

# Designing a Virtual Reality Psychological Game

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## ABSTRACT

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This thesis aims to create a game design blueprint that incorporates Virtual Reality and psychological game elements. The blueprint is built into a playable game demo and then tested with a closed group, answering the following research question: What would a blueprint for designing a psychological Virtual Reality video game be? In addition, the game project raise awareness of mental illness.

The thesis uses literature reviews to form the knowledge base for the game blueprint design, going over virtual reality titles such as Job Simulator and Valve's The Lab as well as psychological games like Amnesia and the Silent Hill series. The study also includes exploratory research into different mental illnesses, before choosing schizophrenia as the main influence. The thesis also follows the guidelines of Alan Hevner's design science for information systems.

The game design blueprint encompasses the project's visuals, game design, systems design, and mechanics related to virtual reality along with psychological gameplay.

The result is a well-received game demo that validates the usability of this design blueprint, which should provide insights into both virtual reality and psychological game design.

Keywords: Virtual Reality, HTC Vive, Game Design, Schizophrenia.

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## 1 INTRODUCTION

Computer interfaces have gone from command line during the mid-1960s to using a mouse and keyboard and the latest touch interfaces. By allowing hand gestures and movements to be taken as data, the controls of the computer have become even more intuitive and interactive with Virtual Reality. Virtual Reality immerses the user in a virtual world, allowing interactions with computer-generated responses, thus creating an illusion of virtual presence for the user. According to a report by Goldman Sachs Group in 2016, a global investment banking and management firm, virtual Reality could be the next big leap in a computing platform as long as the pricing is right and accessibility becomes easier (Bellini et al. 2016, 9 - 12).

Being relatively new to the market, Virtual Reality has seen a lot of video games being made and released for different systems like the Oculus Rift of the HTC Vive, these games range from simulations to short stories that offer high levels of immersions to the player tailoring specific experiences (Bellini et al. 2016, 9 - 12). However, psychological and healthcare-related video games have been next to zero, paving ways for similar projects to appear in other fields (like healthcare, military training, and real estates) exclusively as tools or simulator systems (Bellini et al. 2016, 9 - 12).

Since the release of Virtual Reality, from the HTC Vive station for home desktops to the PSVR for consoles, video games have been one of the main drivers of the market as of 2016 (Bellini et al. 2016, 9 - 12). Some cases of using Virtual Reality in healthcare and education has started to appear and evolve, even potentially disrupting and changing the way

some business models work like in real estates and retail (Bellini et al. 2016, 9 - 12).

### 1.1 Research Background

As an experimental project, the healthcare-related Virtual Reality video game called The Hut focuses on the topic of mental illnesses. Based on the project, this research will go into details of incorporating elements in psychological video games, virtual reality games, and mental illnesses. This project serves both as an internship work and an exploration into making virtual reality games that focus on raising awareness of mental illnesses.

### 1.2 Research Question and Objective

The aim is to create a blueprint game design for a Virtual Reality video game, which focuses on mental illness. This includes creating an experience for the player that simulates a mental illness through both direct or non-direct gameplay mechanics and messages. As a result, the thesis aims to answer the following research question:

**What would a blueprint for designing a psychological Virtual Reality video game be?**

However, since no other similar project or game has been done before, this project also aims to define a suitable amalgamation between both virtual reality and psychological game, with the hope of shedding some light onto the subject.

### 1.3 Structure of Thesis

This thesis is divided into three different parts, with the first going over Virtual Reality and Psychological games case studies as well as different mental illnesses. From there, the second part will apply the theories and studies thereof to a Game Design Blueprint, analyzing and explaining different aspects of design choices of the game. Finally, discussion and conclusions will be drawn afterward in another section, summarizing and reviewing the game blueprint for its limitations as well as legitimate insights.

### 1.4 Organization and Project Background

Company X is an indie healthcare focused games company based in Lahti, Finland. This project was done at Company X as an internship project, aimed at practicing game development and game design. The game project's initial goal was to experiment with virtual reality technology, eventually leading to the goal of creating a psychological virtual reality game that raises awareness on mental illness.

Concepting phases started in May 2017, development was done during the autumn and the playable state of the game was available as of October 2017. This playable project was then tested by a closed group of testers in November 2017.



## 2 RESEARCH METHODS

This section goes over the methodologies of the study, explaining which approach the research will take and how data collection will be done. Also, this section explains why these methods suit this type of research.

### 2.1 Research Methods and Approach

As the purpose of this study is to create a Virtual Reality psychological game design blueprint, this study utilizes the deductive approach combined with qualitative research methods on secondary data sources via essays, reports, and studies taken from various online sources. These methods were chosen due to the lack of advanced knowledge in these areas, while at the same time game design is about finding patterns and meanings which are not present in standardized quantitative methods.

The outcome of the study is to create an experimental blueprint psychological game design for Virtual Reality, one that would reflect mental illnesses in conjunction with the level of immersion provided by Virtual Reality. A deductive approach is used, basing the blueprint on literature reviews of multiple sources.

The research utilized the guidelines of Alan Raymond Hevner's design science for information systems research. The following list is based on Hevner's 7 guidelines for a design science research, each of which will be reflected with what the researcher has done in this thesis. (Hevner et al. 2004, 75 – 106.)

- Design as an artifact: The researcher creates a game design blueprint that contains knowledge of both virtual reality and psychological game theorems and techniques, which qualifies as an artifact.
- Problem relevance: The game project is a game design blueprint developed into a playable demo, aiming to create a suitable virtual reality game that emphasizes schizophrenia.
- Design evaluation: The researcher emphasizes design choices in the game blueprint, referring back to points made in the literature reviews.
- Research contributions: The game project is designed using the researcher's knowledge of video game design, researching virtual reality and psychological games. Both genres included notes and commentaries from successful game developers.
- Research rigor: The project was developed by a dedicated team of game developers at company X, over the course of 6 months with constant feedback and improvements.
- Design as a search process: The project was designed with a literature review based research of the latest virtual reality games. The research also included the exploration of different types of mental illnesses.
- Communication of research: The playable game demo was shown to testers with backgrounds in business and psychology within a closed and controlled environment.

By following Hevner's design science guidelines, the researcher established a better workflow. The results of following Hevner's design science can be observe integrated into different parts of the research.

The project also aims to demystify the psychological virtual reality game field, answering questions surrounding the subject of creating and designing a suitable game for this genre.

In order to design a proper game design blueprint for this project, the game was developed and tested with people with backgrounds related to psychology and video games.

## 2.2 Research Plan

There are four stages in this study which are research objective, literature review, game design blueprint, discussion, and conclusions. The table below is a depiction of the study's progress.

Table 1. A table illustrating the research plan.

<b>Stage</b>	<b>Content</b>	<b>Output</b>	<b>Data</b>
<b>Research Objective</b>	- Design a game design for the virtual reality with psychological elements	- Research question, research objective	

<p><b>Literature Review</b></p>	<ul style="list-style-type: none"> <li>- Obtain knowledge and theories from existing Virtual Reality and Psychological games regarding game design and theme</li> </ul>	<ul style="list-style-type: none"> <li>- Virtual Reality game design theories</li> <li>- Psychological game design theories</li> <li>- Exploration of different mental illnesses</li> </ul>	<p>Secondary sources data: Academic researches, book, analysis of developer's interviews, developer's conference presentations.</p>
<p><b>Game Design Blueprint</b></p>	<ul style="list-style-type: none"> <li>- Create a Virtual Reality psychological game design blueprint based on the knowledge and theories gathered</li> </ul>	<ul style="list-style-type: none"> <li>- Game Design Blueprint for a Psychological Virtual Reality Game</li> </ul>	
<p><b>Discussion &amp; Conclusions</b></p>	<ul style="list-style-type: none"> <li>- Analyse the game design blueprint and reflect on the theories and knowledge gathered</li> </ul>	<ul style="list-style-type: none"> <li>- Comparison notes to research objective</li> <li>- Possible improvements</li> <li>- Retrospective notes on game design</li> </ul>	

The first stage of the study aims at defining the objective for the research. The next stage is a literature review, which is aimed at acquiring game not only design theories in Virtual Reality and psychological video games, but also explore different mental illnesses and conceptualize which is most suitable for the design of the game. Based on those design theories, a game design blueprint of a game project is developed, detailing the features and mechanics of the game and how it coerces psychological aspects into a Virtual Reality game. Lastly, the game design blueprint will be analyzed and re-evaluated to reflect the aspects of mental illnesses

and psychological elements, while also testing the game to a closed group of testers.

