Application Research on Immersive Gaming Experience Based on Virtual Reality Technology

Bilang Wu
Graduate School, Sejong University, Seoul 05006, Republic of Korea
silver3012@163.com

Abstract: With the increasing demand of game players for immersive experience, virtual reality technology (VR) is widely used in the game industry, to a certain extent, accelerate the pace of game industry upgrading, and truly meet the entertainment needs of game players in the game. This paper firstly introduces the characteristics of virtual reality technology, then analyzes the application opportunities, application status and application problems of virtual reality technology in immersive game experience, and finally focuses on exploring the application path of virtual reality technology in immersive game experience. It aims to provide reference for game developers and related technical personnel, and give full play to the role of virtual reality technology in immersive game experience.
Keywords: Virtual Reality Technology; Immersive Experiences; The Game Experience; Application of Technology

1. INTRODUCTION

Virtual reality technology is referred to as VR in English. It refers to the integration of information technology through human-computer interaction with the support of the latest sensor technology, and finally creates a virtual three-dimensional environment. At present, the role of virtual reality technology is played in game experience, and interactive scenes are created based on virtual reality technology, so that game players can personally experience the game and feel the fun brought by the game. From the perspective of game industry innovation, it is necessary to seize the application opportunity of virtual reality technology in immersive game experience.

2. CHARACTERISTICS OF VIRTUAL REALITY TECHNOLOGY

Virtual reality technology shows effects through the construction of virtual world, and the basic characteristics of this technology are summarized as: interactivity, perception, autonomy and sense of existence. With the in-depth development and wide application of virtual reality technology, its technical characteristics are gradually diversified. Under the comprehensive action of three-dimensional imaging technology, three-

dimensional computer image technology and sensory tracking technology, real-time environment and dynamic space are created, human-computer interaction is enhanced, and a variety of aesthetic attributes are presented, as shown in Figure 1.

