Dreaming when you are Awake

A Detective Journey in Mixed Reality Storytelling

A Master of Fine Art Thesis by
Bernice Lai

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A thesis exhibition presented to OCAD University in partial fulfillment of the requirements for the degree of Master of Fine Arts in Digital Futures

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Dreaming when you are awake: A detective Journey in Mixed Reality Storytelling

Bernice Lai

Master of Fine Art in Digital Futures

2022 OCAD University

Abstract

The hustle and bustle of cities are boosting people's mental health problems. Many people lack a reliable method for altering their mental state and lowering anxiety and depression.

Using entertainment as a distraction might be a good idea, like reading and watching movies. However, the majority of the storytelling is not sufficiently engrossing in traditional 2D experiences such as phones and television are insufficiently immersive. My thesis project combines Virtual Reality and Augmented Reality to produce a 360-degree VR animation of a dreaming tour as well as an Augmented Reality detective board with slide images and animation.

This project makes people travel into a fictional realm by using fantasy as escapism. They may be able to escape reality and relax by walking around a wonderful atmosphere in VR video. I am working on a 360 Virtual Reality video and an Augmented Reality interactive board, which is divided into two parts: the first is an Augmented reality storytelling detective board, which will tell the story of a man who created the fantasy land. The audience may learn about the project's background story through pictures and 2D animation; the second portion delves into the 3D virtual reality animation, which immerses viewers in a fantasy world. It depicts dreamy scenes in order to help viewers de-stress and dream while awake.

Keywords: Virtual Reality, Augmented Reality, Animation, 3D modeling, Character design, storytelling, Lucid Dreaming, Nature, Mixed Media, drawing and painting, immersive experience, distraction, narrative

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1. Introduction

Many of us are battling mental health issues, and the hustle and bustle of the city are boosting people's anxiety, depression, and stress levels. Psychology research of 2019 tells 19.1 percent of Americans live with an anxiety disorder, while 6.7 percent have depression, because " the constant stimulation of city life can propel the body into a stressful state." (Fraga, 2019)

I personally am also afflicted by anxiety and depression, I frequently try to relax by distracting myself. I am hoping that by using storytelling as escapism, I will be able to divert people's attention away from their unpleasant emotions. Many people lack a reliable method for altering their mental state and lowering anxiety and sadness. Distracting yourself with entertainment could be a good idea. According to a few 2016 and 2017 reviews and studies, which proves the "pleasurable distractions and entertainment could provide rest and relaxation and replenishing qualities…enjoying leisure activities such as watching movies could boost mood and reduce symptoms of depression." (Benton, 2022)

Most storytelling, in my opinion, is not immersive enough; 2D typical experiences such as phones and television do not make people feel as though they are immersed in a completely different environment. Many people can immerse themselves by simply reading a book or watching a movie, but we may invest more time and effort. I am hoping to create something that gives people energy rather than draining it, such as sleeping. I can only forget about my stress and feel completely comfortable when I fall asleep, which allows me to forget about and separate what happened in real life.

Virtual Reality is a technology that allows people to dream while still awake, it gives the viewers isolation that cuts off the connection with reality. The experience of Virtual Reality is

similar to lucid dreaming, the viewers are fully immersed in a vivid unreal environment. VR also works well for the lucid dream training, the VR-enhanced lucid dream training led to increased lucidity of dream. (Carr, 2021) In VR, I aim to create a fantastic utopia for escapism. People should have a positive emotional experience. It has the potential to allow people to see nothing from their everyday lives and enter a completely different universe.

Augmented Reality could also be used to tell stories in a more immersive way. Making the 2D surface 3D and the images animated in order to get people to interact with the story. Pop-up books are a type of interaction and immersion that allows readers to enjoy a 3D experience from a flat book. AR could also create a 3D model that pops out from the book pages with a variety of interactions. Pop-Up books were the beginning of virtual and augmented reality, “they showed what can happen when creativity and technology collide. Virtual and augmented reality creates an in-body experience for the audience. Stories begin to feel like they are in real life.” (Peters) Augmented Reality is also a way of mixing digital information with real life, so it is also super immersive as people could really think the digital stuff happened in real life.

Both Virtual Reality and Augmented Reality provides a very immersive experience, and both can provide a good narrative and relaxation experience. I want to use these approaches to my project.

1.1 Research Summary

1.1.1 Problem Statement

To complete a multi-media storytelling artwork with Virtual Reality and Augmented Reality, that gives users an immersive experience for entertainment. I need to make the viewers feel both types of immersion. It is both going to a new world and interacting with the real world.

To research this, I found several related works and examples of mental health healing and distraction with Virtual and Augmented Reality, lucid dreaming training with VR, Storytelling with XR, and the elements of good storytelling from the storytellers. I also evaluated a couple of VR and AR works, to learn the good part and avoid the negative components from my perspective.

On websites like YouTube VR, there are already hundreds of 360-degree VR videos. I need to develop a video that stands out from the crowd. The interactivity and narration would be the focus of Augmented reality. I need to create many storylines that is related to each other but do not confuse the viewers.

1.1.2 Hypothesis Statement

My background is as a graphic novel artist, 2D, and 3D animator. My plan is to make a 360-degree Virtual Reality animation and a detective board installation that displays a variety of illustrations. Viewers could download an AR app on their phones to view and interact with the illustrations as well as watch the pop-up layers and animations on the images. The texts would pop out from the images, which tells the information behind the image, the viewers could gather the evidence like the detectives and follow the storyline. There is also a table below the detective

board, that displays the 3D object that could also interact with AR and a VR headset for playing animation.

I intend to create a virtual reality tour in which a character guides viewers through various scenes. Scenes should be set in a beautiful environment that allows viewers to relax. Lost paths in a VR world or the pressure of moving to the next level of the game might cause viewers to become stressed throughout the experience. To completely relax the viewers, I decided to construct a 360-degree Virtual Reality animation; all they have to do now is watch this immersive film.

The goal of this research is to see how an interactive board and a film can give enough distraction from reality for viewers.

1.1.3 Research Questions

-What experience makes people have a distraction from real life, and how to make use of this knowledge in XR experience and visuals?

-How to make an XR experience that enhances storytelling?

- What are the elements of good storytelling?
- How can MR enhance storytelling?
- How does storytelling affect emotion?

1.1.4 Scope and Limitation

My project necessitated a significant amount of time and effort. In Augmented Reality, there are twenty to forty polished illustrations and animations. I am also new to augmented reality software. In the virtual reality section, I need to create a character and rig it and fit into the environment. Every single frame of a 3D animation with high resolution and sophisticated details takes a few minutes to render.

Due to the limitation of time, I limited the scope of my project to the Augmented Reality detective board and a VR video. VR videos would only show the short rendered scenes. The viewers would not have the pressure of time spent during the exhibition.

2. Background

I enjoy storytelling as an artist, creator and a viewer. There are many different types of mediums for storytelling. Other than novels with only texts, I think additional images could help readers feel more immersed in the narrative. Graphic novels have the potential to be more immersive than written novels, and a book with interaction, such as a pop-up book, is one approach to achieve this. For storytelling, the videos may be more effective. All of those features might be combined via augmented reality. It could pop up and move a flat picture, as well as combine 2D and 3D animations and static images.

2.1 Overview

This chapter will be divided into two sections in which I will discuss my research. The first portion will cover Mixed Reality, which includes both Augmented Reality and Virtual Reality, as well as the definition and evolution of those experiences. Understanding how those strategies can be used to improve people's emotional states. I will also give examples of how virtual reality may divert people's attention away from the actual world and help them cope with unpleasant situations through various experiences. The second portion is Storytelling; how can it distract people's attention and provide immersion, as well as how can it operate with mixed reality?

2.2 Mixed Reality

Augmented Reality and Virtual Reality

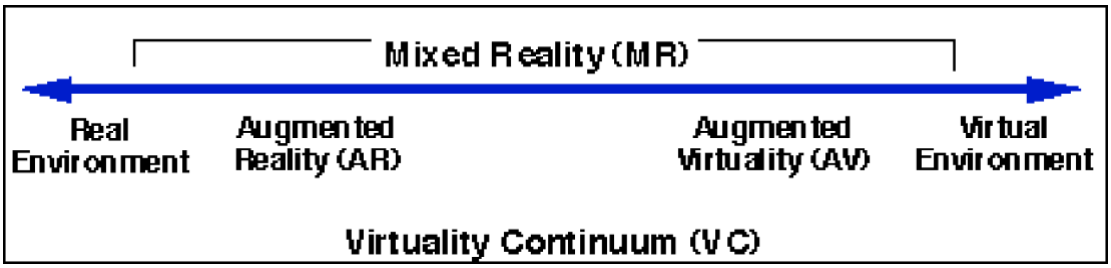

Figure 1. Reality-Virtuality (RV) Continuum from Milgram and Kishino, 1994. (Milgram and Fumio)

Augmented Reality (AR) is a real-time approach that adds digital virtual information to a view of a physical real-world environment. (Carmigniani, 2011) Augmented reality is a blend of the real and virtual worlds that can turn a flat surface into a three-dimensional object. AR is a type of interactive experience that incorporates digital information into the actual world. The majority of it is viewed using glasses, a headset, a projector, or, most commonly, a mobile phone. (Arnaldi, 2018) It creates a vision that combines the unreal with the real in order to engage viewers in the physical world through digitally rendered elements. It is often used in games, navigation, furniture arranging, and social networking, among other things. AR combines the real and virtual worlds to create an engaging experience. It adds the "virtual objects superimposed upon or composited with the real world."(Kipper, 2012) It could be based on a specific location or a specific image. My research focuses on relevant works incorporating storytelling with augmented reality. They use various engagement strategies to make consumers feel a connection to the story.

A human-computer interface that simulates a realistic environment is known as virtual reality (VR). It encourages viewers to immerse themselves in the virtual world. "Virtual Reality technologies completely immerse a user inside a synthetic environment, the users cannot see the

real world around them." The virtual world allows individuals to move around freely. (Kipper, 2012) Virtual Reality is an immersive experience that immerses viewers in a world that is radically different from their own. Viewers could use headgear to explore a world that isn't real. It goes beyond the realms of physical reality and the realms of fiction. (Milgram and Kishino, 1994)

If augmented reality creates a hybrid of digital and physical environments, virtual reality creates a completely digital environment. Both have the advantage of being interactive and immersive. They have the potential to divert attention away from the real world.

Virtual Reality emphasizes distraction, with the most common example being pain relief. Virtual reality has also been used to manage pain and with a wide variety of known painful medical procedures, according to the paper "Immersive Virtual Reality as an Adjunctive Non-Opioid Analgesic for Predominantly Latin American Children With Large Severe Burn Wounds During Burn Wound Cleaning in the Intensive Care Unit: A Pilot Study" (Hoffman, 2019). SnowWorld, a virtual reality game, is the most well-known example. SnowWorld is a virtual reality video game in which players engage in snowball fights. It is made to make burn patients feel like they're inside a snowy 3D canyon. It has a considerable impact on burn sufferers' pain relief. Hunter Hoffman and David Paterson, University of Washington researchers, virtual reality pioneers, and pain specialists, created SnowWorld to occupy the minds of burn patients during painful wound cleaning or physical therapy. Snowball is the polar opposite of fire; the cold, snowy scenery would cancel out the flames and let the sufferers forget about their original hurt. The purpose of this study is to see how effective SnowWorld is at reducing pain in patients. There were 48 children in this study who had massive severe burn injuries that covered more than 10% of their total body surface area. They were going through the most excruciatingly

painful medical treatments while washing their wounds on a regular basis to prevent infection. A full dose of a prescription opioid is rarely enough to prevent the severe acute pain signals that rush the brain during wound cleaning, staple removal, and physical therapy. Opioids work by chemically inhibiting pain signals as they go from the nerves to the brain, but there is a limit to how much pain they can intercept, and the opioid must be used only on young people. Virtual Reality technology does not require any chemicals; all it requires is for the patient's attention to be drawn to it.

When burn victims were engrossed in the VR game, they felt 35 to 50 percent reduced pain, which is comparable to a modest dose of opioid medicines. "Even though pain signals are causing a patient's nerves to fire up, the brain can be fooled into ignoring them by diverting brain activity." (Hoffman, 2019)

Figure 2. Screenshot from the game Snow World.[1]

[1] https://www.geekwire.com/2018/snowworld-melts-away-pain-burn-patients-using-virtual-reality-snowballs/

2.3 Storytelling

Stories are everywhere. Stories may be found in every movie, every novel, every newscast, and every historical event. Storytelling is a way of distraction, a way to make the audience immerse into the story. “Fiction stories are one of the most interesting phenomena that human beings have…we convey truth with stories.” (Gaiman, 2020) Good stories are memorable, no matter if it is it nonfiction or fiction story, it tells the “truth”. It makes people learn from that event they have heard. It needs to be influential. A good fiction story should represent reality and use an unreal story to reflect the facts. Stories are using people’s empathy to influence themselves. Virtual Reality is like an “empathy machine”. Once we put on the headsets, it forces the viewers to “become” part of the story. Empathy could make the story more emotional and influential. (Cummings, 2021)

“Stories can uplift us and change our moods. This changed mood and outlook is no small matter. A reasonable amount of positive emotion and optimism allows us to cope better with adversity and meet the obstacles we face.” In one study done with hospitalized children in intensive care, the storytelling session led to an increase in oxytocin, a reduction in cortisol and pain, which means it is a good and positive distraction. (Field, 2021)

My objective for this project is to create a meaningful narrative that reflects how individuals like us are treated and gives voice to those who have gone through similar experiences. I prefer to create characters with unspecific gender identities because I disagree with gender stereotypes and gendered forms of dress. This character serves as a tour guide for the audience. I want to show more about character development inside the detective board. Throughout my studies, I have been interested in exploring the topic of social taboos. I am expanding my animation skills in Augmented Reality and Virtual Reality.

2.4 Related Works

"Augmenting the Reality of Phantom Limbs: Three Case Studies Using an Augmented Mirror Box Procedure"

Augmented Reality could also use the combination of unreal and real environments to help people overcome their mental healthissues, like phantom limbs. In the paper "Augmenting the Reality of Phantom Limbs: Three Case Studies Using an Augmented Mirror Box Procedure"(Desmond, 2006), Phantom sensation and Phantom pain are common after limb amputation. Patients may have the delusion that their amputated limb is still present. Through exposure to the "mirror box illusion," this discomfort might be managed and alleviated. Through the mirror, the patients could see their missing limbs and "feel" the movements. Virtual and augmented reality solutions may be able to help any patient suffering from phantom pain. They create an "augmented mirror box" to deal with phantom pain. In this treatment, the patient wears a wireless data glove on their intact arm, the information from the glove is transferred to the computer, and their missing arm appears in their view, moving symmetrically with the intact arm in real-time. Real-time tracking of their missing arm. The therapy might also use the computer to manipulate the phantom's movement so that it may move asymmetrically, which would be more realistic. The patient would truly believe their lost limbs were returned to them because of augmented reality technology. According to the paper, this treatment decreases pain, provides more chances for community engagement, and provides significant benefits to patients.

