct creatures together.

The monster itself is menacing, and I wanted users to feel dread at the thought of its approach. As I mentioned in the Research and Influences chapter, it was important to be careful with my approach to inducing fear in the player. Most of the tense moments of the game only take place when the player has some sense of safety and refuge. The first time they encounter the monster, it isn’t even seen by the player. Rather, while the player hides in a small alcove on the lower floor of the Mezzanine, the monster enters the room on the upper floor. The player only hears the monster destroying its surroundings in a fit of rage. They also see rocks falling from the ceiling as it rampages above them, but they don’t see even a glimpse of the
monster until later in the experience.

Figure 4.6: The player spots the monster's shadow looming

The second encounter with the monster is while the player is safely inside the ride vehicle. As the vehicle slowly approaches a tunnel that goes deeper into the cavern, the monster’s shadow looms over them (See Figure 4.6). The vehicle backs up, and quickly changes directions, speeding off to escape the beast. I wanted to gradually introduce the monster to the player by using only sound in the first room, followed by clues of the monster’s destructive path through the tunnels, followed by a small glimpse of its silhouette.

When the player finally meets the monster face-to-face, the story is at its climax. The player finally discovers the location of the black box, and a big decision must be made that will decide the player’s fate. As H.P. Lovecraft said, “The oldest
and strongest emotion of mankind is fear, and the oldest and strongest kind of fear is fear of the unknown.” In the game, I prey on the player’s fear of the unknown via the form of an unseen monster that is stalking them and destroying the environment. The anxiety that the user feels is manageable and not quite the same feeling one might experience watching a horror film. But the effect is still powerful in that it helps engross the user deeper into the story.

4.2 Environment

In designing the environment, I wanted to create a space that was visually appealing and set the tone for the narrative. The user enters this unknown cavern with no preconceptions of what lies within. My goal was to awe them with the beauty of the inner caverns of this world. Blue and purple ice structures illuminate the room, and particle effects created by one of our team members, Thaddaeus Wassynger, create a diamond dust-like effect that surrounds the player in a strange, alien ambiance. The frozen planet is also frozen in time, untouched since the extinction of its original inhabitants. Only when a human organization sends excavation androids to the planet’s temple does the planet show its first sign of life in eons. The following list contains the scenes that I designed, modeled, surfaced, and/or laid out:

1. The Mezzanine

2. Abandoned Equipment Room

3. The Trophy Room

4. The Crystal Garden
4.2.1 The Mezzanine

I had a great responsibility in designing and modeling much of the levels in the game. I created the geometry that makes most of the first level (See Figure 4.7), which we call the Mezzanine for its overhanging two-floor layout. The terrain, including the rocks, pillars, and encasement for the player’s bounds, were all modeled as high-poly versions in ZBrush and then retopologized using ZRemesher and Topogun as needed. In order to preserve the high-poly detail, normal and ambient occlusion maps were baked using xNormal, and then piped into the geometry’s material maps within the Unreal Engine. The interactive elevator was modeled similarly.

All of our surfaces were created either within Unreal’s node-based material system, or using Allegorithmic’s family of surfacing software, Substance Designer and Substance Painter.
In terms of level design, it was important to keep the player within the Vive’s playable space. A square shaped playable area was created for the player to navigate, with an elevator in one corner of the room that allows them to move between the upper and lower floor. On the lower floor (See Figure 4.8), the player encounters the vehicle that will later navigate them deeper into the temple. Because this vehicle takes up a corner of the room in real-world space, it was important to place a boundary around that area in the virtual upper floor of the Mezzanine to prevent players from injuring themselves. The simple solution was to place a large boulder here. Our tests showed that the presence of a virtual boundary was enough incentive to keep a player from walking into that space in the real-world, providing a quick and easy fix for this problem.
4.2.2 Abandoned Equipment Room

