

## The Infinity Game with Virtual Reality Technology

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**Abstract.** Virtual reality technology (VR), refers to the use of computers to generate a kind of visual and auditory directly on the participants, and allow them to observe and operate interactive virtual world technology. However, this work wants VR games to have a psychological impact on people. So, this work came up with a game for that purpose. The whole core feature of the game's design is infinity, and players will learn the true value of life: being brave and taking risks, or staying in your comfort zone. There are two main scenarios for the development of 3D workspaces and environments. The first is the aforementioned corridor, which is the main interactive environment where the player is trapped and needs to find a way out. The second is the hospital, where if the player chooses to leave, he will end up in a hospital bed, which means he will leave his family in the hallway and not be able to see them forever. In the end, this work interviewed nearly 30 different players. Most people gave us positive comments about the game, whether it was the music, the scenes, or the objects, it felt intense and exciting. It also causes them to think about life. Everyone has a different choice. This is in line with the expectations. Therefore, it can be concluded that the success of this game has caused a psychological impact on players and triggered their thinking about life.

**Keywords:** Virtual Reality; Game; Design; Interactive Environment.

### 1. Introduction

The virtual reality (VR) is the method that could use to create and experience a virtual world in the computer system. This method could be used to give the user an immersive sensation mainly through the sight and hearing. The origin of virtual reality technology could trace back to 1838, based on the theory of stereopsis. During that period, the virtual reality technology was more like the definition of three dimension (3D) [1]. Until 1929, an American, Edwin Link designed the first commercial fly training simulator, The Link Trainer. After that, during the 20th century, the virtual reality technology had developed a lot. Until now, the trend of its development is becoming lighter and more convenient.

The VR technology could be used in many fields. For example, in psychotherapy field, the technology that use to cure mental damage called virtual reality exposure therapy (VRET). This method creates a virtual environment for the patient to cure their post-traumatic stress disorder (PTSD). Here are two examples of using this method. First, the psychologists use the computer to create a scenery that a plane is taking off to cure the patients' fear of taking plane. Second, the psychologists use VR to cure soldiers' PTSD on battlefields. These two examples exhibit that the VRET has a bright future of development. It is cheaper and more variable than create a real environment [2].

The VR could be used in many fields in the future; Thus, this work decides to create the game, Infinity. The goal of creating this game is to inspire people to think about one question: should people face the reality or just stay in the wonderful world in their mind. In many art works, the future life is mostly imagined as a world where most people live in poor lives and depend on the virtual world to

escape from the reality, like what the movie Ready Player One described. In the game Infinity, the main character that the player controls, Steve, lost his family in an accident, and he will choose to face the reality that his family died or stay with them in the virtual world.

## 2. Related Work

This work first inspired by the game Super liminal, there was a part of an infinite loop in that game that was very fascinating. Super liminal is a first-person puzzle game based on forced perspective and optical illusions [3]. Puzzles in this game give you a sense of the unexpected. Players need to change their perspective and think outside the box to wake up from the dream. In the game, they use a lot of visual techniques, this work will list two of them. Forced Perspective: Forced perspective is an illusion where the viewer is misled as to the size of an object. Think of the classic photo of a tourist appearing to hold up the Tower of Pisa with their hand. When this work picks up any object in Super liminal, it appears the same size no matter where this work look. Pick up a small chess piece on a table in front of us, look towards a far-away wall [4], and drop it. It's now a giant chess piece! Trompe-l'oeil: Trompe-l'oeil is an illusion where an image appears to be three-dimensional when viewed from a certain angle. A real-world example would be 3D sidewalk chalk drawings. This is used frequently in Super liminal in several different incarnations. In its simplest form, the player may be fooled into seeing an object that isn't actually there. In more elaborate scenarios, objects can manifest themselves out of thin air when the image is seen from the right vantage [5]. In some ways, 3D rendering makes these illusions easy to do: this work can render an object from a particular viewport, and then have that resulting image projected again from that viewpoint. this work can even do this in real life with a camera and a projector. However, these illusions rarely fall on completely flat surfaces, so this work need to be careful not to draw on surfaces occluded by other surfaces. Using the depth information from the camera that took the original image, this work can able to render this correctly.

