

# Research on the Application of Virtual Reality Technology in the Protective and Innovative Design of Traditional Dwellings in Guanzhong, Shaanxi

CHANG Liang

College of Art and Design, Shaanxi University of Science & Technology, Xian, 710021, China

**Keywords:** Virtual reality technology, Traditional folk houses in guanzhong of shaanxi, The research status

**Abstract:** This paper summarizes and states the status quo and advantages of virtual reality technology in the protection of traditional folk houses in the west of guanzhong in shaanxi province by sorting out relevant literature and materials on the protection of traditional folk houses in the west of guanzhong in shaanxi province in recent years. From the perspective of protection process, the research status of preliminary data collection, 3D modeling of key protected buildings and construction of mixed reality platform is sorted out and summarized. A low cost, low investment and high efficiency protection method is put forward based on the combination of traditional residence protection and virtual reality technology. With the support of national policies, this approach will also develop rapidly. In the future, the research should focus on the maturation and realism of the scene, the way of data output and update speed, and multi-sensory interactive experience.

## 1. Introduction

With the development of society and the development of related researches, the current investigation and research on the traditional folk houses in the west of guanzhong shaanxi is mainly to provide support and help for the economic and cultural development of society and the overall planning of the city<sup>[1-2]</sup>. Our country has 56 nations, the region span is big, thus presents the shaanxi guanzhong western traditional folk house of the shape each different. Baoji region, located in the west of guanzhong, shaanxi province, is an important birthplace of traditional Chinese culture (jiangyan culture, zhou-qin culture) and one of the regions where traditional Chinese culture and traditional Chinese folk art are well preserved and developed. Shaanxi province has a profound historical and cultural heritage. In this region, there are a large number of traditional dwellings scattered in the west of shaanxi. The architecture, structure and decoration of these dwellings are mostly completed by folk craftsmen, which interact with other folk arts in the region and have very important architectural art and cultural research value<sup>[3-4]</sup>.

The traditional folk dwellings in the west of guanzhong, shaanxi province are the wisdom crystallization of people's struggle and integration with nature over thousands of years. They are also the concrete expression of humanity, custom, art materials and science and technology in a region and a period<sup>[5-6]</sup>. One is the scattered through the study of this topic in baoji of shaanxi guanzhong west traditional houses make a systematic investigation and statistics and research the value of its relevant 2 it is the western shaanxi guanzhong play the excellent elements, application of traditional folk house, emphasize its application in the regional landscape design as well as the significance and value, achieve a certain level of shaanxi in the landscape design the inheritance and development of the western traditional houses in guanzhong plain<sup>[7]</sup>.

According to the data collected, foreign studies on the traditional folk houses in the west of guanzhong shaanxi province appeared as early as the 1950s and 1960s, mainly focusing on how to better maintain and develop the traditional folk houses in the west of guanzhong shaanxi province. However, with the development of society, the research of foreign scholars has gradually turned into how to do a good job in the ecological construction of traditional dwellings in the west of guanzhong, shaanxi province, so as to further innovate and optimize the traditional dwellings in the west of guanzhong, shaanxi province, and meet the requirements of The Times. For example, Indian

designer Charles correa proposed the concepts of “open space” and “tubular house” to solve the problem of shading and ventilation in a hot and dry climate<sup>[8-9]</sup>. In 1991, British green building design master Robert will and his wife Brenda will pointed out in their book “green architecture: designing for a sustainable future” that ecological buildings have the design concept of respecting the base environment, respecting users, saving energy and overall development. In his book ecological design in 1995, American architect siméon revealed how to apply ecological principles to solve the symbiosis and fusion methods based on the biological world and human beings as the basis of design<sup>[10-11]</sup>. At the same time, also have relevant scholars abroad for Chinese traditional dwellings in the related research in western shaanxi guanzhong, but these studies mainly in China's western shaanxi guanzhong as the breakthrough point of traditional folk house in overall construction development context and the analysis of Chinese and foreign architecture than research, for decoration, aesthetic and cultural connotation is less involved<sup>[12]</sup>. For example, islamic architecture, edited by John d hoge, has carried out in-depth analysis and research on the relevant development process of Chinese islamic dwellings, but lacks analysis and understanding of the structural characteristics, decorative characteristics and aesthetic culture of architecture. Anyway, because foreign western shaanxi guanzhong traditional dwellings is less, the kinds of aesthetic culture and the traditional local-style dwelling houses in western shaanxi guanzhong regional landscape design research also does not see more, more is focused on the study of western shaanxi guanzhong ecosystem traditional local-style dwelling houses building, and the study of Chinese western shaanxi guanzhong traditional dwellings, and influenced by language, culture, environment, etc, the study also in-depth.