Another room I designed was the Abandoned Equipment room (See Figure 4.9, which the player travels through just after leaving the Mezzanine. This room is full of old, rusty containers and mining equipment. As the player enters the room, the Commander turns come in over the headset, commenting on how messy the room looks, as if it were abandoned in the middle of a job. Crystals on the walls emit an eerie glow over the abandoned equipment. Other excavation vehicles are also in the room, broken and covered in rubble. Water drips from the ceiling onto the floor into large pools of water, adding to the idea that this place has long been abandoned and unkept.
The great part about designing a room that features in the ride portion of the game is that I don’t have to worry about space and boundary restrictions created by the foot-based navigation used in the exploration areas. In these areas, I am able to create a scene just like those seen in amusement park dark rides. I found inspiration in real-world rides like Disney’s Magic Kingdom’s Pirates of the Caribbean ride, with scenes such as those in Figure 4.11. The skeletons surrounded by wreckage tell the story of pirates who met their unfortunate end long ago. In the Abandoned Equipment room, I tried to tell a similar story through the wrecked and lost equipment left behind by a missing team of androids.
Figure 4.11: Scene from Pirates of the Caribbean ride at Walt Disney World’s Magic Kingdom
4.2.3 The Trophy Room

The Trophy Room (See Figure 4.16) is the unfortunate graveyard of many androids who were sent to investigate the temple. In the center of the room sits a mountainous heap of broken parts, a dim light shining over its peak. The light highlights the numerous hands and legs, reaching out from the pile as if trying to escape even in death. Meanwhile, the carcasses of a few select androids are impaled on the wall or hanging from the ceiling by their wiry guts. Using blueprints, I made these androids to randomly spark and flicker their eyes, showing that the only life remaining in this room is the remnant energy of old batteries.

I designed this room to show the merciless, cruel nature of the Axag. It has killed hundreds of androids, and the still-functioning brother of them all, the Engineer, swears an oath of revenge as you spiral through this room and deeper into the temple’s tunnels.
4.2.4 The Crystal Garden

The Crystal Garden (See Figure 4.13 is the site of the game’s climax. The user enters the room aboard the Ice Exploration vehicle. As they approach the mysterious altar in the center of the room, the see the illusive Black Box, wedged into an outcrop of crystals. The altar itself glows with a mysterious energy, and two bulbous hands reach out from the steamy waters, almost as if reaching out to the energy. It is here that the monster finally makes itself visible to the player, as it overlooks the altar from a bridge just outside of the room.

I wanted to create a tense situation in this room, while retaining a sense of beauty. This room, once a place of worship for the ancient Mnar, has long since been abandoned. It still houses the source of energy that gives life to the planet, and it remains guarded by the Axag, who has been stalking the player.

This room, surrounded by the cascade of a frozen water, is bathed in the eerie glow of crystals jutting out of the tepid pool surrounding the altar. I believe
the atmosphere effectively creates a foreboding feeling in the player, making it the perfect location for the experience’s climax.

4.3 Industry vs Nature

One of the themes in *Journey to Proxima Centauri* that shows itself in the artistic design is the juxtaposition of industry and nature. Industry is represented by the human’s iron-wrought tools (See Figure 4.14), including the androids, vehicles, and equipment that have intruded upon this untouched, icy world. Nature is in turn represented by the raw forms that make up the temple, the stone structures built by the old civilization such as the ancient elevator and the Crystal Garden (See Figure 4.13). It is also represented by the monster, a pure manifestation of the temple’s energy. These organic shapes and beings were long untouched, and now resist the invasion of humans, who have sent in their machines to excavate the planet’s mysterious energy source.

Figure 4.14: Some pieces of the industrial equipment used by the humans
Nature has mostly taken over the planet, and harsh weather left unchecked by the extinct race known as the Mnar has left the environment to be weathered and torn by blizzard-like conditions. With this in mind, I designed an environment that was covered in ice and rocks, where even the old architecture of the Mnar has been worn down by ice and time. The previous androids who entered the cavern are now covered in rust and decay, unable to move from their frozen resting spots (See Figure 4.15).

![Figure 4.15: The broken down androids](image)

By the end of the game, the player realizes that the Axag, who has been stalking them throughout the temple, has spent its time hunting and collecting the androids in a macabre trophy room. I designed this room to be dark and foreboding, with a pile of broken androids in the center, and other robots hanging from their cables or speared against the walls with sharp rocks. When the player sees the
gruesome results of the monster’s violence, the Engineer, a broken down robot who accompanies the player on their adventure, swears an oath of revenge against the creature for murdering his friends (See Figure 4.16).