### 2.3 Data Collection and Analysis

Qualitative data was used to obtain game development theories and game design choices on how Virtual Reality games are made in the form of literature reviews, as well as how psychological games reflect mental illnesses through their mechanics. The literature reviews were gathered through online articles, books, academic studies, academic researches, and game developers conferences' presentations. No surveys and interviews were conducted due to the experimental nature of this research because not a lot of Virtual Reality psychological games has been done.

Case studies are suitable for exploratory research because of the intensive information was usually given by the developers of the games, or the authors' analysis on said games. Case studies for this research are aimed at providing deeper understandings on how psychological mechanics of certain games are designed and developed, as well as tricks and theorems in making Virtual Reality games intuitive.

The qualitative data collection was divided into three sections, coming from various sources: Books on video game studies from Masto-Finna, game studies and academic researches from Google Scholar's online libraries, recorded game developer conference's presentations from GDC Vaults.

The first section covers the data on two successful virtual reality games Job Simulator and Valve's The Lab, focusing on their game design theories and discoveries during development and prototyping period. The sources are secondary data from the developers' conference presentations, developer diaries, and interviews. The second section covers the data from multiple sources on psychological games and their game design philosophy towards reflecting the human mental condition in video games. Secondary data was taken for this section from Google Scholar online libraries, including books and journal articles. Lastly, the last section will include studies on the basis of the most common mental illnesses, as well as their effects on human mental and physical behavior. The sources for these studies are from Google Scholar online libraries and their respective publishers.

During the testing of the game project, written notes were taken of the tester's experience in handling the game and their feedback on how to improve certain features or mechanics. Also, general observation was done in conjunction with writing the note during testing, focusing on the tester's movements in virtual reality. Afterward, the notes were passed back to the development team for review.

Data analysis in this thesis will be done alongside the game design blueprint, noting the implementations of different theorems and design decisions. These theorems are analyzed and taken from the literature reviews containing commentaries and developer notes.

### 3 LITERATURE REVIEW

#### 3.1 Virtual Reality

This section covers two virtual reality titles, The Lab by Valve and Job Simulator by Owlchemy Labs. Both were chosen due to their financial and critical success, while also revealing their design decisions through online articles and conferences.

##### 3.1.1 The Lab

Valve's launch title for the HTC Vive is The Lab, a free Virtual Reality game that takes the player inside a virtual science fiction world, filled with mini-games and virtual realities. An article on the design of Valve's The Lab, with developer commentaries in July 2016 by Henry Stuart, analyzed the reasons behind the designs of The Lab's Start Room and The Volumetric Menu Room. These designs created a natural sense of teaching and learning for players in virtual space, with a VR-centric design approach that aims to solve the problem with Graphical User Interface (GUI) in VR. (Stuart 2016.)

When first starting the game The Lab, the player is placed into an empty room with a board that has some buttons on them. By experiencing and doing, walking towards the buttons and pushing the big Start button, players are learning the basic interactions in the game.



Image 1. Player's first starting room, with the buttons a bit further away from their starting position (Stuart 2016)

Menus in the game The Lab are presented as 3d virtual objects that players can move around, look at, and interact with. Each of these objects has their own virtual space in the game, and players instinctively learn to navigate the game by manipulating the environment.





Image 2. A spherical map that can be picked up (Stuart 2016)

In order to select a level and change the scene in the game, players can hold a sphere of another dimension and put it on their face. The design of making these interactions a sphere indicates clarity in good design that shows the function of the object (Stuart 2016). As a result, the change scene buttons are obvious and clear to use; a similar design is done for exiting a scene, clicking on the menu button of the Vive controllers will pop a sphere out, using it sends the player back to the menu. Alternatively, the sphere will naturally disappear over time. (Stuart 2016.)

### 3.1.2 Job Simulator

The game Job Simulator, developed by Owlchemy Labs launched back in April 2016 for the PlayStation VR console, HTC Vive, and Oculus Rift. The game puts the player in various job situations within virtual space, emphasizing virtual interactions with in-game characters and objects.

In Games Developer Conference 2017, Alexander Schwartz presented the Job Simulator Post-mortem to speak about challenges and lessons that Owlchemy Labs learned along the way in developing the game. The talk included strong points in choosing the theme and premise of the game, alongside technical difficulties and challenges that Owlchemy Labs encountered (Schwartz & Reimer, 2017). It is important for other developers working in the VR field to learn from these challenges and avoid repeating the same mistakes in the future. The following parts will talk about the aforementioned technicalities.

#### The Tomato Presence

During developments, indoor testing showed that players felt natural when their virtual hands were replaced by the items they picked up, instead of having your hand holding the item. Owlchemy Labs called this the Tomato Presence, during which the object in hand acts as a stand-in for hand presence (Schwartz 2017); it is essential to let the player feel natural in virtual reality in order to maximize the immersive experience.



Image 3. Player's hand is replaced with whatever item they pick up (Schwartz 2017)

Hence, it's important that developers in VR take the idea of The Tomato Presence into consideration when designing virtual interactions in VR.

### Room Scale

Different VR play space for every user is accommodated by Owlchemy Labs, based on the initial settings data saved within either the HTC Vive or Oculus Rift system, optimizing the virtual room sizes accordingly (Schwartz 2017). This allows the player to interact with the virtual space in a more compact manner while retaining the sense of immersion as space is either shrunk or expanded.



Image 4. Different room sizes creates a more realistic play space  
(Schwartz 2017)

The Lab's HTC Vive room size settings. These settings will be saved and used by the VR programs, which data can be utilized to fit accordingly to the room sizes in the game.



Image 5. HTC Vive requires the player to set up a play area before using  
(Schwartz 2017)



Job Simulator different room sizes scale accordingly to player's play area. Note how the different room sizes also come with different items and objects placements, making them more compact without sacrificing any missing objects or features of the game.



Image 6. Different room sizes change the position of objects (Schwartz 2017)

## 3.2 Psychological Games

This section studies the different design decisions behind two psychological horror games, *Amnesia the Dark Descent* and the *Silent Hill* series. Different design aspects will be highlighted along with analysis on why they affect the psychology of players.

### 3.2.1 *Amnesia the Dark Descent*

The academic research article was done by Mathias Clasen in 2016 “A Consilient Approach to Horror Video Games” analyzed how *Amnesia: The Dark Descent* creates psychological responses by encouraging immersion (Clansen, Kjeldgaard-Christiansen, 2016).



Image 7. The player's own sanity meter is shown with a deteriorating brain (*Amnesia: The Dark Descent*, 2010)

In *Amnesia: The Dark Descent* uses a plethora of different variables that change depending on the player's current level of sanity, this sanity system allows for deeper interactions that ties together psychological horror with physical threats within the game world. Being in darkness for too long, facing monsters, or seeing paranormal activities reduces this

sanity level, causing the player to experience visual and auditory hallucinations (Clansen 2016). Mathias Clansen stated that this system of Amnesia's insanity mechanic is designed to steer the player's experience towards a defensive and exploratory playstyle (Clansen 2016). Furthermore, by monsters are attracted to light, hence the player trap in trying to keep their sanity high - might attract the monsters instead, and putting the player in danger (Clansen 2016).



