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Research Article

Immersive Multimedia Art Design Based on Deep Learning Intelligent VR Technology

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The rapid development of computer science has led to the rapid development of new media technology. Among them, VR technology is sought after by the vast market for its multidimensional experience and immersive model. VR technology plays an important role in today's art exhibition and presentation. However, in the process of transforming 2D images into 3D models, traditional VR technology has some problems, such as long loading time, low model decision-making efficiency, and chaotic operation process, which often lead to visual interference when viewers watch art. Based on this background and the interactive page algorithm based on traditional VR technology, this paper studies and improves the visual interference in immersive multimedia art design by using task technology perception matching model (TTF). The results show that the improved task technology perception matching model reduces the visual and auditory interference by 10% in the process of virtual reality art display and viewing, and the model layout is more reasonable, and the utilization rate is higher.

1. Introduction

Multimedia art usually refers to the art form of creation or display with the help of multimedia equipment. In the 1960s, the term multimedia art was first used to describe the "Exploding Plastic Inevitable" of Andy Warhol's rock band "velvet underground," which combines music, performance, film, lighting, and other elements. Since the late 1970s, multimedia art has been regarded as an art form to define works of art made using various electronic media. Compared with traditional art design, multimedia art design contains more multimedia elements, such as audio, video, images, and other multimedia forms [1]. On the contrary, the traditional art design research is usually only through the art display of text, sculpture, painting, and other electronic technologies, and the audience can only experience through vision when viewing or appreciating art. In multimedia art design, the audience can experience various sensory forms such as hearing, smell, or touch at the same time, which has strong interactive characteristics. Therefore, it is also called immersive multimedia art [2]. With the development of computer technology, the research field of art design has also been greatly affected. As a kind of digital technology, intelligent VR technology has been widely used in the research of immersive multimedia art design by virtue of its immersive and personalized experience. The application of VR technology in the field of game design is a mainstream trend in the development of the current game industry. The rich sensory ability and 3D display environment make VR an ideal video game tool. In terms of game development, at present, VR technology is more suitable for the development of role-playing games, action games, adventure puzzle solving games, and racing car games. Its advanced image engine is no less than the image performance effect of the current mainstream game engine, and the integration of supporting dynamics and AI system provides convenience for game development. The full name of VR technology is virtual reality technology. It refers to creating a virtual scene space that does not exist or is difficult to realize through computer algorithm modeling. As a viewer, the viewer can enter the space from the first perspective through a specific device, thus producing an immersive feeling. In the virtual space, the audience's feelings are not limited to vision, hearing, smell, touch, and other senses. This is

a unique condition for immersive multimedia art design. Therefore, intelligent VR technology should be widely used in immersive multimedia art design [3]. On the whole, the impact of multimedia technology represented by intelligent VR technology on the overall art design mainly has the following four points. The first is the influence of multimedia art communication. Multimedia art can be easily popularized on the Internet with the help of multimedia technology, which greatly increases the communication volume of multimedia art design. The second point is to expand the boundaries of art and promote the integration of art and computer. In the process of multimedia art design or creation by using computer technology, artists can achieve image or picture effects that cannot be achieved by traditional art creation methods without being limited by practical conditions [4]. The third is that multimedia art has promoted the optimization and iteration of the art industry to a certain extent and improved people's aesthetic level. This is because multimedia technology simplifies the difficulty of artistic creation to a certain extent, promotes the creation and dissemination of more good multimedia art designs, and shows the audience higher quality art designs to a certain extent. Finally, multimedia art breaks the time and space constraints of traditional art display. Traditional art design requires specific time and space for offline display before it can be appreciated or created by more people. Multimedia design is more open and interactive. As long as artworks are uploaded to multimedia, viewers can communicate online anytime and anywhere [5].

Therefore, as a whole, multimedia art has changed the traditional art, making art creators and art connoisseurs have a better experience in design and appreciation. The development of intelligent VR technology has made this experience a qualitative leap. In the current art creation, the immersive multimedia art design based on Intelligent VR technology gradually replaces the traditional art design and becomes the mainstream [6]. But at the same time, in the immersive multimedia art design experience based on intelligent VR technology, due to the problem of virtual space algorithm modeling, viewers are often disturbed by vision in the virtual space [7]. In order to solve this problem, this paper introduces the deep learning intelligent algorithm, hoping to optimize the intelligent VR technology to model the visual interference problem.

