Research on Virtual Reality Technology in Landscape Design

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Abstract. Through in-depth research on landscape design, it is found that VR technology can indeed improve the visualization, accuracy and immediacy of landscape architects during the research process of landscape design. This technology will bring a revolutionary development in the process of landscape design, and through this technology, 3D vision related information can be connected between virtual and reality. This allows landscape architects to perceive the ecology and concept of design from the five senses, and virtual reality technology also provides a certain theoretical research foundation for future landscape design. To a certain extent, it is conducive to the optimization of the interactive experience of landscape architects. The solution ideas of derivative mixed reality (MR) and augmented reality (AR) are also proposed, as well as the prospect of future development.

1. Introduction

With the continuous progress of society, people's demand for landscape design is constantly increasing, and there are essential changes in the requirements for landscape design. Therefore, through VR technology, designers can intuitively display the design environment and solutions of the entire landscape, perceive the current design ecology and design concepts from the perspective of the five senses, and allow users to immerse themselves in the spatial effects of the entire design [2]. VR technology can not only provide designers with the possibility of spatial transformation from a plane perspective, but also allow designers to perceive landscape design in all directions and perspectives. However, as far as the current literature is concerned, there are relatively few research theories of landscape design in VR, and the application of related technologies combining landscape design and VR in China is relatively small, and a relatively complete research system and practical process have not yet been formed. The project is still in the process of theoretical research, so it is very necessary to further strengthen the research of virtual reality technology in the theoretical process of landscape design. This question is particularly urgent and important!
2. Definition, characteristics, composition and classification of virtual reality technology

2.1. Definition
Virtual reality is abbreviated as VR, which is called perception technology or artificial environment. It uses computer simulation to create a three-dimensional virtual world, providing users with sensory simulations, making them feel like they are experiencing a real physical environment, and they can observe things from three dimensions to provide a timely and infinite space. With the help of unique output and input devices, users can search in the virtual world, which can provide feedback to users, making people feel and experience as if they are in a real environment [6]. The virtual world created by virtual reality technology can be called "supported by 3D computer technology, generated by the computer and carried into the computer".

The 3D color graphics generated by a high-performance computer is called the virtual reality world. This virtual world can be divided into two situations. One is to simulate and reproduce the real world in a virtual reality world (such as cultural relics). In the field of restoration work, virtual reconstruction of protected ancient buildings or buildings is carried out to simulate unfinished construction projects. Another situation is a completely virtual and perceptible world based on people's imagination. With the advent of virtual reality, people can not only feel the objective world through the virtual world, but also break through the boundaries of time and space and experience emotions that cannot be experienced in the real world [1]. Virtual reality basically provides visual, auditory and tactile sensations through a computer, and at the same time allows people to feel the real nature in a very convenient virtual world, reducing the workload and improving its work efficiency to a higher level.

2.2. Characteristic
Immersiveness, interactivity, conception, and multi-perception are the main four characteristics of VR technology.

2.2.1. Multi-Sensory (Multi-Sensory): It is considered to be multiple senses in addition to the vision provided by the computer. Such as hearing, smell, taste and so on.

2.2.2. Immersion (Immersion): using the three-dimensional images generated by the computer to put people in a virtual environment, just like in the real objective world, can give people an immersive feeling.

2.2.3. Interactivity: In the 3D virtual world generated by the computer, people can use some sensing devices to perceive each item in the virtual world, and can feel the weight, shape and taste of the item. For example, when users reach out to grab items in the real world, they can actually feel the specific quality of the items in the virtual reality world.

2.2.4. Imagination: The virtual environment allows users to immerse themselves in the environment of virtual reality, and gain new knowledge in it, and further improve people's perceptual and rational understanding, so that users can experience and feel the new state of association. Therefore, VR In fact, it can actually improve people's creative thinking.

2.3. Constitute
According to the related concepts of VR, VR technology is a comprehensive technology composed of various modern information technologies such as computer science, network technology and AI. VR systems should have good interactivity, timeliness and other general functions, so VR is mainly a professional graphics computer, other application technology software, and with certain input and output devices, to provide a good virtual reality experience [3].
2.3.1. Professional graphics processing computer
The most important thing in virtual reality is the computer, which is not only the core of the entire system but also the key. Mainly responsible for managing the collection and sorting of input information, but also responsible for sending output information. This requires the computer to have timely computing power, so as to continuously update the state of the virtual reality process, and feedback the relevant results to the user through the output device.

2.3.2. Application software system
The application of virtual reality technology is the tools and images provided on the basis of virtual reality computers. It mainly completes the image management and establishment of the entire virtual world, including the geometric figures, behavior rules, physical phenomena, etc. of interactive objects. Real-time rendering of 3D sound and images; establishment and management of virtual world database, etc.

2.3.3. Database
The database is mainly used to store the entire information needed to experience the VR world. In the process of virtual reality, the scene must not only be drawn in time but also updated and invoked in time for the virtual objects of the experience. Therefore, it is very necessary to use a huge database object model for scientific classification.