Figure 4.16: The monster’s trophy room
4.4 The Ride Vehicle

One of the biggest points to consider when designing the in-game model for the ride vehicle was matching up the geometry to the real-world dimensions of the motion simulator. I asked another Clemson student, Philip Hatfield, to create the model for the vehicle. While overseeing Philip’s progress, we made sure that when placing the vehicle in game, it would match up to scale. Measurements were taken of the motion simulator and used as reference for his modeling. When the model was brought into the game, my co-creator, Paul DeBaun, used a calibration technique that employed the use of a Vive Motion Tracker to store the location of the motion simulator, and then tie the in-game vehicle’s position to that of the motion simulator within the playspace.

The design changed as we continued iterating upon both the in-game model and the real-world motion simulator. The final design (See Figure 4.18) features rails that match the safety rails on the actual vehicle. This gives users the ability to see
exactly where they are in regards to the vehicle while wearing the headset. Their hands and feet can be seen in game, making it simple to use the rails as a point of reference. Similarly, one can employ use of the height of the motion platform off of the ground as reference for where they should position their feet to step into the vehicle.

![Figure 4.18: Final vehicle design, model by Philip Hatfield, surface by Cassidy Lamm](image)

The completed look of the vehicle was heavily inspired by the ride vehicle one would encounter at a theme park attraction. During my research trip to Walt Disney World, I was especially inspired by the “Time Rover” featured in Walt Disney’s Animal Kingdom’s ride, Dinosaur (See Figure 4.19). The ride is engineered not only to fit the atmosphere thematically, but also to safely accommodate passengers and provide them with a thrilling experience as they go back in time to capture an Iguanadon. The Time Rover looks appropriate on the exterior, but hides hydraulic-powered actuators within its shell that move the riders in all directions to enhance the motion of the vehicle. Thankfully in our game, there is even more freedom to hide the mechanical inner workings of the real-world motion simulator. The reason for this is that while a Disney ride vehicle must hide the inner mechanics from the
guests’ sight, we only had to hide those mechanics from the user’s path. That is to say, we had to construct the vehicle to keep the player from unintentionally touching any motors or other mechanical parts with their feet or hands. Bearing these factors in mind, Mr. Hatfield and I worked together and constructed an appropriate vehicle design for our needs.

Figure 4.19: The Time Rover vehicle from Walt Disney’s Animal Kingdom
[Walt Disney Company, 2018b]

4.5 Android

During the Journey through Proxima Centauri, the user is accompanied by one of the androids who was the leader of a previous expedition. The Android, who calls himself “The Engineer,” finds himself trapped in the temple caverns after escaping
some terrible calamity and then powering down his body. The player encounters
meets them, but is interrupted by a terrible crash and roar from with the caves. The
Engineer offers to help them both escape the temple, and the player removes The
Engineer’s core module and attaches it to their suit.

![The Engineer in the game](image)

Figure 4.20: The Engineer as he appears in the game

The Engineer’s design (See Figure 4.20) went through many iterations and
critiques from my advisors. Our original design (See Figure 4.21) was crafted by
concept artist Katherine Crossan. While I very much loved the design, a few of us
had some concerns that it didn’t perfectly fit the theme of the game. My co-creator
and I initially imagined the Engineer as a goofy type of character that would provide comic relief with his Wild West accent and witty one-liners. After receiving feedback from our advisors, we quickly realized that we had gone too far with the design. In order to step back from the in-your-face style of the original character design, we kept his personality and boisterous voice, but toned down the character design to a more mechanical, broken-up aesthetic instead of the original more blocky and cartoony design.

![Figure 4.21: Original Concept Art for the Engineer](image)

To approach this task, I took the model into 3D modeling software, ZBrush, and began a process known as kitbashing. Kitbashing is the technique of inserting several pre-made pieces from a library of parts. These libraries can include all sorts
of things, but in my case, I used libraries that contained mechanical joints, nuts and bolts, cables, pipes, and more. I took the old pieces of the android and used them as a rough outline as I created the new android (See Figure 4.22).