Figure 3. Phantom motor execution as a treatment of phantom limb pain. (Ortiz-Catalan, 2016)[2]

[2] https://doi.org/10.1016/S0140-6736(16)31598-7

Tetris Effect

Figure 4. Jellyfish Chorus in Tetris Effect[3]

Tetris Effect is a virtual reality game. Tetris is a well-known small game that is both simple and addictive. Tetris Effect transforms this basic game into something spectacular. It enhances the traditional game with particle and lighting animations, as well as music and sound effects. Every level has a unique theme, with the backdrop, lighting, music, sound effect, and the form of the squares and crack effect all changing. It depicts a wonderful planet. The song would get more impassioned as the square fall faster, and the light show becomes more spectacular. This game relaxes and diverts the viewers' attention away from reality. It makes me realize that, even if it is only a puzzle game, a 360-degree background may make the entire experience more immersive; there are many VR games which are not 360-degree. I believe I could make a immersive experience no matter how interactive it is, 360 degree is the point of immersion.

[3] Tetris Effect: https://www.tetriseffect.game/

“The Modern Way to Banish Pain” by Jerome Burne

The author of the article "The Modern Way to Banish Pain" discusses a case in SnowWorld involving a burn patient named John. John is a twelve-year-old burn victim. He'd be given morphine before starting his therapy, but morphine doesn't always work to relieve all of the agonies. During the wound cleaning, he began to play SnowWorld. “As he swoops and dives through an ice canyon in his mind, a man is doing something excruciatingly painful to his leg.” (Burne, 2004) When you're involved in a virtual reality world, you can only focus on a limited number of things at once, and you're disregarding what's going on with your wound in real life. When the brain receives the information from SnowWorld, the intensity of discomfort can be reduced by up to 97 percent. "This suggests that virtual reality not only impacts how people subjectively experience incoming pain, but it also modifies brain activity," Hunter explains. Virtual reality (VR) is becoming a new way to assist burn sufferers to cope with the pain of healing. It takes the patients into a frozen world with falling snowflakes, igloos, woolly mammoths, flying fish, snowmen, and penguins, among other things, to distract them from their wounds. By shifting patients' attention away from prior traumas, SnowWorld has proven to be extremely effective in preventing painful flashbacks. Their studies revealed that not only do patients report feeling less pain in the snow, but MRI scans also show that it lowers pain signals in the brain. Enhance your degree of comfort. Like what Burne mentioned in his research: A computer game can beat morphine.

Bravemind[4]

Exposure Therapy is another term for virtual reality, Virtual Reality exposure therapy system Bravemind is an example. It was developed at the USC University of Southern California and is available for clinical and research usage free of charge to clinicians and researchers who can demonstrate expertise in the domain of Prolonged Exposure Therapy for the treatment of combat-related PTSD (Posttraumatic stress disorder). It includes virtual situations such as Afghan and Iraqi cities and desert road environments that are important to combat scenarios.

Aside from the immersive visual, the headset also provides the patients with directional 3D audio, vibration, and fragrances. Its goal is to help people who are suffering from post-traumatic stress disorder. Patients in exposure therapy would relive their traumatic memories in order to process them. Virtual Reality technology allows the sufferer to relive their experience in a virtual world rather than relying just on their imagination. A VR treatment, rather than traditional talking therapy, may appeal to young military people. It has been demonstrated to have a significant impact on PTS symptoms.

As the exposure therapy could bring people back to where they went through before, I could do the same thing, but not in a theraputic way. I could make the users went through the dreamlands other than where they were being hurt before.

Figure 5. Screenshot of Bravemind gameplay.

[4] Bravemind: https://www.soldierstrong.org/bravemind/

Spider Phobia

Another example of exposure to VR Therapy is Spider Phobia(Carlin, 1997), which is also beneficial in conquering the phobia. This paper discusses one of Albert Carlin and Hunter Hoffman's examples: employing immersive virtual reality for arachnophobia exposure therapy. The first patient they worked on together was Miss Muffet. She had been clinically phobic of spiders for about two decades. Her spider phobia caused her a lot of problems: she looks for spiders everywhere she goes, she washes her clothes in a sealed plastic bag, she fumigates her car with pesticide and smokes periodically, and so on. Miss Muffet entered SpiderWorld, an immersive virtual reality, as part of her VR therapy. Hunter Hoffman would hold a virtual spider near Miss Muffet's face as part of phobia exposure therapy to help her overcome her fear of spiders, and she would touch a hairy spider in real life as tactile signals to the virtual view, giving the impression that she was touching the virtual spider. Miss Muffet was able to withstand grasping the virtual spider without panicking during the twelve one-hour VR therapy sessions. She was able to dislodge the massive spider's leg. After the therapy, she was largely healed of the problem that had been bugging her for the previous 20 years, and a genuine spider no longer scared her. After Miss Muffet, a large number of people took part in this VR exposure therapy(Carlin, 1997), and more than 300 people have already been effectively treated for phobias.

It shows VR could totally make people believe it is real even they are not trying to. Virtual environments are totally immersive enough for people who want to expose in a different place.

Story-Go-Round: Augmented Reality Storytelling in the Multidisciplinary Classroom

"Story-Go-Round" is a physical platform for creating augmented reality digital experiences. (Berreth, 2020) It creates a cyclical AR story using a designed physical environment, mechanical actuation, electronics, and sensing, as well as interaction and animated digital effects. Through interactive control and gameplay, it is intended to tell a story. This project is a little mechanical "carousel-like" stage that rotates and is controlled by a gaming engine. They built the stages using both hand-crafting and computer manufacturing to create bespoke surroundings. This project is a cyclical AR story game that includes animation and interactivity. The "carousel" spins and the synchronized augmented reality experience appears on the screen in real-time. It was equipped with a depth camera that will scan the small world in real-time to allow for interactivity. It is an excellent example of VR storytelling because it is also combined with cheap electronics, and it is a very innovative way of telling a story by immersing the audience in a little game area. It tells me AR could totally immerse the audience even it is not 360 degree like VR. It could work well as it has the interactive with real work with digital features.

Truth and subjectivity in narrative inquiry: augmented reality & digital storytelling in the university classroom

Lilia Topouzova wrote a journal paper called "Truth and Subjectivity in Narrative Inquiry: Augmented Reality and Digital Storytelling in the University Classroom." (Topouzova, 2021) She discussed how augmented reality may be used to enliven research and instructional discourses by combining aspects from the academic and documentary film worlds, and she

looked at how film and visuals can be used to study history. MauAR[5], an augmented reality app, was introduced by her. The app contains historical content and uses augmented reality combined with storytelling to make the users experience history from the environment around them. The app recreates the soldiers, tanks in the background from users' cameras. The viewers can stand beside the digitally projected Wall and listen to the oral history narratives, they are totally immersed in the story, the history, they feel connected. I want to learn that in my own project. The app included historical material and mixed augmented reality with narrative to allow users to experience history via their surroundings. The software uses images from users' cameras to recreate troops and a tank in the backdrop. We may deduce that the interplay of the unreal and the real is immersive, leading individuals feel like they are there at the event. I want to include that in my own project.

Ghost Giant

The visuals, graphic style, and narration in this VR puzzle game are incredible. You play as a ghost giant who must connect with and care for a young child named Louise in this game. You must assist him and safeguard him from any missions. There are several foreshadowings that make you desire to discover Louise's secret. Despite the fact that it is a virtual reality game, I feel as if I have just watched a healing film. I truly believe I have made a virtual buddy with whom I have shared many happy experiences. It is packed with information, and you are seeing everything through the eyes of a giant. You are no longer a player controlling a character; instead, you are portraying one. The most successful aspect of the game is the narration. It does a

[5] MauAR: https://mauar.berlin/en/

wonderful job of mixing puzzles with stories, and it is a solid tale that makes you care about the characters and affects your emotions. It discusses an important subject, psychological health. It instills this notion in the audience's hearts through the gameplay. In my detective board, I want to study those puzzle-solving techniques. To entice the viewer to follow the clues and into the story's premise.

Figure 6. Cover of Ghost Giant.

Where Thoughts Go[6]

Where Thoughts Go is a Virtual Reality game with audio-based social networking and storytelling. Users will be transported to a realm of exciting dreams and interrogated about their life experiences. They may listen to what other users had recorded after recording their own

[6] *Where Thoughts Go:* https://www.oculus.com/experiences/quest/2406880882663555/

replies. In your hand, your recorded voice will transform into a fairy ball. You can throw it into the air, ground, and then touch other balls to listen to other people's recordings. The sights are stunning, and the setting is designed to encourage visitors to listen to other people's tales. The narrator is everyone. The visuals are appealing, and the telling and listening make players feel as though they are receiving treatment. Everyone has a dream, and they are sharing it with one another. To be aware of each other's relationship. Because my narrative is about a man who transports people to a paradise, I will try to explore a method to get viewers to leave their information in the virtual world.

Figure 7. Screenshot from *Where Thought go* gameplay.

Subnautica[7]

Subnautica is a first-person viewpoint survival action video game. It is now available on a virtual reality headset. The user might explore a stunning, enigmatic oceanic environment with an immersive perspective in this video game. The game's aesthetics are so appealing that spectators may simply pause in a scene to take in the scenery. The gamers may sense their own insignificance in the presence of all-powerful beings. It also has a number of stimulating water sound effects all around so you can listen to underwater critters, fish, and plants. Aside from that, it has an excellent narrative. While the gamers are playing and enjoying the surroundings around them, the enigma is being solved. In an open-world game, it is a big success if the players focus on following the plot. Everything in the game is bringing the players to the conclusion that there is a narrative behind it. Its plot helps individuals reflect on their own lives. There is a lot of foreshadowing in this game that makes the user eager to know the truth. This is exactly what I am hoping to include in my own project: the fundamentals of effective narrative.

[7] Subnautica: https://unknownworlds.com/subnautica/

Figure 8. Cover of Subnautica.

2.5 Summary

In conclusion, their related works have inspired the design of my prototypes. *Subnautica* and *Ghost Giant* show a whole story with foreshadowing and character development. I have the idea of designing my story which is developing from what needs the viewers figure out by themselves from the interactions.

Every 360-degree Virtual Reality project forces the viewer to immerse into a simulated environment, it works for both exposure and distraction. It is easier to make people's minds isolate from real-life, both emotionally and physically, even the pain can be healed. For distraction, maybe the plot in Virtual Reality is not the most important part, the environment is. Like VR ice cave could make the burn patients forget about their wounds. The build-up of the virtual environment should be what I need to focus on.

Overall, through the research and analysis of these experiments and related works, I could imagine the artwork that could immerse people into the story in mixed reality.

3. Methodology

3.1 Research Through Design

In this research, the methodology I am using is Research Through Design (RTD), by exploring sample making and developing several prototypes. Research Through Design is a research methodology where the design process itself becomes a method to gain new knowledge, the making progress itself is a part of doing research. Practice-based research might work better than viewing the theory as an annotation of design examples. (Gaver, 2012)

As I am a beginner in Augmented reality and Virtual Reality, I need to explore different types of software, to create samples for my final artwork. “Sample making is a way to explore possibilities related to different materials techniques.”(Rocha, 2021)

The process of “Research through Design” for this thesis project consisted of three prototyping stages. First was the Story and character design. The second was Augmented Reality which involves storytelling, and the third was Virtual Reality animation that could give the viewers a relaxing and stunning environment.

3.2 Design Progress

3.2.1 Story design

Worldview, theme, character, and plot are the four basic elements of story production. Character is the most significant of the four components. The storyline is pushed by the character, the plot is produced by the character, the character is the focal point of the tale, and this works in movies as well. The protagonist must be active and deal with a problem. It must be straightforward in order for the readers to understand it. The character's development is also crucial; they must

discover themselves and become distinct from the beginning of the novel. Even if the protagonist is an anti-hero character, the fact that the readers admire him keeps the narrative interesting. A major goal is to make a character likable. (Akers, 2009) This is inspiring, and because I'm already invested in the plot, I'll just concentrate on the character's life. It will discover its own way out, since you are familiar with how the character would study what they encountered. A character is not real, it is an artwork, a metaphor for a personality. (Mckee, 1997)

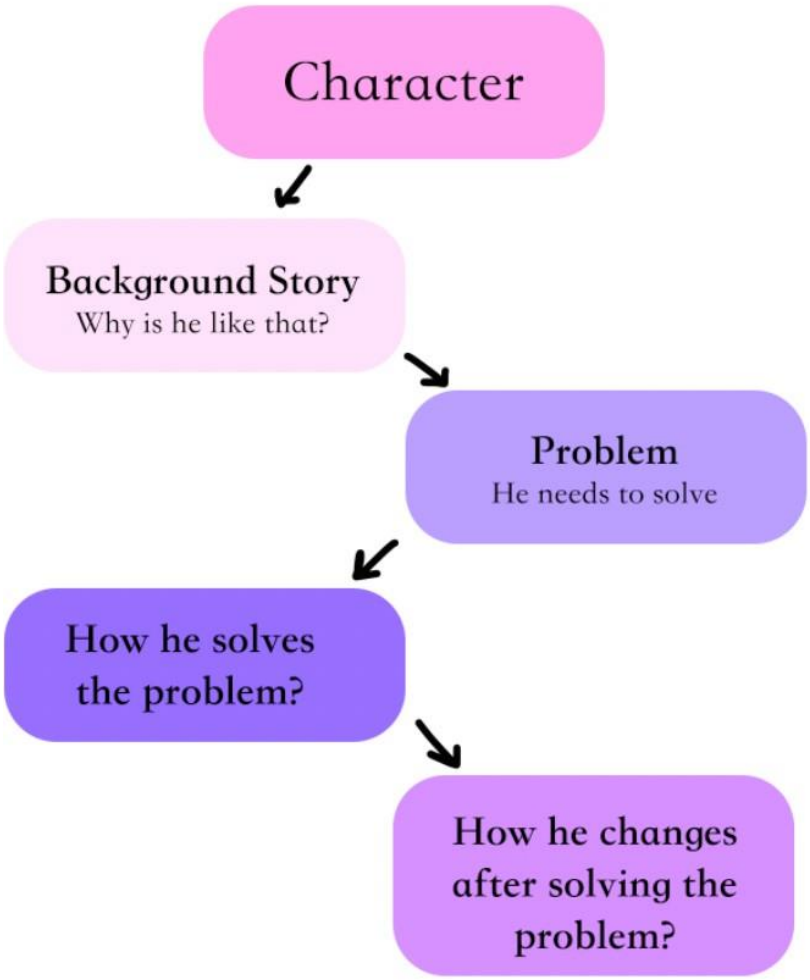

Figure 9. Process of Character design.

