

The application of virtual reality in games

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Abstract—Virtual reality technology is a rapid development of technology in recent years, for the development of the field of video games has a vital role. Using image display, human-computer interaction, and other technologies to generate a three-dimensional environment. Enable participants to interact and manipulate virtual environments and objects in real-time. This paper analyzes the characteristics of virtual reality technology and expounds application of virtual reality technology in video games. Through the background, the characteristics of VR technology are analyzed. Furthermore, we discuss and analyze the interactive influence of virtual reality on games from the aspects of game sound production and somatosensory interaction. Besides, this article also analyzes the differences between traditional 2D games and virtual reality-based games (Horror games and Escape rooms, for example). Finally, it summarizes the electronic games on virtual reality equipment, shows the positive impact of virtual reality on economy and society, and looks into the future of virtual reality.

Keywords—virtual reality, 3D games, immersive experience, somatosensory interaction

I. INTRODUCTION

Virtual reality (VR) is a new science and technology developed in the 20th century. As a computer-aided generation of a high-tech simulation system, Virtual reality is a new technology that generates three-dimensional virtual world by computer computing simulation. Users get sensory simulations similar to those of the real world, such as audio, visual and touch. Compared with traditional computer technology, virtual reality allows users to have more timely immersive feedback when observing and interacting in a three-dimensional environment. With the continuous development of social productivity and science and technology, VR technology has made great progress and gradually become a new field of science and technology. There is a growing demand for this new technology in many industries, especially in the game industry. Many 3D games require interaction in a three-dimensional environment, and virtual reality technology can provide a more realistic environment. As mentioned earlier, virtual reality technology uses computer-generated three-dimensional space as the basis for three-dimensional games. Games using this technology can greatly enhance the realism of the game while ensuring real-time and interactivity [1].

Ever since the birth of computer games, people have been longing for the scenes in computer games to become more realistic and lifelike. Traditional PC games are played by setting up a game scene in which the player is only a participant and only interacts with objects in the game [2]. But no matter how realistic the scene, no matter how high the resolution of the computer screen, the presence and use of the

computer screen can feel like an outsider. However, VR games make the entertainers become active participants in the game and even participate in the setting of the game scene. VR technology is a good solution to this shortcoming. Human-computer interaction technology ensures continuous communication between people and games, and simulation technology gives people a sense of being on the scene.

Although VR technology has been widely developed in the field of games, the relevant literatures are not thorough and comprehensive enough to summarize the field [3-5]. Therefore, this paper analyzes and summarizes the characteristics of VR technology from the perspective of VR development. Then, the influence of virtual reality on games is discussed from the aspects of sound production and motion-sensing interaction. In addition, this article also analyzes the differences between traditional 2D games and virtual reality-based games. Finally, it summarizes the role of VR in interactive games and the impact of VR on the video game industry.

II. MAIN BODY

In today's society, network technology and digital technology are developing rapidly. In this development process formed a complete VR game system. It can create a virtual, loyal environment for users based on the VR applications. In addition, VR reality is one of the most important and widely used technologies in this era [6]. At present, the emergence and popularity of many 3D games have proved the success of VR technology in entertainment games. Therefore, the research and analysis of the application of VR in specific 3D games has high research value. However, at present, many VR production technologies have been used in developed regions and countries just like the United States and Europe, and have achieved good social and economic effects. Also, with no doubts, the development of VR technology in China is also very good. It is very important to explore the technical advantages of VR in game design and improve the overall application level of VR. In this article, we will introduce the VR with development history, characteristics, and its application in games.

A. The development history of VR

VR technology is a new practical technology developed in the 20th century. VR technology contains computer, electronic information and simulation technology [7]. Its basic realization method is to use computer to simulate virtual environment, in this way, it can bring people a sense of immersion in the environment. As the social productivity and technology kept develop continuously, the need for VR technology is growing in all age. VR technology has also created magnificent progress and gradually become a new

field of science and technology. VR means virtual and reality are combined. Theoretically speaking, a virtual world can be created and experienced by VR, which is a computer simulation system. It makes use of a computer-generated simulation environment to immerse users in the environment. The real data and electronic signals generated by the computer will be used by VR, combined with various output devices, so that they can be transformed into phenomena that people can feel. These phenomena can be real objects in the real world, or things we can't see with our naked eyes, represented by 3-D models. Because these phenomena are not actually what we see directly, but the world created by computer technology, that's why they are called VR.