2. Related Work

The research of intelligent VR technology in immersive multimedia art design is based on the selective attention mechanism of human brain. Therefore, how to reduce the visual interference in the process of using intelligent VR technology should start from the visual features of attention in ergonomics [8]. Through psychological research, we know that the process of human brain's attention starts from the visual system and selectively transmits external stimuli to the brain through the relevant optic nerve and makes relevant responses [9]. Fundamentally, attention is closely related to emotion, motivation, and saliency. Recent research evidence shows that the saliency map is sensitive to the salience of an event and exists in many different regions. Now there is evidence that salience in the visual system may be encoded by V1 region from beginning to end, which is the first cortical map of the primary visual pathway. The occurrence of visual interference shows that the human brain has not filtered out irrelevant stimuli, and the irrelevant stimuli are also processed preferentially in the process of visual information processing, resulting in visual interference [10]. Generally, there are two main ways to reduce the visual interference caused by the application of intelligent VR technology. One is to start from the source of the interference to avoid the visual system capturing such irrelevant stimuli. This method requires us to try to make the model concise and accurate in the process of algorithm modeling based on intelligent VR technology to avoid visual interference caused by irregular models; on the other hand, we need to adjust the model information processing priority to avoid irrelevant stimuli being processed preferentially [11]. Previously, some scholars have proved through psychological experiments that the priority of irrelevant stimulus interference processing is determined by the target driven and stimulus driven of the algorithm processor. Because the interference of stimulus drive comes from the outside, and the stimulus often follows the bottom-up transmission sequence, it is faster and more efficient in the process of processing. Therefore, focusing on how to make the important components of the human-computer interface more stimulating and attract the visual attention of the audience is an important way and necessary research means to enhance the immersive multimedia art design experience based on intelligent VR technology [12]. This kind of attention in human-computer interaction is also called user's focus of attention. Attention is an important issue in human-computer interaction, and it also plays a very important role in human-computer interaction applications such as pervasive computing and intelligent space, because in these applications, users' goals and intentions must be continuously monitored. It is generally believed that attention is mainly determined by eye gaze and head posture. Some researchers have proposed a new cone flashlight ray design, which makes the model structure modeled by VR technology algorithm clearer and positioning more accurate and can avoid the visual interference caused by irrelevant lines to a certain extent. In order to more clearly determine the specific positioning in the virtual space, some scholars have expanded various models on the basis of Fitts' law. They can accurately locate the position of objects after rotation, translation, and scaling in the virtual space and avoid visual interference caused by model piercing [13]. Similarly, the optimization of user interaction pages based on VR technology is also inseparable from psychological evidence. Chinese psychologists Huang Zizi and others have long proved the difference between the difference between target features and distractors on the response of attention mechanism through electrophysiological experiments. At the same time, the experiment also found that the gap between target features and interference features is inversely proportional to the interference in the process of attention. Therefore, when the gap between them is large, the impact on interference

will be smaller, and finally the interference will be suppressed. When the difference between the two is small, the effect on interference is larger, which will promote the interference process. Since the senses we use in the virtual space constructed by VR technology are mainly vision, we also need to pay extra attention to the optimization of image interference [14]. In cognitive linguistics, the image in VR space refers to the concrete abstract concept in the process of human-computer interaction. If the audience can directly operate the image in VR space, it can greatly reduce the perception distance and cognitive distance that the audience needs to spend in processing visual information. To some extent, it will speed up the visual information transmitted to the brain for analysis, thus avoiding the priority processing of irrelevant information. Dr. Jakob Nielsen and others put forward ten usability principles for interactive design to solve this problem, providing relevant ideas for interactive page design of VR technology. He believes that the development of human-computer interaction can be divided into four stages. After the first generation of human-computer interaction with keyboard, display, and other hardware devices, with the gradual replacement of machine language by assembly language or high-level language, the second generation of human-computer interaction has gradually developed into an interactive mode based on mouse graphics; finally, with the development of multimedia technology, human-computer interaction has gradually become the most common video or audio interaction in our daily life. Jakob Nielsen reasonably speculated on the development of multimedia art design based on the development of VR technology and believed that the final human-computer interaction mode, which is also the fourth-generation interaction mode, will be the natural interaction mode of multimodal technology integration [15, 16].