2.3.4. Input device
The input device is the key input terminal of the VR system. Its main function is to detect the income signal generated by the user and transmit it to the computer through the incoming device. According to different performance and purpose, the input device is not only the well-known handle The microphone also includes the VR instant detector used by the user to solve the interaction of multiple sensory channels.

2.3.5. Output device
As the output of the VR system, the output device is a kind of feedback to the user's input information. The main function is based on the user's input information, combined with computer graphics processing and other technical software, and then the sensory channel is passed to the user. The output terminal includes not only the screen and earphones, but also the real-time display system of the entire large screen.

2.4. Classification
Four types of reality systems, desktop virtualization, immersive virtualization, enhanced virtualization, and distributed virtualization, are the main reality systems of current VR technology.

Desktop VR is basically a miniature desktop virtual reality system based on the popular PC platform. Use a personal computer (PC) or a main graphics PC workstation to generate the simulation. The user's vision is the PC screen. According to the current simulation situation, the user can use tools such as hoods, glasses, and locators to achieve a full-scale, multi-level, high-level virtual scene, and can browse the virtual world within a 360° range. However, the user cannot fully participate in the process of the virtual world. Even if the user wears the VR stereo glasses, the visual range provided by the screen is limited and will be interfered by the external environment.

Immersive virtual reality system is an advanced, impressive and complex VR system. The use of a closed scene and sound system isolates the user's vision and hearing from the outside world, so that the user is completely exposed to the computer-simulated scene. The user uses such things as a spatial position locator, a digital joystick, and a 3D mouse to input user operations. The computer simulates a real environment according to the data provided by the user and the dynamic situation through graphics processing, so that the user can experience the immersive feeling and fully experience the state brought by virtual reality.
The four virtual reality systems of helmet type, cave type, cockpit type and projection type are important components of the current immersion type. Augmented virtual reality system is a kind of virtual object that does not exist in real life generated according to graphics technology, and the object is placed in the real experience environment through the sensor. With the help of virtual reality equipment, the real environment can be integrated and give The user experiences a situation where a virtual character or scene is experienced in a real environment. This kind of system can not only realize the real-time combination of the real world and the virtual system, but also can make certain changes according to the current real environment. It can not only provide users with a real environment, but also allow users to feel the virtual world in the real environment process, which greatly reduces the degree of calculation in the real environment, and at the same time can perform certain calculations on the current actual objects. The operation reaches the realm of real virtual reality. The biggest feature of this system is that it can integrate the virtual world and the real world, allowing users to achieve more efficient interaction, switching and operation between the two worlds.

For example, engineers and technicians can fully display the internal structure of the machine and its related information and data through the helmet display when performing mechanical installation, maintenance, and debugging, and work according to the prompts of the computer (mobile computer), solving technical problems, making work very convenient, fast and accurate.

On the basis of a network, a distributed virtual environment is provided for multiple remote users. In this environment process, each user can participate in the reality of the same virtual environment by feeling different physical environment locations. Through the computer, each user can realize interactive sharing and operate in the same virtual environment. In other words, the mixed reality system allows users to efficiently switch between the virtual world and the real environment, making it difficult for users to distinguish the boundary between the real world and the virtual environment. The main function of the hybrid virtual system is to provide users with a common virtual environment, each user can achieve the purpose of collaborative work, that is, "real and fantasy interweaving".

However, under the current situation of our country, the landscape design stays in the traditional computer or projector and other two-dimensional display equipment to present the three-dimensional three-dimensional images are pseudo three-dimensional, poor interaction ability, three-dimensional conformation effect is not obvious and other shortcomings, which seriously affect the development and development of three-dimensional technology. Landscape design eagerly hopes to break away from the limitations of two-dimensional screens, obtain a more natural and efficient three-dimensional image display experience, and carry out more accurate and efficient design and services. With the continuous development of VR technology, especially the comprehensive solution of "mixed reality and landscape design", it provides users and landscape architects with a practical way of interaction and an immersive design environment. In design education and During the training process, a very high range of applications and scenarios were demonstrated. With the development of the Internet + and artificial intelligence and with the advent of the 5G era, the virtual reality industry is bound to usher in new development opportunities. Industrial innovation will subvert the current methods of the design industry and benefit mankind.