In recent years, China's development is more and more rapid, the level of urbanization is more and more high, the shaanxi guanzhong western traditional residential protection needs are more and more urgent. Countries in recent years, though, increasing the protection of traditional houses in western shaanxi introduced to implement the strategy of rejuvenating the country “and” inheriting the excellent traditional culture spirit “as the core of protection policy, has announced the 4153 national traditional local-style dwelling houses in western shaanxi guanzhong, but relative to the national within the scope of hundreds of thousands of large western shaanxi guanzhong traditional dwellings base, is still a drop in the ocean. How to protect the traditional dwellings in the west of guanzhong shaanxi more efficiently has become an urgent problem.

## **2. Overview of Virtual Reality Technology**

### **2.1 Introduction to Virtual Reality Technology**

Virtual reality technology is a collection of high and new technologies, which can build an artificial environment accurately reflecting the physical properties and dynamic behaviors of reality. The technology is to create a virtual environment through the computer, using the human sensory system, so that people have a sense of immersive feeling. In this environment, participants can communicate and contact with the environment in real time through various virtual reality tools, so as to better reflect the sense of reality of the virtual environment, as shown in figure



Fig.1 Desktop Virtual Reality System

### **2.2 Development History of Virtual Reality Technology**

The evolution history of virtual reality technology can be roughly divided into four stages:

Before 1963, it contained the first stage of virtual reality technology thought; From 1963 to 1972, the embryonic stage of virtual reality technology; From 1973 to 1989, the initial stage of virtual reality technology concept and theory; Since 1990, the theory of virtual reality technology has been improved and applied.

The first stage: the first stage that contains the technology thought of virtual reality. Virtual reality technology is related to simulation technology, which is a kind of interactive simulation technology for the behavior and feeling of living things in nature. Kite is the earliest invention of Chinese ancient people's experimental aircraft model. It is a natural scene simulating the communication and contact between flying animals and human beings. The image of kite, the sound of flight and the trajectory of flight are the earliest application of simulation technology in China. Edwin a. Link, A western inventor, created A flight simulator based on the principles of ancient Chinese kites, allowing the operator to experience the real feeling of flying in an airplane.

In 1962, Morton Heilig's "full-sensing simulator" was invented, which is the predecessor of virtual reality technology theory and provides a realistic basis for virtual reality technology theory. These three typical inventions all provide theoretical basis for the virtual reality technology theory and have made outstanding contributions. The second stage: the embryonic stage of virtual reality technology. In 1968, Ivan Sutherland, the father of computer graphics in the United States, created an important milestone in the development history of virtual reality technology. He developed the first computer-graphics driven HMD and head position tracking system. This stage for the virtual reality technology of the basic ideas and theoretical development of a good start and lay a good foundation for the exploration of virtual reality technology. The third stage: the initial stage of virtual reality technology concept and theory. In this period, there appeared a typical virtual reality system called VIDEOPLACE and VIEW. The fourth stage: the perfection and application of virtual reality technology theory. This stage is the ideal application stage of virtual reality technology. In some developed countries and a few developing countries, this technology will be widely used in scientific research, flight, medicine, military and other aspects of human life.

### **3. Research on the Application of Virtual Reality Technology in the Protection of Traditional Folk Houses in the West of Guanzhong, Shaanxi**

#### **3.1 Research Status**

##### **3.1.1 Digital Reconstruction of Traditional Residential Buildings in Western Guanzhong Shaanxi Based on Su and 3dsmax**

This process is the key to the whole project. Before 3d modeling, it is necessary to collect data and information of traditional dwellings in the west of guanzhong, shaanxi, and master accurate data. In order to better show the overall appearance of key buildings in traditional folk dwellings in the west of guanzhong, shaanxi, the transformation from two-dimensional planning to three-dimensional research and analysis needs to be carried out by using computer 3D software. For example, liu yuan et al. used Arc GIS City Engin software to carry out three-dimensional modeling of traditional residential buildings in zhongtian village, hengyang City. According to the actual needs of the project and the actual situation of traditional folk houses in the west of guanzhong, shaanxi province, Sketch Up and 3DSMAX are selected for the establishment of 3d model.

##### **3.1.1.1 Three-Dimensional Modeling of Traditional Folk Houses in Western Guanzhong Shaanxi Based on Sketch Up**

Sketch Up is fast in modeling and requires low accuracy of surveying and mapping data, but at the same time, the modeling accuracy is also low and the performance is poor. Therefore, Sketch Up is used to carry out digital reconstruction of the representation of traditional residential buildings and the location relationship in the west of guanzhong, shaanxi province. For example, duan linfeng et al. used SkecthUp to build a 3d model of the key protected buildings in the western guanzhong traditional residential buildings in shaanxi province in the protection work of ganxian egret in shaanxi province.

### **3.1.1.2 3D Modeling of Traditional Dwellings in Western Guanzhong Shaanxi by 3dsmax**

The modeling speed of 3DSMAX is slow, and it requires high accuracy of surveying and mapping data. At the same time, the accuracy of the model is also higher and the performance is stronger. Therefore, 3DSMAX is used to express the important position, volume and architectural style of traditional dwellings in the west of guanzhong, shaanxi.