3.2.2 Story Narrative

This is the story I have been developing for this thesis project, according to the narrative theories I have researched. A man with long pink hair, he always brings people he encounters and brings them to the fantasy land he created. People who visited his dreamland would wake up on their beds the next morning. They initially assumed it was simply a dream, but after sharing their experience on social media, they discovered that there are many others who have had similar experiences, so they grouped together and discovered that this man really exist in real life.

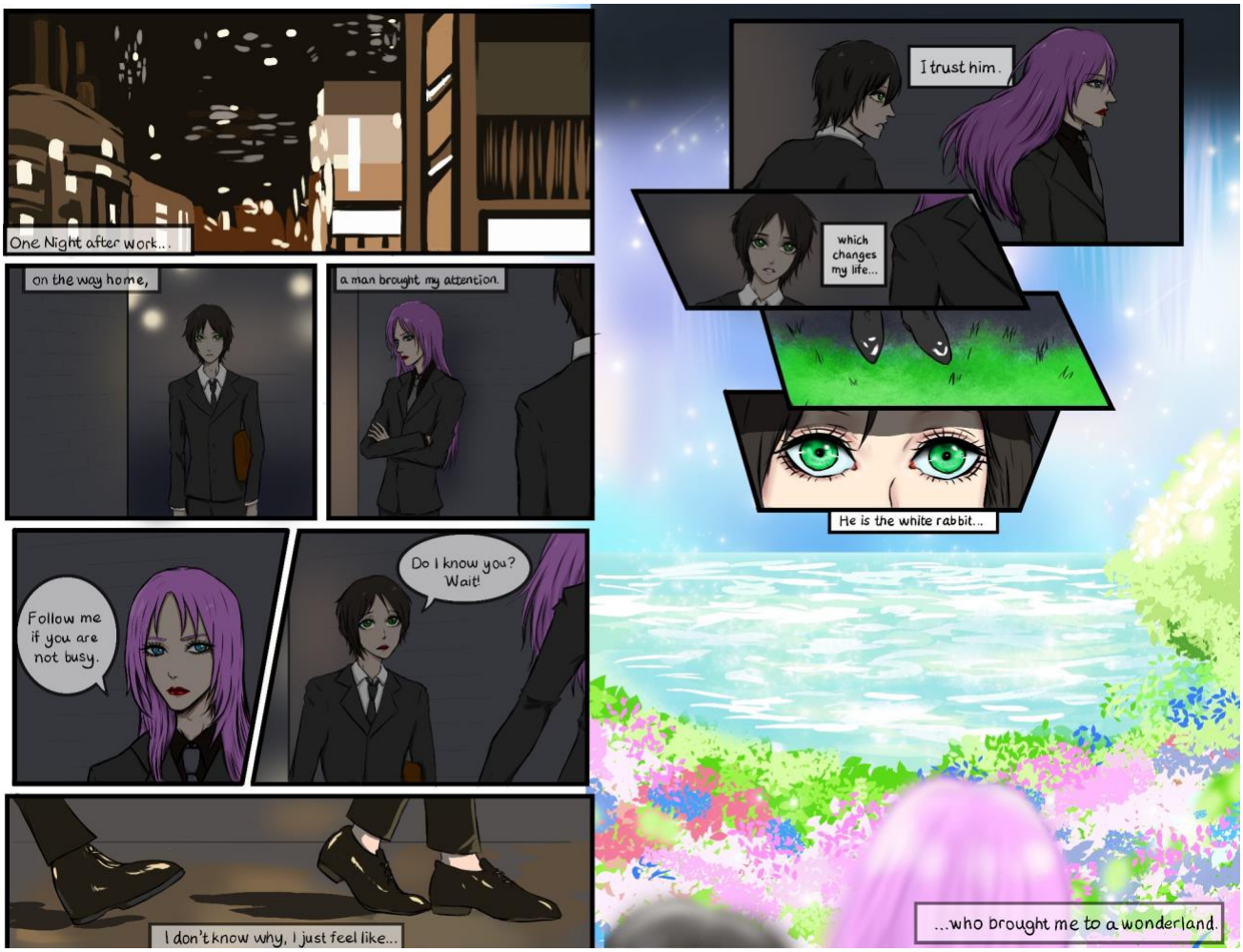

Figure 10. My comic of plot introduction.

This man travels all around the world, and individuals from many countries seek his help. Someone noticed that this man had taken a book from the British Library and noted his name on the borrow list as "Luca Ferrari." They discovered that the name belongs to a child who died in Florence 70 years ago after conducting research on the name. After WWII, this boy grew up in an orphanage in Florence, and they pay a visit to the orphanage.

They met and interviewed the orphanage's founder. According to the founder, a boy called Stefano was born in 1945. Because he was born with pink hair and his father was a mafia member who died, he faces discrimination. There was just one boy, Luca Ferrari, who wanted to be Stefano's friend and tried to protect him. Stefano was depressed for a long time when Luca died of tuberculosis at the age of nine. After that, he began to dye his hair in an attempt to fit in with the rest of society. He left the orphanage in 1965, and while he exists for more than 70 years, he appears to still be in his 20s.

From the clues the Stefano they found, they realized Stefano has short brown hair before 1999, he started to show his original hair color afterward. Being different would not be discriminated against like before, the LGBTQ is fighting for equality.

One of the witnesses told that she had heard Stefano say: The world accepted me, so it is time for me to repay.

This might be the reason Stefano is trying to help people around and created a dreamland.

3.3 Learning from Evaluation of related works

I am trying to evaluate my own project, so I gathered the data for some of the popular AR and VR games and apps, and trying to evaluate them with storytelling, immersive and emotion.

3.3.1 Storytelling and Immersion evaluation

Title		Genre	Comfort Rating
Moss		Action, Adventure, Puzzle	Comfortable
Beat Saber		Casual, Music, Sports	Comfortable
Tetris Effect		Arcade, Puzzle, Relaxation/Meditation	Comfortable
Subnautica		Adventure, Exploration	Comfort: Intense
Youtube VR		360 Experience (non-game), Casual, Movie	Comfortable
Netflix		Movie	Comfortable
SuperHot VR		Action, Puzzle, Shooter	Comfortable
TRIPP		Casual, Productivity, Relaxation/Meditation	Comfortable
Maloka		Relaxation/Meditation	Comfortable
Guided Meditation VR		Casual, Relaxation/Meditation, Travel	Comfortable
Nature Treks VR		360 Experience (non-game), Relaxation/Meditation, Simulation	Comfortable
Ghost Giant		Adventure, Casual, Narrative	Comfortable
Elixir		Adventure, Casual, Narrative	Comfortable
Shadow Point		Exploration, Narrative, Puzzle	Comfortable
Myst		Adventure, Narrative, Puzzle	Comfortable
Zenith: The Last City		Action, Adventure, RPG	Comfortable
A Township Tale		Adventure, RPG, Simulation	Comfortable
Skyrim		RPG	Comfort: Intense
Where Thoughts Go		360 Experience (non-game), Relaxation/Meditation, Social	Comfortable

Figure 11. VR games I gathered and the Comfort Rating from Steam and Oculus.

Figure 11 is the table I made for the VR games I had play and the comfort Rating Oculus and Steam have shown. I am going to rate them with my own criteria about Storytelling and Immersion. The comfort rating is from the oculus website, the rating from themselves.

	Storytelling	**Immersive**
1-2	No story	No 360-degree environment, low quality visual rendered.
3-4	No storyline, but have a level system and goal, making players want to keep playing	No 360-degree environment, no movement.
5-6	Having a simple storyline	No 360-degree environment, having movement or gameplay.
7-8	Having a storyline, a clear goal.	360-degree environment.
9-10	A clear storyline, developed character and foreshadowing.	360-degree environment, yourself as a character.

Figure 12. My own criteria for storytelling and immersion.

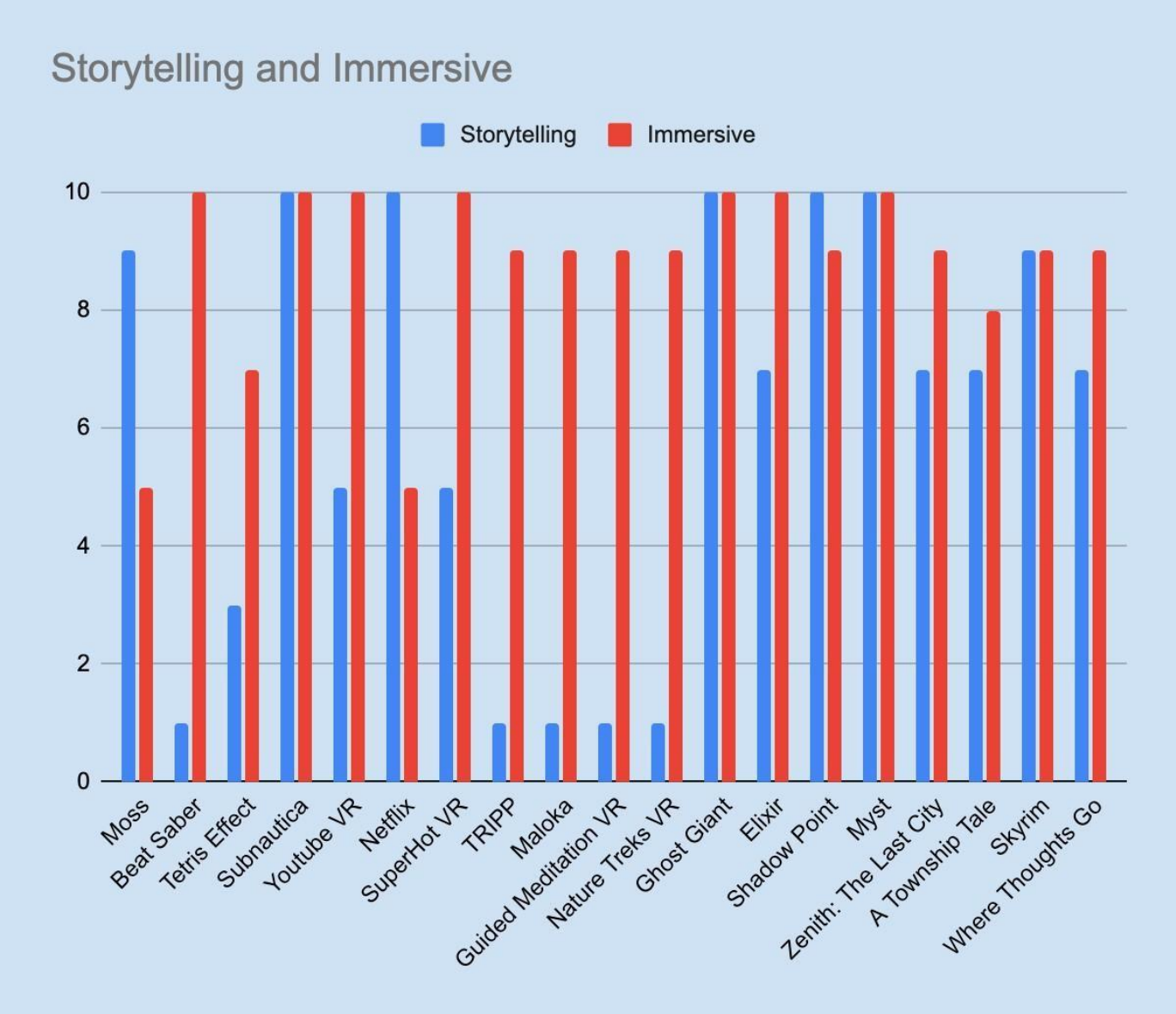

Figure 13. My rating for the VR games I have chosen.

My criteria for immersive and storytelling are quite subjective. The games that have a 360-degree environment would all be above 7. Moss[8] and Netflix[9] are both only 180 degrees, so they are only five. I realized that Virtual Reality is actually forcing people to immerse themselves. It is actually hard to notice real life after we put on the headset. The level of immersion is much higher than I expected, and it is much more immersive than all other kinds of media. If reading a book could make you immerse into the texts, VR is forcing you to immerse into a visual environment. The players are not making themselves immerse into VR, it is actually the opposite, the players are hard to not immerse in and realize what happened in real life. The level of immersive in VR is hard to be below five. You could really think of yourselves as a character inside the story. Most of the videos on YouTube VR are travel tours, so there is not a lot of storytelling. Netflix VR is showing whatever on the Netflix website, there are no 360-degree videos, it only gives a big screen and cinematic feeling, so I gave a full mark on storytelling and five on immersive.

From my rating, I know that I do not need to worry about the level of immersion if I have the 360 video in the VR headset. It is more immersive than any kind of media. I need to have a clear storyline and foreshadowing to make people have the curiosity to continue.

[8] Moss: https://store.steampowered.com/app/846470/Moss/
[9] Netflix: https://www.oculus.com/experiences/quest/2184912004923042/

3.3.2 Emotion Evaluation

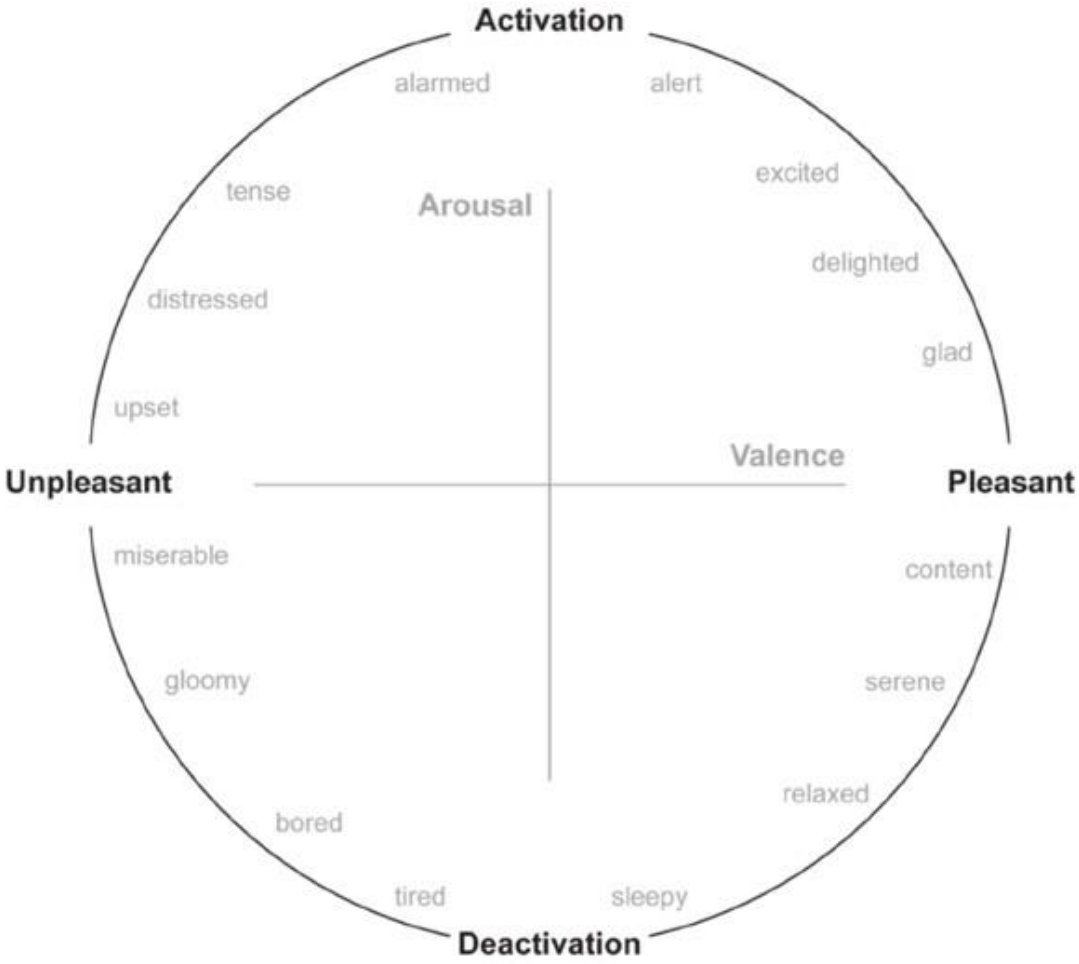

Figure 14. James Russell Arousal-Valence model from 1980. (Corredera, 2019)

In this section, I am using James Russel's Arousal-Valence model to evaluate the emotional states of the VR and AR app and games.