VR technology has a short history. It was first developed in 1929 by a Simulator designed by an Englishman to train pilots, and then in 1956 by another Englishman to develop Sensorama, a multi-channel simulation experience system [8]. This is the first period of VR technology. The second period is the embryonic stage of VR. In 1972, a man named Nolan Bushnell developed the first video game that can be interacted with, Pong. The concept of VR and the initial formation of the theory took place in the third period. In the 1980s, VPL first proposed the concept of VR. The fourth stage is the further improvement and application of VR theory from 1990 to now [9]. Since the 21st century, VR software development system has been developing, such as MultiGen Vega, Open Scene Graph, Virtools and so on.

B. The characteristics of VR

The first characteristic is immersion. It is the main feature of VR technology. The idea is to allow users to become and feel part of the environment which is created by the computer system. When users use it, there will be perception including touch, taste, smell and so on, resulting in psychological immersion, feeling like entering the real world.

The second feature is interactivity, which refers to the user's degree of manipulation of objects in the environment and the degree of feedback from the environment. The higher the two degrees, the higher the interactivity of the environment.

The third feature is multisensory, which means that the computer technology should have many perceptual schemes, such as hearing, touch, smell and so on (Figure 1).



Figure 1. A boy can get sensory feedbacks with the VR device

The fourth feature is conceptualization. Users can broaden their cognitive scope in virtual space and create scenes that do not exist in the real world or environments that are impossible to happen.

The last feature is autonomy, which means that users can achieve their goals according to their own behaviors in the virtual environment.

III. THE APPLICATION OF VR IN GAMES

A. Stereo display technology and sound production technology

In games, we can recognize that visual effects have a lot to do with video games. While display technology, especially stereoscopic display technology is an important supporting technology of video games. In order to further enhance the experience of the game so that the player can be immersed in this game. At present, we can know that the display used is desktop stereoscopic display or helmet display. The screen of desktop stereoscopic display generates left and right eye view, alternately at a certain frequency [10]. And the user needs to wear stereoscopic glasses to have a good experience. Helmet display is another stereoscopic display device used in VR system. (See Figure2). The helmet is fixed and the head and the helmet cannot move relative to each other. It mainly takes images through the display on the helmet. And both of which are ordinary displays. Both displays provide users with a 3-dimensional field of view that enhances the game experience while in use.



Figure 2. All kinds of VR devices.

In video game consoles, sound output is just as important as graphic form in the players experience. In the experience process, the three-dimensional simulated sound is different from the familiar sound, which is a spherical sound that is generated around the ears and the sound is mainly above and in front of the head and behind the head. In resound allows users to accurately determine the position of the sound during the game, which is more effective. It can enhance the realism of the game by combining it with real game scenes.

According to the different types of applications, dynamic scanning technology is generally used in VR technology to carry out stereoscopic display. Dynamic scanning technology relies on the periodic motion of display equipment to form the imaging space. For example, the screen translation, rotation and other movements to form three-dimensional imaging space. In this technology, the stereoscopic image is projected onto the screen in a two-dimensional slice by a certain way, and then the screen does high-speed translation or rotation at the same time. Because of the visual residue of people's eyes, what they observe in human eyes is not a discrete two-dimensional picture, but a three-dimensional image composed of them. So, the stereo system using this technology can achieve true three-dimensional display of images. In addition, according to the different motion modes of the screen, this technology can be divided into translation body scanning display technology and rotating body scanning display

technology.

B. Somatosensory interaction technology

With the continuous development of science and technology, motion-sensing interaction is a brand new operation mode in VR, which further promotes the change of operation and gets rid of the mouse and keyboard, such as complex motion capture device, the user can through your body, on the main point for effective control, the application of VR, it effectively reduces the barriers to entry, but also expand the application range of VR, we are on the process of use, can really into the game, It's a new kind of revolution, and it's pushing the boundaries of how games are played [9].