3. Method

This paper mainly studies the problem of visual interference in virtual reality space in the process of multimedia art design display based on VR technology. A simple test can reflect the application of visual interference in real life. The test can be completed by two people. A stretched out a finger and asked: what is this? B replied, "1." A stretched out two fingers and asked: how much is 1 plus 1? B replied, "2." A stretched out three fingers and asked: how much is 2 plus 2? At this time, if B is a little distracted, he will look at A's fingers and blurt out, "3." The visual interference phenomenon in virtual reality space is called visual interference effect. First, we need to build a visual interference model to enlarge the visual interference phenomenon in the space and improve the observability and operability of the human-computer interface. After the model is determined, we use virtual ray and mouse button as the main methods to explore the interference problems and use virtual ray and mouse to trace the interference problems in the virtual reality space. According to the tracing and tracking signals, we can find the error caused by visual space interference or the cognitive load of human-computer interaction pages. Then we can determine the interference task according to the found problems and search the target in the virtual space. As VR technology is a virtual reality space, the specific interaction space of users in the process of immersive multimedia art design display is between the overlap of real 3D space and virtual 2D space. Therefore, when searching task targets, we should take 2D and 3D targets into account at the same time. Finally, through the Fitts' law algorithm, combined with the lateral inhibition paradigm in cognitive psychology, the problem evaluation and optimization method of visual interference task in the research of immersive multimedia art design based on VR technology is confirmed. Here, we mainly choose the analytic hierarchy process for multidimensional comprehensive evaluation and determine the optimization method through the principle of optimal solution. Our main experimental evaluation indicators are the reaction time of users to the interference in VR virtual reality space, and the subjective experience of users for the entry-level multimedia art design and display based on VR technology. Finally, we propose a TTF model. The biggest feature of this model is that it solves the problem of visual interference in VR virtual space, which is rarely studied by previous researchers, and optimizes the availability of human-computer interaction in the complex environment in VR virtual space. The specific research ideas of this paper are shown in Figure 1.

First of all, we need to establish the capture model of virtual reality space interference signal in VR technology. This is because there will be a large number of multimedia artworks in the space of immersive multimedia art design and display based on VR technology. Although the interference signal can connect with the audience and cause some interference in the process of artistic creation and viewing, the magnitude of the interference signal is still large compared with the specially constructed objects in the space. Therefore, in the virtual reality space based on VR technology, we cannot obtain interference signals through normal immersion multimedia art appreciation, so we need to establish a special acquisition model for interference signals. The acquisition model of interference signal is based on the visual interference effect of human-computer interaction. In psychology, the brain's response to external stimuli is called attention, which is divided into conscious attention and unconscious attention according to the active intensity of attention. However, both conscious and unconscious attention will occupy the processing resources of the brain. Human senses may receive a large number of stimuli at any time, and perception does not respond to all stimuli. Selective retention of perception ensures that people can focus on important stimuli or important aspects of stimuli, eliminate the interference of secondary stimuli, and more effectively perceive and adapt to the external environment. The interference signal is a kind of attention source which has no obvious significance for the unconscious and brain processing. So, we need to first explore how interference signals attract the attention of the brain. Here, we have learned from previous studies that attention is selective. According to the selective theory of attention, the interference effect is caused by the brain paying too much attention to the target signal and ignoring other intentional