Figure 15. AR games and apps I am evaluating.

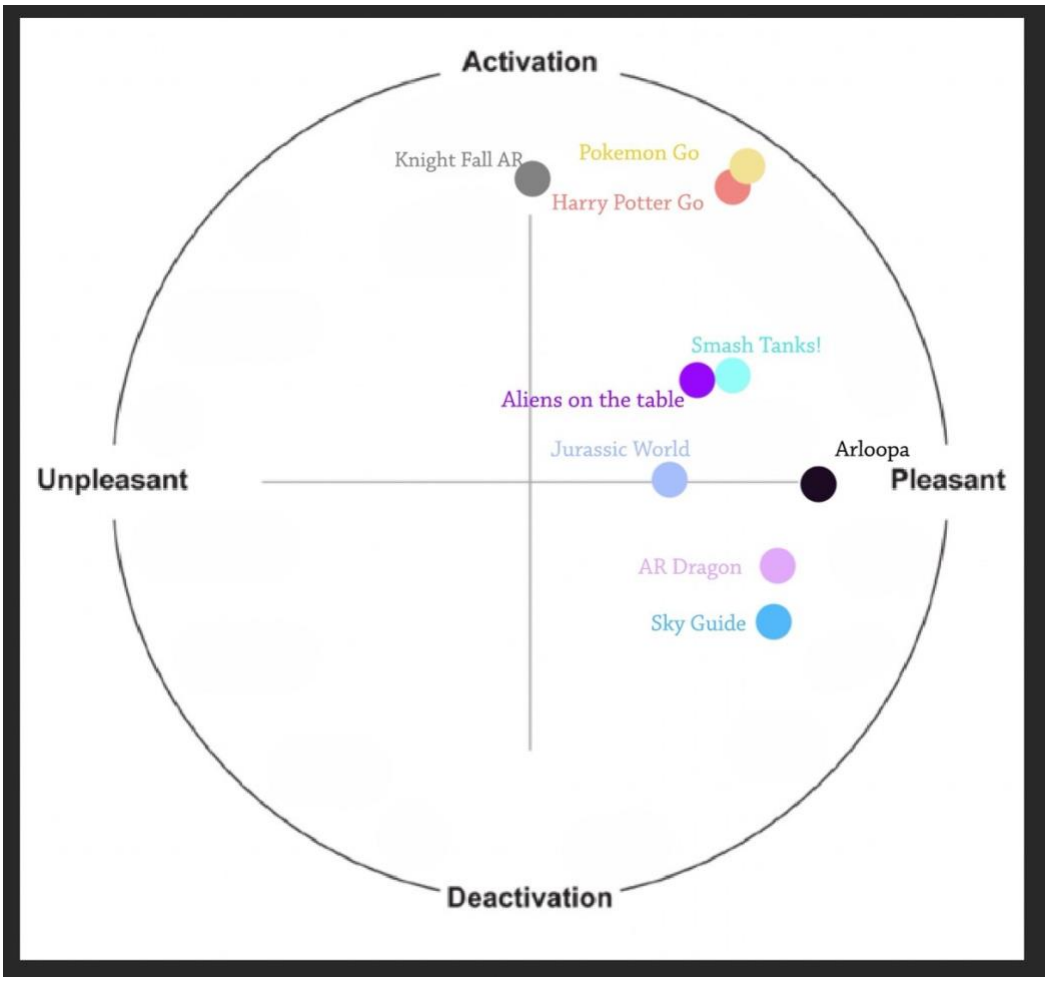

Figure 16. Emotional Rating for AR works.

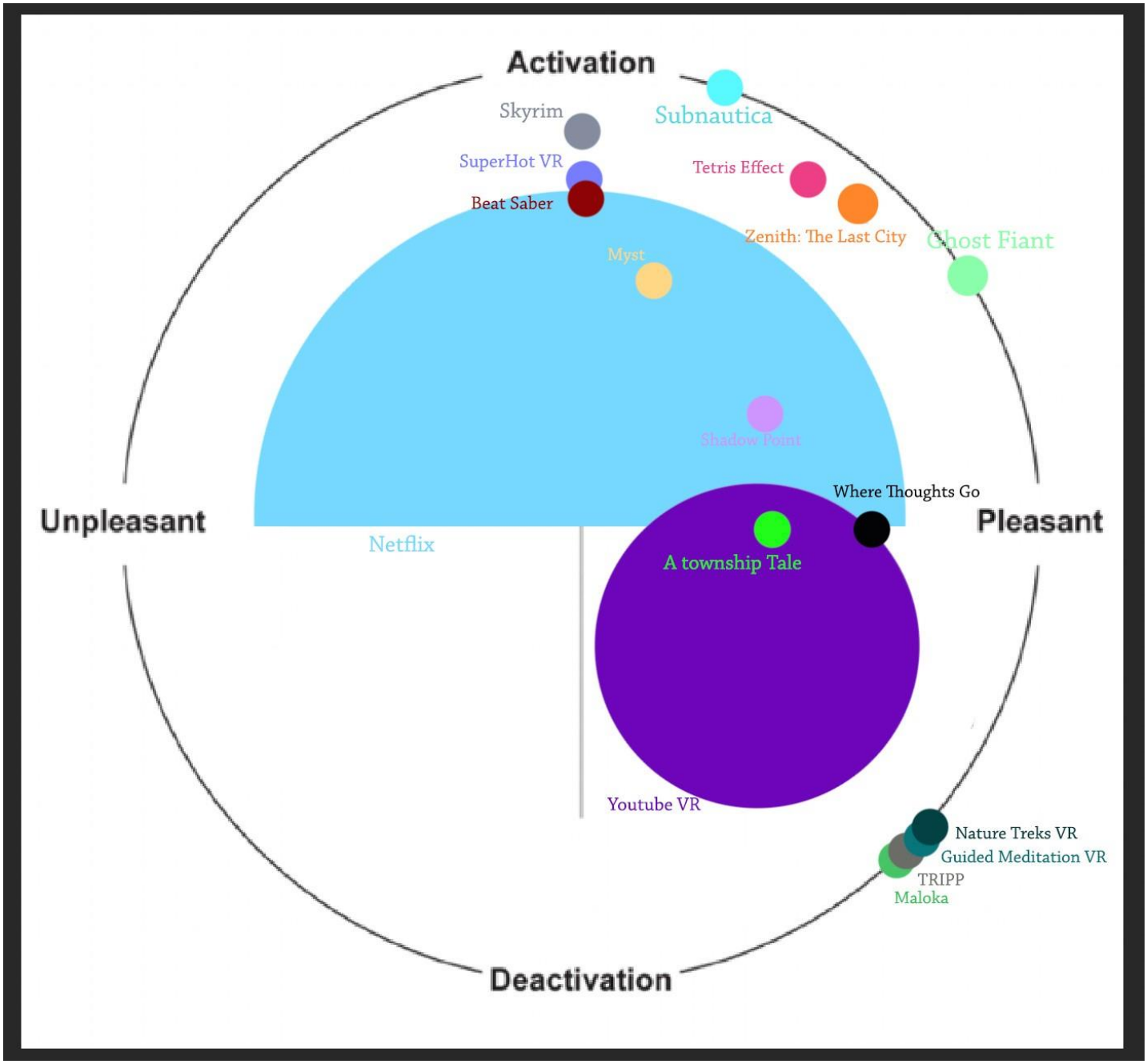

Figure 17. Emotional Evaluation for VR projects.

Netflix VR has all types of movies, so I will prefer they would not make the audiences move to the calm and boring level. Many of the Youtube VR videos are just making the audiences visually enjoy and relax, so most of them are on the right downside of the Arousal Valence diagram. The goal of my VR project is to stay on the left side of the diagram. I want to make people feel happy and relaxed. I will call the right side of the diagram positive emotion. Most of the games are stayed on the upper side of the diagram, cause the game would bring the excitement and nervousness of losing the game, which makes the game interesting, not boring. The meditation VR experience would be more "boring" than the VR gameplay because the point is relaxation.

As a result, instead of making a VR game, I decided to produce an animation. To release people of any pressure to complete an experience. The storyline may also add to the pressure of completing the game, bringing it closer to the meditative VR experience. There is no clear storyline or gameplay, simply visual enjoyment.

In the AR section, Knights Fall, Pokemon Go and Harry Potter Go needs a lot of movements and actions, so they are on the top section. Kingdom Fall is a war game, it is not relaxing and enjoyable scene to watch, so I made it in the middle of the pleasant and unpleasant. They other two games are more about collections, so it is happier to play. Arloopa is what makes reading more interesting, it made a flat book into a pop up animation book, so I put it in the right section. Sky Guide is an app that makes the viewers recognized the constellations. The users would not have any pressure of playing it and it shows the beautiful starry sky, it should be a relaxing and pleasant app. The more pressure the viewers get, the higher it will be on the diagram.

4. Prototype

4.1 Overview of the Prototyping

This chapter introduces the project's work progress, including a description and procedure, as well as the result and reflections for each step. Dreaming: A Detective Adventure in Mixed Reality would be available in both VR and AR.

4.2 VR Prototype Iterations

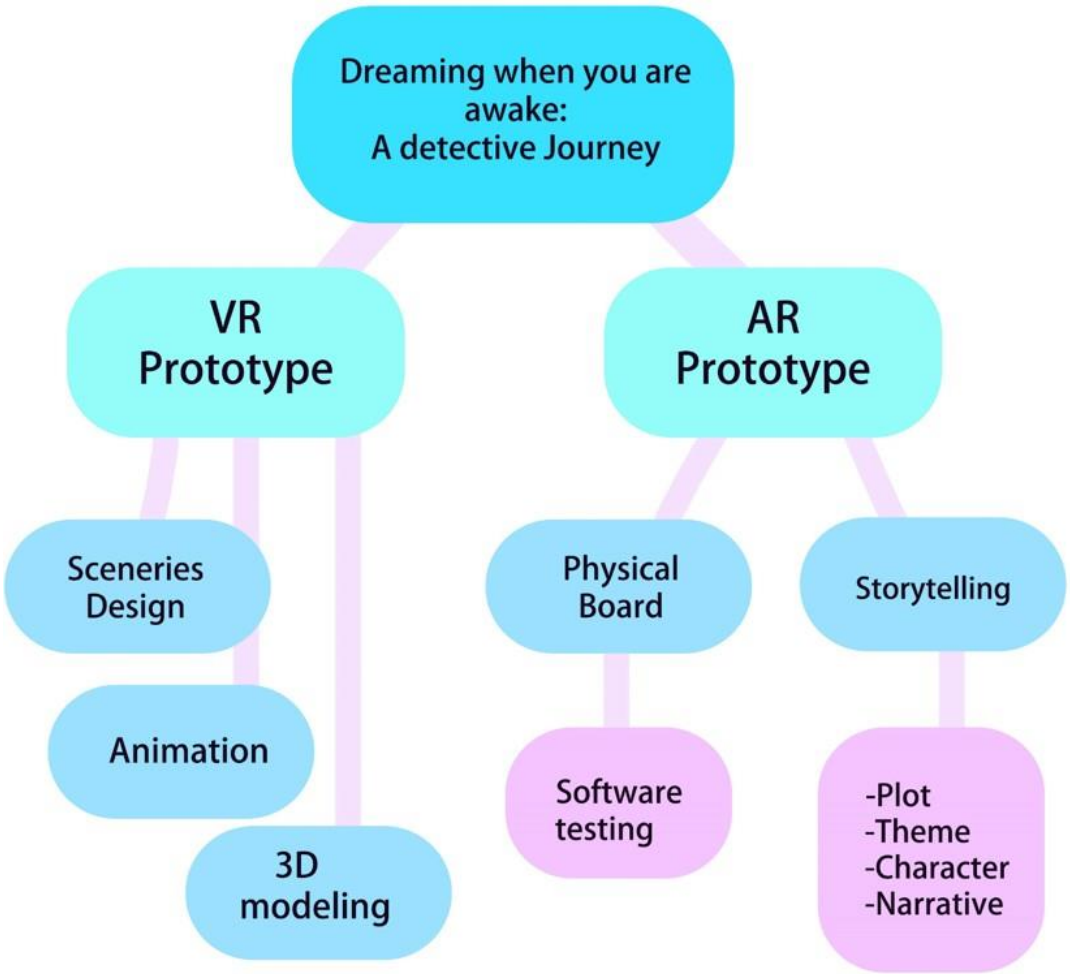

Figure 18. Process of making VR and AR Prototype.