### **3.1.2 Construction of Mixed Reality Platform Based on Lumion for Traditional Folk Dwellings in Western Guanzhong, Shaanxi**

The initial mixed reality scene is similar to the street scene in the goole map. For the real image reprocessed, the scene is restored through special technology and the deformation of two-dimensional photos. This method has low efficiency, high requirements for hardware equipment and poor interactivity.

## **3.2 Advantages of Virtual Reality Technology in the Protection of Traditional Dwellings in the West of Guanzhong, Shaanxi**

### **3.2.1 Low Protection Cost**

Training personnel learn to use surveying and mapping tools, data input, 3D model production can be carried out, unlike the western shaanxi guanzhong traditional residential protection technology to the high accuracy of staff requirements, but also save part of the repair work, save a lot of money.

### **3.2.2 Multi-Sensory Effect**

In the simulated environment, users can not only see the 3D display effect, but also sense of hearing, touch, smell and vision are synchronized, generating an immersive feeling, which is of great significance for the inheritance of traditional customs and culture.

### **3.2.3 All-Round Three-Dimensional Display**

Virtual reality technology can be used to simulate almost the same environment as the reality, what can be seen next to the building, the use of virtual reality technology can be restored to the environment of high similarity, so that users can observe the building and environment from multiple angles.

## **3.3 Defects of Virtual Reality Technology in the Protection of Traditional Dwellings in the West of Guanzhong, Shaanxi**

Although virtual reality technology is suitable for the protection of traditional dwellings in guanzhong, shaanxi, there are still many problems. The virtual reality technology itself still has some problems of key technology improvement and breakthrough, which can be summarized as the following three points:

1) Accurate and timely positioning of large-scale multi-target. At present, among VR products that have entered people's life, the HTC Vive Pre has the highest positioning accuracy and the shortest time delay.

2) Extension of perception. Vision is the most important, complex and informative sensor in human body. Most of the actions of human beings need to rely on vision, such as avoiding, grabbing and recognizing obstacles in daily life. However, vision is not the unique channel for people to feel the outside world.

3) Reduce dizziness and eye fatigue. Currently, all VR products on the market will cause dizziness and eye fatigue.

## **4. Improvement Direction and Prospect of the Application of Virtual Reality Technology in the Protection of Traditional Dwellings in the West of Guanzhong, Shaanxi**

At present, the manifestation of virtual reality technology is relatively simple, which is mainly

reflected in the auditory sense and visual sense. However, in the protection of traditional folk houses in the west of guanzhong, shaanxi, people need a sense of reality more. There are several development directions as follows:

1) Virtual dynamic environment. To be authentic

The dynamic 3d scene further depicts the 3d static environment and increases the virtual field

The fullness of the scene and the maturity of the content system.

2) Multi-sensory interaction. The establishment of

On the basis of the virtual dynamic environment, the participants' multi-dimensional feelings of the virtual environment should be increased, not only in the sense of hearing and vision, but also in the sense of smell and taste, through the comprehensive response of the object senses, to deeply understand the cultural charm of traditional folk houses in the west of guanzhong, shaanxi.

3) Development of new interactive equipment.

4) Display technology. At present, there are two ways to present virtual reality, one is desktop level virtual reality, and the other is high-performance immersive virtual reality. Although the first form is simple, it does not feel real. The second form gives people more real feelings, but they need to wear heavy equipment to have more real feelings. What we need to strive for is the reality of the scene and the simplification of equipment, so that participants can accept sensory input.

5) Real-time three-dimensional graph generation. At present, the data information changes with each passing day, and the data needs to be updated in real time. Although the generation technology of 3d virtual graphics has been relatively mature, our key goal is to achieve "real-time generation". The goal of our longitudinal research is to improve the refresh rate of the data of traditional dwellings in the west of guanzhong, shaanxi, and to reflect the time change of traditional dwellings in the west of guanzhong, shaanxi.

6) Commercial cooperation. In order to promote the economy of traditional dwellings in guanzhong and western shaanxi, and to deeply explore the intrinsic value of traditional dwellings in guanzhong and western shaanxi, it is necessary to conduct commercial cooperation with local companies and enterprises, and increase the research on virtual reality technology of traditional dwellings in guanzhong and western shaanxi.

## 5. Conclusion

With the increasingly updated digital technology, the overall digital virtual reality protection of traditional dwellings in guanzhong and western shaanxi will become the future development direction, and the addition of new technologies will play a key role in improving the level of cultural heritage protection of traditional dwellings in guanzhong and western shaanxi. Around the virtual reality technology in this paper the application of the traditional houses in western shaanxi guanzhong protection this topic, first of all, the virtual reality technology and virtual reality technology in the protection of traditional houses in western shaanxi guanzhong application research status are analyzed, and virtual reality technology in shaanxi guanzhong west practical application in the field of traditional dwellings protection technology and the existing problems, in view of the question proposed the virtual reality technology in the field of traditional houses in western shaanxi guanzhong protection advantage, and then the virtual reality technology in the traditional local-style dwelling houses in western shaanxi guanzhong protection in the future development direction is prospected.

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