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Virtual Exhibition Hall based on Blender and U3D: "Cloud Weaving Dream" Chu Embroidery Virtual Exhibition Hall Design

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Abstract: Due to the impact of the epidemic, offline exhibitions and exhibitions have been hit, and have been suspended, delayed or moved online. Virtual exhibition halls are now being developed and improved. Visitors to exhibition halls are no longer limited to the local area, but more visitors come from all over the country or even abroad. Therefore, pavilions with remote tour function become very important. This paper firstly studies the application trend and preliminary practice of digital design in the field of virtual exhibition hall at home and abroad from the perspectives of 3D modeling technology and virtual exhibition hall construction. Secondly, it expounds the characteristics of 3D experience in virtual exhibition hall from three aspects of immersion, interactivity and conceivability, and compares virtual exhibition hall with traditional exhibition hall to summarize the advantages and potential of virtual exhibition hall. Then, the basic analysis and comparison of 3D modeling software is done, and the effect of blender and unity on the construction of virtual exhibition hall is described. Finally, the virtual exhibition hall is applied in the inheritance and dissemination of Chu embroidery, and the virtual exhibition hall of Chu embroidery is designed in detail.

Keywords: Virtual Exhibition Hall; Blender; Unity3D; Three-dimensional Modeling; Chu Embroidery.

1. Introduction

1.1. The Purpose and Significance

1.1.1. Research Background

Affected by the epidemic, offline exhibitions have been impacted and have been suspended, delayed or moved online. And under the wave of digital transformation, the new model of virtual exhibition hall has brought new momentum and growth point to the exhibition industry worldwide.

The construction of virtual exhibition hall requires the application of virtual reality technology and three-dimensional modeling technology. Virtual reality technology is a kind of practical high technology, comprehensive application of multiple disciplines knowledge, 3D interactive logic imaging as the core. The technology effectively simulates the behavior of organisms in the natural environment, such as sight, hearing and motion, and is a constantly developing and changing interactive technology.

The construction of virtual exhibition hall applies many advanced technical means, such as high-definition image rendering, all-round sound design and haptic feedback technology, which can generate three-dimensional interactive scenes full of vivid sense and realistic sense, so as to provide users with a more immersive experience. In addition, the virtual exhibition hall can also support multi-language, multimedia elements, such as video, music, pictures, etc., so that users can more easily understand the information expressed by the exhibits. At the same time, the use of network technology, virtual exhibition hall can connect users in remote areas, to achieve cross-time and space visit interaction, so that the exhibition activities have a wider influence. In general, virtual exhibition hall technology is gradually becoming a new way of cultural exchange and display, bringing people richer audio-visual enjoyment and deeper cultural cognition.

Virtual implementation technology is composed of two main bodies: one is the user, and the other is the object of action [3]. The implementation process of virtual exhibition hall is often for visitors to experience the virtual exhibition hall scene to generate sensory signals, and after sensory feedback, action signals are generated, which are demand instructions, and the instructions are transmitted to the virtual reality technology system. Virtual exhibition hall technology is an extended application in the development of virtual reality technology, and its function principle is the same. Through the combination of virtual reality technology and exhibition hall scene, network communication technology and exhibition hall design are used to benefit the audience and provide help for the development of cultural communication.

As the saying goes, "Wine is also afraid of deep alley." At present, the virtual exhibition hall is constantly developing and improving, but at the same time, it also exposes the problem of weak publicity. Visitors to the exhibition hall are no longer limited to the local, more visitors from all over the country and even abroad, so the exhibition hall with remote tour function has become very important. In the past, the only way to get to know the exhibition hall was through the text and pictures on the web page, or by taking the time, effort and money to visit it remotely. The emergence of virtual exhibition halls has effectively made up for the limitations of current publicity.

1.1.2. Purpose and Significance

The exhibition hall industry is a rapidly developing service industry in today's society, which is expected to usher in the great development of the exhibition hall industry in the next few decades. The development of the exhibition hall is limited by many factors such as weather and traffic, time, space, cost and safety. The combination of virtual reality technology and exhibition hall technology is an important means to solve the development obstacles of exhibition hall industry.

