A brief analysis of the method of VR games to enhance immersion---- taking the game "Mind Concretization Company" as an example

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Abstract. Virtual reality technology has been used in many fields recently, including video game. Its unique features make it an ideal platform for immersive games. However, can't achieve complicate operation and frequent interruption are two major problems that block PC or host game players to try on VR games. To find new solutions, we design the game "Mental concretization service center", to increase the sense of immersion and attract more players. In contrast to other pure puzzle-solving games or exploring games, our project focus more on the plot, aiming to create an emotional bond between players and protagonist and guide players to reach their own ends. For each level, the scenes are accord with character's personality and will change its styles to match the plot or contribute to puzzles. Moreover, we used multiple senses such as environmental sound to inspire players figuring out the puzzle, forcing them pay more attention which thus led to immersion. With the help of game engine, we built our first version and tested it in a small scale. The result was encouraging, showing that our methods had some preliminary effects on improving immersion.

Keywords: Virtual reality, immersion, game, mind concretization.

1. Introduction

Virtual reality technology is a new technology developed based on computer digital technology. It has obvious characteristics and advantages, and can bring visual impact to users intuitively and deeply [1]. It bases on 3D graphics technology, multimedia technology, simulation technology etc., and create a realistic virtual world of 3D vision, touch, smell and other sensory experiences with the help of computers and other equipment, creating a virtual world that can have a strong feeling of immersive. Up to now, it has applied to various fields including entertainment, medicine and art design. Typically speaking, Higher immersion, greater interactivity and high fidelity are the three main characteristics of VR games [2].

Due to these features, virtual reality is absolutely an ideal platform for game design. Traditional video games focus the players' attention on the characters. By controlling their movements, players can have a feeling of being brought in. Virtual reality games, instead, combine the player's own actions with the instant response of the game environment, bringing players a new game experience. Since 2016, a large number of virtual reality game works have emerged worldwide [3]. There are many types of games involved, including strategy, adventure, action and storytelling. In these games, because of the obvious characteristic that it is difficult to acquire such experiences in reality, people can not only relax their body and mind, release pressure, but also involve in emotional connections in the game interaction to let players realize the added value of games in addition to entertainment value [4].

However, there are still some notable drawbacks lies in most virtual reality games. One of those is interruption, which could influence player's immersive experience a lot. For example, typically, video game will be divided into different levels. After each level there will be a loading time. How long it will be depending on the performance of your device. For wearable VR glasses, they are weak

at generating sophisticated scenes, meaning that the loading time might be quite long, which is annoying. Meanwhile, the most common way of controlling is through a game console. Unlike the keyboard and mouse, it is less powerful and precise to make complicate movement or give orders simultaneously. These disadvantages may act like walls blocking PC game players to try on VR games.

Our project aims to find new solutions to the drawbacks above. With the increasing pressure on people's study, work and life, the virtual world with a strong sense of immersion can not only meet people's visual aesthetic needs, but also enable many users with psychological and cognitive needs to escape from reality for a short time to meet their psychological needs [5]. We focus on how to increase immersion in the VR environment by building an emotional bond between the character and the player. The main story is a boy who travel to other people’s inner world and help them overcome some mental problems.

The settings will change frequently between the reality and imaginary worlds, bringing the players in and sharing feeling with the characters. To create a full immersion, we make some innovations including multi-sensory on the interactive mechanism.

2. Game outline design and plot writing

Compared with 3D games or 2D game production, VR games focus on the user's actual experience, and do not need to set up a large number of guidance processes in the early stage to help users understand the basic content of the game [6]. The main keynote of the game is a puzzle game with storytelling, and the gameplay has been extended to collect, solve puzzles, parkour and other types of games In multi-level mode, the plot uses the unique interactive performance and immersive experience of VR technology to drive players to explore the game map and collect props, thereby making up for the lack of interaction in traditional puzzle games and enhancing the authenticity of the game's plot. In the game "Mind Concretization Company", players need to play as an ordinary boy with a chance to join a high-tech company and treat mental problems by using a special machine to enter the brains of others. The game creates an immersive experience that allows players to step inside their characters and help them overcome pain, fear and regret. They'll explore the character's inner world and real world, collecting items that can act as a bridge between the world and the keys to the puzzle. At the same time, they can learn the stories of different people and communicate with them emotionally. The story is told in first person and comes from a silent and aloof high school student who recently joined the company and begins his journey of healing others. The protagonist's inner world is explored from the first-person perspective, but the plot animation can be expressed in 2D, and the protagonist's own image can also appear. The plot continues to serve as part of the game's role in enhancing the player's emotional connection and immersion.