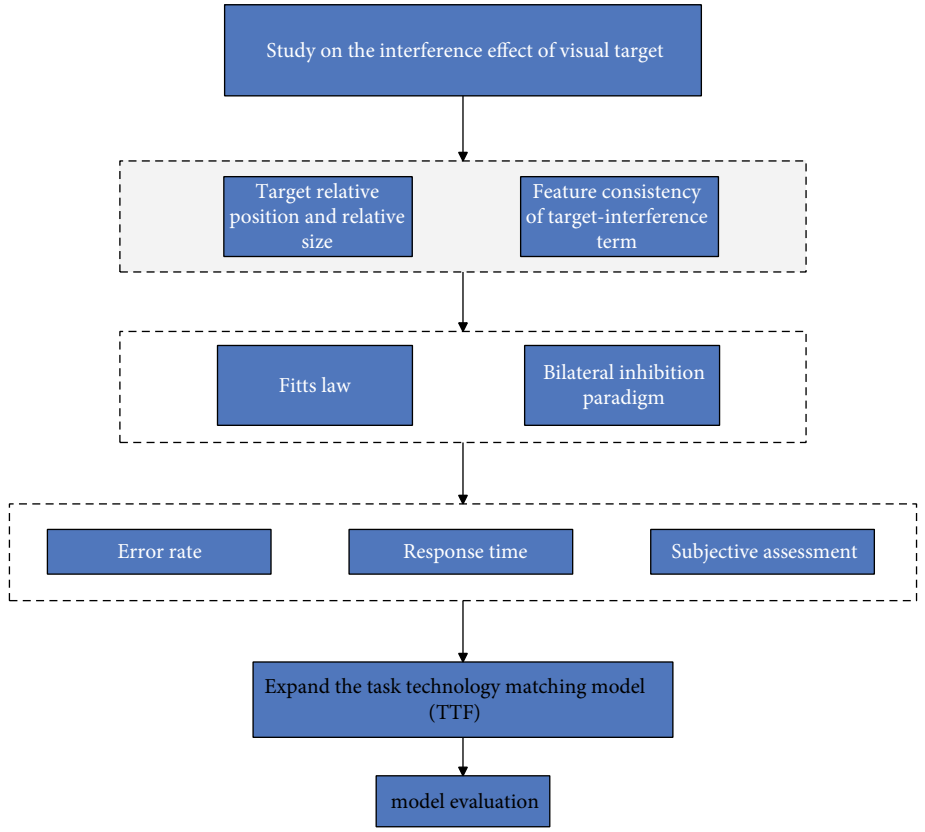

Figure 1: Research framework of visual interference in virtual reality.

stimuli. Therefore, in the process of jamming signal acquisition modeling, we need to redesign the allocation proportion of attention resources, try to enlarge the selective proportion of jamming signals again, and ignore other immersive multimedia art designs in the virtual space based on VR technology, so as to search.

For VR technology, the common paradigm of object search in virtual reality space is single target search paradigm. Single target search paradigm is often used for local search. Therefore, in practical application, the area of the search target area a is usually not too large; otherwise, the search efficiency will be low. We assume that the visual field area of the normal line of sight search of the audience is α, and if the frequency of normal blinking is t, the relationship between it and the probability that we usually find interference signals within the search time are shown in the formula

$$t_m = \frac{t_0 \times A}{\alpha \times P_0}. \tag{1}$$

In order to more intuitively express the probability of finding interference signals, we change the time interval from the search time required for one blink to the probability of finding interference signals in the whole search time period, and then we can obtain the probability of finding interference signals when the search time period is agreed. This probability can be used as an indicator to measure the ability of the algorithm to capture interference signals in the future. The specific expression is shown in the formula

$$F(t) = 1 - \left(1 - P_{sg}\right)^n. \tag{2}$$

Formula (3) can be obtained by simplifying formula (2).

$$F(t) = 1 - e^{-\lambda t}, \tag{3}$$

where T represents the total time, and the substitution method is used to replace P. The specific process is shown in the formulas

$$t = nt_0, \tag{4}$$

$$\lambda = -\frac{\ln\left(1 - P_{sg}\right)}{t_0}, \tag{5}$$

$$\ln\left(1 - F(t)\right) = k - \lambda t. \tag{6}$$

According to this model, we enter the immersive multimedia art design virtual reality space of VR technology to capture interference signals. The specific results are shown in Figure 2. From Figure 2, we can see that the overall signal is divided into two segments, and there is a certain law in the first half. The attention signals in the first half

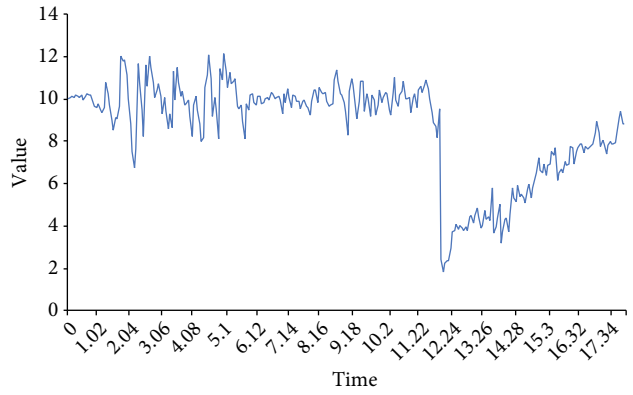

Figure 2: Immersive multimedia art design based on VR technology virtual reality space interference signal changes.