4.2.1 Iteration 1: Virtual Reality Environment

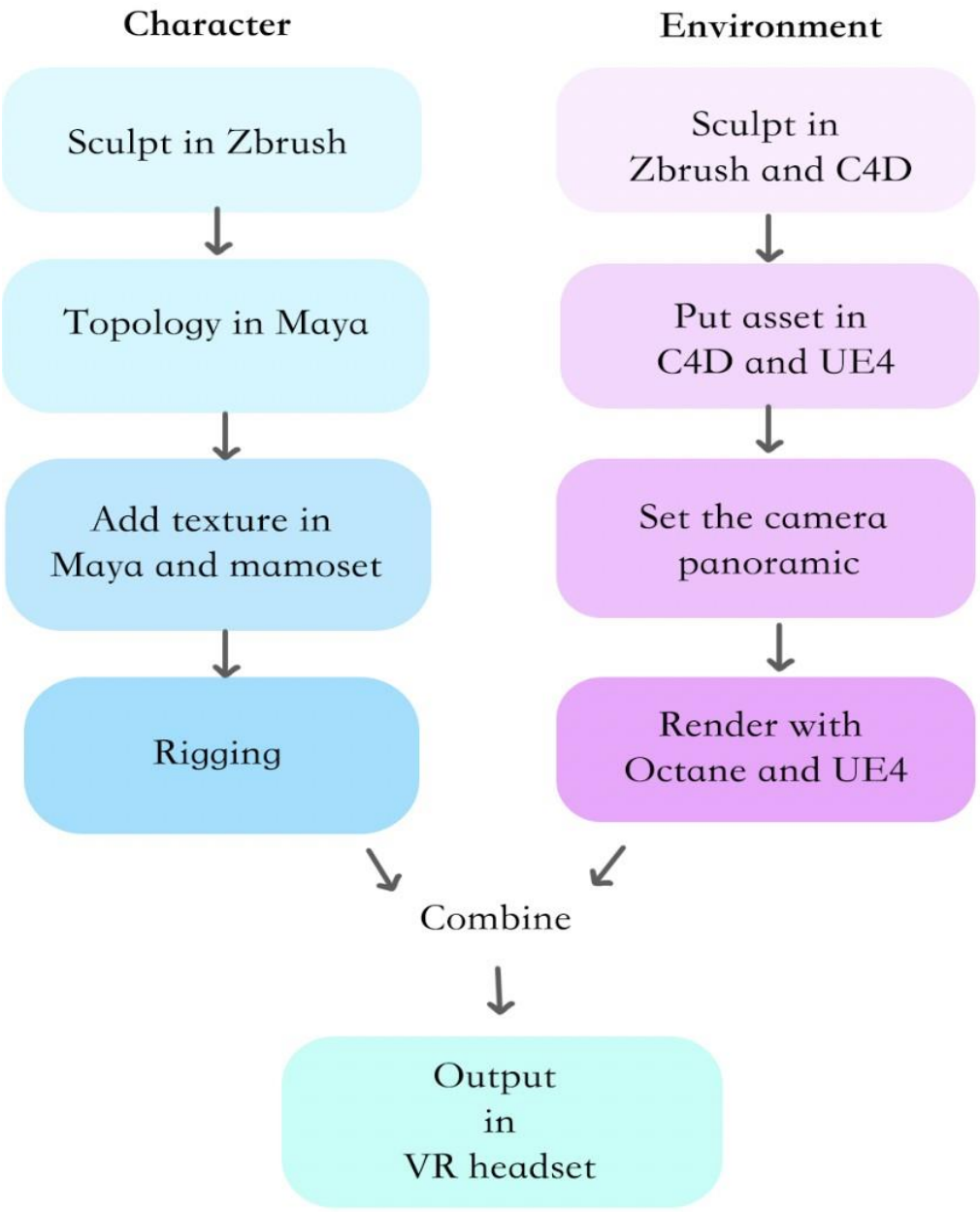

Figure 19. Process of making Virtual Reality animation.

I am working on a 360-degree virtual reality animation video. Because individuals could lose track of the aim and spend time learning how to control it, I would like to make the experience "watching" rather than "playing."

Scenery design, 3D modeling, rendering, and VR animations would be the center of the Virtual Reality experience. After I finish the animation, I aim to upload it to YouTube so that anybody who does not have a headset may watch it. After designing the sceneries, I drew them out and used Brush and Cinema 4D to 3D model them. There is also character modeling in the form of a character who leads the way for the watches.

For better quality of rendering, I used the octane render for Cinema 4D and used the panoramic camera to render an HDRI video. It needs a few minutes for one single frame, the final rendered scene looks well, but it will only have shorter animation outcome. For the scenery design, most of them are inspired by real natural wonders, I tried to reveal their stunning effect digitally, to reach the goal of making people have a great escape and distraction.

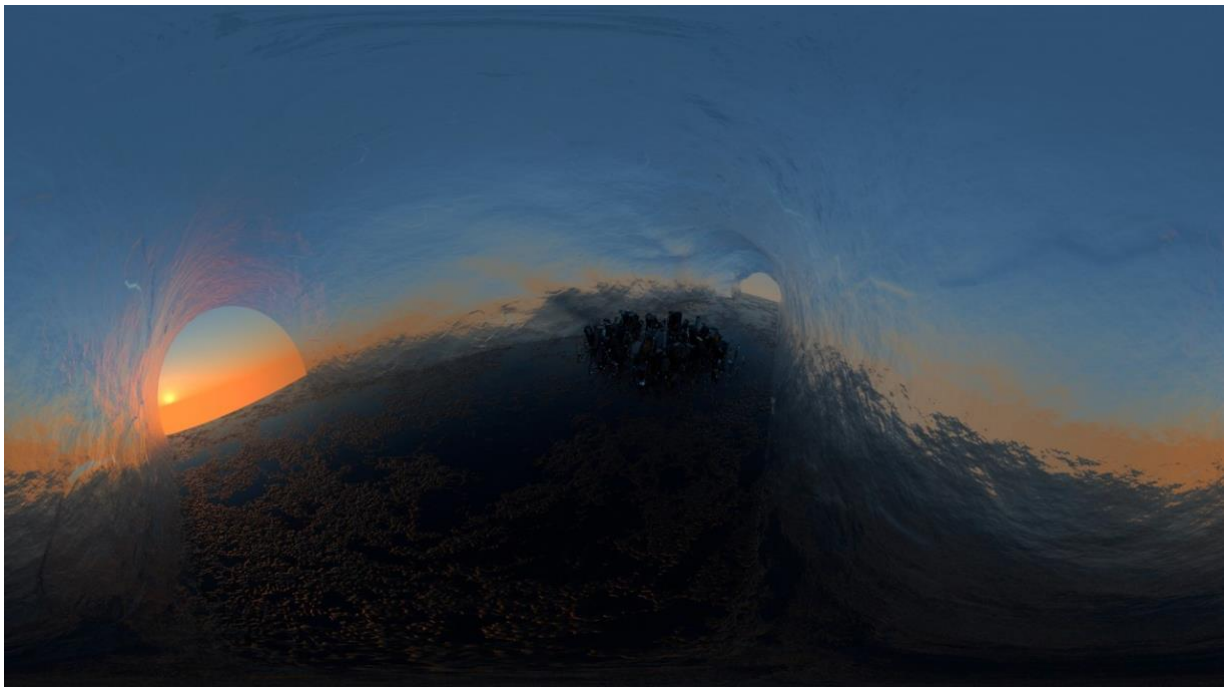

Figure 20. Octane rendered the Icy cave with a Panoramic camera.

Figure 21. Octane rendered flower field made with Forester.

Inspired by Waitomo Glowworm Caves in New Zealand, I made glowing crystals in dark caves. I put the mixed lights inside the crystals to learn the effects of thousands of twinkling glow worms. (Schmalbruch, 2021)

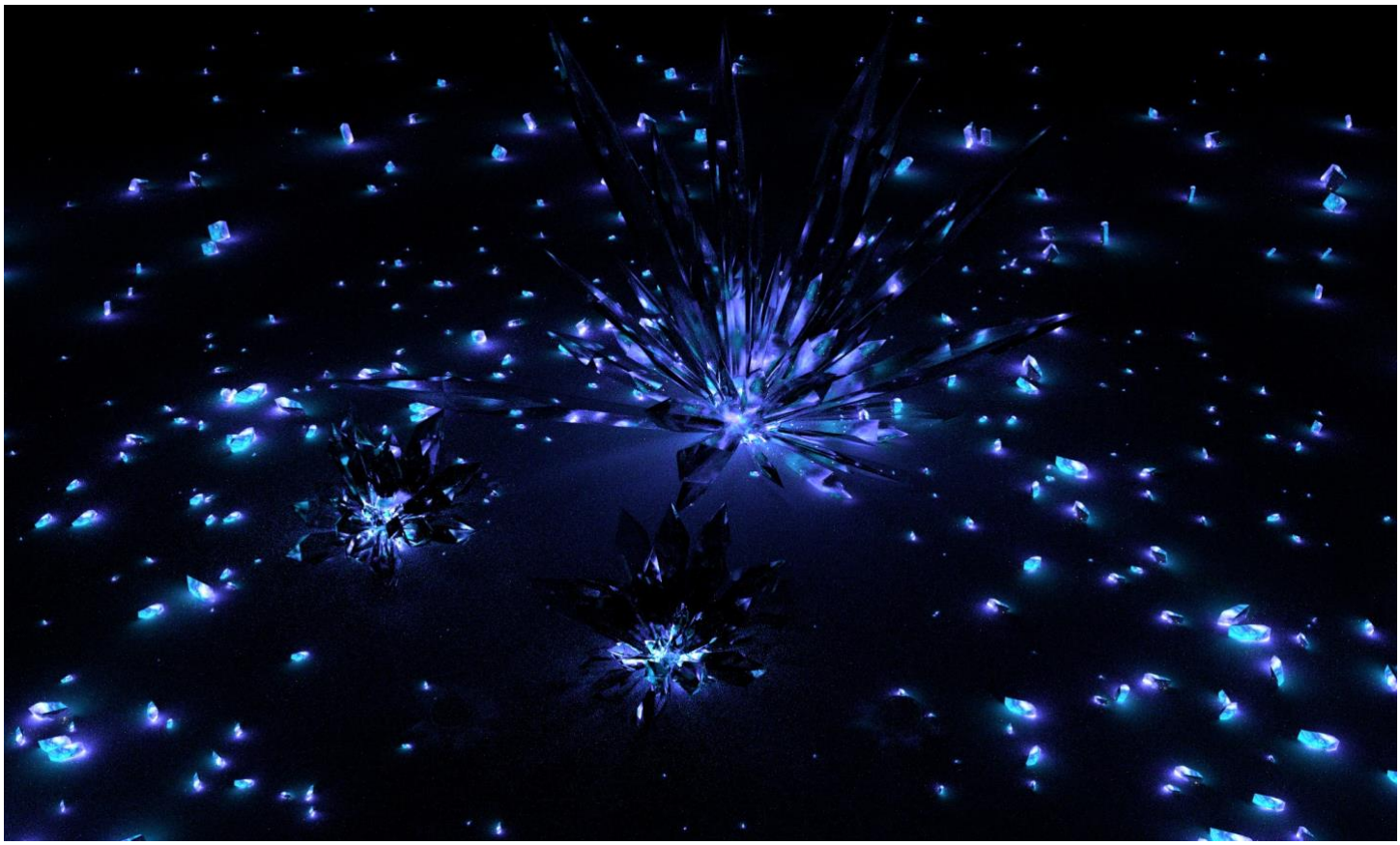

Figure 22. Octane rendered glowing crystal.

Figure 23. Octane rendered cave.

Aurora is one of the most magical awe-inspiring natural phenomena wonders on earth. It is unpredictable and beautiful. I hope I could make the aurora scene that people could see them anytime they want on VR. (Austin) I tried many ways to form the texture and movement of Aurora on Octane, but they all not turned out well. I could see the particle pieces if I want to form the semi-transparent light. It could work if it is in low resolution, but if I want to show people a good VR experience, I need to render it in very high resolution, which reveals all the details. I bought the aurora HDRI skydome from Juuso Voutilainen on Artstation[10]. They are all 12k photographs. It also saves a bunch of time to render the video, the weak point is the aurora is not moving.

[10] Juuso Voutilainen on Artstation: https://www.artstation.com/northlogic

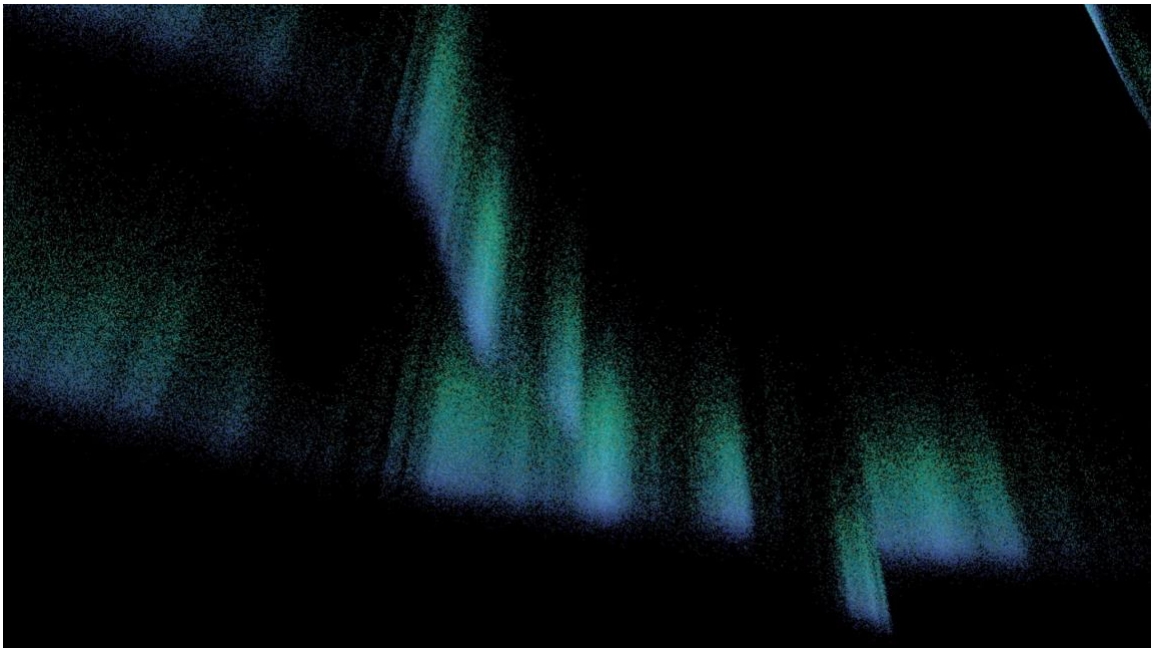

Figure 24. Octane rendered aurora. Failing piece.