## 3. Methods

For the overall core function of this game design, infinity, the players will learn about the true value of the life: being brave and adventure, or stay in their comfort zone. There are always many chances or decisions in the life that need to make choices between two. People think there is always one that is better than another one. In the game, there are also two choices each player has to make, which is leave the corridor or stay. When players choose to stay inside of the corridor, they will face a challenge that whatever they finish the later tasks or not, they cannot get out of this corridor forever, but instead, Steve, which is the main character, is able to meet with their families when circling. If the players choose to leave the corridor by clicking the button of leave shown on the UI, players will suddenly be sent to another three-dimensional environment which Steve is lying on the hospital bed, which means he leaves his family in the corridor and cannot meet them forever, but instead, Steve is back in reality. The two choices mean two completely different lifestyles which leads to essential considerations of each player.

### 3.1 Scenes

For the development of three-dimensional workspace and environment, there are mainly two different scenes. The first one is the corridor as mentioned previously, and it serves the main interactive environment in which players are trapped inside and have to find ways out [6-7]. In the Unity 3d, the corridor can be divided into three parts, which are walls, ceilings, and floors. Each of these is constructed in 2d mode. Building the quadrature ceiling requires vertically shift in the wireframe, and the ratio is 2:1, which better fits the corridor construction (Figure 1-2). In the game display, Full HD is 1920\*1080. For other non-interactive tools on the wall are from assets store in the Unity 3d. The FPS controller contains three elements which are born scene, character 1, and character 2. The born scene is set as default, and the position of transformation for X, Y, and Z is respectively -23.245,

2.069, and -0.306. Other parameters such as the lightning for cast shadows is on and receive shadows. The light probes, reflection probes and anchor overrider are set as blend all probes in order to transform smoothly between scenes. For the development of hospital, the interface is used as system collections, and the Mesh Collider is mixed in an attempt to make Motion Vectors per object dynamic [8]. The rotation of the hospital bed model scale is set respectively as X=3.8846, Y=3.8846, Z=3.8846. The character controller for slope limit is 45, and step offset is 0.3. The radius, skin width, and height are also set respectively as 0.5, 0.08, and 1.8.