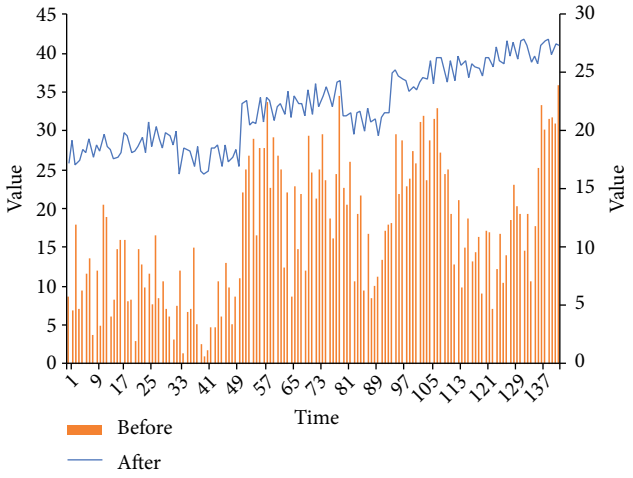

Figure 3: Comparison of variation trend of interference signal before and after amplification.

basically fluctuate up and down around the signal value of 10, and the fluctuation range is within 2. Therefore, the attention signal value for immersive multimedia art design in VR virtual reality space is about 10. The abnormal signals that fluctuate regularly up and down correspond to the interference signals we catch. The regularity of interference signals also shows that there is a fixed probability in the process of our capture. When the search area and search time are large enough, the frequency of interference signals will be wirelessly close to our capture probability. However, since the single target search paradigm used in this paper is used to capture interference signals, which is only used for local search, the search area will gradually increase with the increase of search time at any time, and the transmitted signal value will fall in an irregular cliff, which is caused by the inaccurate search due to the large search range. Therefore, the jamming signal search model set in this paper can effectively capture jamming signals to a certain extent, but it is necessary to pay attention to the scope of the search area in the process of use to avoid the capture failure caused by too large a scope.

After determining the capture of the interference signal, we began to study it. However, we found that the strength of

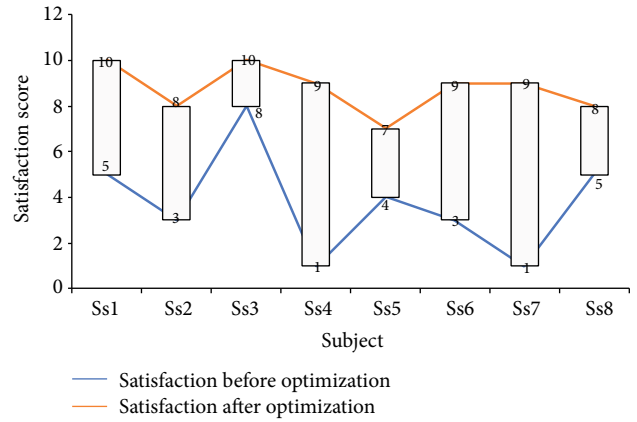

Figure 4: Comparison of subjects' satisfaction before and after optimization.

the captured interference signal value was not enough to support the subsequent analysis of the characteristics and causes of the interference signal. Therefore, we need to improve the algorithm to amplify the magnitude of the captured interference signal for the convenience of subsequent research. According to Figure 2, we can roughly confirm that the signals in the virtual space of immersive multimedia art design based on VR technology are mainly sinusoidal, so we can use the sinusoidal signal amplification method to amplify the interference signal, and the specific expression is shown in the formula

$$v(t) = V_m \sin(w_0 t + \theta), \tag{7}$$

where T represents the change period, w represents the angular velocity, and the relationship between them is shown in the formulas

$$T = \frac{2\pi}{w_0}, \tag{8}$$

$$w_0 = 2\pi f_0. \tag{9}$$

In the actual operation process, we found that although the signal of immersive multimedia art design based on VR technology in the virtual space is sinusoidal distribution, the sinusoidal amplification algorithm alone is not enough to operate when amplifying the interference signal, which may lead to the distortion of the amplified signal. Therefore, we introduce the deep learning algorithm to amplify the interference signal through the artificial intelligence neural network algorithm.

