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*Retraction*

# Retracted: Urban Landscape Design Based on Virtual Reality Technology

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope
(2) Discrepancies in the description of the research reported
(3) Discrepancies between the availability of data and the research described
(4) Inappropriate citations
(5) Incoherent, meaningless and/or irrelevant content included in the article
(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

## References

[1] X. Li and Y. Guo, "Urban Landscape Design Based on Virtual Reality Technology," *Advances in Multimedia*, vol. 2022, Article ID 3154353, 6 pages, 2022.

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*Research Article*

# Urban Landscape Design Based on Virtual Reality Technology

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Different from the western classical stone buildings, China has formed the traditional architectural style with wood as the main body since ancient times. With the progress of the times and the collision between Chinese and western cultures, people put forward higher requirements for the current urban planning and landscape design, hoping that the future urban landscape design can follow the style of "Chinese and new." Traditional urban landscape design usually adopts solid model, rendering renderings, or three-dimensional animation, but these methods all have some defects. With the development of computer technology and the rise of Internet industry, virtual reality technology appears, and because of its excellent multiperception, immersion, interactivity, and autonomy, it is gradually applied to medical, military, entertainment, virtual city, and other fields of human life. Urban landscape design based on virtual reality technology is an important technical way of urban landscape design at present. It can help designers to better perfect the design details, experience it personally in the design process, find the existing problems and defects in the current design in time, and improve the design efficiency. It can also assist urban planners to make corresponding decisions. However, due to the high cost and the shortage of technical personnel, it is only implemented in a small area at present. Take the virtual Los Angeles project in the United States as an example, which is a typical case of the application of virtual reality technology in urban planning and construction and successfully realizes the interactive function between users and virtual environment. With the continuous development and improvement of virtual reality technology, there are more and more corresponding talents, and this technology will be widely used in the future urban planning and construction, forming our own "middle and new" urban landscape style.

## 1. Introduction

As one of the birthplaces of human culture in the world, China has a profound historical background, and after a long history and culture, it has formed a unique architectural culture style, which is different from the architectural style with stones as the main body in western culture [1–4]. China is a typical oriental architectural model with all kinds of trees as the main body to build houses. China has a vast territory, both in the dry north and the humid south, and there are high-quality woods suitable for its climatic conditions [5, 6]. Since modern times, especially after the reform and opening up, under the collision of Chinese and western cultures, people have a newer understanding of urban architecture, and at the same time, they have put forward higher requirements for living environment and urban landscape design [7–10].

In recent years, China's urban construction is developing rapidly on a large scale, followed by various urban landscape design problems. For example, some cities lack a unified planning for the overall image and emphasize the uniqueness of each building. Some cities blindly copy the western modern architectural style, are keen to build a large number of skyscrapers, and seriously lack Chinese traditional architectural style. Actually, Mr. Liang Sicheng, the father of modern architecture in China, has pointed out the correct architectural style for us: "Chinese and new" is the top grade, "western and new" is the inferior, "Chinese and ancient" is the second, and "western and ancient" is the last [11–14]. That is, it should be based on Chinese traditional culture, based on Chinese architecture, and integrated into western modern style, and the two should be perfectly integrated to form a "new Chinese" architectural style [15–18]. The future

urban landscape design should follow the "Chinese-new" style, which can not only inherit the essence of Chinese architecture but also contain all the excellent architectural styles in the world, thus showing the restrained Chinese spirit [17, 19–21] (Figure 1).

Traditional urban landscape design is limited by the constraints of time and space when obtaining urban environmental information, so it cannot record the disappeared urban landscape, and the display of landscape design effect is also restricted by many factors [22–25]. As we officially enter the Internet information age, various emerging Internet technologies emerge in endlessly, and virtual reality technology is one of them. With the continuous development and improvement of virtual reality technology, we can display the real city status by computer and virtually reproduce all the landscapes, roads, and vegetation in the city [26–29]. The urban landscape design based on virtual reality technology has a far-reaching impact on the display and design of urban landscape. Virtual reality technology can be used to restore and reproduce the urban architectural landscape that has disappeared in the long history, and can design the existing urban landscape online. It can also be used for virtual design of future urban landscape. The urban landscape design based on virtual technology is of unspeakable importance to the past, present, and future urban landscape design and has a great research prospect.

## 2. Virtual Reality Technology

Virtual reality technology is to simulate a three-dimensional virtual space by using a computer system, so that the user can have all the perceptive abilities such as vision, hearing, touch, and even smell like the real world in the virtual space and make the user immersive. Virtual reality technology has opened up a new way for human beings to better understand the world. In the past, human beings could only experience the world personally, but now, they can use natural ways to interact with the virtual environment and help us create and experience the virtual world.