Image 8. The player encounters a monster in Amnesia: The Dark Descent (Amnesia: The Dark Descent, 2010)

Psychological horror principles from Amnesia: The Dark Descent can be seen through an analysis of the game (Elvira, Linderoth, Brown, 2015). Amnesia is used within the game's context to link the player's connection together with the protagonist, Daniel, who wakes up in a haunted castle

having lost his memories. Daniel is affected by intense visual and auditory hallucinations that can kill him (Elvira 2015, 232 - 240). Daniel, as well as the player, have to rely on their senses and Daniel's own hallucinatory voices giving instructions. This plays into how Amnesia works as a mental illness and it links in with in-game mechanics that governs player agency, giving the player the same experience the protagonist is going through which ingrains the psychological horror (Elvira 2015, 232 - 240).

On the aspect of sound and visuals, *The Dark Side of Game Play: Controversial Issues in Playful Environments* book by Torill Elvira Mortensen emphasized different uses to instill creepiness through a high level of immersion (Elvira 2015, 232 - 240).

Sound design for Amnesia: The Dark Descent was referred to as first-person hearing (Elvira 2015, 232 - 240), this means that the separation between diegetic sounds and non-diegetic music are played in a way that mimics the hallucinatory nature of an unstable mind. Daniel's movements are tied with diegetic sounds like the footsteps of the player, Daniel's heavy breathing, creaky wooden floor, and cries for help in the distant darkness. The non-diegetic music, however, is very low in volume and are linked to objects within the background: small, indistinct violin notes, loud but brief bassoon played when a door is opened. The non-diegetic sounds are unobtrusive in nature, but they suggest a more sinister and darker tone to the environment that instils a natural psychological fear to the player. (Elvira 2015, 232 – 240.)





Image 9. The player's vision is filled with a red hue, as sanity gets low (Amnesia: The Dark Descent, 2010)

On the aesthetics aspect, Amnesia's "sanity effects" heightened the tension of the player experience through disturbing sequences with horrifying visuals. As pointed out by (Elvira 2015, 232 - 240), the visual sanity effect includes changing the player's point of view, tilted camera angles to simulate balance disorientation, increased darkness, and warped spatial proportions to further make the rooms more confusing. Amnesia also used a drastic change in color of the screen during these sanity gameplay moments, a technique demonstrated in "Dynamic Lighting for Tension in Games" by Magy Seif El-Nasr (Elvira 2015, 232 - 240). This shift in saturation expresses danger directly to the player, as red is commonly used as a color of confrontation and warning.

### 3.2.2 Silent Hills

The Silent Hill series is known for its survival horror gameplay, terrifying monsters, with a flawed protagonist whose personality shape the world they inhabit. It's this psychological aspect that makes Silent Hill unique in its narrative and designs, as stated by Torill Elvira Mortensen in *The Dark Side of Game Play: Controversial Issues in Playful Environments* (Elvira 2015, 226 - 231). The enemies design are a literal representation of violence and lust that reflect the protagonist's own past traumas. A clear example for this would be James Sunderland from *Silent Hill 2*, whose trauma produced two iconic monsters: the Bubble Head Nurses and Pyramid Head, representing James' sexual desires and guilt over the murder of his own wife.



Image 10. The concept art for Bubble Head Nurse and Pyramid Head (*Silent Hill 2*, 2001)

Due to the psychological nature of the monsters in *Silent Hill* created by the protagonists' minds, the player avatars are hence flawed, vulnerable

human beings whose perception of the world is twisted (Elvira T. 2015, 226 - 231). This creates a paradigm of design during a time where psychological horror was still new and scarce, further putting the player in something they haven't experienced and out of their comfort zone.

As stated by Thainá Cristina Demarque in Auditory Hallucination: Audiological Perspective for Horror Games, a research of the SBGames 2013 aimed at discovering techniques applied to digital games, auditory hallucinations in the Silent Hills series were important elements in psychological horror games (Cristina, Soares 2013). The research focused on certain segments from Silent Hill 3 and Silent Hill, emphasizing the importance on the design of sounds: strange unknown voices, static radio noises, slamming doors in the distance, moans, and the sound of someone sobbing (Cristina 2013). These elements incited more fear in players and triggered psychological responses after preliminary tests (Cristina 2013).

The research included a list of common perceptions about auditory hallucinations that subjects associate and identify with (Cristina 2013):

- Voices have identities: Subjects associated the unknown voices with an unknown person or entity.
- Purpose and meaning: Subjects associated the voices with its own meaning and purposes, often splitting into either a benevolent entity or malevolent entity.
- Power of the voices: Subjects think voices are omnipotent, creating a sense of helplessness and losing control.

- Consequences of resisting: Subjects think that bad things will happen to them if they don't follow the voices' instructions.

### 3.3 Psychological Explorations

Video games have a fair share of mental illnesses, although not all of them has been done either successfully or unsuccessfully. The following are some of the most common mental disorders/illnesses found and used in video games, with definitions taken from various articles of the American Psychiatric Association's website:

- **Dissociate amnesia:** Patients under this mental illness often incur a loss of memory, either short-term or long-term. Featuring one of the most successful titles in videogames history, the psychological horror video game Amnesia explored this mental illness by putting the player in control of an amnesiac. (Wang 2016.)  
Wang P. 2016. **Depression:** Abnormal levels of self-esteem or loss-of-interest, low energy, pain without clear causes. Often done and referred to a lot with PTSD or Psychosis, as the episodes of the mental disorders wear off the patient is left with depression or low-moods; Hence in video games, depression often accompanies other mental disorders. (Parekh 2017.)
- **Schizophrenia:** a Mental disorder that changes patterns in which patients think and understands, experiences are often auditory and visual hallucinations. Despite this, not much of Schizophrenia has been done or explored in video games directly, although

hallucinations are depicted it is not explicitly stated that Schizophrenia was the cause. (Parekh 2017.)

- **Obsessive Compulsive Disorder (OCD):** Patients with OCD usually feel the need to obsessively do something, to a point that they disregard their own safety or others. Neverending Nightmare, an indie psychological horror video game succeeded in portraying OCD and depression in their game via layers of hell manifested by the protagonist's psychological state. (Gorrindo, Parekh 2017.)
- **Psychosis:** Symptoms that accompany psychosis often are hallucinations, delusions, thought disorder, abnormal brain behaviors. A psychological action indie game developed by Ninja Theory game studio, Hellblade, puts a strong emphasis on story and Psychosis – letting the player experience the hallucinations of the protagonist as the world shapes and changes along. (Coffey 2015.)
- **Post-traumatic-stress-disorder (PTSD):** Traumatic experiences can cause mental instability and stress or anxiety, post-trauma. Often used in video games that includes war, rape, murder, or horrors; Notable examples are Call of Cthulhu: Dark Corners of the Earth, Dead Space 2, and Darkest Dungeons. PTSD has been a staple of the horror genre in video games, giving leeway for the developers to change how characters behave in a video game and give players a sense of progression. (Parekh 2017.)
- **Paranoid personality disorder:** Anxiety/fear-induced thought process, often leading to delusions or irrationality. Example with

Darkest Dungeons is the most notable in how characters the player control will go crazy or paranoid and has to be put into a rehab building in the game, leaving them unable to participate in combat or be usable until after rehab is done. (Parekh 2016.)

- **Bipolar disorder:** A mental disorder that causes periodic episodes of depressions and mania. Filmic and video games depiction of bipolar usually focuses on the extreme transition of personality in a character during some story set pieces, though seeing bipolar from the player's point of view is almost never explored upon. (Parekh 2017.)
- **Anxiety disorder:** Abnormal levels of feelings of fear or anxiety, leading to physical symptoms such as fast heart rate or shakiness. Anxiety is used in conjunction with other mental illnesses in video games, frequently taking an effect on the player's health or control of the game via in-game mechanics. (Parekh 2017.)