3. Game function design

3.1.Emotional link and mood enhancement

Players need to explore in different spaces, find objects, interact with the scene, and use props and abilities to solve the puzzles required by the game plot; the success of exploration and puzzle solving will promote the development of the plot. All perfectly explored triggers will earn achievement mementos, and all collectible achievements will go into special episodes. If the puzzle fails, the content of this episode needs to be replayed. A poor choice of plot can lead to a bad ending. Through branching endings, the plot develops in different directions depending on the player's choices. The expectation of the game is that the player can guide the protagonist according to his own values to reach the end point recognized by the player. By solving these puzzles, players can gain pride and confidence. Helping others also gives them a sense of accomplishment. The player may have an emotional connection with the character. Some of them may find similar experiences in their daily lives.

3.2.Increased immersion

The game requires frequent changes to the surrounding environment. Non-immersive formats make transitions between different settings less continuous than immersive ones (like loading pages), which can be a big distraction for players. Therefore, the functional design needs the support of VR technology, so that players can complete the game settings, interact and enter different levels in the VR game to produce a more excellent immersive audio-visual experience.

4. Game scene design

4.1.Scene layout design

The game environment is biased towards a variety of styles of scene secret rooms. In the scene layout, different areas are planned according to the game content of different levels. Filling in the light in a virtual reality animation scene will improve the effect of the film and guide the audience to attract the attention of the masses [7], and the positions of the light and the portal are reasonably planned, but it will be decided according to the different game goals whether to plan the player's fixed moving route and prop distribution: the goal is biased towards exploration At times, the layout of the scene will become complex and diverse, the route will not be planned in a fixed way, and the props will be evenly distributed. When the goal is biased towards customs clearance and plot development, the scene layout and route will be more fixed, and the distribution of props will be independent.

4.2.Scene style design

In addition, the style of the game will also change according to the scene: the style of the game in showing the main world will have advanced technology like the real world. The depiction of the environment is realistic, and the overall scene is biased towards a futuristic sci-fi style. In showing the inner world of different characters, there will be different styles in terms of personality and life experience. The overall scene tends to be dreamy, psychological horror and weird liminal space style. On the one hand, this design can better make players feel immersed in traveling between reality and dreams, and on the other hand, it can be combined with the plot to highlight the specificity of different styles and scenes, so that players can have different psychological and sensory experiences.

4.3.The effect of atmosphere creation

While the plot progresses, the scene plays a role in creating different atmospheres and sensory experiences, thereby increasing emotional connection and immersion by affecting the player's psychological state. The above two points, whether it is the scene layout or the style design, are designed to create the corresponding atmosphere of the game. For example, when creating a stimulating and tense atmosphere, the color of the game is dark colors such as blue, purple and black, and the props and architectural arrangements are more chaotic and compact (Shown in figure 1), and when it comes to creating a sense of uncertainty of exploration, design style may often move toward a threshold space style: people don't know what to expect, but something will happen (Shown in figure 2) [8-9]. If the plot achieves the purpose by directly stimulating people's emotions, then the scene atmosphere is to stimulate the player's sensory experience to affect the player's psychological feelings to achieve the purpose.