*2.1. The Development Process of Virtual Reality Technology.* The development process of virtual reality technology can be summarized into four stages:

(1) The first stage: before 1963, the idea of virtual reality technology was born. Virtual reality technology is a kind of interactive simulation technology. Kites invented by ancient Chinese people simulate the interaction between flying animals and human beings. After kites were introduced into the west, westerners invented various kinds of aircraft according to their principles, which enabled human beings to have the ability to "fly." Both kites and flying machines contain the idea of virtual reality technology, which lays a solid foundation for the emergence of virtual reality technology

(2) The second stage: from 1963 to 1972, virtual reality technology sprouted. Ivan Sutherland, the father of computer graphics, developed the first head-mounted stereoscopic display and head position tracking system driven by computer graphics in 1968, which officially started the exploration of virtual reality technology

(3) The third stage: from 1973 to 1989, the concept and theory of virtual reality technology came into being. At this stage, early virtual reality systems began to appear, among which VideoPlace and View systems are the most representative ones (Figure 2)

*2.2. Technical Characteristics of Virtual Reality.* With the continuous development of virtual reality technology, it is widely used in various fields of human life such as medicine, military affairs, and architecture. Generally speaking, the main features of virtual reality technology are shown in Table 1.

*2.3. Application of Virtual Reality Technology*

*2.3.1. Application in the Medical Field.* Virtual reality technology can help hospitals to realize individualized treatment and simulate the therapeutic effects of different treatment schemes on patients. Compared with traditional doctors' meeting discussion and subjective judgment, various treatments are performed on virtual patients, medical data are obtained, and patients' specific physical reactions are analyzed and summarized, so as to make more reasonable judgments and choose the best treatment plan. According to the patient's actual situation, a virtual operation environment is set up to simulate the whole operation process, so as to predict various possible situations in the actual operation process and improve the success probability of the operation. The application of virtual reality technology in the medical field helps doctors to choose a more reasonable treatment plan, effectively reduces the risk of patients on the operating table, and has a good auxiliary effect on surgery.

*2.3.2. Application in the Field of Education.* With the improvement of education level, today's teaching is no longer confined to the classroom, so it is necessary to encourage students to go out of the classroom more and learn about the outside world. When you cannot go out, you can use the Internet to observe the actual situation outside based on virtual reality technology and create a learning environment for students to explore nature and know society. The emergence of virtual reality technology has changed teachers' teaching mode and presentation of teaching materials, improved students' learning enthusiasm, made the teaching classroom show diversity and novelty, and accelerated the pace of educational reform.

*2.3.3. Application in the Field of Cultural Relics and Historic Sites.* Through virtual reality technology, we can realize more precise and long-term protection of cultural relics, monuments, etc., and at the same time, we can better display them, highlighting China's profound cultural heritage. Using data image collection, the three-dimensional model of cultural relics is established, and all kinds of data of cultural relics are built and stored in a database. We can use virtual

Figure 1: "Chinese and new" architectural style.

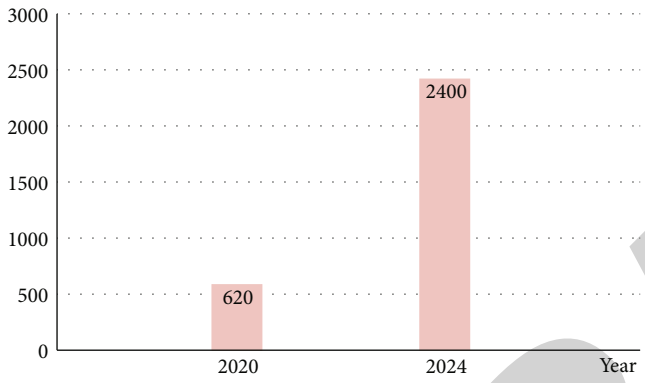


Figure 2: Market scale of global virtual reality industry in the future (unit: 100 million yuan).

technology to repair cultural relics, plan various repair schemes in advance, simulate them one by one, select the best scheme to shorten the construction period, and display intact cultural relics and historic sites. Virtual reality technology is of great significance to the protection and display of cultural relics and has accelerated the development of cultural relics industry.

*2.3.4. Application in the Field of Urban Planning.* With the improvement of people's living standards, people have gradually put forward higher requirements for urban planning, which requires a greener and more harmonious urban environment. Urban planning based on virtual reality technology can make designers feel the design effect and improve the design efficiency. At the same time, it can also show the specific planning scheme to the public, simulate the actual environment, make use of the user's immersive experience and the friendly interaction between the user and the virtual environment, bring strong and realistic perceptual impact to the public, and make specific urban planning to satisfy more people.