The development of virtual exhibition halls provides new ideas for the promotion and inheritance of cultural relics and

culture, which can increase interaction and broaden publicity channels. Virtual exhibition hall has three important characteristics: immersion, interaction and imagination, which is referred to as 3I characteristics, which can be understood as some abstract thinking and conceptual knowledge, and is a plastic field for the application and development of simulation technology and human-computer interaction technology. At the same time, the construction of virtual exhibition halls related to Chinese culture can enhance the public's sense of common Chinese culture. The construction of cultural relics digital protection project can realize the permanent preservation of cultural relics through the digital management platform, which can provide the basis for cultural relics research, cultural relics restoration, publicity and display. The virtual exhibition hall technology has well inherited the above characteristics.

As a new means of display, virtual exhibition hall can not only make up for the limitations of traditional venues, but also increase the exposure of venues and exhibits on the network. Traditional venues and exhibitions are mostly limited by the size and location of the venue, resulting in many exhibits can not be displayed at the same time, and the audience can not enjoy all the exhibits. The virtual exhibition hall can present all exhibits to the audience in a virtual way through digital technology, eliminating the restrictions of geographical location and no longer limited by the area of the site, greatly improving the audience's visiting experience. In addition, the virtual exhibition hall can also increase the exposure of exhibits and venues on the network. Through the online virtual exhibition, more people can know about the exhibition hall and exhibits, so that the audience can understand the exhibition in different time and space, and expand the scope of the audience. At the same time, the virtual exhibition hall can be shared on the network, using social media and other platforms to increase the exposure of the exhibition hall and exhibits, and improve its visibility and influence.

Virtual exhibition hall is an important means of modern museums and exhibitions, which can make up for the limitations of traditional venues, and improve the network exposure of exhibits and venues, which is of great significance for increasing the audience and improving the exhibition effect.

1.2. Virtual Exhibition Hall Overview

1.2.1. Virtual Reality Technology

Virtual Reality Technology Overview

Virtual Reality (VR) technology is a collection of simulation technology, computer graphics, human-machine interface technology, multimedia technology, sensing technology, network technology and other technologies cross frontier disciplines and research fields, and includes two main bodies of users and objects. Among them, the user refers to the person who enters the virtual world through the client, and the object is the virtual reality technology system developed using various tools (including software and hardware). The interactive operation between the user and the object constitutes the user's experience in the virtual reality technology system. Virtual reality technology system uses sensory signals to transmit various stimulus information to the user, and finally triggers the user's action signal, so that the user can feel a variety of real experiences.

Virtual exhibition hall is a digital exhibition place established by virtual reality technology. Exhibits, exhibition halls, display design and other contents are presented to the audience through computer-generated 3D vivid images. The virtual exhibition hall uses a variety of technologies to realize real-time interaction and participation between the audience and the exhibits. Virtual exhibition hall is one of the applications of virtual reality technology in education and training, scientific research, cultural inheritance, commercial publicity and other fields, and has become one of the hot spots of research and attention at home and abroad.

The application of virtual reality technology to virtual exhibition halls has many advantages. First of all, virtual reality technology overcomes the limitations of traditional scenes such as space, geography and time, and can be used anytime and anywhere. Second, virtual reality technology can analyze and process large amounts of information, data and intelligence, allowing users to access and manipulate information in an unprecedented way, and achieve a sense of realism and immersion in it. In addition, virtual reality technology can also achieve multi-person collaborative operation and interaction, making communication and collaboration between people more convenient and efficient.

In addition to these advantages in the field of virtual showrooms, virtual reality technology has also had a profound impact on other fields. For example, in military simulation, virtual reality technology can provide soldiers with immersive simulation training, help them better understand the battlefield environment and improve their ability to cope with emergencies. In the medical industry, virtual reality technology can provide doctors with more efficient medical education, thereby improving their diagnosis and treatment. In education and teaching, virtual reality technology can provide students with more intuitive, vivid and comprehensive educational resources, thus enhancing their learning interest and effect. In the field of developing publicity and entertainment, virtual exhibition hall technology can provide rich experience and interaction, and bring users more abundant entertainment and experience.