![Remodeled Engineer](image)

Figure 4.22: Remodeled Engineer

After the remodel, I used Substance Painter to give the new Engineer a fresh coat of paint (See Figure 4.23). When creating the new design, I wanted him to retain his friendly appearance. I kept his eyebrow-like head plating, and placed a round, earmuff-like disc on each side of his head (like ears) to resemble the face of a monkey.
(the cuddly kind, not the tear-off-your-face kind). I decided to make use of a gentle simian-inspired design to juxtapose the Axag’s gorilla-inspired design.

Figure 4.23: Surfaced Engineer
4.6 Technical Design

4.6.1 Making an efficient playspace

Previously mentioned in the Research and Influences section was the issue caused by a limited VR playspace. It was important that I allow the user to fully explore their environment, but with only an 11’7” x 11’7” (minus the area required for the vehicle) playspace (See Figure 4.24), I had to think of a way to expand the users’ traversable space.

Figure 4.24: Maximum area of movement

Many VR games make use of a technique called “teleporting,” where the user can “cast a line” into the distance, and then warp to that location at will (See Figure 4.25). While efficient, this movement metaphor wasn’t what I wanted for the player in Journey to Proxima Centauri. I feel that teleportation removes the player from their sense of immersion. My solution was inspired by the level reusability exhibited
by horror game P.T.

Figure 4.25: Teleportation in a VR game

Two methods of transportation were invented and added to the game to allow users to reuse their playspace. The first was an elevator. The first area of the game, the Mezzanine, has two floors, separated by an ancient elevator left behind by the now extinct Mnar (See Figure 4.26). When the player stands on the elevator platform and presses the button, a safety gate lifts up around them (to incline users not to step off of the platform) and then proceeds to move up or down, depending on which floor they are currently on. Using the elevator, we were able to essentially double the user’s playspace in the first room.
The second method of transportation, which may be regarded as the mechanical mascot of the entire virtual experience, is the Ice Exploration Vehicle. When users enter the vehicle and turn on the ignition, they are driven deeper into the temple caverns. As the users exit and re-enter the vehicle, they are able to explore an infinite number of scenes and rooms.

By removing the need for teleportation, I believe that I was successful in keeping the users engaged and immersed in the virtual world. Rather than instantly warping from one location to another, the user is urged to explore their environment and discover how it can be used to visit new locations.
4.6.2 Modular Design

Figure 4.27: One of the rocks used for terrain building

Most of the rocky terrain and walls was created using only a couple of different rock meshes. The pieces were scaled, rotated, and placed in different ways to create unique looking terrain. I made use of LODs to ensure efficient polygon usage while maintaining perceivable detail. LOD, which stands for level of detail, is the technique of changing a mesh to a less topologically dense version as the player moves farther away to maintain detail without sacrificing performance. Unreal has a built-in system for doing this, and by choosing which LOD a mesh should change to depending on the distance of the player from the mesh, I was able to easily set up efficient environment meshes.
Chapter 5

Conclusions and Discussion

The Journey to Proxima Centauri project was a successful leap into the world of Virtual Reality gaming. Through many obstacles and hurdles, the team has accomplished its original goals and reached beyond to new heights. Many new users will be able to try out the game for themselves at SIGGRAPH 2018.

Many assets were created for this game, offering new challenges in both design and production for the team to overcome. Creating the experience itself revealed many hurdles in Unreal Engine 4 and was a great learning experience. As evidenced by the reactions of the many people who have tried the game so far, the original vision of creating an immersive world has been reached.

The themes in the game are clearly communicated to the user, as long as they follow along with the story. The environment, the characters, and various interactions guide the user through the narrative, and testers have been able to pick up on the relationship between the androids and the humans, while praising the environment for its cohesiveness and attractiveness. Moving forward, the team will explore the relationship between gamers and their environments even more. Continuing the research that began at Walt Disney World, the team will strive to obtain a greater
understanding of what makes people “feel” when they are in a strange and new place, and how to capture that in a virtual world. Humans are not so easily fooled, so it takes a deep understanding of how we perceive our surroundings to convincingly create a virtual manifestation of a fantastical place.

There is still work to be done on the project, especially if it is accepted to be presented at SIGGRAPH. There are many improvements to be made in creating an even higher level of immersiveness for users and there is also one final scene in the game that still needs to be brought to completion. The team has full confidence that the game will prove itself thanks to the hours of hard work and dedication placed into creating the game, and we look forward to the enjoyment of future players.
Bibliography