It is mainly based on human motion capture to complete a series of operations, to the human body motion capture a variety of ways, usually will adopt the way of multiple cameras on the steps, to capture a user's posture and movement, step is done, can through the computer control command to relevant actions for effective implementation. Execution, to computer through relevant to the human body movement tracking, and put them to the computer of the motion capture to interact in order to further enhance the detection effect, also can wear special auxiliary equipment to complete the relevant operation, the user can handheld devices, equipment can be placed beside, hand-held devices sent by receiving device to receive the signal, So as to realize the recognition of human movement. In the whole process of the activity, players through the relevant software control commands, to achieve the virtual world in the game [11].

C. The influence of interaction in VR games

Speaking of VR interaction, we still have to start from the beginning of the game. At the beginning, people interact with games through the handle. With the popularity of computers, computer games have gradually emerged, followed by a new way of interaction is the keyboard. But these two methods obviously lack immersion. In other words, the player is looking at the computer screen or TV, but the keyboard or handle is controlled in his hand, which separates the player's vision from the control, that is, the player is not completely immersed in the game. In the horror game, the player controls the protagonist to attack the enemy, or escape the enemy, or decrypt. These operations only occur on the keyboard or handle, which can not bring players into the game and make players feel that they are facing these frightening monsters.

Although fundamental fears, such as the unknown, are inherent to the human being [12], more specific fears, such as darkness and apparitions, are individual and can vary from person to person, depending mainly on personal experiences [13].

However, the interaction mode brought by VR is really new. VR, when compared to non-immersive technologies, induces a higher level of emotion on its users [11] Through VR glasses and VR handle, players can better experience the direct interaction with monsters. Some simple actions, such as opening the door and picking up a prop, can shock players more than traditional games. Still taking half-life as an example, the interaction in this game is also a highlight, aim at the target, wave your arm, and then catch the thrown object. This interactive scheme based on intuitive feedback can be said to perfectly solve the old problem of how to quickly, conveniently and accurately take objects in previous VR games. Moreover, gravity gloves do not have any sense of compromise for game design, but perfectly fit the game setting

of "Half-Life" series.

In most scenes, gravity gloves are the main force to explore the unknown. It allows player to get what they want on the premise of minimizing actions. That's reason that interaction scheme of gravity gloves is almost perfect.

IV. THE STUDY OF MODEL IN VR GAMES

A. Traditional 2D horrible games

After half a century of development, the game has developed from two-dimensional plane game to three-dimensional game, and then to today's VR game. Model changes play a vital role. Fear can be identified as an emotion experienced in a dangerous or painful situation [10] For the two-dimensional horror game, the source of constructing the horror game is nothing more than the design of scene art, the contrast of music and the promotion of the plot by words. The role that the model can play does not seem to be so great.

For example, as shown in the figure 3 in the game "fireworks", shaping the feeling of terror and depression comes from the author's design of art and scene.



Figure 3. 2D horror game scene.

The background of the game is set in the mountain town around 2004. The nostalgic watercolor painting style and the cold and strange atmosphere remind people of the night when they first saw ghost films in childhood. The game pursues the implication of Oriental terror. There is no horror picture posted on the face, and even there are few ghosts, but the penetrating coolness will follow [12].

B. VR in horrible games

In three-dimensional games, the meaning of the model is unusual. The real model provides players with a good sense of immersion. For example, in the game "outlast", the real and detailed model makes the player seem to be in a world full of zombies, which makes the player feel afraid.

But even in three-dimensional games, three-dimensional models are still presented in our eyes in two-dimensional form, that is, we must observe these three-dimensional models through the screen [13]. However, the generation of VR enables us to observe the three-dimensional model in a three-dimensional way. In other words, the sense of presence and fear given by these models can be brought into full play as shown in the figure 4. This is the advantage of real model in VR. For example, in game half life:alyx, the exquisite VR model is very close to reality. People once thought they were in the world of zombie riots. Through these models, we can rummage around the shelves for therapeutic syringes and shotgun bullets. The control tool hacked into the alien

interface. Throw a bottle out of the window to draw the enemy's attention. Pull the headhunting crab off your face and throw it out of the window.



Figure 4. 3D horror game model.