### 3.4 Schizophrenia

Schizophrenia is the mental disorder chosen to center on the project that Company X was doing. Schizophrenia is a mental disorder that affects how a person thinks, feels, and behaves (Barry 2012). People with schizophrenia might experience auditory and visual hallucination, such as hearing or seeing something that isn't there or constantly felt like they're being watched. Also, schizophrenia can cause the person to feel isolated and less apathetic towards others, as well as being emotionally numb and lacking motivation (Barry 2012).

By definition, schizophrenia is comprised of three main symptom categories: positive symptoms include auditory hallucinations, delusions, and thought disorder; negative symptoms can be social withdrawal and demotivation, while cognitive dysfunction symptoms might include attention problem and working memory (Barry 2012). These symptoms are worked into the game design of this research, combining visual and auditory mechanics to emphasize the schizophrenic disorder.

According to a study done by the U.S National Library of Medicine, no consistent improvements to these symptoms were made by any treatment. The maintenance treatment study on Schizophrenia by associate professor Thomas E. Smith in 2009 claims that schizophrenia has a 1 out of 100 ratios, and 75% of schizophrenics have relapses and repeated symptoms. Within the same study, they found that family interventions or psychoeducational interventions, with enough care, can reduce relapses more effectively than continued antipsychotic drug applications (Smith 2009). This means that even without drugs and medications, one can overcome schizophrenia symptoms with the right mindset and support from families and friends; hence, the game design blueprint will address this with different ways the player can cope with the game itself.

## 4 GAME DESIGN BLUEPRINT

This section will be going over different parts of the game design blueprints for The Hut, along with some pictures from the project. Note that although a lot of designs were documented and written most of them aren't realized or achieved during the development of this project. The blueprint model has gone through considerations and iterations within the working environments of Company X, with game developers and designers giving suggestions and building a prototype of the game. The blueprint, however, will be more theoretical and serves more as a proof of concept rather than an actual prototype, as the playable demo was far from the blueprint's aims. The game was tested with a playable version built with Unity 5 for the HTC Vive.

### 4.1 Story and Settings

As the game starts, the player character is placed on the top of a mountainous area covered in a heavy blizzard, at midnight. After looking around, the player character can see that they are trapped here as the only way back is now a broken bridge leading to the other side of the mountain. In front of the player is a worn-down wooden cottage with a wooden shed behind it, the door is slightly opened with a warm yellow light bleeding out indicating the intended path. This will force the player to go inside the cottage, as it is more inviting and holds a clear visible objective.





Image 11. The warm yellow light invites the player, drawing attention to go inside.

The settings for the game being in a Nordic cottage getaway gives a strong emphasis on isolation and forces the player to take sanctuary inside, under a heavy blizzard. This starting point disconnects the player from the sense of familiarity and puts them out of their comfort zone. The isolated setting of the blizzard also discourages players from going off the beaten path, as there are no other ways to go logically other than going inside the house. The isolated environment in the game also helps build the theme of loneliness and serves as a metaphor for the character's own isolated mind and social situation.



Image 12. The cottage sits isolated on top of a mountain.

Inside the cottage, the player finds a talking fire spirit inhabiting the fireplace along with a lot of useful items such as canned foods and drinks like coffee and tea. As the player tries to survive via resource management of in-game systems involving eat drink and keeping warm, the fire spirit and a radio will be talking to the player to help guide them along the way. Besides hunger, thirst, and temperature, the player will also have a sanity state that deteriorates and can be reset once they finish an objective (i.e. successfully making a good dish, clean up the garbage inside the cottage, keeping warm, etc.). When the sanity state of the player goes low, the fire spirit and the radio will start to deceive and trick the player instead of being helpful in addition to annoy the player in general.

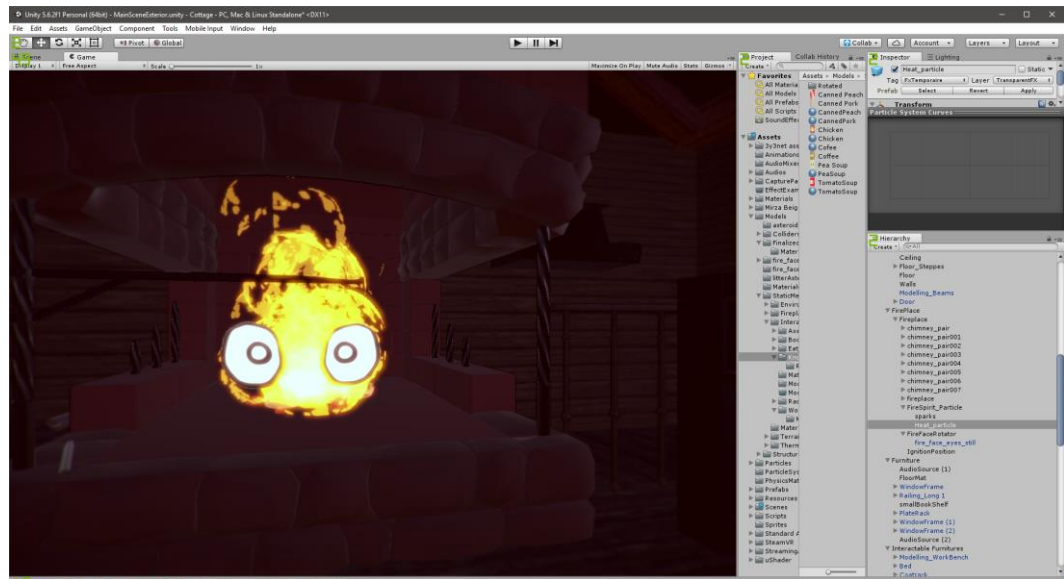


Image 13. The Fire Spirit, sitting inside the fireplace looking at the player.

Once the player has eaten well and hydrated, they can choose to sleep by using the bed in the cottage, this will save the player's progress and resets their sanity level to a higher medium. However, sleeping will cause the fire to go down and hunger/thirst level to go down as well. The player will die if they run low on temperature or starve/dehydrate, resulting in a reload into their last checkpoint of sleeping.

At a point in the game, when the player is in the cottage, the window will blast open and blow in a lot of cold air and snow, reducing the temperatures of the cottage. The player then finds a way to fix the situation by going outside to the back shed and grab some more woods, the shed also has a fire axe that the player can use to chop any wooden furniture into firewood for the fireplace. The firewood can then be used to keep the fireplace going and fix the window. If the player used up all of their available resources and maintained a good balance of resource management, the game will end with the fireplace slowly going out and the

player passing out shortly after the front door is opened and a voice (and a dark figure) calls out to the player – with sunlight shining behind them, indicating the dawn of the next day.

#### 4.2 Aesthetics

Graphics can engage the player and also inform them the topic of the game. Locations, signs, objects, characters all tell the player subconsciously what the game is about.

The project The Hut went with a cartoonish look similar to Job Simulator by Owlchemy Labs, using hand-painted textures and simple 3d meshes. Using low polys meshes reduces the development time and efforts in creating in-game assets, this is also because the involvement of interns for this project meant that Company X did not have enough people experienced with creating realistic 3d environments. Hand painted textures are used due to Company X's history in making 2d mobile games, allowing room for more details in the low poly 3d meshes.



Image 14. Hand-painted textures of the wooden objects inside the cottage.



Image 15. Low poly 3d meshes of the outdoors environment.

### 4.3 Goals and Core Game Mechanics

The player's interactions and goals are tied directly to the game system, once inside the cottage a timer will start ticking down on the Virtual Reality

headset, pushing the player to start finding food and maintain heat and helps indicate which stats are going down.