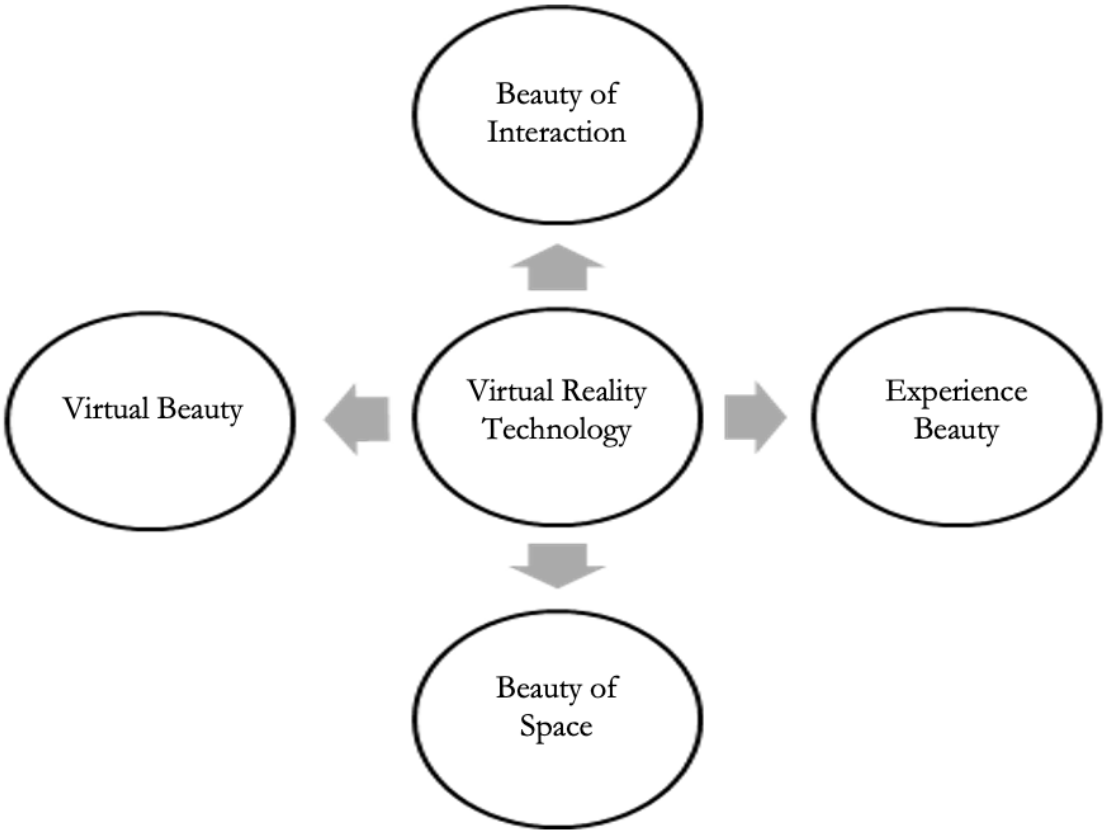

Figure 1: Aesthetic Performance of Virtual Reality Technology

2. THE APPLICATION OPPORTUNITIES OF VIRTUAL REALITY TECHNOLOGY IN IMMERSIVE GAME EXPERIENCE

2.1 The Needs of the Development of the Times

People are not unfamiliar with virtual reality, because virtual reality has a certain market foundation, and the market scale is from small to large, and virtual reality resources are increasingly rich, so the introduction of virtual reality technology in the game industry is a manifestation of the development trend of The Times (Checa & Bustillo, 2020). Nowadays, VR games have entered the public eye and are popular with gamers. VR games, as their name implies, are created by virtual reality technology (Yao, 2022). VR game products enable consumers to obtain a strong interactive experience under the visual impact, thus stimulating consumers' desire to buy. Virtual reality technology has long been used for immersive game experience, supported by the refinement and innovative development of

product lines (Fan, Jiang, & Deng, 2022). For example, smart wearable devices with virtual reality functions are widely popular, which is a necessary condition for game players to experience games in an immersive way.

2.2 Environmental and Technical Support

At present, the network operation environment is innovating rapidly, which provides a broad space for the integration of virtual reality technology and game industry (W. Zhang, Yuan, & Yan, 2022). In 5G wireless transmission mode, mainstream VR devices become a reality independently, truly replacing the transmission mode calculated by PC carrier (Shi, Wang, & Ding, 2022). The reason why VR games have a large market space and can strongly attract consumers is because of the role and effect of VR technology, that is, the three-dimensional virtual space meets the needs of game players for independent feeling and real experience in interactive scenes (Yan & Lv, 2020).

2.3 The Driving Force of Cooperation

Nowadays, game enterprises apply virtual reality technology through cooperation with advertising companies and film and television companies, promote game products by means of advertising, and enhance the attractiveness of films through VR visual impact (J. Zhang, Zhang, & Feng, 2022). Together, the topic of immersive game experience based on virtual reality technology will receive more attention, so as to tap into potential gamers and enhance the engagement between gamers and VR games. In addition, when game enterprises cooperate with consumers, by collecting consumers' feedback, they can appropriately upgrade VR products, thus innovating the game industry and enabling consumers to obtain a sense of immersion in the game experience (Menin, Torchelsen, & Nedel, 2018).

3. APPLICATION STATUS AND PROBLEMS OF VIRTUAL REALITY TECHNOLOGY IN IMMERSIVE GAME EXPERIENCE

The application of virtual reality technology in the game industry has enriched players' game experience to a certain extent, expanded the scale of VR game market and increased economic benefits. However, from the perspective of reality, the application level of virtual reality technology in immersive game experience needs to be further improved. The following is to explore the current situation and problems:

3.1 Status Quo

According to Guanyan World data Center, the market scale of China's virtual reality industry from 2020 to 2022 is summarized, as shown in Table 1.

Table 1: Market Size of Virtual Reality Industry in China from 2020 to 2022 (Unit: 100 Million YUAN)

Years	Size of Market
2020	150.5
2021	228.5
2022	620

As can be seen from the table data, the market scale of China's virtual reality industry has been expanding in recent years, from 15.05 billion yuan in 2020 to 62 billion yuan in 2020. The scale of China's virtual reality industry will exceed 250 billion yuan by 2025, according to the Industry White Paper (2022). It can be seen that the market prospect of virtual reality industry is good and the market space is very broad. According to XYZ-Research, a market research institution, the scale of China's VR game market from 2020 to 2022 is summarized, as shown in Table 2.

