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The Immersive and Interactive Experience in Virtual Reality Games and Films

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Abstract: Virtual reality technology is one of the modern technologies that have been widely concerned in recent year. Its application in the game and film and television industry has produced many works with new experience, especially in immersion and interactivity. Generally, most available resource nowadays focuses on discuss the feasibility of VR application in innovation of traditional works but lack but there is a lack of discussion on VR games and VR movies from the perspective of creating immersion and interactive methods and effects. This essay will discuss the immersive and interactive effects in VR games and VR films separately. In the first part of VR games, it will elaborate how the effects are provided through the VR hardware. Then in the second part, it will discuss the different design techniques used in different styles of game including action games, horror games, exploration games and serious games. As for the discussion on VR films, this essay will take the two most extensive categories of VR movies, panoramic films and VR documentaries, as examples to discuss how VR films achieve the effect and how the performance is. The overview on the immersive and interactive effects in VR games and VR films can provide examples and problems to be solved for creators to produce higher quality work in the future.

Keywords: Virtual reality, Games, Films, Immersive and interactive

1. Introduction

Virtual Reality (VR) has achieved rapid development in recent years. It is a comprehensive technology that creates a virtual 3D space using the combination of multiple digital media technology including computer graphics, tracking and positioning sensor, artificial intelligence and other information processing technology [1]. Users, with the help of relevant software and hardware equipment, are able to explore and act in the virtual world obtaining immersive experience in vision, hearing, touch and even smell. Moreover, through the application of 3D visualization technology in the VR environment, users can obtain unique interactive experience with virtual objects in the program [2]. In the half decade from 2016 to 2021, numerous VR companies, such as Oculus, promoted their devices and the decreased price and increased number of VR software make it available to larger amount of people. VR game hardware devices can be divided into game hosts terminals, mobile terminals and independent integrated devices based on different host types [3]. VR in each platform has opened up new paths for modern industries and been applied in various realms. Movie and video games are two of the industries that make good use of the advantages of VR

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technology. It is the better immersion and interactivity that provides users revolutionary experiences which surpasses the traditional works.

This essay aims to discuss the immersive and interactive effects in VR games and VR movies. In the VR game part, this essay will elaborate the immersion and interactivity of VR games firstly from the characteristics of VR games by explaining the advantages of VR games in operations and function realizations. After that, illustration such as horror games or storytelling games will be given to support elaboration of the modeling of scenes in VR games. As for the discussion on VR films, it will first discuss the immersion and interactivity application in VR films apropos the genres including panoramic movies and documentaries. Secondly, the essay will state the unique settings for enhanced experience that can only be implemented in the VR environment.

2. VR Video Games

2.1. Characteristics of VR Games

VR video games require specific hardware and software that have higher performance than ordinary equipment. The most basic VR hardware includes a host which stores necessary electronic components, a head mounted display (HMD) which contains two micro screens for each eye of user to display the virtual world and the controller that is responsible for input and output [3]. The unique equipment allows players perform more operation and actions compared to those games in other platforms leading to stronger immersive and interactive experience.

2.1.1. Immersive Effect Using HMD

The transformation in perspective on traditional game platforms is controlled by mouse or handles. Players need to move the mouse, push buttons or wave the handles to control the camera. In VR games, the player perspective is controlled by using motion tracking technology in HMD such as the Meta Quest device introduced by Oculus shown in figure 1 [4]. Control of wearing the HMD both simplify the operation and increase the immersion of acting the character in game.

Figure1： Meta Quest 2 in 2022 [4].

Moreover, HMD provides not only the scene of virtual world, but also the audio of the environment. The sound effect in VR games has a stronger sense of space and three-dimensional effect. However, currently most of the VR game developer neglect the sound effect design in VR games resulting in serious homogenization. The traditional way of collecting and reproducing sound does not adapt to the VR environment, which leads to the impairment of the authenticity of the sound effect [5].

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2.1.2. Interactive Operation with Special Controller

Traditional games allow players to control and operate the game content or scene elements through buttons and icons. While retaining the key input on the controller, VR games also allow players to interact with objects in the game by moving the handle and changing gestures. The controller can be handles or data gloves attached with sensors to capture and simulate the action of hands and fingers. The operation of the game is thus simplified and expanded. Players in other games can only perform the limited interaction with objects and the interaction actions are always the designed animation that player cannot change. While in VR games, players are able to do whatever the action they want. In addition, players in VR game can communicate with each other through their gestures or body language, which is difficult to realize in other games. Figure 2 shows the possibility of holding virtual lectures in VRChat [6].