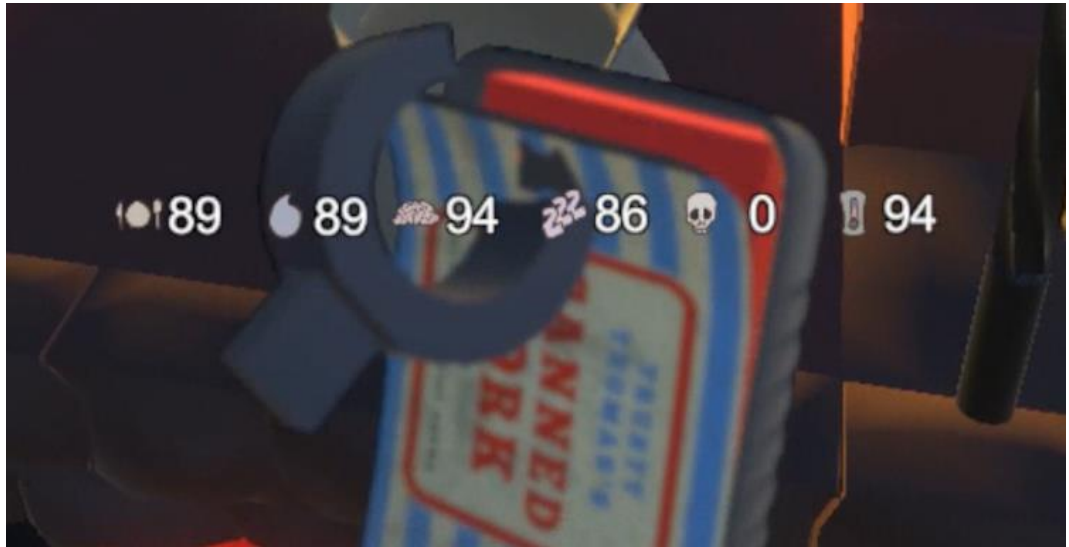


Image 16. Different stats represented on the player's screen.

The main systems in The Hut that the player needs to manage include body temperature, foods and drinks, energy, and sanity. Body temperature equates directly to player survivability, as hypothermia will kill the player right out. In real life situation, lower body temperature will also introduce problems for clear thinking; hence, low body temperature will add a multiplier to the deterioration rate of sanity which is always going down.

Sanity is used as a trigger for other scripts in the game, depending on what number sanity is at. Though not fully developed in the game, sanity should work similarly to how it is in Amnesia: The Dark Descent. For The Hut, sanity determines the responses from the fire entity and the radio channels, both of which are increasingly more absurd the lower the player's sanity goes.



Energy has a few thresholds, which lets the player be able to move different sized objects and hold them without dropping. Small objects like food cans and books won't need much energy, but heavier furniture like the bed or table will require a high level of energy to move; likewise, actions like chopping firewood would require an equivalent level of energy. If the player does not have enough energy, the items they pick up will drop as their hands begin to shake and unable to hold the heavier items.

Just like in Job Simulator, player's hands are replaced with the object, this refers to the Tomato Presence.

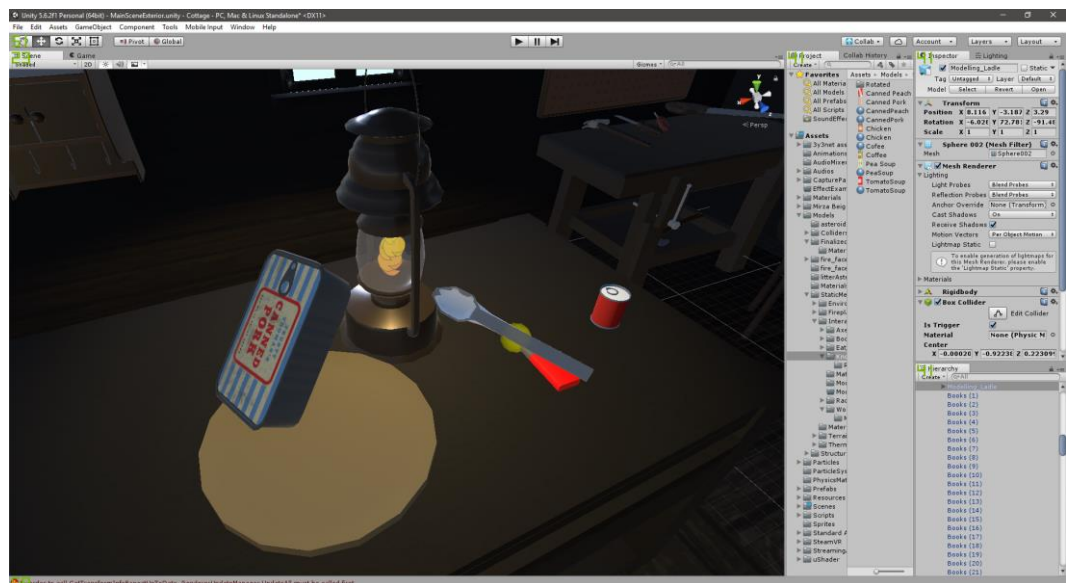


Image 17. Hands are replaced with objects upon pickup.

The list below is used for determining the approximate time the player will spend idling in the game, not doing anything. The time spent is dependent on other systems of variables in the game, thus calculated from such systems. The formula for calculating time in minutes and deterioration rate is  $Time * 60 = 100 / Deterioration Rate$

- Deterioration rate for hunger is balanced so that an idle player can last around 12 minutes in a Cold/Freezing environment, 20 minutes in a Warm environment, and 6 minutes in a Hot/Burning environment.
  - Cold/Freezing: - 0.15/s
  - Warm: - 0.08/s
  - Hot/Burning: - 0.3/s
- Deterioration rate for thirst is balanced so that an idle player can last around 9.5 minutes in a Cold/Freezing environment, 20 minutes in a Warm environment, and 8 minutes in a Hot/Burning environment.
  - Cold/Freezing: - 0.175/s
  - Warm: - 0.08/s
  - Hot/Burning: - 0.2/s
- Deterioration rate for body temperature is balanced so that an idle player can last around 8 minutes in a Cold/Freezing environment, 22 minutes in a Warm environment, and indefinitely in a Hot/Burning environment.
  - Cold/Freezing: - 0.2/s
  - Warm: - 0.075/s
  - Hot/Burning: + 0.25/s
- Deterioration rate for sanity is balanced so that an idle player can last around 22 minutes in a Cold/Freezing environment, 33 minutes in a Warm environment, and 13 minutes in a Hot/Burning environment.



- Cold/Freezing: - 0.075/s
- Warm: - 0.05/s
- Hot/Burning: - 0.125/s

Hunger and Thirst add more depths to the game, giving the player more resources to control and a broader but not necessarily higher level of difficulty. Hunger and dehydration will be indicated in the game via the character's stomach grumble sounds and character making sounds with the mouth. Foods and drinks work on a standard over 100 percentage system, with different foods and drinks providing different numbers to other stats such as hunger, thirst, temperature, sanity, and energy. Hunger and thirst will add multipliers to the deterioration of energy, sanity, and body temperature; as long as hunger and thirst are below 50.

Table 2. Relationship system between food and drinks to different types of stats.