Table 2: China's VR game Market Size from 2020 to 2022 (USD 100 Million)

Years	Size of Market
2020	3.8
2021	4.2
2022	6

As can be seen from the table data, the scale of China's VR game market has expanded from 380 million USD in 2020 to 420 million USD in 2021 and 600 million USD in 2022. This means that the application rate of virtual reality technology in the game industry has increased significantly in these three years, so the application research of immersive game experience under virtual reality technology should be expanded in breadth and depth. In recent years, the production and sales of the game industry under virtual reality technology have maintained good growth, among which the sales volume of VR devices has been on the rise (Pellas, Mystakidis, & Kazanidis, 2021). However, due to the high cost of VR devices, some consumers are hesitant to buy VR devices, so the sales volume of VR devices has been on the rise slowly (Li & Zhou, 2022). With the improvement of immersive experience requirements of game players, more and more game players believe that the expenditure fails to better meet the real experience, and put forward suggestions for upgrading and improving the existing virtual reality technology. Objectively, there is a certain gap between the effect of

immersive game experience based on virtual reality technology and the expected requirements. In order to further optimize the effect of VR game experience, solutions should be put forward on the basis of problem analysis.

3.2 The Problem

The application of virtual reality technology in the game industry in China is in the growth stage and has not yet reached the mature stage. Specific issues are sorted out as follows: First, technology is not updated in time. The design and development of VR games need the support of serial technology, otherwise, the scene effect, picture quality and character image of the game will be affected due to the stagnation of technology, and the game experience of players will be weakened, and players will not be able to invest in the game. For example, if the material of VR helmet is not advanced enough, the volume is not timely, and the VR rendering effect is not optimized enough, the picture resolution is low, and the serialized technical problems cannot be achieved in a short period of time, players will experience dizziness, nausea and other phenomena when wearing VR equipment, which greatly weakens the game experience of players. It can be seen that the main factor affecting players' game motion sensing operation is the technical level. Currently, the existing controllers are difficult to accurately perceive body details, and cannot solve the problem of body sensing due to large errors, which will eventually affect players' game experience (Wang & Jiang, 2022). Second, VR equipment costs too much. VR hardware manufacturers generally have a low level of technology, resulting in superficial technology development, and VR devices are sold at high prices. In addition, there is no strong connection between VR game manufacturers and VR hardware equipment manufacturers. In the development and application of VR equipment, costs are increased due to single power and scattered resources, so that VR equipment only serves a small part of VR game players, and most players cannot obtain the immersion of VR games. Third, ignore the emotional experience and presence of gamers. As everyone knows, in order to make the game experience in virtual reality into its environment, it is necessary to let the player get a more natural and real somatosensory operation, so that the player can produce emotional reactions, and then the player will be completely in the virtual game, in the virtual world to feel the so-called real. In reality, VR game design and promotion focus too much on results, relatively speaking, and underestimate the emotional experience of players. Fourth, VR technology is applied unilaterally in immersive game

experience. At present, VR technology is mostly used in game scene design. Relatively speaking, the game program design and character modeling based on VR technology are not in-depth enough, which makes players unable to invest in the game process and easily affect the game experience due to the distraction of energy. In the long run, it is not conducive to the deep integration of virtual reality technology with the game industry, and it will reduce the satisfaction of game players.

4. THE APPLICATION PATH OF VIRTUAL REALITY TECHNOLOGY IN IMMERSIVE GAME EXPERIENCE

In the past, game players only experienced the game through the mouse and keyboard. Now with the support of virtual reality technology, players experience the game through the application of game devices, enjoying the visual impact brought by tourists and obtaining the real auditory experience. In order to realize the effective application of virtual reality technology in immersive game experience, we should start from game program design, scene design, character design and other aspects to maximize the interaction between game devices and players.

4.1 Requirements for Application

First, improve technology with The Times. Virtual reality technology is used for immersive game experience. It is necessary to ensure that the game picture in the player's mind is consistent with the body's reaction, otherwise, visual vertigo will occur and the game experience will be easily weakened. In this connection, it is necessary to match the latest real-time tracking technology to coordinate and synchronize the game picture in your mind with your body's reaction, reduce vertigo, and enable players to obtain a good experience in VR games (Tao & Fan, 2021). Second, reduce the cost of VR games. VR game experience ensures authenticity under the action of virtual reality technology and related equipment. In order to expand the popularity of VR games, it is necessary for VR hardware manufacturers to strengthen the research and development of VR related technologies and reduce the price of VR equipment, so that more VR game players can experience games at a lower cost. Finally, focus on the emotional experience of the player. Based on virtual reality technology to enhance the immersive experience of game players, technological innovation is carried out according to the emotional experience of players, so as to awaken the positive emotions of players. In the process of VR

game, the emotional reactions of players can be learned, and the visual excitement of players can be aroused through visual feedback. Meanwhile, the attention of players can be attracted by sound, so that they can be highly invested in the game with a strong sense of atmosphere, and finally enhance the sense of presence of players. In fact, emotional reaction and presence affect each other. By creating a VR game environment with strong presence, players can have strong emotional reaction and emotional resonance, so as to truly enhance the authenticity and immersive player experience.