Conversion from 2D Scene to 3D Scene

Virtual reality scenes can make up for the shortcomings of traditional two-dimensional scenes. Traditional 2D scenes only have X - and Y-axis coordinates, and lack Z-axis orientation information. Virtual reality technology can build a realistic three-dimensional scene, so that users can experience the scene more truly, and even feel its immersive feeling. In addition, virtual reality technology can increase the user's sense of immersion and reality through the application of multiple senses such as sound, light and smell, and improve its experience effect and perception ability.

Table 1. Comparison between Traditional Display and VR Display

SUBJECT	EXHIBITION	COLOR	MOVE	CONTROL	IMFORMATION
2D planar graph	plane	Single			
3D planar graph	S3D	Abundant		Simple	
Video	S3D	Abundant	Dynamic	Ordinary	
VR	S3D	Abundant	Dynamic	Excellent	Available

1.2.2. Display Design

Display Design Overview

Display design is a very important design system, which is not only an aesthetic display, but also a complex and efficient system for conveying information. Display design relies on visual communication means to display the necessary information in front of the public, so that the audience can quickly and accurately obtain the information they need, thus having a significant impact on their psychology, thought and behavior.

The core of display design is the efficient delivery of information to the audience. In the design of an exhibition, the placement, lighting, color, text and logo of the exhibits need to be carefully matched to achieve the best display effect and information transmission effect. Through clever design and layout, the audience can enjoy the exhibits, pavilions and other relevant information, so as to obtain a deeper and richer content of the exhibits, which plays a crucial role in the success of the exhibition.

The purpose of display design is to achieve the ultimate goal of display function, and its functional range is very wide, which can involve museums, libraries, exhibition halls, exhibition halls, shopping malls, display cabinets and other fields. It can provide better display results for customers, and it can also provide more convenient and richer information for the audience. Therefore, display design is a creative design activity, which constantly applies new design concepts and technologies to practice, not only needs to pay attention to visual effects, but also needs to meet user needs and experience, so that each audience leaves a deep and unforgettable impression.

Virtual Exhibition Hall based on Display Design

Virtual exhibition hall is an exhibition place presented by digital technology, which contains rich display design elements to attract the attention of the audience, stimulate their interest in the exhibition, and bring them a colorful exhibition experience. The exhibition design included in the virtual exhibition hall covers five aspects: exhibition theme and promotion, exhibition layout and space, exhibition display and decoration, light and sound, interaction and participation.

1) Theme and Publicity of the Exhibition

In the virtual exhibition hall, the theme and promotion of the exhibition are very important display design elements. Through exquisite posters and theme promotion, the corresponding special page is set up on the Internet to attract visitors to enter the virtual exhibition hall. At the same time, language, image and color design are also important elements to be considered in display design.

2) Exhibition Layout and Space

For the virtual exhibition hall, the design of exhibition layout and space is very important. By creating exhibition space in a reasonable way, including channels, exhibition halls, booths, exhibits, etc., visitors can better understand the theme and content of the exhibition. At the same time, the addition of digital maps and navigation systems in the virtual exhibition hall can facilitate the audience to quickly enter and view the specific exhibits.

3) Exhibits Display and Decoration

In the virtual exhibition hall, the display and decoration of the exhibits is one of the key elements of the display design and the application of digital technology. Through specific exhibition arrangements and decorations, visitors can be attracted to better understand the historical and cultural significance of the exhibits. Especially for some experiential exhibits, interactive design and multimedia display using digital technology can attract more interest of the audience.

4) Light and Sound

In the virtual exhibition hall, sound and lighting are also indispensable elements of the display design. The appropriate use of color, light, shadow and sound design in the exhibition can enhance the atmosphere of the exhibition and improve the appreciation and experience of the exhibits.

5) Interaction and Participation

Virtual showrooms allow for interaction and participation through digital technology. This display design element provides the audience with the opportunity for real-time interaction and engagement, facilitating communication and connection between the audience and the exhibits. In the virtual showroom, interaction and participation can include interactive games, online surveys and audience voting.

To sum up, the display design elements contained in the virtual exhibition hall are very rich, and these elements interact with each other to play the role of immersive expression of the theme and content, and provide all visitors with a rich and profound visual experience.