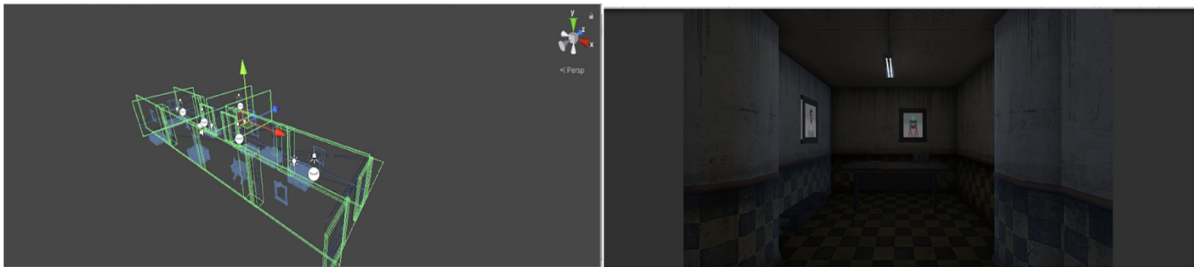


Fig 1. The corridor from modeling

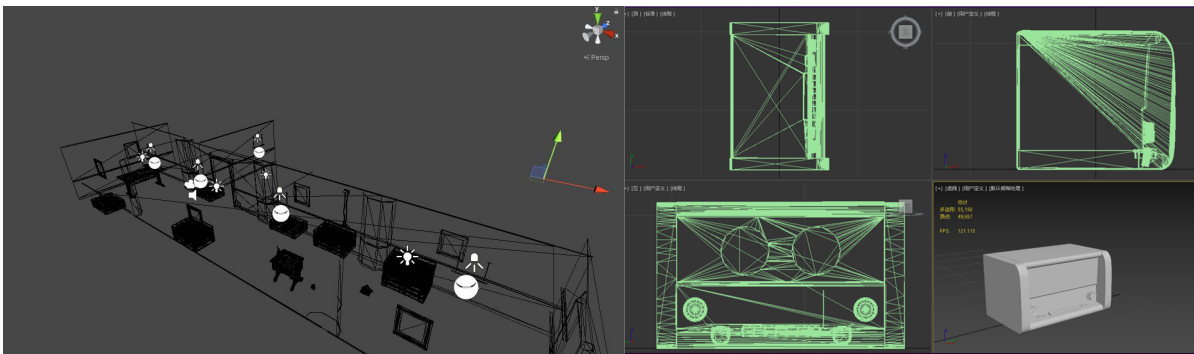


Fig 2. Model building process

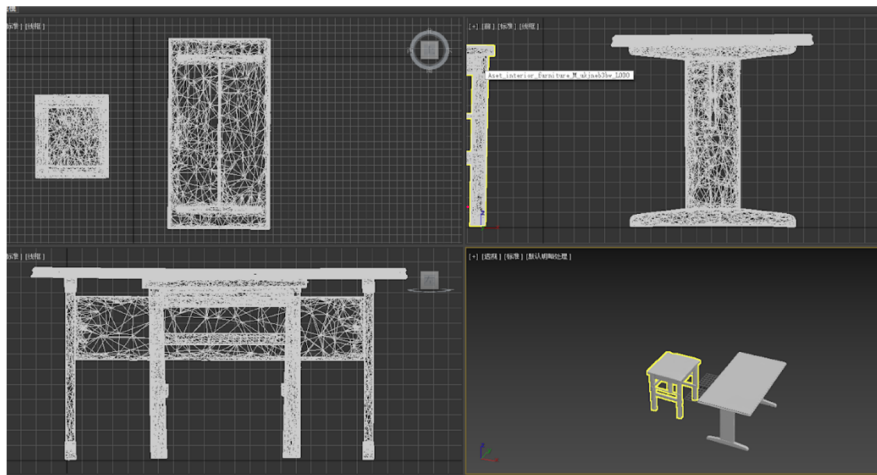
### 3.2 Character Design

Drawing the general size and location of eyes, nose, and mouth on paper, then moving it into digital version and finally adjusting its real size and eliminating the residuals between the visual effects made on paper and on PC was the general process of modeling the characters. For Steve's wife, Jane, and Steve's daughter, Anny, because in the story setting, they are dead, the team then planned to make them be in a half-transparency outlook in order to make them look like real souls. However, when finishing the last step of modeling, this work suddenly found that they looked so weird and even scared like ghosts rather than souls though it was not what they intended to do. Because the UI interactive interface is not shown respectively as the occurrence order.

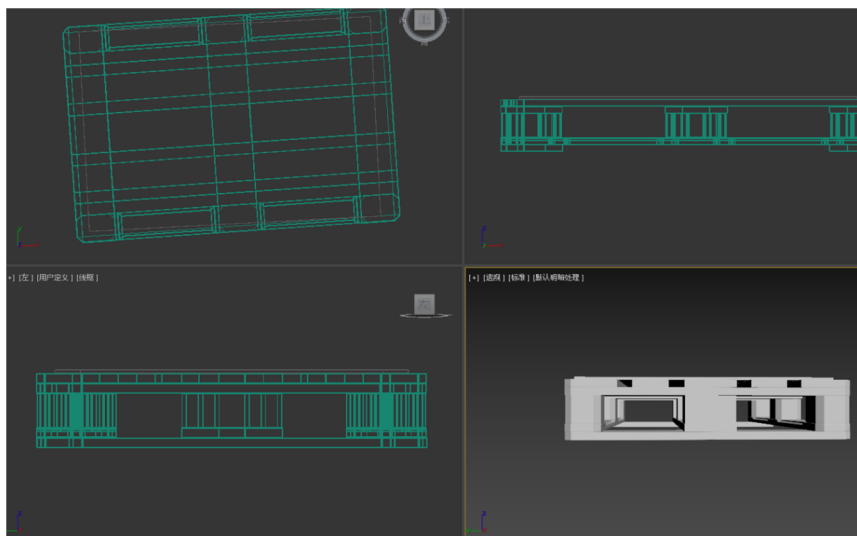
### 3.3 Model Building

For the overall process of 3d modeling, there are three different aspects of function served by a variety of platform, such as Houdini, 3d max, and maya [9]. First, the interactive tools in this game are achieved by using different parameters of polygon in the 3d max (Figure 3-4). Calculating the sizes of polygons such as pentagon or hexagon are essential to model the later three-dimensional space. All the old tables and chairs inside of the 3d environment also are modeled by using wireframe corresponded with the specific size which is 43\*39\*28. Although the standardized benchmark for a regular cuboid do not match with the specific size, in order to construct a sense of fold and old, 43\*39\*28 would be the best fit in such an environment [10]. Secondly, the three-dimensional render of the characters which are Steve, his daughter, and his wife, are applied through transparent mode. Curating the half-transparency is the only key way to extrude the characters. Since the way Steve shows is through first-person perspective, and his wife and daughter are shown through third-person

perspective, the achievement of interacting between two types of different perspective is crucial when deciding the parameters. Finally, modeling special interactive tools such as the radio and the newspaper has to be both modeled and coded, since the sense of interactivity with players. The subtotal of accumulating the polygons is 55,192; the climax is 49,657; FPS equals to 121,115. The degree of light and shade is auto-generated because the value of default setting.