4.2 Application Performance

4.2.1 Used in Program Design

The all-round experience of VR game players is closely related to the game program design. Specifically, the degree of game software development affects the running speed of the game. When using virtual reality technology, it is necessary to ensure the high-quality development of the software, reduce the lag phenomenon of players in the game process, and meet the needs of players to play freely. To some extent, under the virtual reality technology, for the reasonable setting and efficient management of game resources, it is good and fast to complete the task of rapid game development and high-quality design. During VR basic programming design, it is necessary not only to correctly write game code, but also to properly allocate resources and strictly control resources, so as to perfectly integrate virtual reality technology and game programming, which is the key to the transformation of game scene from two-dimensional to three-dimensional, and also an effective path for players to experience immersive experience. In the VR game programming stage, the reference of additional parts can be preprocessed in the virtual scene first, and then the installation package can be generated. To do so, there is no need to rely on traditional R&D tools. During the game, with the help of VR equipment personalized Settings, and appropriate adjustment of the game scene, based on the three-dimensional model, to achieve the same basic game program and game background design. In addition, you can check whether the basic program design of the game is consistent with the game Settings in the feedback process of the game experience of the players. Finally, according to the feedback of the players, the program design scheme can be adjusted appropriately to ensure the immersive game experience of VR players.

4.2.2 For Scene Design

One of the factors that affect the player's experience is the game environment. Based on this, when virtual reality technology is applied in immersive game experience, it is necessary to build VR game ecological environment, mainly from hardware upgrade and software update. For hardware upgrade, that is, VR hardware equipment manufacturers deeply study and develop the latest technology, and provide a stable game running environment for VR games with the assistance of technology. Not only that, but also strengthen the hand between VR game manufacturers and VR hardware equipment manufacturers, optimize resources in a cooperative way, so that they can be applied in the enhancement of immersive experience of VR games. Truly promote the VR game ecological environment upgrade, better attract players. In the three-dimensional scene design, the software and hardware are also dynamically upgraded and updated, which helps the functions of virtual reality technology to play, better serves the game scene simulation, and finally provides a real game environment for game players to experience the game in an immersive way and get fun from it (Chen & Zhong, 2021). To strengthen the immersive game experience, virtual reality 3D dynamic scene layout is the prerequisite. In order to ensure the success of one-time application of virtual reality technology, Visual C++ simulation design should be carried out through simulation experiment, and the scene layout should be adjusted according to the experimental results, and the image quality should be improved to optimize the game atmosphere and interactive effect. During this period, virtual simulation technology is appropriately introduced to cooperate with virtual reality technology to create three-dimensional and realistic VR game scenes, so that players can be immersive in the game and enhance the sense of reality and experience. Generally speaking, the lighting design in the game scene affects the atmosphere of the scene, coupled with visual, auditory and other sensory stimuli, will let the player wholeheartedly into the game scene, enjoy the atmosphere of the game world. For example, after the application of virtual reality technology in the Brookhaven Experiment horror shooting game, the player is the hero and heroine in the game. As the game progresses, the player combines himself with the hero in the virtual scene. The fierce face of the zombie, the violent action, and the bloody scene will make the player feel nervous and stimulated. At this point VR game pleasure multiplies. Another example is the application of virtual reality technology to design corridor moonlight and color light in the thriller game "Paper Man". With the switch of light and color, the

atmosphere of the game scene becomes extremely strange, which stimulates the players' nerves to a certain extent and makes the players produce fear and cramped psychological reactions. Under the change of the game environment and game screen, players focus on hearing and vision, and try their best to improve their perception ability with the help of senses, so as to truly enhance the sense of immersion and feel the real atmosphere of the game scene physically. The Twilight Pioneers action game uses virtual reality technology, and players can feel the weapon cutting in the game by waving the controller. When the real scene is synchronized with the action of the game situation, the players' desire to experience will be aroused.