## 3. Problems Existing in Traditional Urban Landscape Design

*3.1. Defects of the Solid Model.* Entity model is one of the methods used in traditional urban landscape design in China. Although the solid model can show the city three-dimensionally, it cannot observe the whole city from the perspective of human beings. It can only show the appearance of buildings well but cannot reflect the internal details of buildings. The model shows each building in three dimensions in front of us, but it is limited to the display of large buildings, but it cannot show the details of the city's streets, greening, underground pipelines, etc. It is more just a display of the overall image of the city, lacking the ability to analyze and evaluate the urban landscape in the surrounding environment from the perspective of people. In the design of miniature landscape, this defect is more prominent, and it is impossible to show its details completely through the solid model; even because of its small volume, there is a certain discrepancy between the solid model made and the actual landscape. (Figure 3).

*3.2. Defects in Rendering Renderings.* The traditional urban landscape design in our country often adopts the method of rendering renderings, showing the details of streets and buildings in the city on a two-dimensional plan and observing the whole city from a human perspective. However, when this method is adopted, a picture can only show a small detail in the urban landscape design, and it is a discrete and individual visual effect picture, which cannot show the whole urban landscape completely. In addition, rendering renderings are always static, are lacking in three-dimensional sense, and cannot show the volume of buildings well, which makes people's understanding of some landscapes have a certain deviation. When designing miniature or garden landscapes, in order to show their complete details, a large number of rendering renderings may be needed to achieve the purpose, which requires a large amount of resources.

*3.3. Defects of 3D Animation.* With the continuous development of computer network technology, in addition to solid models and rendering renderings, computer-generated 3D animation has gradually become a common method of traditional urban landscape design. Generally speaking, 3D animation has largely solved the problems of the first two design methods, but it is still not the best urban landscape design method. Although 3D animation has strong stereoscopic impression and smooth motion vision, it can observe

Table 1: Main features of virtual reality technology.

| Serial number | Characteristic | Expand on |
|---|---|---|
| 1 | Multi-perception | In addition to the visual perception usually possessed by computers, virtual reality technology should also possess all the perceptual abilities possessed by normal human beings, such as hearing, touch, and even smell. |
| 2 | Immersion feeling | Also known as the sense of existence, it refers to the degree to which users feel about their surroundings when they are in a simulated environment. The ideal state is that the simulation environment is enough to confuse the real with the fake, which makes it difficult for users to distinguish the real from the fake in the three-dimensional space created by the computer and think that all the surrounding environments are real. |
| 3 | Interactivity | It means that users can actually operate the objects in the simulated environment and get corresponding feedback from the surrounding environment. For example, in simulated driving, users can actually feel the feeling of holding the steering wheel, and the external environment moves with the movement of the vehicle. |
| 4 | Independence | It means that all kinds of objects in the virtual environment built by computer can move autonomously according to the laws of movement in the present world. |

Figure 3: Schematic diagram of urban entity model.

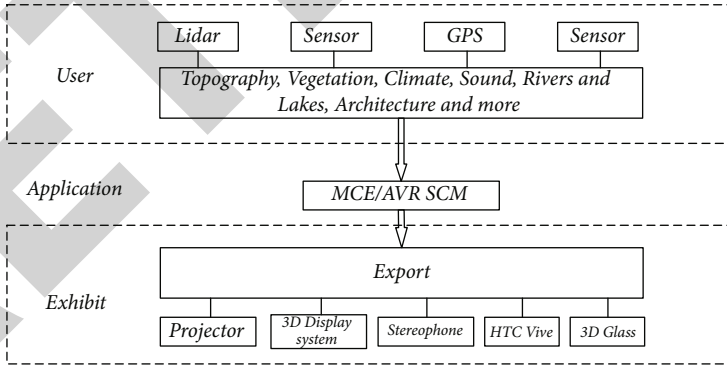


Figure 4: Framework of landscape virtual reality system.

the whole city well, but 3D animation limits the observation route, and the observer can only follow its set movement route, so it is impossible to realize human-computer interaction, so that the observer can set the observation point and modify the movement route by himself.

## 4. Application of Virtual Reality Technology in Urban Landscape Design

### 4.1. Landscape Design Based on Virtual Reality Technology

*4.1.1. Landscape Design Purpose Based on Virtual Reality Technology.* In the landscape design work, apart from the overall design of the park, designers also need to design rockery, ponds, lawn lamps, and other landscapes in the park. These landscapes are difficult to display by rendering renderings because of their complex structures. Using virtual reality technology, using computer to build a three-dimensional space model to display the final effect of landscape design, not only the visual effect is more stereoscopic and accurate, but also the motion simulation can be carried

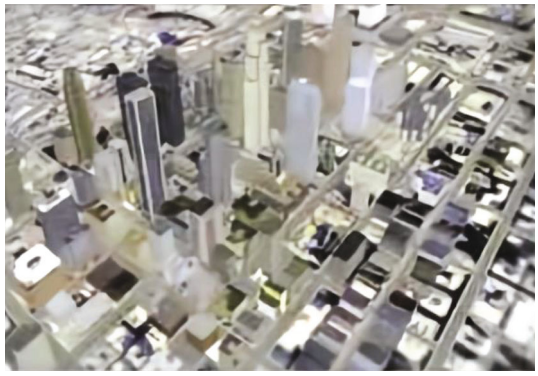

Figure 5: Virtual Los Angeles system.

out. When time and space change, it can still be displayed in an all-round and three-dimensional way.