In summary, Immersive experience is the biggest difference between traditional 3D games and VR game. What the figure4 shown above is half-life: alyx. It may have been an hour since the game began and the player got the gun for the first time. In this hour, players can only wander around the scene like a real person, or touch everywhere, and then walk along with the game plot. It can be said that there is no way to play here. But even so, the vast majority of players have not been discouraged. What is the driving force of this game? This is immersion. When you create an unparalleled real environment, players will immediately begin to immerse themselves in the world, explore and feel the world, and enjoy some fun brought by the world.

C. VR in escape room games

As a popular game in recent years, secret room escape game is loved by a large number of people. However, because such games are generally indoors and have specific venues, they need to occupy the venues and people's commuting time. So, we want to explore the advantages and possibilities of this kind of games in VR.

There are many decryption games in VR games, which are similar to the secret room escape game we refer to. But not exactly. For example, VR decryption game the room. These games only serve one or two people. Of course, the purpose is the same, solve the puzzle and escape the maze. From figure 5, we can see that the interaction between players and the game is real-time and immersive [14-15]. This advantage perfectly fits our VR game of secret room escape.



Figure 5. The interactivity of VR Games approaching reality

But secret room escape is a multiplayer party game. Here are some characteristics.

- Secret room escape game can improve the efficiency of team work. A recent survey noted that 19% of players are described as having characteristics of a "corporate group"[6]. The popularity of "corporate casual" or "serious casual" escape rooms is related to the belief that Escape Room is good for team building. Team building activities are designed to improve personal relationships and social interactions for the benefit of the entire team [7,8].
- VR gives people an unprecedented sense of immersion and interaction. Because VR can provide a sense of immersion close to reality, that is, only such games in VR have their unique significance. Through the design of multiple levels and the guidance and division of labor of the team, the author can make a large-scale multiplayer online party game with 6-8 people. If this kind of game is realized on VR, it not only saves the manufacturing cost and space occupation of the secret room in real life, but also reduces people's commuting time and enables people to have parties and play remotely without contact., This helps the company team to improve their work efficiency and tacit understanding of cooperation.

In future research, we could adjust for team familiarity, comparing existing teams with newly formed teams. We can change design variables such as team roles or difficulty levels. We can compare VR escape rooms to escape rooms in the traditional sense as well and even to other types of activities [15].

V. CONCLUSION

VR refers to a special environment generated by computers. People can place themselves in this environment with various special devices and operate and control the environment to achieve special purposes. Through the analysis and discussion of VR technology in the field of games, we can know that VR is characterized by immersion, interactivity, multisensory. Compared with the traditional man-machine interface and popular window operation. In VR, "virtual" means generated by the computer, while "reality" refers to the environment existing in the world. The world created using VR technology allows users to transform themselves into a digital "shadow" via external devices, creating a doppelganger of themselves to enter the virtual environment. In this environment, people can completely control the world they create, and even create another world of their own. This is the qualitative leap of VR technology thought. The following will summarize and prospect from the following aspects.

A. Advantages of 3D games on VR devices

Compared with traditional PC 3D video games, games on VR devices can bring users a more realistic feeling. Through VR devices, players can better interact with the scenes, objects, and missions in the game. As in the horror game example used in this article, gravity gloves are a VR device that would be a near-perfect interactive solution for video games. At present, there are two main ways to play video games, keyboard-mouse, and gamepad. In the future, VR device interaction will become the third mainstream game operation.

B. The positive impact of virtual reality on social interaction

VR can handle social interaction and teamwork better than traditional computer devices. In team-based games, VR has a unique meaning because it provides a near-real immersion, such as escape rooms and hide-and-seek games. And through VR devices, space occupancy and manufacturing costs in real life can be reduced. The reality brought by VR can draw the distance between players. This provides a way to accomplish close social interaction without close contact in the real world. This is particularly relevant in the event of a major global crisis or pandemic, like the COVID-19 pandemic that began in 2020.

C. The future development of virtual reality

There are many techniques involved in adding 3D games to VR, such as machine learning, gesture recognition, and map editing. With existing modeling platforms and game engines, it is possible to integrate computer games into VR devices. The use of VR in 3D games can bring more interactivity to games. VR games have a good future in the video game industry. Perhaps VR games will revolutionize the gaming industry and become the next global economic wave.

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