1.3. Research Status in China and Global

1.3.1. 3D Modeling Technology

In China

In China, the development and practice of 3D modeling technology has gone through three stages. At first, 3D modeling is mainly applied to industrial Design and architectural design, such as CAD (Computer Aided Design), modeling software, etc. With the rapid rise of mobile Internet and game industry, 3D technology has become popular, and more and more enterprises have introduced it into product development and marketing. At present, in China, 3D modeling technology is widely used in games, animation, movies, architecture, automobiles and other fields, and has developed a certain degree of 3D modeling technology and software development capabilities.

At present, the development and practice of 3D modeling technology in China are mainly concentrated in the following fields:

1) Game and Anime Production

In China, game and animation production is the main application field of 3D modeling technology. For example, The Three Kingdoms, Tencent games, NetEase games and other games have adopted three-dimensional modeling technology.

2) Architectural Design and Real Estate Industry

3D modeling technology is widely used in architectural design and real estate industry. For example, VR technology allows customers to take a virtual tour of a house that has not yet been built in order to better understand their needs and make more informed decisions. Practical cases include Vanke Objective 3D's V+ intelligent retail development solution, Sunac Future World's 3D VR roaming solution, and so on.

3) Robots and Automatic Control

Artificial intelligence and other technologies can be used to mathematically process scene data such as image and speech recognition, so that robots can make a specific degree of autonomous decision-making. For example, the smart home with its own artificial intelligence system, the global magic robot masterpiece T9 created by the United States with

violence and beauty.

Global

The earliest virtual reality technology originated in the United States, and its technology research level is still in a leading position in the world, and American technology represents the forefront of international technology research. [7] In 1998, U.S. Vice President AI Gore proposed the concept of digital Earth, and digital cities and campuses have become the focus of research, promoting globalization. In 2012, Oculus plans to improve the expensive and cumbersome problem of VR equipment, the development of VR equipment, then the explosion of capital, VR into a new era. Developed countries attach importance to the development of VR, and their investment continues to increase. VR technology has been widely used in games, advertising, medical care, education and other fields, integrating multimedia, Internet, artificial intelligence and other technologies, broadening the scope of people's perception, and has a profound impact on current technology, culture, life and other fields.

1) Aviation and Automotive Industry

3D modeling technology is widely used in aviation and automobile industry. BMW, for example, uses 3D modeling to design and produce high-performance cars.

2) The Medical Industry

The medical field can use 3D modeling technology to build medical devices or medical instruments with higher accuracy and less risk, such as CT. For example, make a human model for simulating the surgical process before surgery, and show similar disease mechanisms and treatment plans for patients.

3) Virtual Reality and Gaming

3D modeling technology is widely used in virtual reality and games. For example, Ubisoft is a game development company that uses 3D modeling to create great games like *Assassin's Creed* and *Red Dead Redemption*.

Brief Summary

In general, 3D modeling technology has become an indispensable tool in many fields, and its development and practice are also characterized by constant innovation and change. In the future, 3D modeling technology will continue to explore new application scenarios, improve performance and accuracy, and continue to promote the progress of the digital age.

1.3.2. Virtual Exhibition Hall Construction

Global

Virtual exhibition hall is a display form based on the integration of three-dimensional modeling technology and virtual reality technology, which can present rich, three-dimensional and interactive display effects at relatively low cost and resource investment. In recent years, with the development and application of virtual reality technology more and more, virtual exhibition halls have been widely used in the world, and have formed different stages of development.

1) The First Phase: The Transitional Stage (mid 1990s - early 2000s)

The first virtual showrooms appeared in the 1990s, but at that time virtual reality technology was not advanced enough, and the presentation effects tended to be simple and fixed. Basically, it is based on 3D modeling technology, mainly used in machinery, automobile manufacturing, construction, aerospace and medicine and other fields. In 1994, Japan's Mitsubishi Motors Corporation launched its first virtual exhibition hall, *Mitsubishi Digital Gallery*, which showcases the design concepts and technical features of automobiles.

2) The Second Phase: The Functional Stage (2000s – 2010s)

By the beginning of the 21st century, virtual reality technology has accelerated its development, expanded more functions and applications for virtual exhibition halls, and has been widely used.

With the gradual improvement of multimedia technology, the virtual exhibition hall presents more interaction and experience. Now the virtual exhibition hall can not only display products or design concepts, but also integrate video, audio, animation or other multimedia elements, so that the audience can better feel the scene and atmosphere of the display. In addition, it can also interact with the real scene, guide and so on. In 2010, *Austria's Kunsthistorisches Museum Wien* (Vienna's Art History Museum) launched its first virtual exhibition hall, which focuses on artifacts and exhibits from ancient Egypt.