3. The relationship between virtual reality technology and landscape design

From its birth to maturity, VR technology has become a brand-new user expression mode in the process of continuous development in recent decades. This technology not only completely avoids the limitations of traditional landscape design and the unity of thinking. It also provides more practical design solutions and concepts for current landscape architects or other students, adopts lower-cost design devices, and possesses more efficient and faster processing equipment. With the continuous development and optimization of VR technology, this technology will bring new breakthroughs to landscape design, and will also completely change the entire design plan and concept of current landscape architects, making future design plans more scientific and rationality. Designers can use VR technology to achieve more efficient landscape drawing design, freeing them from tedious work, so that they have more time to think and analyze the layout and actual effects of the landscape design.
process. The application of virtual reality and actual scenarios can not only meet the functional requirements of various industries, but for an engineering project, it takes an extremely long period from the initial drawing design to the final completion acceptance. With the rapid development of network 5G technology Advances and the arrival of visualization technology [5]. Virtual reality technology can completely place the designer in an immersive design space environment process, allowing the designer to observe world objects from any angle, and to deeply experience the proportions in the design space process, allowing the designer The design plan is more in line with the needs of the actual situation, and its design effect will be more complete [6-7]. Improving virtual reality technology will change the current design concepts and plans of landscape architects. They can use this technology to immerse themselves in the virtual environment, and they can improve every detail in the virtual environment, and can quickly address the shortcomings, modify. Through this virtual reality technology, it can not only effectively enhance the work efficiency of designers, free them from tedious work, and further reduce their work pressure, but also can further improve the work efficiency of the entire industry and make more Of landscape architects have plenty of time to think about design concepts and plans.

4. **The method of virtual reality technology in landscape design**

4.1. **Investigation of behavior and psychological characteristics**

The core of this method is based on the user's behavior, analyzing the environmental function and designing based on it. Summarize the behavior and psychological characteristics of the local project people, and understand the factors that affect the use of the landscape to guide the landscape planning and design.

4.2. **Construction of virtual scene**

The preliminary design plan is confirmed after consideration and modification, and the sketch master software is used for the plan design. Construct virtual reality scenes on the determined models, and use lumion software to render virtual reality scenes.

4.3. **Experience the spatial effect**

Due to the characteristics of mixed reality (MR), the impact that interactive holographic visualization content can bring to the audience is a shocking experience similar to that of a science fiction film entering reality. MR technology is very suitable for displaying large and complex landscape designs. These works are not easy to carry and disassemble, and it is difficult for the audience to see the actual object or understand its internal structure. By using mixed reality technology to produce 3D holographic content for these landscapes, it is very convenient to display the details of the product in any place and on any occasion.

4.4. **Feedback and preferred solutions**

In the virtual scene, the interactive behavior of the user can be feedback in real time, and the efficiency and pertinence of the feedback information can be ensured. If MR and BIM can be perfectly combined, the "virtual" MR, BIM data and the "real" construction scene can be superimposed and compared, then we can even evaluate and feedback the project progress and construction accuracy at the landscape construction site. Bringing huge imagination space for the advancement of intelligent optimization of the landscape design engineering industry.

5. **Future development prospects**

As a high-tech technology, virtual reality technology has great development potential and broad application prospects. Whether it is software promotion or current hardware use, there are a large number of practical problems that need to be solved and changed. The development of virtual reality
in landscape design And the main task of the application is to improve the input device. The change of input mode will bring about the change of terminal mode! Because only input can transmit people's thoughts and actions to the computer. One is the positioning of the person/head in a 360-degree environment, and the other is the input of actions, including gestures and somatosensory. This rule has been verified on the PC platform that uses the mouse and keyboard as input, and the smart phone platform that uses touch input as the mainstream \[8\]. Virtual reality technology has the positioning of a gyroscope, and in the future there will be body gestures and AI camera input methods. The change of these input devices will usher in a new computing platform. The development and maturity of this technology is determined by the sensor. The first is the gyroscope, with which you can perform a 360-degree view. The second is the positioning device. With it, it can walk in the so-called 6DoF six degrees of freedom, and perform 3D displacement in space \[10\]. The two input forms will completely change the foothold of landscape design. And augmented reality AR is also using gyroscopes. The gyroscope is not only 360 degrees, but is now also used as a positioning device to cooperate with processing technologies to obtain information about the surrounding environment while obtaining its own spatial position, so that virtual objects can be stably placed in the real space \[9\]. This is a very important part for the development of future landscape design. From this point of view, it also allows users to experience a higher level of immersion and interactivity. AR is more difficult, so the arrival of real AR may be farther than the arrival of VR. The industry is also constantly improving the way virtual reality technology interacts to make it more convenient and natural. The development of the level of interaction mainly depends on the development of the locator, the transmission of data, the recognition of gestures and the dynamic sensibility of characters. How to efficiently transfer the actions of characters to the virtual environment is one of the current issues that this technology needs to focus on. Every move of a person, including where your eyeballs are looking at, can affect the virtual interaction. Smarter input must also be combined with processing capabilities, which are all complementary to each other, so as to move forward together. The output device, whether it is through the OLED screen or the optical waveguide technology of the optical lens, can transmit the tactile sensation to real people through some sensors. For example, through temperature and odor control, to achieve the ultimate goal of delivering hot and cold fragrance, these are very important to enhance the sense of presence, and will ultimately enhance the experience and effectiveness in landscape design. The efficient combination of VR system and landscape design will give landscape architects and use them to bring a broader development space. At the same time, it will further promote the development and progress of the entire landscape design industry, and my country's future landscape design will move forward in this direction. I firmly believe that my country's research results in this field will definitely be in the forefront of the world!

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