4.2.3 Used in Character Design

The effect of character design in VR games affects the game experience of players. Based on virtual reality technology, the authenticity of characters is ensured, so that characters fit the scene and are close to reality, and players can truly obtain immersive experience. In fact, character design is critical, which affects the quality of VR games and the player experience. In the process of character modeling, it is necessary to carefully set characters, appropriately adjust characters and optimize the background, and complete the production of characters in VR game scenes with high standards and strict requirements, so that players can truly experience and feel in the game, and finally deepen the impression of players on VR games, which helps to enhance the viscosity between players and VR games. For the future virtual reality technology and immersive game experience to lay a foundation.

From a practical point of view, ZBrush software has a high utilization rate in character model construction, based on character characteristics, to strengthen the player's character experience. It should be noted that when developing characters in VR games, modeling and analysis should also be carried out from the aspects of clothing and dress up, so as to enhance the characteristics of characters, ensure the proportion coordination of characters, and the rationality of structural design, which can greatly enhance the realism of players' games. For example, the design of mutant people in the VR game Resident Evil 7 takes the human body structure as the design reference to enhance the realism of mutant people and thus improve the immersion of players. In addition to being used for human body model to enhance players' immersive game experience, virtual reality technology can also be used to enhance the fidelity of characters through

the application of face and head model. The head and face modeling of characters are completed based on the mode of three courts and five eyes, and the facial parts of characters are carefully adjusted, so that players can have immersive entertainment in the game and obtain good game experience.

5. CONCLUSION

To sum up, the era of virtual reality technology is quietly coming. Under the background of this era, VR technology affects the game experience of game players. In order to maximize the application effect of virtual reality technology in immersive game experience, it is necessary to master the application requirements of VR technology, and apply technology from three aspects of program design, scene design and character design, so as to shorten the distance between players and the virtual game world and bring good game experience to gamers. In addition, it pushes VR technology to the next level and drives the gaming industry to prosper.

References

Checa, D., & Bustillo, A. (2020). A review of immersive virtual reality serious games to enhance learning and training. *Multimedia Tools and Applications, 79*(9), 5501-5527.

Chen, Q., & Zhong, J. (2021). VR Technology and Development Issues of the Chinese Game Industry. *Dongyue Tribune, 42*(9), 93-103+102+191-192.

Fan, X., Jiang, X., & Deng, N. (2022). Immersive technology: A meta-analysis of augmented/virtual reality applications and their impact on tourism experience. *Tourism Management, 91*, 104534.

Li, W., & Zhou, Q. (2022). I Feel Like Playing a Game: A User Experience Study on VR News. *International Journalism, 44*(4), 78-95.

Menin, A., Torchelsen, R., & Nedel, L. (2018). An analysis of VR technology used in immersive simulations with a serious game perspective. *IEEE Computer Graphics and Applications, 38*(2), 57-73.

Pellas, N., Mystakidis, S., & Kazanidis, I. (2021). Immersive Virtual Reality in K-12 and Higher Education: A systematic review of the last decade scientific literature. *Virtual Reality, 25*(3), 835-861.

Shi, A., Wang, Y., & Ding, N. (2022). The effect of game–based immersive virtual reality learning environment on learning outcomes: designing an intrinsic integrated educational game for pre–class learning. *Interactive Learning Environments, 30*(4), 721-734.

Tao, J., & Fan, C. (2021). Gamified Course Objective Design from the Perspective of Immersive Learning Theory: Mechanism, Framework, and Application. *Journal of Distance Education, 39*(5), 66-75.

Wang, R., & Jiang, J. (2022). On the Boundary Between Movies and Games in Virtual Reality. *Journal of Zhongzhou, 2*, 143-150.

Yan, Z., & Lv, Z. (2020). The influence of immersive virtual reality systems on online social application. *Applied Sciences, 10*(15), 5058.

Yao, J. (2022). VR Game Design Work 'Light Century'. *News Enthusiast, 10*(146).

Zhang, J., Zhang, Y., & Feng, F. (2022). Research on User Experience of Virtual Reality Sports Games Based on Cognitive and Emotional Aspects. *Science Technology and Engineering, 22*(16), 6592-6598.

Zhang, W., Yuan, L., & Yan, R. (2022). From Gamified Learning to Learning Metaverse: New Framework and Practice Essence of Immersive Learning. *Journal of Distance Education, 40*(4), 3-13.