3) The Third Phase: The Intelligent Stage (2010s - present)

With the rise of artificial intelligence, virtual showrooms can now be more intelligent. By analyzing the interests and needs of the audience, as well as the behavior of the audience in the exhibition, the virtual exhibition hall can be automatically adjusted according to different scenes, so that the audience can get a better display experience.

In addition, the development of VR and other technologies has also created better application scenarios and possibilities for the intelligent virtual exhibition hall. In 2020, Germany's *Mercedes-Benz* launched its first Virtual exhibition hall named "*Virtual Experience*" at the *ESSEN MOTOR SHOW*, showing the latest design concepts and technological features of Mercedes-Benz cars. The exhibition hall is equipped with an intelligent navigation system that can automatically navigate according to the interests and needs of visitors to provide a better display experience.

In China

In China, virtual reality technology has developed rapidly in the past few years, which has also promoted the application and development of virtual showrooms.

In China's cultural field, the application of virtual exhibition halls has achieved great success. One example is the successful launch of the virtual exhibition "*Palace Treasures: Qianlong's Imperial Collections*" by the National Museum of China in 2019. The exhibition uses virtual reality technology to enable the audience to feel the beauty and history behind the precious cultural relics in the Qing Dynasty palace culture. This method successfully breaks the space and time limit of traditional cultural relics exhibition, and at the same time makes the exhibition more interactive and experiential, which is an innovative way to improve the display of cultural relics.

In addition, the application of virtual exhibition halls in the commercial field is also developing rapidly. Taking Taobao of Alibaba as an example, the company launched its own virtual exhibition hall, enabling merchants to display products and brands in the virtual exhibition hall, which caters to the needs of the market. At the same time, it can greatly shorten the time and cost of the supply chain, facilitate the shopping environment for consumers to visit the mall and buy things at home, and improve the brand awareness and reputation.

Finally, in the field of scientific research, the application of virtual exhibition halls also has extensive potential. Taking the aerospace field as an example, the virtual exhibition hall can simulate simulation experiments and understand the performance of spacecraft at different altitudes and airflow fields, so as to improve the efficiency of research and

development and reduce potential risks. It is an efficient and low-cost simulation experiment method.

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1.4. Main Content of the Paper

The main content of the design consists of two levels of virtual exhibition halls, and the building covers an area of 2750m². The overall design includes: Chu embroidery pattern transformation, exhibition hall double-layer plan, *blender* exhibition hall model, Chu embroidery pattern scene modeling, exhibition hall 3D projection display, exhibition hall roaming, touch screen interactive game design.

For software and technical operations as follows:

Blender is used to build the main building of the exhibition hall and some small decorative objects.

3D projection of the pavilion with Blender;

Use Unity3D to build other models with a large number of faces and realize the selection of interactive platforms;

Using Unity3D to build character model and add character roaming collision detection;

Using Unity3D to realize interactive game operation;

2. 3D Experience in Virtual Exhibition Halls

2.1. Features of Virtual Exhibition Halls

2.1.1. Immersion

Immersion is one of the most important characteristics of virtual exhibition halls. Users can walk into a real pavilion in the virtual space as if immersive, feel the atmosphere and characteristics of the exhibits, so as to achieve a similar experience effect with the physical pavilion, which is also known as immersion. The generation of immersion is closely related to the design and technology of the exhibition hall, which is achieved through the interaction and effect of various technical equipment in the exhibition hall.

Taking "*Tencent Cultural Relics*" as an example, the virtual exhibition hall integrates 3D modeling technology, holographic projection technology, intelligent voice guide technology, high-definition image technology and other advanced technologies, so that users can enjoy the millennium cultural treasures at close range in the virtual exhibition hall, feel the charm of cultural heritage, and obtain a real visiting experience. Through a variety of interactive means such as 360-degree panoramic display, virtual tour, immersive interaction, users can deeply participate in the exhibition, not only can freely browse the exhibits, but also can further interact with the exhibits through the support of interactive equipment, increase the immersion between users and exhibits, and achieve a similar physical exhibition, real and highly immersive visiting effect.