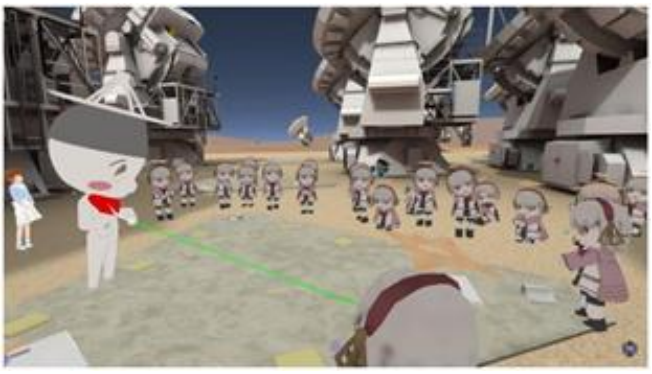

Figure2： Virtual ALMA Tour in VRChat [6].

Controller can also collect the biology data and use electronic pulse to feeds back tactile simulation to users. The control of the character is more like the control of player's own body since the operation is combined directly to player's action in real world and the interaction with objects is more realistic. Therefore, the preciseness of the interaction is the significant concept that VR game developer ought to solve. The failure of realizing preciseness causes the mistake in distant feeling and the delay of operation leads to sickness during usage. At last, the immersion effect is corrupted.

2.2. Content Design of VR Games

Apart from specific hardware support, game content is another considerable factor that influences the immersive and interactive experience in VR games. Surpassing ordinary games, VR games place the player, witnessing in first perspective, in the center of the story， either an active tale or a passive perceptive event [7]. Players are able to better feel the game atmosphere from the whole body to enhance the sense of game substitution, so that players can resonate with the work of the game produce. In this concept, it is the creative idea and effort of designer that strengthen the immersion and interactivity in VR games. At present, the common games in VR are action games, horror games, exploration games and serious games. The following part of the essay will elaborate the immersive and interactive effect in these types of games respectively.

2.2.1. Action Games

Because the actions of players' upper limbs and even the whole body can be reproduced in VR through the location and gesture capture of the controller, action games in VR environment have a more immersive experience than those in other environments. The characteristic of game offering players extraordinary ability to overcome difficulties is magnified in the VR environment [8].

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Figure3： Screenshots of Blade and Sorcery [9].

In the battle game Blade and Sorcery, players are able to brandish a weapon or cast spells in VR world through performing the same motion in real world instead of using keys to perform actions in traditional games (Figure 3). Using action to simulation battle tends to be more immersive than pressing keys on the keyboard or shaking the handle. Apart from battle game, sports game also sports games also provide players with realistic sports experience through action simulation. Especially for extreme sports such as mountain climbing, which are extremely dangerous, if carried out in VR, the danger can be reduced while the excitement of sports is still maintained so that even novices can immerse themselves in such sports (Figure 4).

Figure4： Mountain climbing in The Climber [10].

In addition, players' ability changes in VR will be clearly sensed even if they are not informed in advance [8]. An experiment of players in atrial game whose jump height ability was strengthened in the game were astonished because of the vanishing of their extraordinary ability when the enhancement was turned off [9]. This perception of players' own state also reflects the immersion of VR games.

2.2.2. Horror Games

In VR environment, players have more realistic feelings about the layout of the game scene and more interactive options. Some details or functions which are unable to achieve the expected effect in other environments can also be implemented. Action games focus on the operation in VR environment to strengthen the immersion, while horror games work on the scene construction. VR Horror games

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received great popularity in 2017 and the best-selling game was Resident Evil 7: Biohazard (Figure 5) [10].

Figure5： Close distance to the threat in Resident Evil 7 awaking the dread.

Threats surrounding and conspiracies surging, players are also frightened by backward attack [11]. By strengthening the environment construction and surrounding atmosphere, high level of immersion is created to awaken the fear in the players and force them to actively solve puzzles and find ways to survive [12]. Research has proved that emotional impact of horror games in VR causes higher anxiety during the game and more ease after escape by recording the physiological indexes such as heart rate and skin conductance response [13].

2.2.3. Exploration Games

The simulation of real environment or construction of fantasy world in VR, applying high level of computer graphics, allow players to explore or reconstruct the world precisely. Contacting with things which are unavailable in daily life and interacting with different objects in a virtual environment, players in VR sandbox games can directly play with the objects, making use of their natural expression, to perceive interactive visual feedback of the environment like building blocks or playing with sand in childhood [14]. In other VR exploration games such as No Man's Sky, players are accessible to operate some vehicles like spaceship or Mecha to explore in the world. The driving simulation has stronger immersion and interactivity because players can have precise operation in the cockpit in figure 6 rather than operating outside the vehicle in third person perspective.