<b>Food's relationships and stats number</b>										
<i>How Food is determined to be Cold/Hot/Burnt - over 100</i>										
	Hunger		Thirst		Body Temperature		Sanity		Energy	
Canned Tomato Soup	Cold	7	Cold	4	Cold	-7	Cold	0	Cold	2
	Warm	10	Warm	8	Warm	13	Warm	9	Warm	4
	Hot	4	Hot	-3	Hot	9	Hot	-5	Hot	3
Canned Beans	Cold	10	Cold	0	Cold	-3	Cold	0	Cold	3
	Warm	14	Warm	5	Warm	10	Warm	5	Warm	6
	Hot	6	Hot	-9	Hot	7	Hot	-9	Hot	5
Canned Pork	Cold	15	Cold	2	Cold	-5	Cold	0	Cold	4
	Warm	23	Warm	3	Warm	10	Warm	7	Warm	10
	Hot	9	Hot	-5	Hot	7	Hot	-13	Hot	8

<b>Drink's relationships and stats number</b>										
<i>How Drink is determined to be Cold/Hot/Burnt - over 100</i>										
	Hunger		Thirst		Body Temperature		Sanity		Energy	
Snow	Cold	0	Cold	2	Cold	-9	Cold	0	Cold	-5
Water	Warm	0	Warm	6	Warm	3	Warm	2	Warm	5
	Hot	0	Hot	3	Hot	5	Hot	4	Hot	2
Coffee	Warm	-2	Warm	4	Warm	5	Warm	9	Warm	10
	Hot	-4	Hot	2	Hot	7	Hot	13	Hot	5
Tea	Warm	0	Warm	6	Warm	5	Warm	3	Warm	8
	Hot	0	Hot	3	Hot	7	Hot	6	Hot	4

Similar to how Job Simulator achieved its level of detail in playable Virtual Reality, in-game items and objects in The Hut are all interactive with the player. As demonstrated like in Job Simulator, the items should be designed to replace the player's hand models when they're picked up. Food cans can be picked up and opened, putting them next to a heat source will cook the food and possibly burning them if left unattended.



Image 18. Various items in the game are interactive, and all can be picked up.

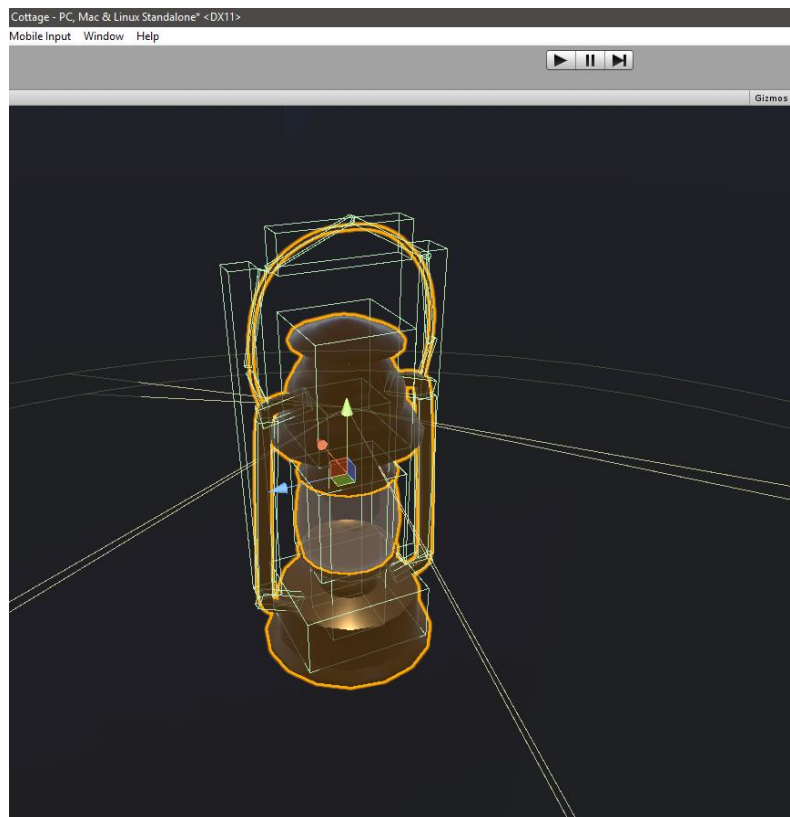


Image 19. Hitbox of a lamp with physics enabled.

Due to the frigid weather setting in the game, all the foods and drinks inside the cottage will be either canned or boxed. The player will have to cook them to maximize what they get out of the food, likewise, the drinks will need to be heated up. Water will be made available by melting snow, which falls into the house via the windows.



Image 20. Different canned food package designs found in the game.

Cookware will hold foods, snow, and liquid in place by putting one onto the other. All items are rigged with a rigid-body system in Unity for physics interaction, this allows the items to collide with each other and enable scripts for cooking.

In the game, the player can acquire firewood for keeping the fireplace heated with the use of two items: the axe and the lighter. Using the axe,

furniture could be broken down and fed to the fireplace. However, if the fire has gone out completely, the player will need to use the lighter to light it up again, after putting firewood inside the fireplace.

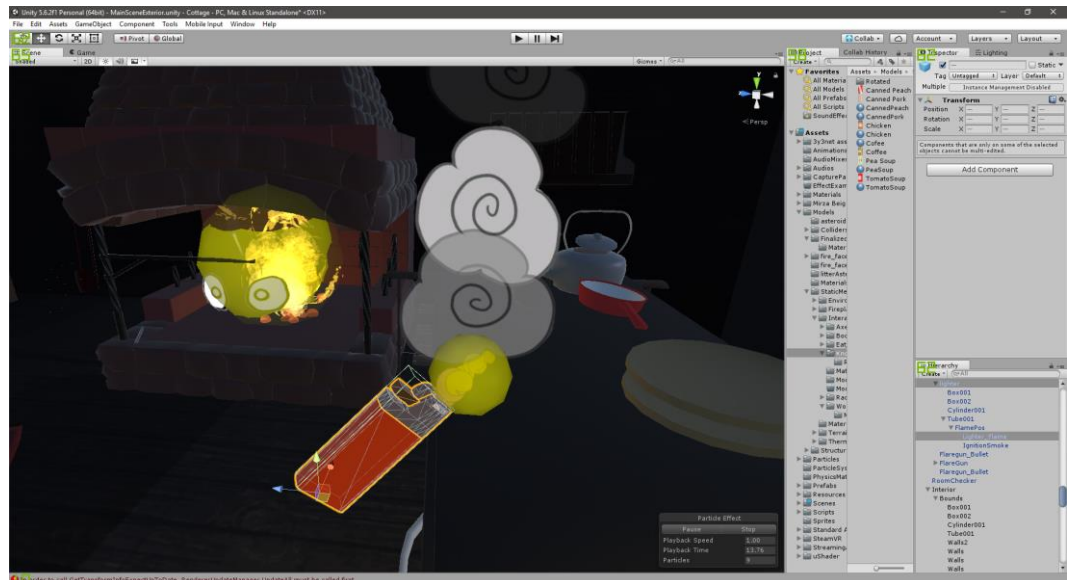


Image 21. Lighter burning smoke off of wooden furniture in the cottage.

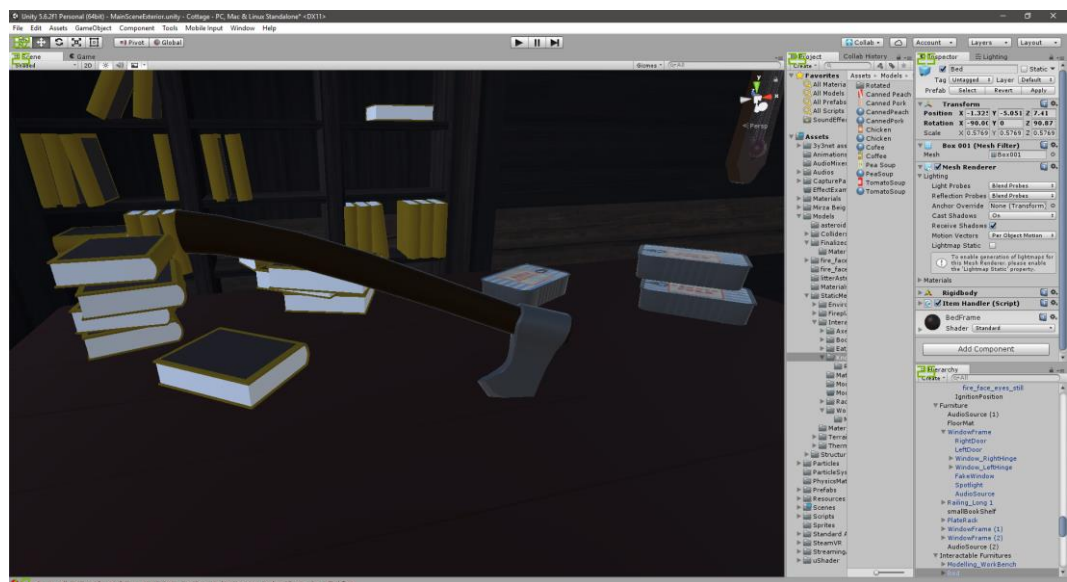


Image 22. The fire axe found lodged in a wooden table in the game.