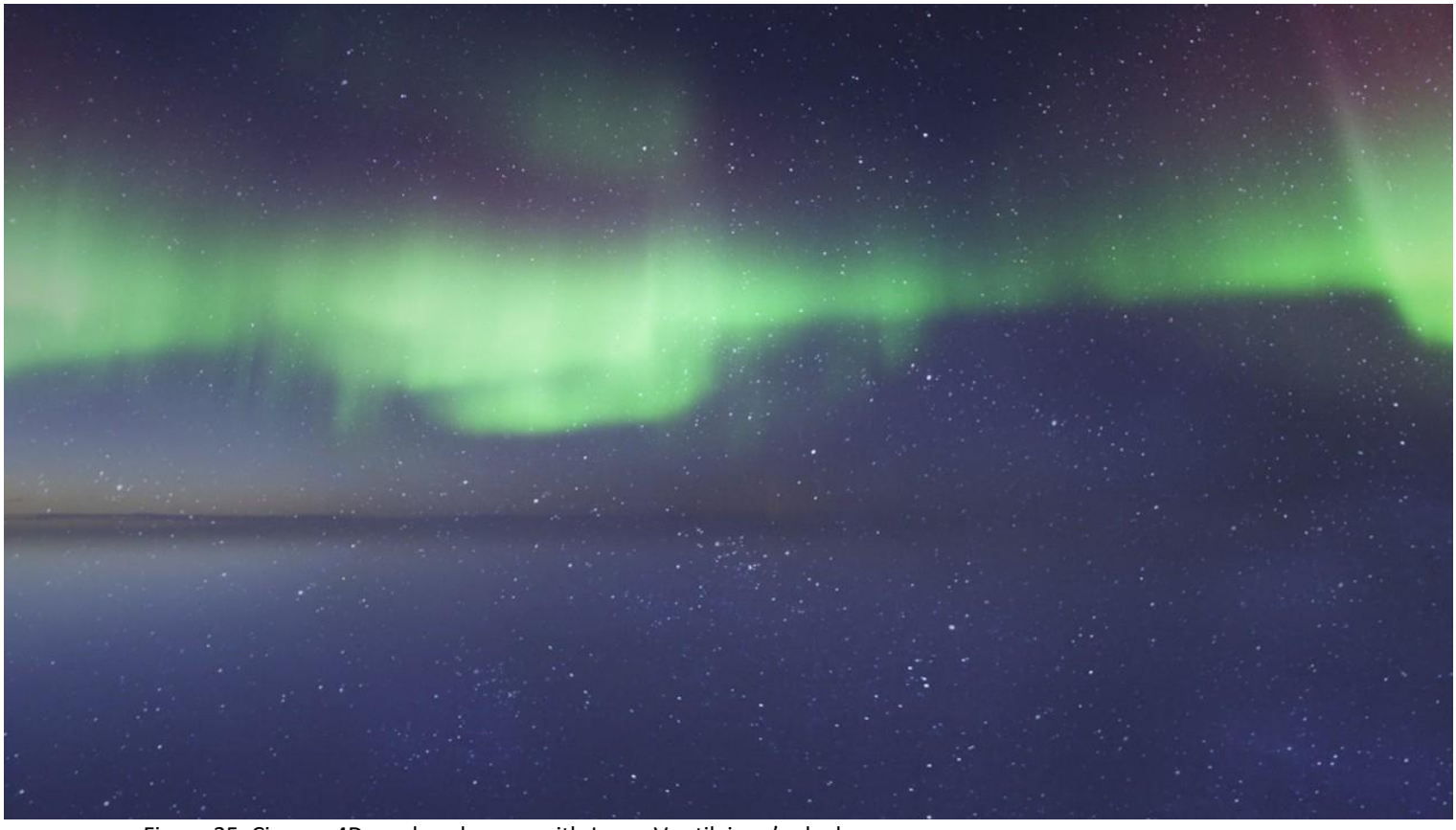

Figure 25. Cinema 4D rendered scene with Juuso Voutilainen's skydome.

In this prototype, I experimented with a variety of textures and settings in order to create a realistic 3D world that would allow people to immerse themselves. The biggest issue, I noticed, is time for rendering. My original goal was for a character to guide the audience, however, there are many more frames than are required. High resolution is essential to provide a high-quality VR experience to the audience. I would simply render the short clips of each scene because some scenes require more than 10 minutes for a single frame.

4.2.2 Iteration 2: Undersea Church Tour

Undersea Church Tour is a 360-degree virtual reality animation video I posted on YouTube.[11] The viewers could move the camera by dragging and clicking the mouse. It would be also output into Oculus Quest.

Every clip is rendered in Cinema 4D. Instead of using a character acting as a guide, I used the texts to guide the audience. It shows: “Welcome.” “Let’s go.” I made the bubble animation, jellyfish, and stained glass with light effects. To form the colorful lights, I made the abstract paintings with vivid colors in photoshop and made them the patterns on the stained glass windows. Render times were about 2 minutes for one single frame, so the time would not be the big issue for this animation.

[11] https://youtu.be/p0eMEgcrIcM

Figure 26. Abstract painting for the stained glass, made in Photoshop.

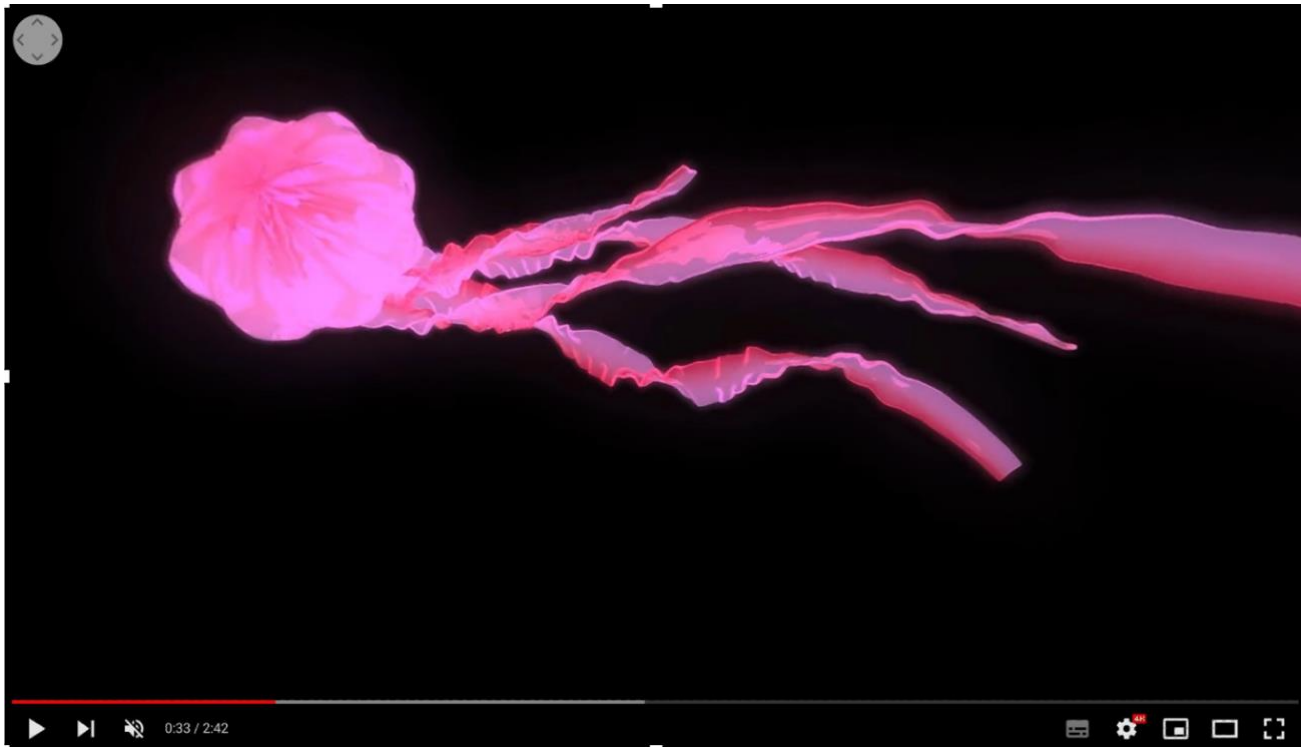

Figure 27. Jellyfish flowing around the viewer in *Undersea Church Tour*.

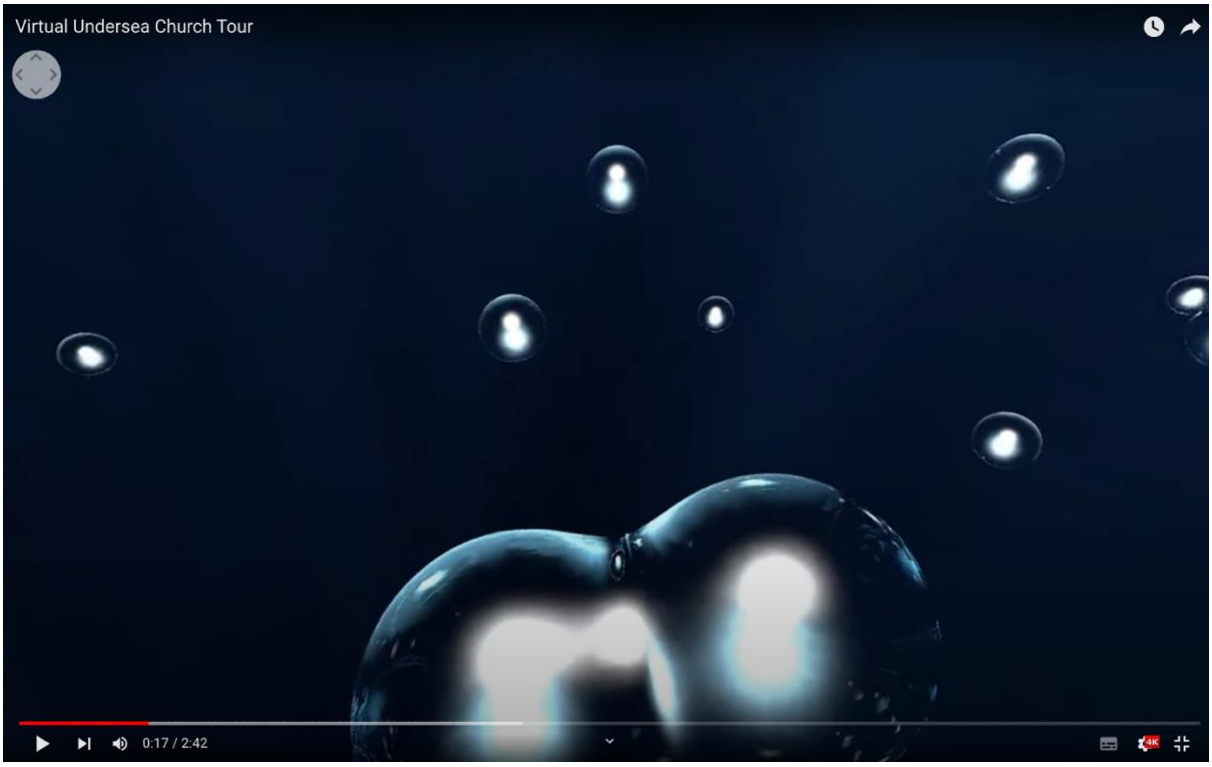

Figure 28. Bubble scene in *Undersea Church Tour*.

Figure 29. Screenshot of *Undersea Church Tour.*

Figure 30. Screenshot of *Undersea Church Tour*.

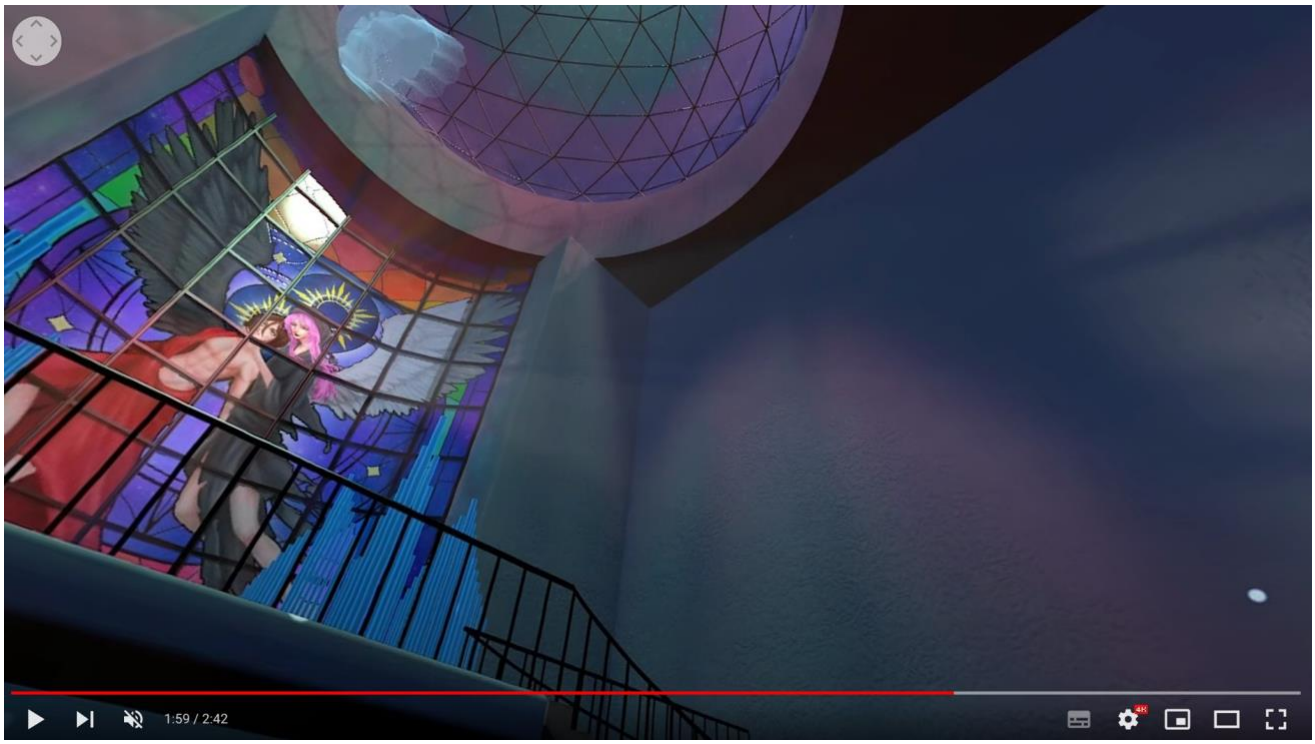

Figure 32. Close up look of the stained glass in *Undersea Church Tour.*

Figure 33. Close up look of the Organ and Stairs in *Undersea Church Tour*.

Undersea Church Tour is a completed animation, I sculpted all the organ pipes, piano, stairs, seats and architecture. I also painted every stained glass on Photoshop. It is not immersive enough for playing on YouTube. It would be playing on Oculus Quest Headset. More scenes would be added to this animation.