Figure6： vehicle cockpit in No Man's Sky.

Using available or unavailable technics in real world, players in VR exploration games achieve immersion and interactivity through the visual and operation effect.

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2.2.4. Serious Games

Instead of entertaining, serious game aims to train or educate players relevant knowledge and skills by simulating real situations and requiring players to complete some tasks. VR serious games provide more realistic simulation allowing players perform systemic reaction and precise hand operation. For example, in 2020 a research team designed a VR serious game simulating an emergency earthquake happens at Auckland City Hospital and investigated its effectiveness of using for emergency response and security training [15]. The game reproduces the real scene of the hospital in VR and simulates the damaged facilities and falling objects during the earthquake offering players an immersive sense of involvement in a hazard. The game has a strong interactivity because correct and wrong behaviors will both lead to the corresponding results based on the reaction of players in the limited time. The research finds out that participants gained significantly improved knowledge about earthquakes as the immersive experience is more attractive than watching videos and the realistic threats which is difficult to simulate in actual exercise forces players to concentrate on following the instructions to survive [15].

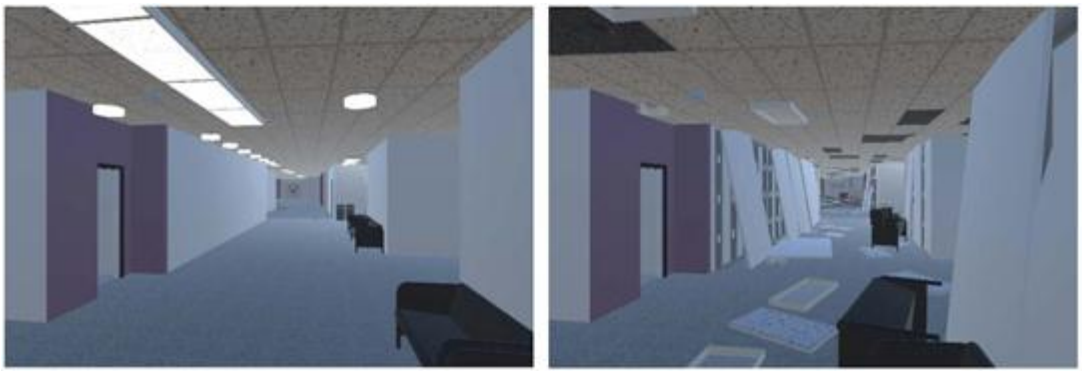

Figure7： The scene before and after the earthquake [16].

Another example of VR serious game is medical training game. Medical students are able to practice their skills on patients with minimized risks but realistic cases before the actual operation (Figure 7). They can also have access to expensive instruments and rare cases [17]. The Egypt research team using PathoGenius VR to test VR medical training states that medical students prefer using VR for training because of its immersion and interactivity rather than writing case diagnosis [17].

2.3. VR Game Conclusion

VR games, strengthening the First-Person Perspective, allow players to experience the realistic virtual space by fully integrated into the virtual characters so that players have closer observation and experience on the game surroundings. Realized by operation substitution and scenario construction, the immersive and interactive effects in VR games are affected by both hardware equipment and software content. After the discussion, the immersive and interactive effects in VR games are inspiring and deserves to improve although there are problems such as sickness caused by imprecise interaction and limited immersion due to technical limitations or low-level constructed game scenes. Moreover, with the maturity of gesture tracking and whole-body motion capture technology in VR, the use of virtual hand interaction in VR games will greatly enhance the immersion of the game, and create more interesting game content with producers. The next part of the essay will discuss how the effects perform in VR films.

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3. VR Films

3.1. Characteristics of VR Films

As another high-profile VR application industry, VR films have been tried by many Hollywood film companies and directors since 2014. Different from games where players experience the story as the subject of content, audiences of films obtain the information from the perspective of the object [18]. VR films, compared with normal films, provide audiences unique watching experiences in terms of scene exploration, intuitive feeling and information acquisition [19]. It aims to forge an immersive and interactive storytelling mode so that the audiences have more profound emotional expression [20]. Research found that the physiological state of the audience when watching VR movies is significantly different from that when watching traditional movies, especially in the speed and amplitude of change [20]. The audience's pleasure, anger, fear and other emotions generated by the scene are enhanced in the VR environment, making VR movies more immersive. Moreover, audiences used to only watch the film from the certain camera shot set by the producer, but in VR films audiences can observe things freely based on their own selection so that they can obtain more information from the scene and have access to details and sidelines which are not suitable for displaying in the main plot in traditional films. Currently, the most common VR film genre are panoramic movies which is also the most basic form of VR film generation and VR documentary.