**Fig 3.** Model building process details



**Fig 4.** Model building process details

## 4. Result

The story of the whole game is adapted from the inspiration this work got from a movie. this work also changed some games according to the pictures when this work played the game, so the whole game has a strong narrative. Meanwhile, the story has a strong mystery. At the same time, this work wants to give readers a unique sense of depression. this work uses several methods to highlight this feeling: first, this work uses a gray color and suppressed lights to give players a tense and exciting atmosphere. Let the players unconsciously get nervous in the process of playing, and firmly hold the hearts of the players. Secondly, this work uses a kind of depressive music to create the atmosphere. this work should know that music is a very special prop in the game and can also bring a unique experience to the player. In this process, this work also tested many kinds to find better background music.

Another important feature of the game is that this work makes two different endings according to the story. Players can choose their final outcome through their own choices and feelings made in the game. In the process of interacting with various items, players will gradually understand the whole process of the event, so each player will have his own different choices. In the opinion, only such a game can be truly called a fabulous game, and only when there is the right to choose independently can this VR game become more attractive. the first ending is that after knowing the background of the whole thing, the protagonist chooses to be reunited with his family in this virtual space forever. But at the same time, his real body will also be unconscious forever. This seems to be a very stupid decision, but after the thinking, this work think that when people really encounter this kind of thing, they will not be so easy to let go of this kind of concern, because human feelings are very complex. the second outcome is just the opposite. In this ending, the protagonist will wake up in the hospital and leave the virtual world forever. But at the same time, the protagonist also has to bear the fact that his wife and children have died. This is a very cruel decision. this work believe that everyone has his own choice, so this work hope that players can have more autonomy and freedom when playing the games, and can make their own choices. this work also made different scenarios for this. this work created a happy scene when players and their families this work reunited. At the same time, this work also produced the scenes of the wards that woke up in the hospital and the whole hospital.

As shown in the Table 1, this work interviewed nearly 30 different players.

**Table 1.** Performance evaluation analysis

	Innovation	immersion	Fluency	definition	Integrity
75-100	√	√			√
50-75			√	√	
25-50					
0-25					

This work gave a good evaluation in this game. Different endings have attracted people's attention, especially by a wide range of players. Everyone can make different choices. It also shocked us that it was a game completed in a few weeks. In terms of clarity, perhaps because of time, some of them are not careful enough, but they are excellent in most items. In terms of immersion, it gives people a sense of tension and excitement whether it is music, scenes or objects. It will be better when it is made into a VR game. In terms of completeness, there are not only the completion of the game, but also many details, whether it is the background of the game, the music of the game or interactive items, which make the game very attractive. This work also hope that more people can experience this game. This game is not very large, so it can be easily applied to any computer, so it is very excellent in terms of fluency, especially in the interaction of props, which is very smooth, and there is no strange feeling when opening the door. This work think storytelling is also a highlight of this game. The two endings are also closely related to the story theme, so that players have a strong sense of participation and won't feel bored

## 5. Conclusion

In this passage, this work mainly discussed about how to create a virtual environment to give the player a sense of immersive, to be inspired by the story to think about what is a meaningful life and whether people would prefer an ideal virtual world or a real world. In order to find the solution of these questions, this work created the game: Infinity. In Infinity, the player will experience the virtual space this work created to feel what the character in the story, Steve's feeling is. The player will feel the sense of staying in a half-limited region, that is a circling enclosed space, in the game, this work created an infinite staircase to let the player feel it. this work uses the main storyline to enable the player think about the question: stay in an ideal virtual world or a real world. this work created the demonstration of the last part of the game where the player has to make the choice in the end and the 3D models that this work uses still need to be improved to create a stronger sense of immersive. The

virtual reality technology development is still improving. The use of it can make a very strong affection on the development of science and technology, it has a very broad prospects on the areas such as physical, medicine, media, military use, aerospace and industry. However, it still needs to improve to deal with the problems like how to make it really feels like the real world and how to let the user adapt to this virtual reality environment. Thus, the development of virtual reality technology will not be so smoothly.

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