Therefore, the immersion of virtual exhibition hall is realized through the interaction and coordination of a variety of advanced technical equipment. It can bring users a colorful, real and participatory exhibition experience, integrate digital technology with culture and art, and provide an effective new way for the popularization and promotion of culture and art.

2.1.2. Interaction

As a digital cultural display platform, virtual exhibition hall's interactivity directly affects user experience and participation. The virtual exhibition hall with poor interaction may have the following disadvantages: First, the user experience is poor, because the exhibition hall lacks interaction, users cannot be immersed in it, and it is difficult to understand the meaning and history behind the exhibits; Second, low user engagement, because of the lack of participatory interaction, user engagement is difficult to sustain, and it may be difficult to attract more users to participate; Third, the exhibits are lengthy, although the virtual exhibition hall can display more cultural relics, but for users, they may feel unable to start, and the emotional experience is insufficient.

Take the "*Palace Museum Digital Culture Display Project*" as an example, which is dedicated to the digital protection and inheritance of the cultural heritage of the Palace Museum. In terms of interactivity, the project adopts multi-dimensional interactive methods, such as virtual tour, multimedia interactive terminal, interactive video projection, etc., so that visitors can enter the virtual environment of the Forbidden City, interact with cultural relics and history, enhance immersion and participation, and improve users' cultural taste and experience.

The virtual exhibition hall with good interaction allows visitors to better understand the historical materials and knowledge behind cultural relics by improving the diversified interaction between man-machine and personnel. Through the digital presentation of museum cultural relics, these precious cultural relics can be more widely inherited and promoted, while strengthening the interaction between culture and society, so that the quality of cultural education is superior. Therefore, the significance and value of virtual exhibition halls with better interactivity lies in enhancing the cultural identity of visitors, promoting cultural exchanges, helping to protect and inherit cultural heritage, promoting cultural exchanges and interactions, and enhancing social and cultural development.

2.1.3. Conceptuality

Conceptualization in a virtual exhibition hall refers to the ability of the exhibition hall to present exhibits and achieve interaction through digital technology and innovative ways. This conception is of great significance and value, which can create a richer, professional and diversified display space and interactive experience, improve the artistry and entertainment of digital cultural display, and display the value and charm of cultural relics more effectively.

Take the Digital Culture Display project of the Palace Museum of China as an example, which uses digital technology to digitize cultural relics and present them in a virtual exhibition hall. Using technologies such as virtual environments, the project achieves a deep and interactive display of cultural relics. At the same time, the project through a variety of innovative ways, such as 3D digital cultural relic models, holographic projection, etc., the exhibition hall presents a more realistic cultural atmosphere, attracting more visitors, and realizing a win-win situation between digital cultural display and cultural relic protection and inheritance.

In the virtual exhibition hall, imaginativeness can also enhance the interest of the exhibition and enhance the effect of cultural education. Through multiple interactive means, such as physical samples, virtual reality technology, 3D projection, etc., the historical background and cultural

connotation of cultural relics are displayed, so that the audience can have a deeper understanding of the story and knowledge behind the cultural relics. This can enhance visitors' academic literacy, enhance their understanding of the cultural center and their support for cultural undertakings.

In addition, the imaginativeness of the virtual exhibition hall can promote cultural exchange and interaction. Through digital technology, cultural heritage presents an interpretation that transcends time and space and is not limited by geographical space, so that people around the world have the opportunity to understand and appreciate contemporary art works and intangible cultural heritage of different cultures, histories and regions, thus promoting cross-cultural understanding and communication.

Therefore, the imaginativeness in the virtual exhibition hall is of great significance and value, which can create a better cultural exhibition space, broaden the channel of cultural exchange, improve the quality of cultural education, and promote the development of cultural undertakings.

2.2. Comparison between Virtual Exhibition Halls and Traditional Physical Exhibition Halls

2.2.1. The Shortage of Traditional Physical Exhibition Halls

Compared with the virtual exhibition hall, the traditional physical exhibition hall has the following shortcomings.

