

Application analysis of Digital “VR Technology” in Grassland Landscape Design in Inner Mongolia

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Abstract:

Since the issuance of the “Opinions on Promoting the Implementation of the National Cultural Digitization Strategy” by the General Office of the Communist Party of China Central Committee and the General Office of the State Council, the “digital” aspect, particularly VR technology, has demonstrated great vitality and development potential in artistic design. Traditional design techniques need to integrate with modern showcasing technologies. By using VR technology to showcase Inner Mongolian grassland landscape design proposals, it can present the design ideas and outcomes of traditional designers in a more intuitive, concrete, and vivid manner to the end-users. This helps end-users gain a better understanding of the information about the Inner Mongolian grassland landscape and contributes to the improved promotion of the image of Inner Mongolian grassland..

Keywords:

Digital, VR Technology, Inner Mongolia Grassland Landscape, Apply Analytics

1. Introduction

Represented by the Inner Mongolia grassland, the northern grassland landscape of China is the main body of China's temperate grassland. While most people may associate it with vast and flat plateaus, the Inner Mongolia grassland landscape actually includes a wide variety of complex landforms, such as plateaus, mountains, hills, plains, loess, volcanoes, and more. Therefore, the design of Inner Mongolia grassland landscapes is a highly complex and systematic task. Traditional design techniques, which lack diversity and creativity, can no longer fully meet the requirements of modern landscape design in the rapidly developing digital society. As a result, more advanced design and presentation techniques are needed to create more vivid, rich, and accurate design outcomes. The development of VR technology can not only help designers better observe landscape designs in three dimensions but also inspire their creative consciousness through interactive modes. Meanwhile, it can give users a sense of immersive experience, bridging the gap between people and the environment. In this article, we will first briefly analyze VR technology, then

summarize the Inner Mongolia grassland landscape and describe the importance of using VR technology in designing Inner Mongolia grassland landscapes, and finally explore the application of VR technology in the design of Inner Mongolia grassland landscapes.

2. The Definition and Analysis of VR Technology

VR (Virtual Reality) technology, proposed by Jaron Lanier in the early 1980s, is a comprehensive technology that integrates computer technology, sensor technology, human psychology, and physiology. It simulates the external environment through computer-generated virtual systems, providing users with immersive and interactive simulated experiences that incorporate multiple information, three-dimensional dynamics, and interactive simulations. When users are completely immersed in the virtual environment through VR display devices, they can experience sensory perceptions that are indistinguishable from the real world, creating a captivating and immersive experience.

VR technology can transform the designs created by designers into realistic three-dimensional scenes, allowing designers and clients to experience and explore the design proposals. Through VR headsets, users can immerse themselves in virtual spaces and perceive design effects in a more realistic manner, including materials, lighting, proportions, and spatial layouts. During the design process, VR can assist designers in better understanding and planning spaces. Thus, VR technology offers modern advantages that traditional design lacks, such as immersive exploration, interactive activities, and conceptual creation. With its real-time three-dimensional spatial representation and interactive operating environment, VR technology revolutionizes the previous mundane, passive, and monotonous interaction between humans and computers. By integrating VR technology into landscape design, it enables the expression of macro designs from virtual micro-designs and transforms traditional design into a new and modern form.

3. The Application of VR Technology In Grassland Landscape Design In Inner Mongolia

3.1. The richness and uniqueness of the Inner Mongolia grassland landscape

The Inner Mongolia grassland is the largest grassland in northern China, with unique geographical, cultural, and natural landscapes. Therefore, the characteristics of landscape design in Inner Mongolia grassland are closely related to its unique geographical environment, cultural history, and natural scenery.

As a representative of Chinese grasslands, the Inner Mongolia grassland features vast and elongated landforms, primarily composed of plateaus interspersed with plains, divided by the Greater Khingan Range, Yinshan Mountains, and Helan Mountains. From a micro-perspective, it includes various grassland landforms such as forest grasslands, meadow grasslands, typical grasslands, desert grasslands, deserts, and mountain grasslands. The grasslands boast diverse grass and vegetation species, forming towering plateaus, densely forested mountains, undulating hills, boundless plains, basins surrounded by mountains, and distinctive wind-sand landforms, loess landforms, as well as volcanic and lava landforms. The characteristics of grassland landscapes vary throughout different seasons and regions.