$$v(t) = \frac{V_s}{2} + \frac{2V_s}{\pi}\left(\sin w_0 t + \frac{1}{3}\sin 3w_0 t + \frac{1}{5}\sin 5w_0 t + \cdots\right). \tag{10}$$

However, signal distortion is unavoidable in the process of jamming signal amplification. In order to ensure the accuracy of the final data results, here we use a nonlinear

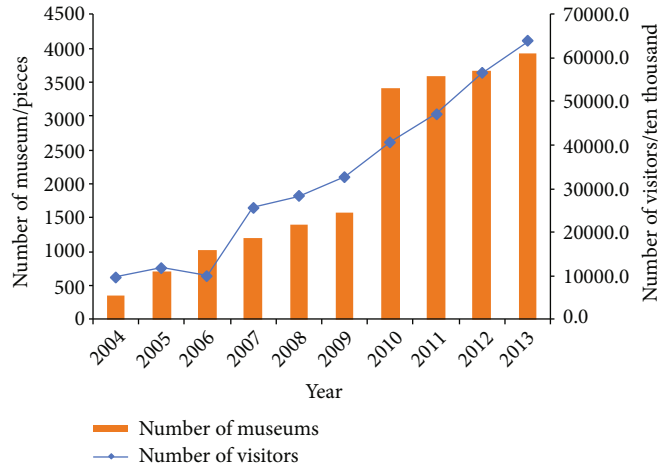

Figure 5: Trends in the number of museums and visitors in recent years.

function based on the theory of deep learning to measure the degree of distortion in the amplification process. The specific expression is shown in the formula

$$\gamma = \frac{\sqrt{\sum_{k=2}^{\infty} X_{ok}^2}}{X_{o1}} \times 100\%. \tag{11}$$

We compare the intensity of the interference signal before and after amplification, and the results are shown in Figure 3. From Figure 3, we can see that the interference intensity generally increases by 20%~50% after amplification, and according to the fluctuation of signal value, the amplification after controlling the degree of distortion is more stable than the nonamplified interference signal.

After getting the interference signal data and data preprocessing, we can analyze the interference signal in detail and eliminate the interference signal at the algorithm level. Here we use the extended task technology matching model (TTF model) to eliminate the interference signal at the algorithm level. TTf model is mainly to adjust the characteristic parameters of the target task in the virtual reality space where the immersive multimedia art design based on the deep learning intelligent VR technology is located from the algorithm model, so as to reduce the probability of the interference signal being noticed as much as possible, and achieve the unification from the target task and algorithm task, so as to reduce the visual interference in the virtual space. The algorithm first evaluates and scores the algorithm from 8 different dimensions and summarizes the scores of visitors from an objective and subjective point of view. The specific expression is shown in the formula

$$E = \frac{\left|Z_{\text{ptest}} - Z_{\text{etest}}\right|}{\sqrt{2}}. \tag{12}$$

ptest stands for the standard score, and etest stands for the score of the subjects after completing the immersive multimedia art design based on deep learning intelligent VR technology or visiting. In addition, we will also monitor the physiological data of the subjects in the virtual space, such as eye movement, as a comparison of the algorithm before and after improvement. See formulas (13) to (14) for the specific expression of eye movement.

$$R_r = \frac{N_r}{N_f}, \tag{13}$$

$$R_r = \frac{T_r}{T_f}. \tag{14}$$

Taking eye movement data as the reference of the subjects' reaction time, the satisfaction ratio is brought in to calculate the subjects' satisfaction with the optimized immersive multimedia art design experience based on deep learning intelligent VR technology. The specific expression is shown in the formula

$$C.R. = \frac{\lambda_{\max} - n}{(n-1)R.I.}. \tag{15}$$

Finally, with a total satisfaction score of 10, we recorded the satisfaction of 8 subjects. The specific results are shown in Figure 4.