First of all, the exhibition space of traditional physical exhibition halls is restricted by factors such as geographical location, architectural structure and site area, and the exhibition scope and exhibition time are relatively narrow. The virtual exhibition hall is not subject to these constraints, and its display space can be expanded and extended through digital technology, which can carry out more diversified cultural heritage presentation and exhibition activities.

Secondly, the traditional physical exhibition hall can only accommodate a small number of audiences, and can not meet the needs of different audiences. While some visitors may not be able to see the exhibition on-site, virtual exhibition halls enable remote visits. In addition, the virtual exhibition hall can also provide different experiences for different audiences, such as visual, auditory, tactile and other forms of experience, so as to improve the interaction and experience of visitors.

Third, the traditional physical exhibition hall is often difficult to ensure the safety and protection of exhibits, such as fire protection, anti-theft, control of light and so on. In the virtual exhibition hall, cultural relics can be displayed after 3D digital processing, effectively avoiding the risk of leakage and damage, and providing a more reliable mechanism for the protection of cultural relics.

Finally, the traditional physical exhibition hall only relies on physical display and text description to present the history and cultural connotation of cultural relics, which often has limitations. For example, there is a lack of guides, no one to explain the situation. The virtual exhibition hall can more vividly show the history and connotation of cultural heritage through multimedia presentation, 3D model display and other ways, and enhance the sensory experience and learning effect of the audience.

Taking the National Museum of China as an example, the virtual exhibition hall creates a diversified cultural experience with the help of digital technology, and pioneered the display of cultural relics through VR technology. The speech recognition technology based on deep learning enables the audience to interact with cultural relics through voice, adding a sense of science and technology and interaction to the exhibition hall. In contrast, traditional physical showrooms often struggle to provide such an experience and level of technology. Therefore, virtual exhibition halls have broad application prospects in cultural heritage protection, cultural exchange, cultural education and other aspects, which brings great challenges to traditional physical exhibition halls.

2.2.2. Advantages of Virtual Exhibition Halls

1) Protect Cultural Relics

Virtual exhibition halls play a huge role in the protection of cultural relics. It can preserve and present cultural relics more finely by means of digital technology, so as to achieve long-term protection and inheritance of cultural relics.

First of all, the virtual exhibition hall can preserve the original appearance of ancient cultural relics completely, accurately and comprehensively through 3D digital technology. This digital preservation method is more reliable than traditional handwritten records or photos. It can not only save the shape, size, color and other information of cultural relics, but also collect important information about cultural relics' materials, production processes, historical background and other aspects, providing a more reliable basis for the research, protection and inheritance of cultural relics.

Secondly, the virtual exhibition hall allows the audience to experience the charm of ancient relics up close without the need for real objects. Through virtual reality technology and multimedia, the audience can interact in real time, independently experience and explore the internal and external structure and details of cultural relics, which greatly enhances the audience's perceptual cognition of cultural relics, but also reduces the vulnerability of cultural relics. However, the use of virtual exhibition halls as display media and preservation with restoration and restoration and other high-tech means can not only effectively reduce the erosion of cultural heritage by nature, but also present cultural heritage to the public in the form of images [4].

Finally, the virtual exhibition hall can also monitor the various states of cultural relics through digital technology to further ensure the safety of cultural relics. For example, digital technology can be used to monitor environmental parameters such as temperature, humidity and light in real time, find problems in time and take measures to ensure the safety of cultural relics. At the same time, the virtual exhibition hall also provides more effective means for the protection of cultural relics, such as renovation, restoration and backup, which greatly improves the security and sustainability of cultural relics.

Taking the Mogao Grottoes of Dunhuang as an example, the virtual exhibition hall plays an important role in the protection and inheritance of the murals in the Mogao Grottoes. Due to the long age and bad environment of the Mogao Grottoes in Dunhuang, many frescoes have appeared weathering, cracking and other phenomena. Through digital technology, many research institutions at home and abroad have carried out comprehensive and systematic 3D digital protection of the Mogao Grottoes in Dunhuang, recording the murals, stone carvings and details of the grottoes in a full range of digital records. These data are stored on the server and backed up, providing the most reliable data guarantee for the long-term protection and inheritance of the Mogao Grottoes. At the same time, the virtual display based on digital technology also allows more people to enjoy the mural images of Dunhuang Mogao Grottoes at close range, which

not only enhances the interest and protection awareness of Mogao Grottoes, but also enhances the sense of identity and cultural confidence in Chinese culture.