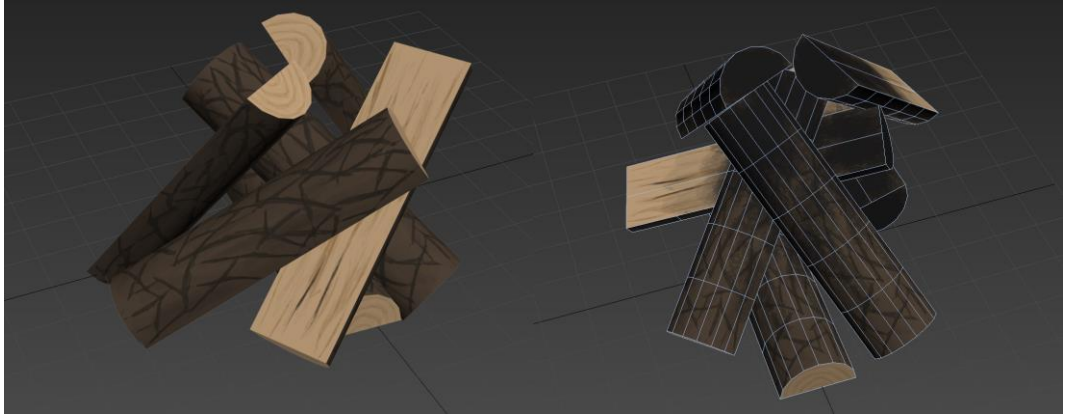


Image 23. Firewood 3d model, fuel for the fireplace.

#### 4.4 Psychological VR Mechanics

In *The Hut*, a few game mechanics were designed to mimic a sense of illusion and hallucination setup by *Schizophrenia*. This was done through in-game objects with audio cues that would interact with what the player was doing in-game. Mental illness-induced addiction is the core problem that the team at Company X wanted to take on, along with giving the player a sense of relaxation within a cozy cottage.

The first addition to this was the fireplace, the fireplace has a fire spirit inhabiting it which could be interpreted as the character's own hallucinations manifested into reality. The fire spirit can talk, giving different responses with different mood and intervals depending on the player's sanity meter. Like in *Amnesia*, the player's own sanity changes throughout the game and resets at checkpoints. These checkpoints are saved once the player completes an objective, like successfully cooking a meal and eating it or find the location of a quest item.

The fireplace spirit can also comment on what the player is doing, making it seem more alive and interactive from the player's point of view.

Interactions can range from the player feeding firewood to the fireplace to the player messing about with the environment, handling items or moving the furniture around. The player's sanity level will control how much the fire spirit will be talking, and the fireplace will be more vulgar and try to trick the player the lower the sanity level goes. Additionally, sparks will fly out from the fireplace while the firewood burns; lower sanity will cause the fire spirit to shoot out more sparks. These sparks can set fire to items and objects inside the cottage if the object is dry enough.

The second psychological mechanic was the radio, which can be found inside the cottage on the table. The radio can be turned on and off, tuned to different channels, and adjust volumes just like a regular radio would. Different radio channels act both as indirect tutorials and set the mood of the game, with channels giving instructions on how to use items in the game to slow and relaxing music channels. This is done by having different audio files loaded into the object in the game, triggering when the player turns the knobs on the radio to a certain angle.



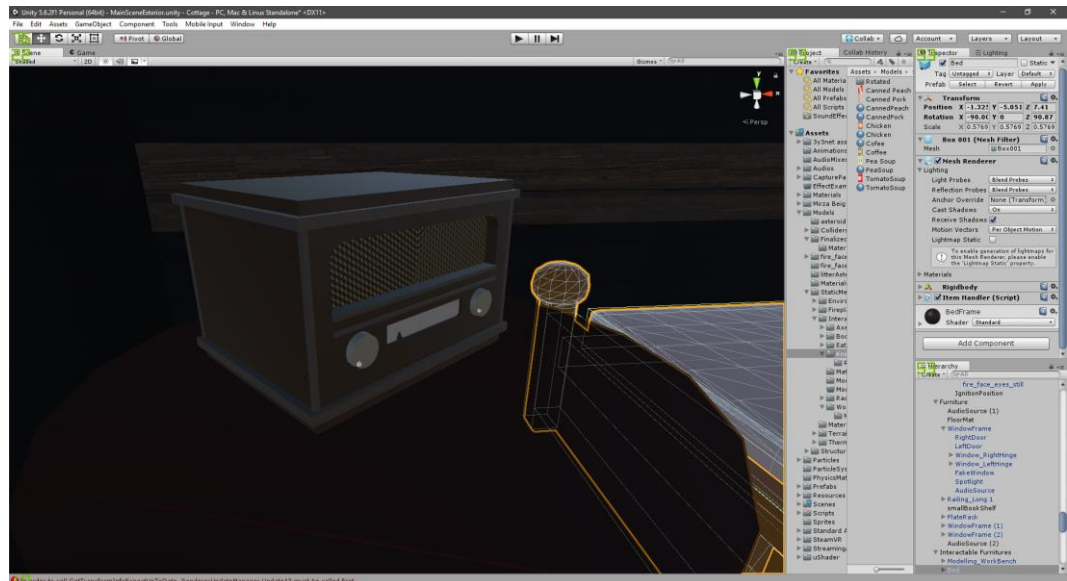


Image 24. The radio in the game, with two knobs for changing channels and volume.

Similar to the fireplace, the radio will have different behaviors based on the player's current level of sanity. The contents of the radio channels will change, giving more nonsensical and haunting audios if the player's sanity is too low. This mimics the experience of auditory hallucination that's often associated with schizophrenia.

#### 4.5 Message and Meaning

The Hut project includes different endings based on the player's interactions with the game, these endings carry different messages and are achieved through different means. During development and testing of the game, two different endings were implemented, a good ending and a bad ending.



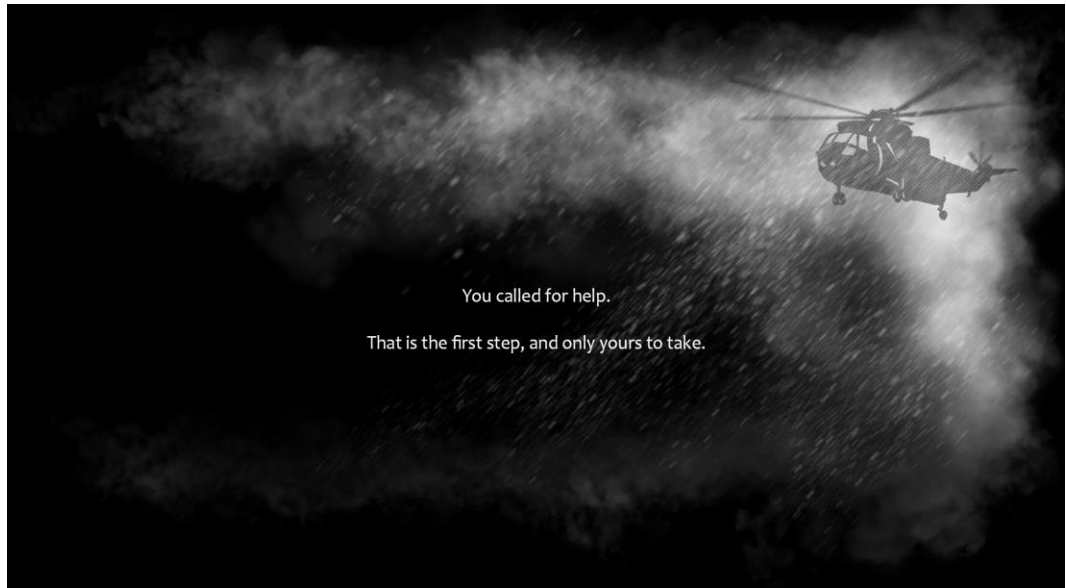


Image 25. The good ending screen, after the player successfully shot the flare gun.