4.3 AR Prototype Iterations

4.3.1 Iteration 3: AR slides

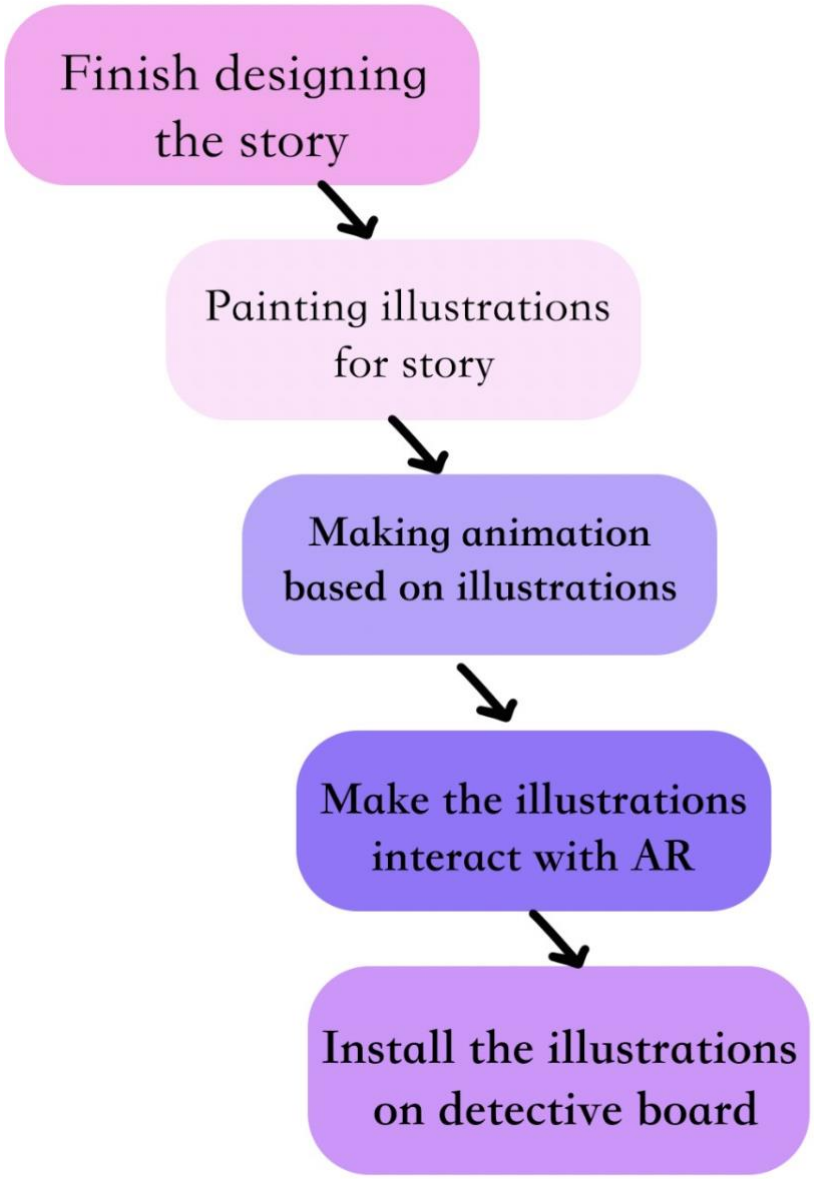

Figure 34. Process of making AR detective board.

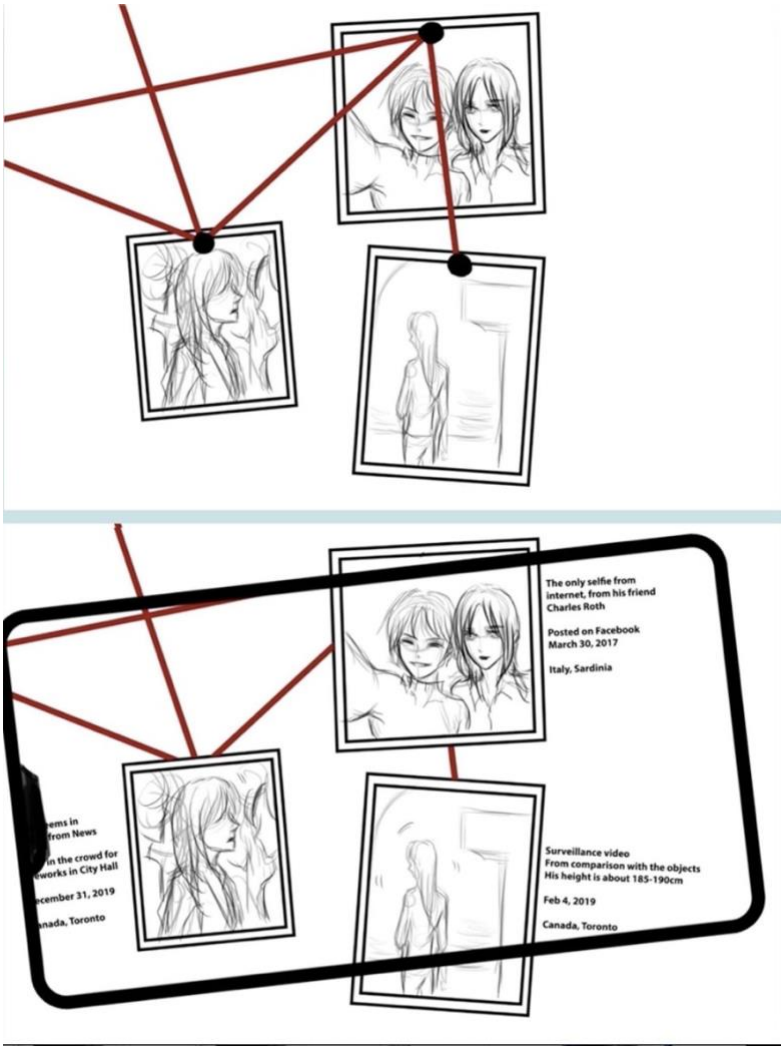

Figure 35. Expected Outcome for AR interaction.

The illustration, picture arrangement, and software testing are the focus of this project. I am new to Augmented Reality, so testing out different apps is a significant hurdle for me. I need about 30-40 images for this Evidence Board that are tied to one another and have a couple of different storylines. I am making an augmented reality app that will target all of the images and interact with the viewers.

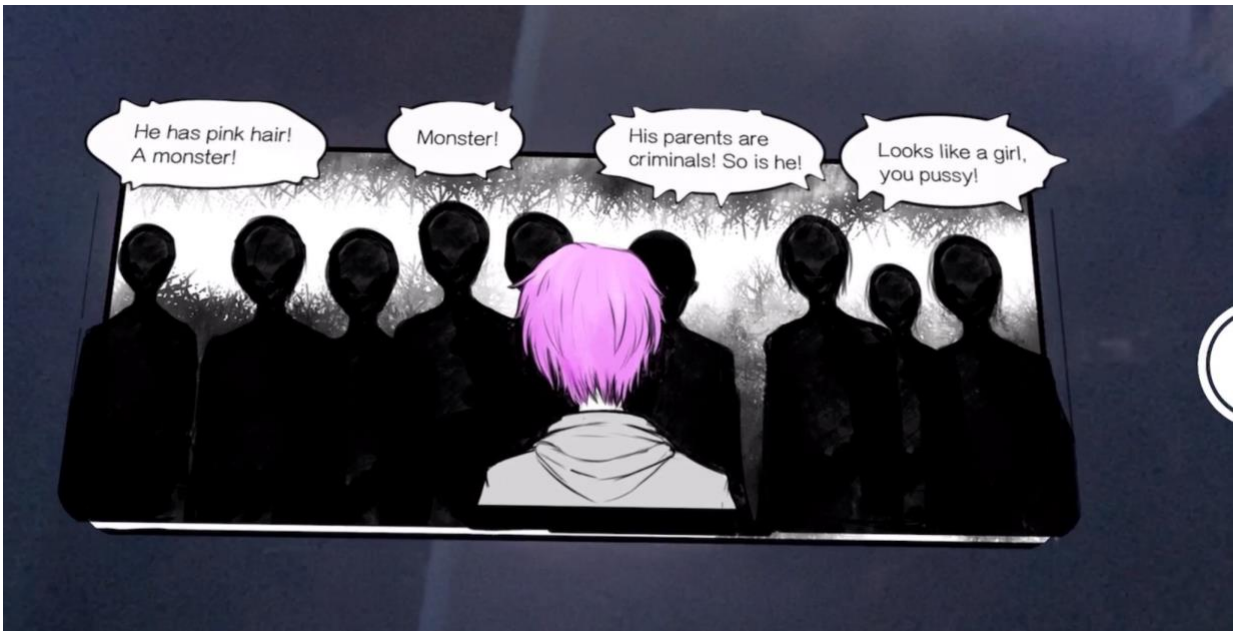

Figure 36. Testing for Slide AR with my comic drawing.

In this prototype, I used Adobe Aero[12] and the Slide AR[13] app as my AR tool. Adobe works well on putting the assets together, but if the files are too big or if there is more than one asset, they would just pop out. Slide AR app works well for making the flat images pop out from the target image, and make it looks like a pop-up book, the 2D surfaces become more three-dimensional. But it can only work with one single image target at one time. I need to try more about the multi-targets AR.

4.3.2 Iteration 4: Wedding sculpture

I am creating a sculpture with augmented reality animation. The sculpture would be two upper bodies of a man, one is in a Chinese wedding dress, the other one is in a vintage suit. Both

[12] Adobe Aero: https://www.adobe.com/ca/products/aero.html
[13] Slide AR: https://apps.apple.com/us/app/slide-ar/id1439367917

upper bodies are coming out from two opposite sides of a wooden plane, like the position of a mirror. This will present the different states of the same man.

The one with the wedding dress is smiling, there are also many exquisite Chinese pieces of jewelry on him, and detailed embroidery on his wedding dress. The one with the suit is weeping, he is brushing the traditional rouge on his lip, he is having short hair. There is one love letter on the table. The augmented reality animation would interact with the area on the wooden plane, they are like the moving background of the sculpture.

The sculpture will be about 17 inches tall, and one plane as the stand. I used the Super Sculpey[14] to sculpt the bodies and use the UV resin for the crying tears. The jewelry is made from iron pieces and wire, paint with gold metallic acrylic paint. I used acrylic paint to color the sculpture and the wooden plane. I also used the air-dry clay to make a traditional rouge container and painted the gloss gel medium to form the texture of jade.

Speaking of China, people might think it is one of the least open-minded countries, same-sex marriage is not legalized yet, and people are uneducated about queer topics. Actually, queer history exists for a long time, there were even many emperors who have boyfriends, the intense discrimination started in the 20th century, and same-sex relationships and cross-dressing are prohibited until 1997. (Prager) Although Taiwan is the first country that legalized same-sex marriage in Asia, they lose the vote for having the gender equity education act.(Huang, 2011)

Seeing a queer man crossdressing a Chinese wedding dress would be intensely problematic. From the style of the suit, I want people to know the character is in the era of the

[14] Super Sculpey: https://www.sculpey.com/products/super-sculpey-beige-clay

Republic of China, which is the era of the starting the discrimination. Making two mirror position sculptures is a way of contrasting the happiness and pain of “Being yourself” and “Pretend to be what others like”. The wedding Costume and Jewelry in Chinese culture are beautiful, I hope everyone has the right to wear them. Gender should have equity, I hope Mainland China and Taiwan will be more open-minded, they should no longer be the old-fashioned country.

The expected outcome of the project is two detailed handmade sculptures, coming out from the painting. The viewers could use the phone to interact with the sculpture, see the animated background, and know the beauty of Chinese culture. They might feel the contrast of two sides of the same person.

Figure 37. Photo of the sculpture, profile side.

Figure 38. Photo of the sculpture, wedding side.

Figure 39. Photo of the sculpture, weeping side.

I used Artivive[15] as the tool for AR interaction. It is a website where users may upload slide assets to image targets and use the Artivive app to interact with the physical image. On the wedding side of the sculpture, I used a gif of falling flower petals, two slides of wedding brands, and a red ribbon ball. On the weeping side of the sculpture, I targeted two windows in the background, I add a slide of raining animations and another slide of the window for AR interaction. I also made an animation for the love letter on the table, there are teardrops appearing on the love letter. As the water drops increase, the red drops appear, which could be either blood or rouge.

Figure 40. AR testing for the rainy window.

[15] Artivive: https://artivive.com/

Figure 41. AR testing for the wedding ceremony.

Figure 42. AR Animation on the love letter.

The outcome turned out well, everything went as planned. People could use one app to interact with many targets. But there are views limitations on Artivive. There are only 100 views allowed for free. I have more than 30 targets overall, and I might use up all the views for testing.

Artivive could work as a single project for this sculpture, but not my whole project. Unity Vuforia might be the best choice for the multi-target AR interaction.

4.4 Final Iteration

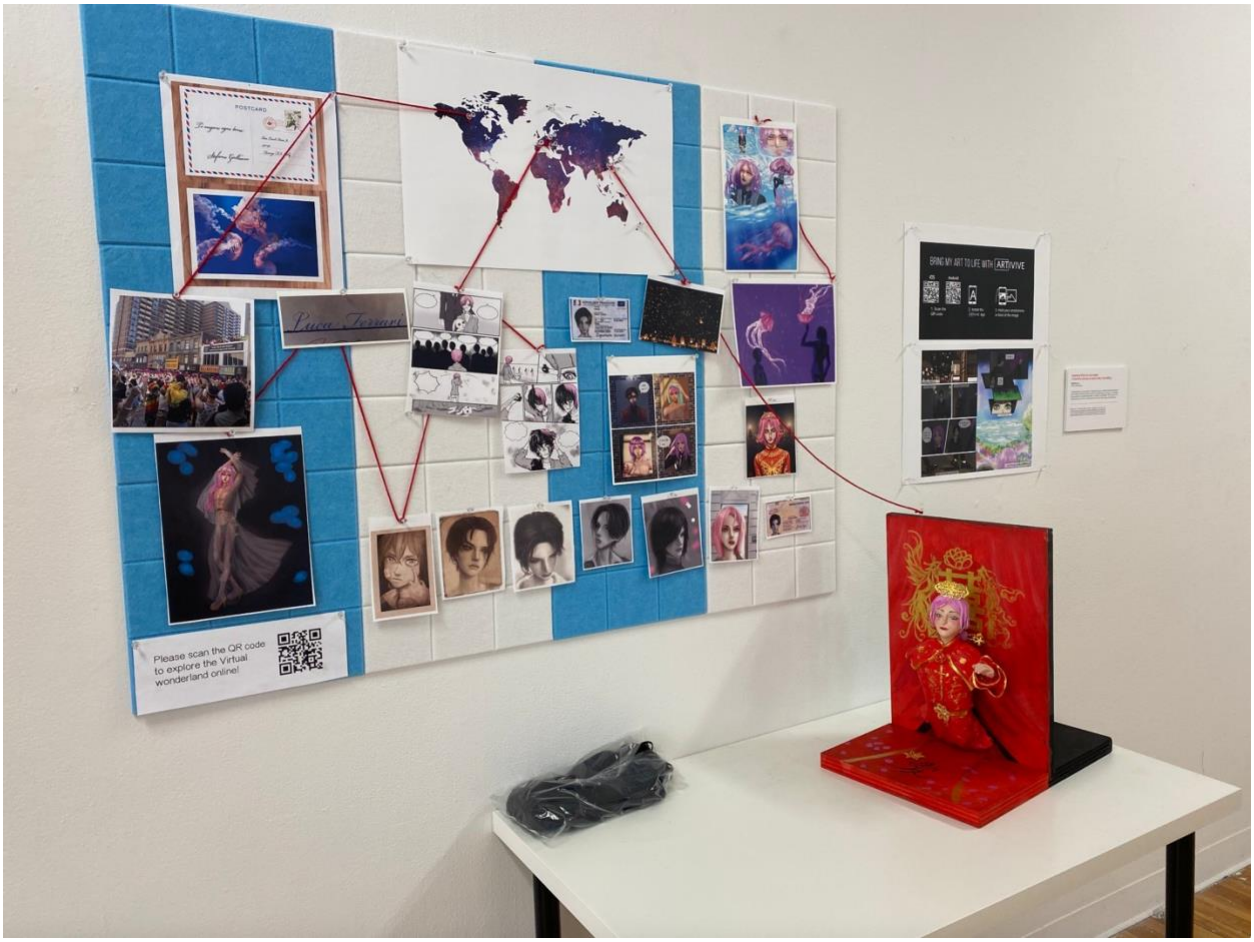

Figure 43. Photo of physical detective board and physical sculpture.