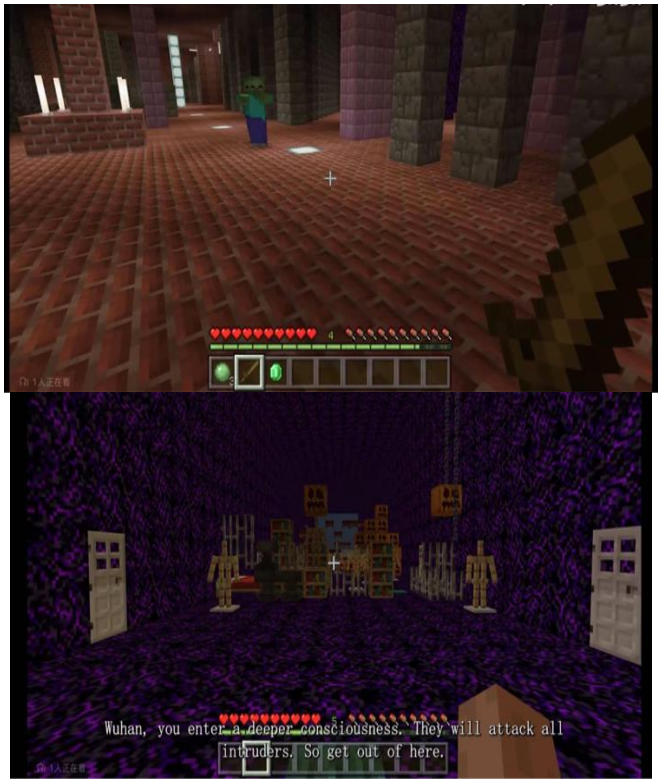


Figure 1. The atmosphere of the game

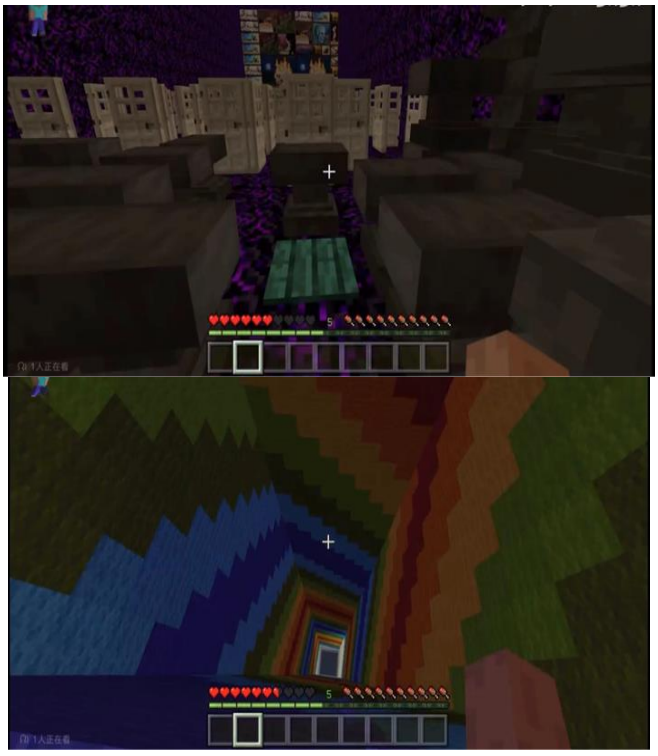


Figure 2. The style of uncertainty for exploration

4.4. Game module design

In order to test the degree of the game's immersive experience and the realization of the purpose of the game, the demo version of the game is currently designed with three levels, and the clearance method of each level is different from the module design:

4.5.The module design of the "Memory" level

The goal of this level is to find the key in the complex maze (Shown in figure 3), and then find and open the door that you can leave. The whole scene is blocked by various rooms and walls of different shapes. The road is tortuous and the clearance road is not fixed. route. The channels in different rooms of the scene are triggered by buttons, through mirrors and paintings, etc., which require and encourage players to explore the scene. Treasure chests are evenly distributed around the scene, where players can search for keys, weapons or achievement fragments. Achievement Fragments All Searches can synthesize achievement items, which are used to reward players who are willing to explore all the details of the scene. During this period, the player explores to the monster's spawn point and encounters the attack of the monster. The player needs to dodge or use weapons to fight against it. During this period, the health value is set. After being attacked by monsters for many times until the health value is zero, the game will restart. This level guides players to explore, search for props, battles and a series of operations in the maze through the plot, while matching complex scene design to enhance the player's sense of immersion.

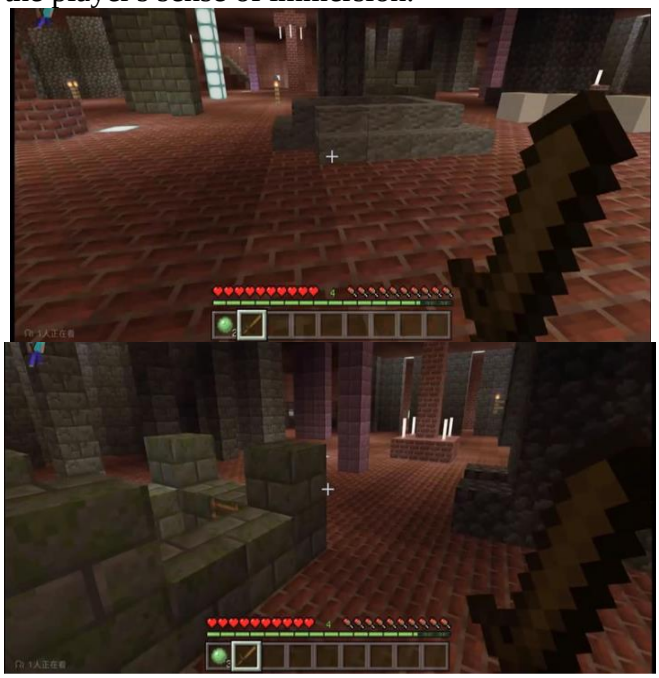


Figure 3. A huge maze in level 1

4.6.Modular design of the level "Locate by Sound"