4. Result Analysis and Discussion

Through the final results in Figure 4, we can clearly see that after the optimization of visual interference for VR technology based on deep learning intelligence, the satisfaction of the subjects of immersive multimedia art, whether used as design or display, has been greatly improved, indicating that the optimization method proposed in this paper has an obvious positive effect. In fact, VR technology based on deep learning intelligence is still most used in the research field of immersive multimedia art design in the exhibition stage. For example, in recent years, China's digital museums have gradually sprung up. According to statistics, when the digital museum was emerging, the growth rate of visitor flow of traditional museums was far lower than the new number of

Figure 6: VR scene of "Forbidden City beyond time and space".

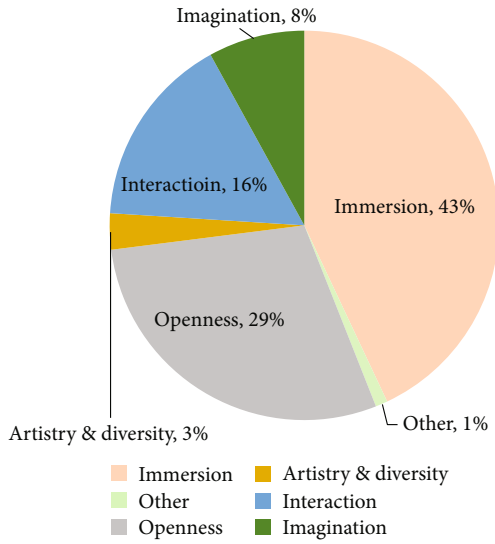

Figure 7: The advantages of intelligent VR technology based on deep learning for immersive multimedia art design.

museums, and the growth showed a certain downward trend. See Figure 5 for specific data.

This shows that the rise of digital museums has a certain impact on the development of traditional museums, but digital museums also have incomparable advantages over traditional museums. For example, if digital museums can rely more on in-depth learning intelligent VR technology for immersive multimedia art design exhibitions, they will occupy a smaller area than traditional museums, and because the visiting action actually takes place in the virtual reality space of VR technology, immersive multimedia art designers only need to reconstruct the design works in the virtual space. In this way, visitors can visit 100% of the works without worrying about accidental damage to the works. At present, there are similar projects in China, such as the "Forbidden City beyond time and space" project jointly cooperated by the Palace Museum and IBM in 2013. That is, a virtual "Forbidden City" space is created by using VR technology in actual proportion. Tourists can enjoy relevant art and design in the virtual space. Some scenes are shown in Figure 6.

Finally, we interviewed the creators and visitors of immersive multimedia art design about their views on the intelligent VR technology based on deep learning. Among them, only 3% of the subjects were not optimistic about the technology, while 97% of the subjects had expectations of supporting and popularizing the technology. The main expectation was that the use of intelligent VR technology based on deep learning could bring more immersion to immersive multimedia art design, and there is more interaction between the visitors and the works, as well as the convenience of visiting. See Figure 7 for details.

5. Conclusion

The rapid development of computer science has led to the rapid development of new media technology. Among them, VR technology is sought after by the vast market for its multidimensional experience and immersive model. To sum up, intelligent VR technology based on deep learning plays a positive role in promoting the development of immersive multimedia art research. Therefore, it is very necessary to optimize this technology to make the development of immersive multimedia art research. Based on this background and the interactive page algorithm based on traditional VR technology, this paper studies and improves the visual interference in immersive multimedia art design by using task technology perception matching model (TTF). Although some scholars have paid attention to the problem of visual interference in human-computer interaction, the traditional research on entry-level multimedia art design based on VR technology mainly focuses on the structural characteristics of VR technology itself and that VR technology is the expression of the interaction between art and human-computer interaction. However, it is seldom optimized from the algorithm level of VR technology. Therefore, this paper improves the modeling algorithm based on VR technology by using the deep learning algorithm, so that the subjects' satisfaction with the experience of intelligent VR technology based on deep learning in immersive multimedia art design increases by 10%, which improves the subjects' sense of immersion and experience to the greatest extent, and also has certain value for immersive multimedia art design.

Data Availability

The figures used to support the findings of this study are included in the article.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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