In terms of cultural diversity, the Inner Mongolia grassland is a multi-ethnic region. The design of grassland landscapes should fully consider the local ethnic cultural characteristics, including horse-riding culture, Mongolian yurts, grassland music, traditional attire, and more. The landscape of Inner Mongolia grassland also includes vast grasslands, lakes, rivers, mountains, wildlife, and unique tourist attractions such as Mongolian yurts, horse racing venues, and Nadam festival sites. Designers need to skillfully integrate these natural and cultural landscapes to create vibrant, natural, and harmonious spaces.

Landscape design in the Inner Mongolia grassland needs to emphasize the interaction between nature and culture, allowing people to get closer to nature and appreciate its beauty. However, traditional design methods may not perfectly showcase the richness of the Inner Mongolia grassland landscape in design proposals and may have limitations in conveying information to the audience. Therefore, in order to better represent the diversity of Inner Mongolia grassland landscapes, designers need to introduce new presentation channels, such as VR technology, into traditional design techniques. This will allow the audience to experience the diversity and variability of the Inner Mongolia grassland landscape and better appreciate its regional characteristics.

In conclusion, landscape design in the Inner Mongolia grassland is characterized by diversity, ecological conservation, integration of nature and culture, and ethnic features. Designers need to have in-depth understanding and research of local culture and natural environment, and integrate modern technological means to create landscape designs that reflect the grassland's characteristics and meet objective requirements.

3.2. The necessity of applying VR technology in Inner Mongolia grassland landscape design

Traditional design techniques, such as hand drawing, computer-generated renderings, and the commonly used 360 and 720 animations, have limitations in conveying the full potential of landscape designs. For example, a rendered video of a landscape only captures a specific moment or season, limiting the viewer's experience to that particular time frame and failing to create a true sense of immersion. This restricts the diversity of landscape forms and the distinctive regional cultural characteristics from being effectively conveyed. In contrast, the utilization of VR technology in design presentations allows designers to transform their dynamic concepts into preset scenes. Users wearing VR headsets can simulate various scenarios and timeframes within the rendered landscape scenes by interacting with VR controllers. Moreover, VR technology can reduce design time and costs. Compared to traditional methods, VR enables rapid generation of diverse landscape scenarios, allowing designers to quickly assess the effects of different design proposals. This reduces the need for repetitive on-site inspections and design revisions, ultimately saving time and resources.

When applied to grassland landscape design, VR technology showcases its advantages in visualization and providing users with immersive experiences. It allows users to explore different regions and seasons within the same location, offering a more realistic visual experience. In the context of Inner Mongolia grassland landscape design, VR can simulate natural elements such as the sky, mountains, grasslands, cattle, sheep, and flowing water, aiding designers in capturing the essence of the

landscape and making it more feasible. It creates an immersive experience that transports users to the authentic scenes of Inner Mongolian grasslands, where they can feel as if they are truly immersed in the phrase “where the wind blows low, the grass bends, and the cattle and sheep roam.”

VR technology has become an effective means to validate the success of environmental design rendering and has optimized traditional design processes. It adds a comprehensive and innovative presentation channel to the systematic procedures of grassland landscape design, allowing for a more complete expression of the multidimensional spatial imagery of Inner Mongolia grasslands. VR not only conveys design information but also establishes interactive communication processes and immersive modes of human-computer interaction. Viewers not only receive design information but also gain intuitive visual and auditory experiences. By utilizing VR technology for presentations, the audience transcends limitations of time and space, allowing for a deeper and more profound impression of Inner Mongolia grassland landscapes in their minds.