The final output is a physical detective board with the illustrations that are all image targets of Augmented Reality; and an oculus quest headset that plays the VR animations. The viewers can scan the QR code to download Artivive on their phones and interact with the illustrations. They can also put on the headset to watch the VR video.

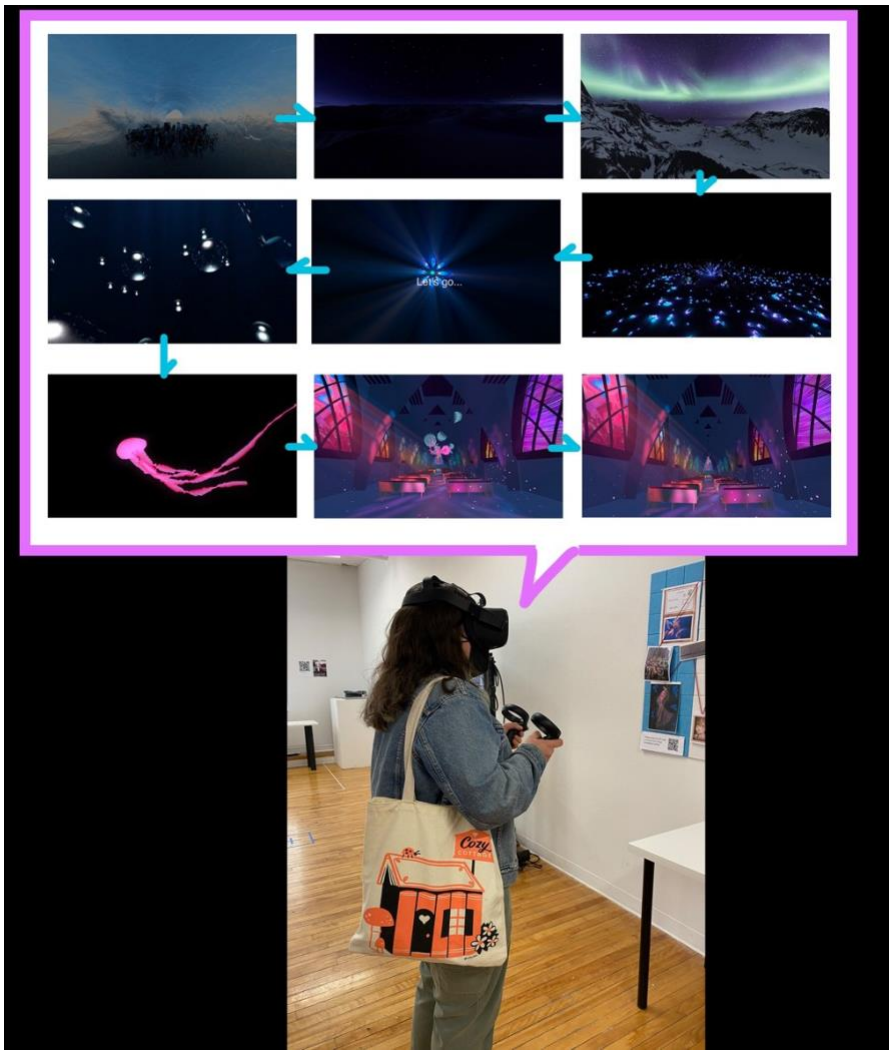

Figure 44. VR Scene Sequence

In the VR video, I put nine rendered scenes together. The first scene is the ice cave; the second scene is the desert with starry sky; the third scene is ice mountain with Aurora; the fourth scene is the glowing crystal; the fifth scene is the stained glass with flowing water, the sixth scene are the bubbles, which leads the viewers undersea. The seventh scene is a jellyfish that flows around the viewer, the final scenes are going through the undersea church. In this video, the viewers could enjoy the visual in both nature and interior. Exploring the immersive virtual space.

Figure 45. AR interaction with physical detective board.

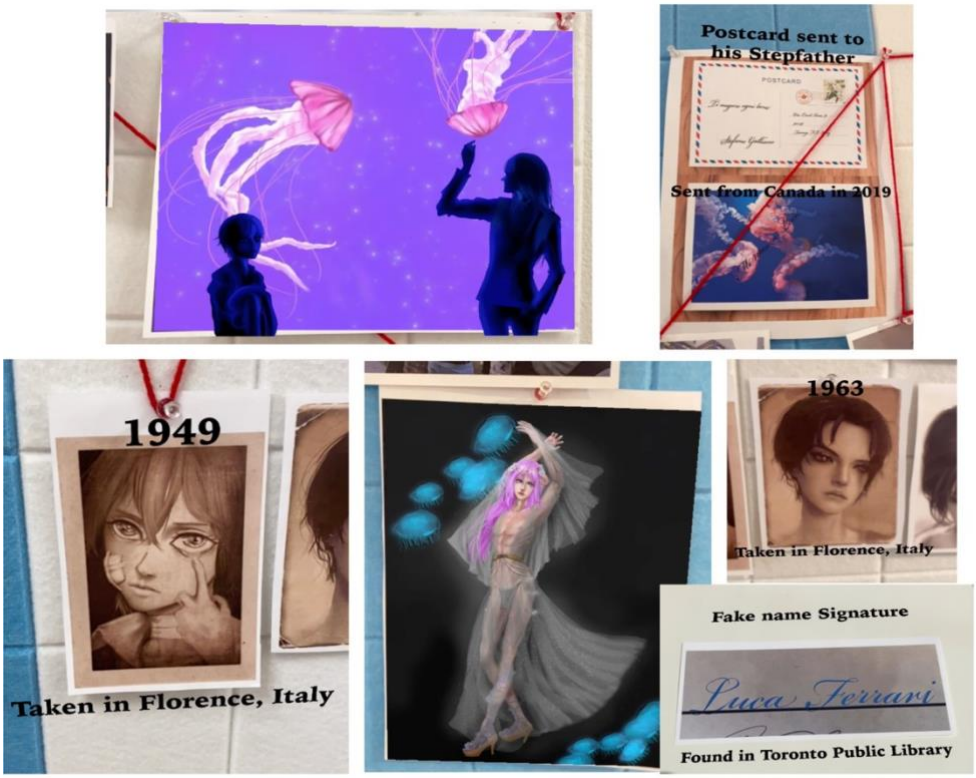

Figure 46. AR illustrations.

With the interaction of Artivive App, the texts will reveal beside the images on the phone screen, to tell the story behind the picture. Some of the images would become animation with AR. It shows the changes and experiences of the character, also the arts that people making for that character. Physical sculpture also works with the image target.

4.5 Summary of Prototypes

The iterative prototyping method is assisting me in achieving my final project aim of Dreaming When You Are Awake: A Detective Journey in Mixed Reality Storytelling. Each prototype required me to test a particular piece of software to see whether it was functional or not. Each prototype provided me with fresh ideas, and I was able to determine which one was the most effective in achieving the goal. I also know which parts I should concentrate on in order to complete it on time and with the desired outcome for the audience. I could finally work on building AR and VR assets.

4.6 Evaluating the Prototypes

From my evaluation criteria in figure 12, I evaluate my *Virtual Reality Undersea Church Tour* five out of ten if it is only seen on YouTube. But it would be able to reach nine to ten when I put them into the VR headset. A 360 degree could easily to get immersed. The AR detective board would be about seven to ten, it has a clear storyline, it is full of clues, which are the foreshadowing, it could make the viewers curious about the next section. The complexity of the story in my AR part could reach the level of the game called Ghost Giant mentioned in the background section. The immersion of my VR is close to the mediation projects, so that the

emotion level of arousal and valence is also closer to the mediation projects, like TRIPP[16], Nature Treks[17], etc. It is more calming than exciting, and it is aimed at making the audience feel comfortable. The AR section of the story has greater interactivity and emotional activation; it is similar to Jurassic World in that it focuses on image targets; viewers are not under any pressure to win the game; all they have to do is look and participate. They both stayed in the right area of the Arousal and Valence model, which is my goal.

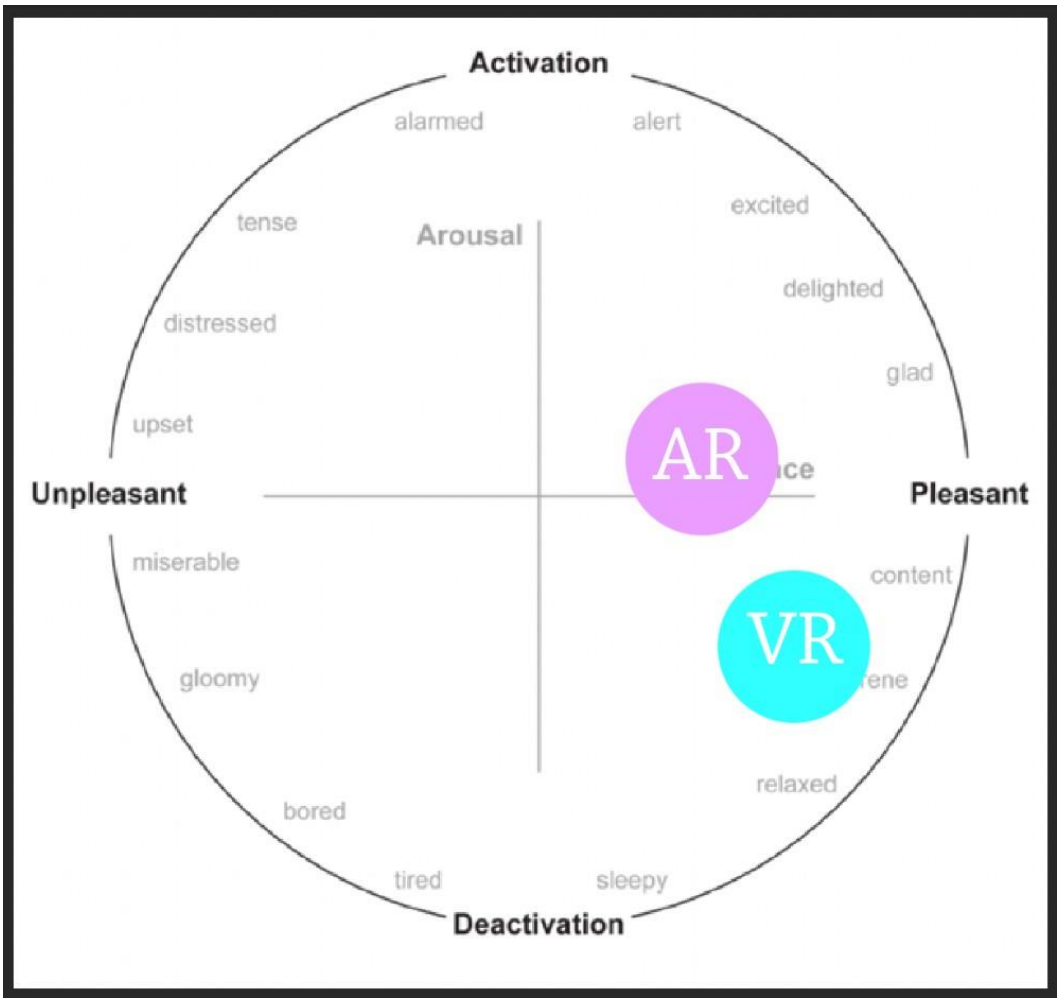

Figure 47. My emotional evaluation for my own VR and AR works

[16] TRIPP® - Virtual Reality Meditation Ad· https://www.tripp.com/vr
[17] Nature Treks: https://www.oculus.com/experiences/quest/2616537008386430/

4.6.1 User Testing

It is an installation project and I want to evaluate from more people's opinion, so I gathered the feedback from fourteen participants during Grad Show from the Graduate Students from OCAD University.

In their responses, all participants enjoy the visual in Virtual Reality, one of them reported the desert scene moves too fast, but everything other than that is enjoyable. 7 of them told they want to stay in this virtual environment all day. 4 participants reported the music works well with the video. Most of them described this is a beautiful animation and give them positive affect and asked me to give them the YouTube link of the video. Everyone think it is immersive, they feel they are actually in the space.

In responses of AR detective board, 6 participants reported the animation is stunning with illustration, they were "surprised". One of them want to know more about the story and asked me to explore further in the future. Most of them like the interaction of the AR and the illustrations, 9 of them are interested with the story and asked me the development about the character.

5. Conclusion

5.1 Contribution

In conclusion, my thesis project challenged my abilities to use completely new mediums and tools, as well as attempt a variety of software to achieve the best result for my desired outcome and overcome the problems I encountered in each prototype. I am new to augmented reality and virtual reality, but I selected this theme to push myself and incorporate my animation expertise into these new technologies. The 3D animations part require additional refinement, such as longer animations and better resolutions. It would also be nicer if I included some minor VR interactivity. But I think it turned our fine for avoiding all pressure that might appear for the viewers. I consider it is a good piece to make people feel positive and enjoy visually.

5.2 Limitations

My ultimate goal was to create a character who guides the audience around the VR scene; the animation would take 20 minutes and be rendered into a realistic setting. An advanced animation like that would take many months to a year to complete; it is like a company project or a job for multiple people. It could be possible to create a realistic environment, but rendering would take an “eternity”. It needs more than 10 minutes for a single frame, and there would be 24 frames in a second, it is taking too long. I need to focus on the other areas first. It is too ambitious, but I will try to finish in the future, maybe with my friends and using more computers.

5.3 Directions for Future Work

I like to design the character and make the immersive animation. I want to make my character alive in the future. I will finish the 3D modelling, topology and texture of the character and rigging him into my VR environment.

Future possibilities for this artwork would also be the software changing. I am new to 3D artworks, Unreal Engine could be better for a high quality animation. It is not beginner friendly, I need to be proficient on that to build environment and save more time.

This project has a lot of potential, there is no limitation about how many scenes and illustrations I have in this project. I could always add more and find more usable software. I also hope I could do more sculptures and also add crocheting, which is what I am proficient about, into the AR interaction. This project could never end.

I want to explore more Virtual Reality animations that could show the stories. To make the advanced animation with character and stunning environments, to make the audience immerse into both virtual environment and the story itself. I will also explore on making the VR games, to make the audience interact in VR and follow the story like the game called Subnautia mentioned in the background section.

5.4 Final Remarks

This is a project that pushed my future into the area I never explored before. I made my first AR painting, my first VR animation, and my first sculpture. I learned a lot of how VR and AR helped people to go through the mental health issues. I hope I reached the goal to give people

positive distractions with my artworks and story. I am making people become part of my story, part of the environment I built, and making them know my character. They walk into my world.

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