When designing, designers can use the real-time imaging function of virtual reality technology to display the three-dimensional effect of the designed landscape in real time, which is conducive to finding and solving the defects in the design in time and effectively improving the work efficiency. Through the three-dimensional display effect of virtual reality technology, designers can have all-round personal feelings about the design of garden landscape and can also simulate and analyze the movement mode of garden landscape participating in action. According to the requirements of the owner, the management department, and other parties, the designer simulates and selects the appropriate landscape design movement mode, analyzes and summarizes the landscape design from multiple angles, improves the key details in the landscape design, and promotes the quality of the landscape design.

*4.1.2. Landscape Simulation System Based on Virtual Reality Technology.* A complete virtual reality system not only needs fully functional software running programs but also depends on the cooperation of all kinds of hardware. The landscape virtual reality system designed this time mainly includes three structural levels, as shown in Figure 4.

The first layer is the user layer, where users send instructions to the computer to simulate the landscape, and the computer collects all kinds of landscape information through a series of front-end hardware. The second layer is the application layer, which generates a three-dimensional rendering of the landscape according to the information collected by the first layer according to the user's instructions. The third layer is the display layer, which presents the garden landscape map generated by the system to users.

*4.1.3. The Main Application of Virtual Reality Technology in Landscape Design.* In the virtual reality system of garden landscape designed this time, the designer can choose the observation angle and route at will and feel the surrounding bright or dark, deserted, or busy conditions during the route and feel the moving garden space, instead of a static building. In landscape design, virtual reality system can be used to realize multiangle observation, and it can also replace the greening arrangement in the landscape, exchange trees in different positions in the garden, compare different greening effects, select the best position for greening, and improve the greening degree of the whole garden. In addition, the virtual reality system is also a scientific management platform, which enables both the designer, the owner, and the corresponding management unit to accurately understand the actual situation of the landscape design and assist the managers in making decisions.

*4.2. Typical Cases of Virtual Reality Technology in Urban Design.* There are many cases of city simulation system based on virtual reality technology at home and abroad, and the virtual Los Angeles system developed by Los Angeles University is called one of the most successful virtual city systems in the world. Based on virtual reality technology, combined with three-dimensional model simulation of aerial photos and street videos, a virtual city system covering Los Angeles is established. Because of the huge coverage area, the total data volume even reaches TB (1 TB = 1024 GB) level. As one of the most successful virtual city systems in the world, virtual Los Angeles is extremely elaborate, taking the model of Los Angeles University Hospital as an example, even so elaborate that it has the ability to roam every level inside the hospital. In addition, every street, pool, ceiling, and other objects are associated with the object information stored in the database, so users can click on the corresponding object to get its specific information no matter where they are in space (Figure 5).

## 5. Conclusion

With the development and perfection of virtual reality technology as the research background and urban landscape design as the research object, this paper applies virtual reality technology to urban landscape design based on its multiperception, immersion, interaction, and autonomy. It focuses on urban landscape design based on virtual reality technology and gives some typical cases of virtual reality technology in urban design. When virtual reality technology is applied to urban landscape design, it can effectively realize three-dimensional real-time simulation, help designers find and solve the defects in design in time, and better ensure the rationality of landscape design. Nowadays, as an important technical method of urban planning and design, virtual reality technology can make people experience the design effect personally.

As a gradually mature computer science, virtual reality technology represents a brand-new way of information processing, which can bring users a more immersive and realistic experience. It is widely used in medical, military, entertainment, virtual city, and other fields in daily life, providing convenience for people and helping them better explore and know the world. At present, virtual reality technology can play an auxiliary decision-making role in urban construction, but it has not been popularized. The main reason is that the cost of hardware and software needed to build virtual reality system is high, and it takes a long time to build a model with a large coverage. With the continuous maturity and improvement of Internet technology, these problems

will eventually be solved, and virtual reality technology will be widely used in future urban planning and design. With the continuous maturity and perfection of virtual reality technology, these problems will be solved one by one. In the future urban planning and construction, virtual reality technology will play a more important role.

## Data Availability

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

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

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