4. Research on the Application of VR Technology in Inner Mongolian Grassland Landscape Design

4.1. Application strategies of Inner Mongolian grassland landscape design based on VR technology

When applying VR technology to the design of Inner Mongolian grassland landscapes, the main objective is to create an immersive experience for the audience, making them feel as if they are truly present in the vast grasslands. The planning and creation of the scene's elements play a crucial role, such as unique Mongolian yurt structures, herds of livestock, Mongolian people wearing traditional ethnic costumes, and the diverse range of grassland landscapes mentioned earlier. The construction and rendering of models are fundamental elements in showcasing VR technology. Therefore, in the landscape design of Inner Mongolian grasslands, the utilization of VR technology faces the primary challenge of constructing three-dimensional models. This involves software technologies such as CAD, SketchUp, 3ds Max, etc., to establish terrain and architectural models and create three-dimensional models of the grassland landscape blocks to be presented to the audience. By employing Unity3D software technology, VR effects can be produced, transforming the basic software-generated two-dimensional images into a three-dimensional space that represents the virtual landscape of Inner Mongolian grasslands, conveying dynamic effects to the audience.

Furthermore, VR technology enables the synchronous use and transmission of text, sound, and images. With the assistance of VR goggles and VR controllers, users can freely navigate within the scene, while also being able to switch between different temporal and seasonal elements within the same setting. This achieves an interactive and immersive spatial experience, engaging multiple senses of the audience simultaneously. Consequently, the presentation of grassland landscape information becomes more comprehensive, showcasing the design details of Inner Mongolian grassland landscapes from various angles and enhancing the aesthetic impact of the design. (Figure 1. Program map)

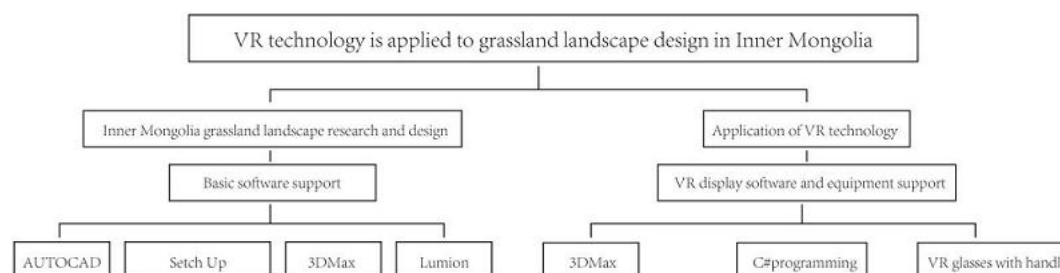


Figure1. VR technology uses Inner Mongolia grassland landscape design program map.

4.2. The demonstration of the design effects in Inner Mongolian grassland landscapes based on VR technology

With the support of the aforementioned technology, designers aim to make their works more compelling, vivid, and impactful. To achieve this, they utilize software to create scenes, lighting effects, color atmospheres, and other elements in order to showcase their designs through visual representations. Traditional static renderings have limitations in terms of realism and partial rendering effects, and audiences are unable to quickly view desired angles. While rendering technology has progressed to include 360-degree and 720-degree displays, some customers' needs are still not met. Therefore, based on VR technology, the design of Inner Mongolian grassland landscapes can effectively address the limitations of traditional renderings by providing a more immersive experience. By considering the scene from a human-centered perspective, when audiences wear VR headsets and controllers, they can freely move around the scene, change the time of day, and adjust weather conditions such as rain and snow to view different perspectives of the Inner Mongolian grassland landscapes. They can also explore various features and landscape nodes previously set by the designer in the space from all angles. This approach provides different experiences for audiences of different genders and ages, allowing them to fully immerse themselves in the Inner Mongolian grassland landscape design. By applying VR technology to showcase Inner Mongolian grassland landscapes, the focus is on meeting the needs of the audience, including local residents and tourists, and enabling them to experience and appreciate the design in a more realistic and high-end manner. This also promotes the image of the Inner Mongolian grassland landscape.

5. The Prospects of VR Technology in Landscape Design in Inner Mongolia

The immersive experience provided by VR technology allows designers and clients to fully immerse themselves in the beauty and uniqueness of the Inner Mongolian grasslands. Through VR headsets, they can roam in a virtual environment, experiencing the vastness of the grasslands, undulating terrain, rich vegetation, and unique lighting and climate conditions. This immersive experience helps designers better understand and express design concepts and share design visions with their audience, while audiences can appreciate the beauty and charm of the grasslands from the comfort of their own homes or offices.