3.1.1. Panoramic Films

Most panoramic films are transformed into three-dimensional virtual space where provides free choice of perspective and partial interactive influence on the basis of plane films. It is also the upgrade of 4d movie which is the transformation from Augment Reality to Virtual reality. Oculus Story studio released it first VR film: Lost. Following the robot arm searching for its lost part in the forest, audiences deeply experienced the realistic forest environment where each piece of the falling leaf is traceable [21]. Elements in the scene will also react to the audience. The firefly can be scared away by audiences and the robot arm can discover the audiences (Figure 8) [18]. Such detail designs improve the interactivity of VR film allowing audiences feeling more realistic of existing in the virtual world. But the interactivity is still limited in the film. Although the robot arm discovered the audience, audience still cannot communicate with the robot arm and affect the film content.

Figure8： The robot arm in Lost [18].

Panoramic films also changed the photographing method of traditional cinematics. The roles of original art theory system, such as composition skills, scene scheduling and scene arrangement, decline in panoramic film because of the liberation of the audience's perspective, which brings new filmmaking skills to the producers as well as challenges [21]. For example, the high intensity continuity of the screen makes the VR film must provide a certain transition effect for the audience

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rather than simple transition or blank picture. Otherwise, the audience will be confused by frequent camera changes. In addition, due to the limitations of current hardware performance, the resolution and smoothness of panoramic movies are not very satisfactory, resulting in a negative impact on the immersion of the panoramic movie.

3.1.2. VR Documentaries

The key of VR documentary is not only to show the environment of the subject, but also to bring the audience into the identity of the subject, so that the audience can experience the theme of nature, disaster, war, etc. in the scene, leading to deeper immersion and stronger emotional fluctuations. VR documentary is expected to become the carrier of new news or scientific journals as it can reduce the boring characteristics of traditional documentaries. Audience can learn the life of bees from the perspective fa bee, experience the adversity of refugee suffering floods or witness the life of people living in poverty by assuming himself one of the members. The first Chinese VR documentary 'Kindergarten in the mountain village' in 2015 discussed the problem of leftover children by recording their daily life in a single shot. In the long shoot, audiences have enough time to experience their life, thinking and growing emotions [18]. Audiences also select their own perspective. They can perform the close observer in the same scene or a playmate listening to the children, and the most important thing is to play the role of the left behind children themselves to feel the loneliness of life. Watching how the children writing, doing housework drawing in a very close distance, audience intuitively feel their desire for their parents' company (Figure 9).

Figure9： Kindergarten in the mountain village [18].

The linkage of sound effects and pictures also played a great role in VR documentaries as sound can be an important method of guiding narrative advancement. In Kindergarten in the mountain village, sounds of children playing together come first before the scene shows up, driving audiences to follow the sound and pay their attention to the next story part. The visual shock and on-the-spot experience of VR documentaries have been improved due to various such techniques.

3.2. Conclusion of Film Part

VR film strengthens the concept of space in terms of the time concept of traditional films. The scene transformation originally reflected by the lens and screen now directly puts the audience in the virtual space. Traditional forms of artistic expression have become more scientific, but new forms of artistic expression are also required to ensure the immersion of VR films. Panoramic films focus on the structure of space, so that the audience can enjoy the contents of the film from multiple angles and play the role of being in the environment. VR documentary aims to reproduce the scene in virtual space, so that the audience can experience the emotion expressed by the scene. The immersive effect

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of VR films is relatively mature, but the interactivity is still lacking. In most VR films audiences are like invisible ghost wandering in the scene. They cannot affect the world and the world make no difference to audiences though the audiences can react to the film contents such as getting away from the train rushing towards the camera or hanging up the arms when a gunner aims at the camera. At present, the generally accepted possible method to improve the interactivity of films is to make films game like. By setting options and detecting behaviors, the audience can influence the plot. With the development of other advanced technology such as Artificial intelligence, the adaptive movies are not impossible in the future.

4. Conclusion

In conclusion, VR games and movies, making good use of the characteristics of technology and equipment, improve and create more immersive and interactive works on the basis of traditional works. VR games and movies also have shortcomings that affect immersion and interactivity, such as insufficient accuracy and poor device performance. With the upgrading of hardware system and the continuous improvement of image processing technology, virtual reality technology will continue to make progress in the future. Its application in the game and film and television industry will also produce more excellent works with high immersion and high interactivity with the improvement of technology. Finally, the impact of VR will extend to all fields bring many reformations to the society.

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