The goal of this level is to find the correct route by hearing in a dangerous scene in the case of visual loss (Shown in figure 4). The lighting settings of the scene are very dim, and the player enters the level immediately into a blinded state, and can only see the surrounding environment at a very close distance. The early story will give players a hint that they need to use hearing to explore the road. The ground part of the overall scene is visually identical, but the ground area is different: the correct area will make a sound similar to wind chimes when walking; the warning area will sound when walking Stop; and when the player walks into the dangerous area, the trap will be triggered, which immediately shows that the game has failed and is teleported to the starting point of the game, and the game needs to be restarted. Players need to use their hearing while walking to find the correct path and reach the end. Among them, the player may go to some detours, which will increase the difficulty of the game, but the player can search for achievement items to improve the player's satisfaction. Through the innovative gameplay of sensory deprivation and stimulation, combined with story guidance, this level encourages players to reduce the strangeness and fear of the player's initial exploration, but also enhances the sense of immersion during play and the player's sense of achievement after completing the level.



Figure 4. The scene which can hardly to see but listen in level 2

4.7.The module design of the "Chasing Battle" level

The goal of this level is to conduct a chase battle in a road area full of obstacles. Players need to pass the obstacles in a parkour manner to avoid the pursuit of the terrifying monsters behind (Shown in figure 5). The number of monsters in this level is large and the movement speed is very fast. Players need to keep running all the time to avoid them. Players will encounter many obstacles in the process of escaping. In some cases, players need to find the only way through which obstacles can pass. In this case, the player needs to avoid obstacles that have a negative effect on the player. During the escape process, players are bound to be attacked by monsters, so they need to try their best to run to the end area before the health value drops to zero to clear the level, otherwise the game will restart. In the process of escaping, if the player is calm enough, he will find an achievement item hidden somewhere, which will bring positive effects to the player. The overall level of the process is terrifying and tense, bringing players full emotional experience and audio-visual immersion. This level further enhances the player's nervousness and fear through the sense of urgency of the time limit generated by the monsters and the horror style of the scene design, thereby improving the player's play immersion.



Figure 5 Dangerous monster chasing behind in level 3

5. Game model construction

5.1.Secret room design

The overall game scene is mainly composed of secret room elements. The overall modeling of the scene design of the secret room is based on the style of future sci-fi and liminal space. Some secret rooms are full of plot and real and clear, while others are large and empty., and the player explores alone. Usually, the secret room coexists with crises and opportunities, but players are often encouraged to explore boldly and solve puzzles independently. By giving players different psychological games and psychological feelings, it greatly enhances the player's sense of immersion and achievement.

5.2.Organ Design

Generally speaking, in puzzle games, organs play an important role in the game. Players often need to try or speculate to interact with the organs to change the content of the game and the direction of the plot. Players will generate positive feedback such as opening doors or making monsters disappear, and may also trigger negative feedback such as slowing down, being trapped, or even losing the game. The triggering option of the organ is fully handed over to the player, thereby increasing the playability of the game and further enhancing the player's psychological feeling to enhance the sense of immersion.

5.3.Character and Monster Design

The protagonists and plot characters in the game are all human beings in the normal world, and different costumes are set according to different identities such as students, researchers, and bosses. (Figure 6) Due to the first-person perspective of the game, the appearance of the protagonist is rarely seen by players, and its rich narrative is mainly reflected through dubbing and plot. As an important part of the game experience, the monsters in the game will change their shape and main color according to the different scene styles. Monsters in the inner world are often set as some negative emotions, mental illnesses and mental disorders in the inner world. (Figure 6) Usually monsters will actively attack the player and trigger the effect of reducing the health value. This threat makes the

game more complicated and increases the psychological feeling and immersion experience of the player when playing.



Figure 6 Human model (Left) and monster model (Right) with simple functionality

6. Result and discussion

6.1.Experimental analysis

For our design, we got some relevant data. We created a questionnaire to ask how viewers feel. There are the questions: 1: what about the story? 2: what about the game screen? 3: when u watch the video, do you immersive in it?

We found some people who were interested in virtual reality games to be the subjects of our first version, and sent out a questionnaire after they made it through. In terms of the age of the participants showed that 60% of participants at the age of 12-18, and 25% of them were 18-24, meaning that young people interested in virtual reality game most (Table 1). Among all the attendees, 63.64% people thought our design has a good story, and 18.18%. thought the story is not too bad. Our plot had succeeded to some extent. The next question was about the artistic designs of the three level. Over 50% people thought all of three levels has a colorful game screen, but someone said that we just make good game screens in some of the levels. They commented that we need to put more details for our design of game screen. About the third question, over 60% people think they immersed in the game (Table 2). Of cause, the rest thought our design was not that immersive or didn't let him feel immersion at all. Though our methods had made some contributions to increasing immersion, we still need to make more progress to fit different people's tastes on playing games. Surprisingly, all of the subjects claimed that they finished all the levels in less than 10 min, and even 40% of them finished in just 5 min.