Using VR technology, designers can create highly accurate virtual models for spatial planning and layout of Inner Mongolian grassland landscapes. They can explore different design options in a virtual environment, including plant configuration, positioning and proportion of landscape elements, etc. This real-time, visual feedback helps designers make more accurate decisions and optimize design

plans to create the best landscape effects. VR technology can help designers better understand the natural environment and climate conditions of Inner Mongolian grasslands. Through simulation and perception functions, designers can experience changes in different seasons, lighting conditions at different times, and the impact of weather factors on the landscape. This helps designers better evaluate and adjust design plans to meet landscape needs in different environmental conditions.

At the same time, VR technology provides designers and clients with opportunities for participatory design and co-creation. Designers can collaborate and communicate with clients in real-time in a virtual environment, jointly exploring and modifying design plans. This interactivity and real-time feedback help improve the quality of design and client satisfaction and promote cooperation and understanding between designers and their audience.

In terms of cultural heritage preservation, VR technology can be used to document and protect the cultural heritage of grassland areas. Precious cultural sites, traditional art forms, folk activities, and more can be preserved and passed down through virtual displays and digital reconstruction. People can experience these cultural heritage sites firsthand through VR, whether it's ancient architecture, traditional crafts, or folk stories, enabling their dissemination and protection. In terms of cultural exchange and education, VR technology can provide opportunities for people to learn about and understand grassland culture. Through virtual tours, interactive displays, and educational content, people can learn about the cultural characteristics of grassland regions, including their history, traditions, language, music, dance, and more. This interactivity and immersion help cultivate interest and respect for grassland culture and promote communication and understanding among different cultures. VR technology can also be used to promote tourism resources and attractions in grassland areas. Through virtual tours and experiences, people can get a preview of the beauty and charm of the grasslands and learn about the unique features and tour routes of different attractions. This pre-experience helps attract more visitors to grassland regions, boosting the development of tourism and economic benefits. VR technology also allows people to travel through time and experience the historical changes and evolution of grassland culture. Through virtual reconstruction and interactive displays, people can experience the grassland's way of life, traditional customs, and cultural activities in different historical periods. This cross-temporal experience enables a deeper understanding of the diversity and uniqueness of grassland culture.

VR technology provides new creative and presentation methods for Inner Mongolian landscape design. Through immersive experiences, spatial planning and visualization, environmental perception and simulation, participatory design, and collaborative creation, designers can better understand, plan, and express the unique beauty of Inner Mongolian grasslands. Audiences can gain a better understanding of the natural environment and cultural background of the grasslands, thereby enhancing their interest and enthusiasm for grassland tourism.

6. Conclusion and Prospect

Currently, under the call of national policies in China, the application of VR technology has already had a significant impact on the design industry. However, there is still limited research on the application of VR technology in grassland landscape design, particularly in Inner Mongolia. By incorporating VR technology into the design process of Inner Mongolia's grassland landscapes, designers can

enhance the visualization of their works, showcasing sustainable design strategies and their impact on the grassland ecosystem. Designers can simulate the long-term effects of their proposals, demonstrating how sustainable practices can preserve the ecological balance of the grassland and mitigate potential environmental impacts. Additionally, designers can utilize VR devices to better evaluate and observe their design concepts, enabling real-time modifications, quick iterations, and design optimization. This also provides a novel technological approach for audiences to explore and experience the grassland landscapes. Through VR technology, the vastness and diverse landscape of Inner Mongolia's grasslands can be better showcased, allowing audiences to customize their virtual tours based on their preferences, and offering a deep, comprehensive, and immersive interactive experience. This facilitates the appreciation and attention towards the rich landscapes of Inner Mongolia's grasslands. The future outlook of VR technology in grassland landscape design is promising, as it can create immersive, highly interactive, and sustainable experiences that not only capture the beauty of the grasslands but also promote environmental awareness and cultural preservation.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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