The good ending is achieved by using the flare gun in the game to call for help, a representation of how the mental illness can be overcome with the help of others and by the player wilfully seeking for help. This is apparent also for schizophrenia, as mentioned in earlier sections with preventative therapies being more effective than just using medicinal treatments.

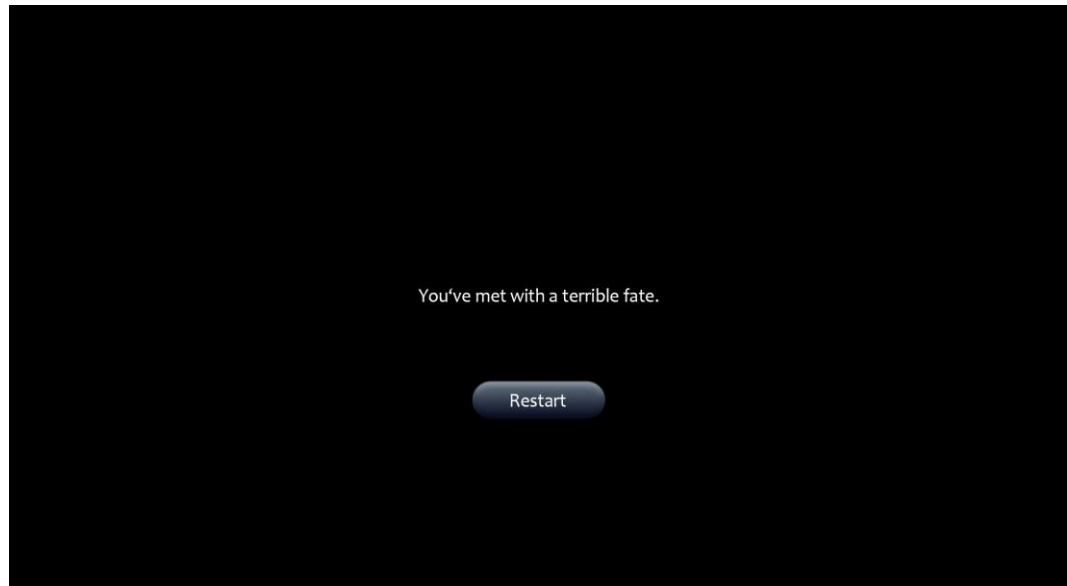


Image 26. A death screen appears whenever you die, with a restart button.

The bad ending is achieved through various ways, often resulting in one of the player's stats lowering and reaching zero. The cause of death is then mentioned in the game ending screen, showing what the player should have taken care of themselves with. This is an emphasis on how important taking care of one's self with basic needs is, during coping with mental illnesses such as schizophrenia.

#### 4.6 Testing

The Hut project was at a playable stage after 5 months of development, company X was able to gather enough potential investors and enthusiasts. This section will go over how the test was set up, background information on the testers' occupations and their reasons for testing the game, and the results of the test all of which will remain closed as recordings were prohibited. However, observations and written notes were taken from the testing session.

The testing of the game was done in an indoor environment, on the HTC Vive and a personal computer that was brought in by company X. Each tester was introduced to basic controls and premise of the game before trying out, knowing that the game will be about mental illness.

Testers consisted of two groups, investors and former addicts who have developed some forms mental illness. The investors tested and judged the game based on marketability and development potential of the game, while the former addicts gave their impression on how the game affected them as they played.

The test was well received by both the investors and former addicts, who approved the emphasis on the importance of basic needs in the game like food and heat. The game was also deemed easy to pick up and play, even for testers who weren't familiar with neither virtual reality nor video games.

Afterwards, testers also discussed and shared their inputs on how the game covers the subject of mental illness, commenting on the lack of a proper story for the game. Additional constructive feedback includes expanding on the player's potential range of activities within the game, adding in more interactive objects and items, and the game's potential educational uses.

## 5 DISCUSSION AND CONCLUSIONS

This chapter summarizes the thesis, comparing the outcome to the predetermined objective, and judging its reliability and validity. Lastly, the limitations and conclusions of the thesis are presented.

### 5.1 Summary

The goal of the thesis was to design an ideal virtual reality psychological game that mixes well the elements of both fields, with an emphasis on mental illness. The research provided insights virtual reality game developers' theorems, giving tips and tricks on how to make and design virtual reality games. Case studies on psychological horror video games *Amnesia* and *Silent Hill* provided information on visual, character, narrative, and audio design to manipulate a player's psychology.

The game project delivered a high-level blueprint design document with pictures, with explanations looping back to the case studies on why certain mechanics and design decisions were made during development. The blueprint was developed to a degree into a playable demo that served as a proof-of-concept, which was afterward tested for playability, marketability, and development potential by a closed tester group.

In conclusion, the game design blueprint was successfully created and tested to a degree with positive reception. The game design blueprint can be used as a starting point for development on virtual reality psychological games.

## 5.2 Objective versus Outcome

The objective of the study was to design a blueprint of a virtual reality psychological game, combining elements from previous existing video games. The outcome is a game project done by company X, which was received well by testers. The game blueprint also answered the research question on combining different elements from virtual reality and psychological games into a cohesive result. The objective was not only done by designing a blueprint, but also tested as a practical demo. Hence, the outcome of the research can be considered to meet its objective.

## 5.3 Limitations

This research has a few limitations. Firstly, this research is a study of virtual reality and psychological game at the present time. This means that when more advances are made in the future, some of the research concepts here will be less insightful and outdated. Secondly, a lot of design aspects of the game were only a blueprint due to technical and skill limits of the team working on the prototype of the game. Hence, the project as a whole serves more as a proof of concept rather than a real game.

## 5.4 Reliability and Validity

According to Eisner, qualitative research can help “understand a situation that would otherwise be enigmatic or confusing” (Golafshani 2003, 601). This translates into the different theorems and techniques used in both Virtual Reality games and psychological games studied in this thesis,

which were explained by the game makers themselves and further analyzed by different authors. Also, the sources used for this thesis were all relatively new and not obsolete, due to the topic of this research including Virtual Reality and psychological games which are both new.

Validity could be tested, according to Patton, by using triangulation as it “strengthens a study both by combining methods. This can mean using several kinds of methods or data, including using both quantitative and qualitative approaches” (Golafshani 2003, 603). The case studies in this research were examined with multiples sources, coming from different authors on the same subject at different time and location. This is suitable for the thesis’s aim, as the objective is to design a game blueprint coalescing the theorems and designs behind both psychological and virtual reality games.

Furthermore, as the game was met with good receptions from potential investors and testers, the project could be considered a successful proof of concept.

### 5.5 Suggestions for further study

Due to the technical limitations and time constraints on the project, suggestions for further study would be to fully develop all the aforementioned game mechanics in the game design blueprint. In addition, testing the game on a wider audience would allow for better results and feedback.

The game design blueprint is a model of reference for any developers

looking to create a virtual reality psychological game; however, each part of the game blueprint covers both virtual reality and psychological elements. Hence, the thesis is useful for either approach to design whether it is virtual reality or psychological. Also, the thesis is insightful for game designers in general because it is a blueprint.

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