Table 1. Questionnaire Results on age and finishing time

Age	**12-18**	**18-24**	**Over24**
Proportion	60%	25%	5%
Finishing time	Less than 5min	5-10min	Over10min
Proportion	40%	60%	0%

Table 2. Questionnaire Results on game experience

Question	**Good**	**Average**
What about the story	63.64%	18.18%
What about the artistic designs	Over 50%	/
Do you immersive when you watch the video	over 60%	/

7. Discussion

How to achieve immersion also is the most important things about the game. When we made our final project, we have asked for some friends that how to achieve the immersion for game. Of course, they give us some feedback, and the same point in those feedbacks is achieving through player empathy. For it, we surveyed TGA's Game of the Year in previous years, just the table. We also collected the ratings of FAMICOM which is one of the most famous game review sites. According the table 3, the game screen, soundtrack and plot got the 10 points the most times. So, achieving immersion, we need to think to let players feel that they are in the game world and they can do they think what they want. Actually, give some freedom to players can encourage the player to explore the game world and good game screen and soundtrack can make them easy to immerse the game.

Table 3 Score of get "The Game of the Year" from FAMICON

Game	Game screen	Soundtrack	plot	Gameplay	Total
The Legend of Zelda: Breath of the Wild (2017)	10/10	10/10	10/10	10/10	40/40
God of War (2018)	10/10	9/10	10/10	9/10	38/40
SEKIRO: Shadows Die Twice (2019)	9/10	10/10	9/10	9/10	37/40
The Last of Us: Part II (2020)	10/10	10/10	10/10	9/10	39/40

By the way, a good game needs to put more time and more energy to make it perfectly. We will try our best to improve gameplay and make player can immerse into the game.

For our design, according the rating of FAMICOM, we can know what we need to perfect our work. Initially, the plot or the story of game is one of the significant things in games because a good story can catch the players' eyes! We created a huge world about our game, but we just show a little of it, so we need to put more details in the future and make our plot more unique. About the gameplay, we are going to make a puzzle game, which can attract most players to play. Actually, there are not all the player are interested in the game of puzzle. So, in the future, we will think about adding other combat system and richer interactions to enhance the player's gaming experience. And important things about gameplay is the gamer experience in the game. "Gamers do have a well-defined implicit notion of what gameplay is, and, when talking about gameplay and their play experiences, they always refer to what can be done in the game, focusing on:

- What the player can do;
- What other entities can do, in response to player's actions (i.e. how the game responds to player's decisions)." (From Gameplay and game mechanics: a key to quality in videogames [10]). For the gameplay, also we need to think about what the gamer feeling when they play the game and their experience. The soundtrack and the game screen are more difficult to achieve, the soundtrack requires us to listen to a large number of music to choose, also we maybe need a group which is good at music to manage it, and the realization of the sense of picture requires us to understand the basis of painting theory first and also it need a group of professionals to make it. In the future, we will try our best to make a better experience of game screen and soundtrack.

8. Conclusion

This research project was conducted to find distinct solutions and methods to increase the immersive feeling of virtual reality games. Considering the apparent defects, interrupting and simple interactions, we designed the game "Mental concretization service center", combining the puzzle solving with storytelling as well as collecting and parkour. The main aspect of the game is traveling between real word and others' inner worlds by solving puzzles and collect things. We hoped to bond the players with the characters in the game, so we designed branches of plots that allow players to make choices based on their own values. The scene design is in line with the plot and the character's

personality and life experience, giving players a visual contrast between different worlds. The overall style tends to be imaginary, futuristic and psychological horror. With the help of real-time game engines, our game could make smooth transitions between different scenes.

We designed and built three levels: “Memory”, "Locate by Sound" and "Chasing Battle" and find some subjects to test our project. About 70% of people said they were attracted by the plot, and more than 60% of people said they had a sense of immersion while playing our game. The result showed that the methods we used in our design had some effects on creating immersion. However, we also found some problems and had received suggestions from the test. For example, little time of completing each level may reveal that the difficulty is too low. Besides, we are happy to see many teenagers are interested in virtual reality games. The market potential of it immeasurable and it is rewarding to keep exploring new ways to improve playing experience of VR games by enhancing immersive feeling.

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