2) Strong Interaction

Virtual exhibition halls have great advantages in terms of interactivity. It can use digital technology and multimedia interaction to achieve interaction and communication with the audience, thereby increasing the audience's sense of participation and experience, and can dynamically update and adjust the exhibits according to the needs and feedback of the audience.

Virtual exhibition halls can use interactive display methods to increase the audience's sense of participation and experience. Through multimedia and other technical means, the audience can have interactive experience with the exhibits, such as operation, games, competitions, interaction, etc., so as to obtain more comprehensive information and experience effects of the exhibits. For example, the exhibition of "*Babaoshan Tomb*" (八宝山之墓)in the virtual exhibition hall of Shanghai Museum allows the audience to participate in interactive operations such as making stone beds, carving sarcophagus and decorating braziers, so that the audience can have a deeper understanding of *Babaoshan Tomb* and increase the depth of participation and impression.

The virtual exhibition hall has the advantage of personalization and customization, which can be dynamically updated and adjusted according to the needs and feedback of the audience. Through digital technology, the exhibition hall can collect the feedback and behavioral data of the audience, adjust and optimize the exhibits to meet the different needs of the audience, so as to improve the participation and satisfaction of the audience. For example, the "Voice of the Audience" project of the Metropolitan Museum of Art collects a large number of feedback and suggestions from the audience through digital survey and communication, which provides important references and guidance for the design and subsequent update of the exhibits.

The virtual exhibition hall can also realize the all-round display and in-depth explanation of the exhibition content through digital technology and multimedia interaction, and improve the audience's understanding and cognition of the exhibits. For example, the virtual exhibition hall of the National Museum of China uses multimedia technology to present detailed information such as the historical background, cultural relics and achievements, and archaeological process of Sanxingdui Site to the audience, so that the audience can have an in-depth understanding of Sanxingdui culture and deepen their understanding of prehistoric culture.

Therefore, the advantages of the virtual exhibition hall in terms of interaction are mainly reflected in interactive experience, personalization and customization, as well as all-round display and in-depth explanation, providing the audience with a richer and deeper experience and understanding of cultural relics.

3) Commercialization

Virtual exhibition halls also play a significant role in commercial terms. It can provide various forms of marketing and promotion services for enterprises through digital technology and multimedia means, such as brand publicity, marketing, sales promotion, etc., so as to improve the brand awareness and market share of enterprises.

Virtual exhibition halls can be used for brand promotion and promotion of enterprises. Through digital technology and multimedia means, enterprises can display their products, services and brand image in the virtual exhibition hall, and carry out interactive experience and communication with the audience, thus improving brand awareness and impression depth. For example, the famous automobile brand Volvo uses virtual exhibition halls and multimedia technology to show its new products and brand concepts to the audience, attracting the attention and interest of a large number of potential customers and consumers, and improving brand awareness and reputation.

Virtual exhibition halls can provide businesses with opportunities to boost sales and increase revenue. Through digital technology and multimedia means, enterprises can combine their products and services with virtual exhibition halls, and launch various promotional offers and gift activities to attract more consumers and customers, and improve sales and revenue levels. For example, the well-known e-commerce platform Taobao uses virtual exhibition halls and VR technology to build its online mall into a virtual shopping scene, attracting a large number of consumers and customers to shop, and increasing the platform's sales and revenue level.

Virtual exhibition halls can provide businesses with data collection and market research opportunities. Through digital technology and multimedia means, enterprises can collect audience feedback and behavioral data, analyze and research consumer needs and preferences, so as to provide decision support and reference for enterprises' market strategy and product design. For example, the famous brand Coca-Cola uses virtual exhibition hall and multimedia technology to collect consumers' feedback and behavioral data, analyze and study consumers' preferences and needs, optimize its products and brand strategies, and improve its market share and competitiveness.

To sum up, the virtual exhibition hall is mainly reflected in the aspects of brand publicity and promotion, sales promotion and increased revenue, data collection and market research, etc., which provides enterprises with new forms and channels of marketing and promotion services, and enhances the enterprise's brand image, market competitiveness and economic benefits.

3. Related Technical Software

3.1. The Characteristics and Comparison of 3D Modeling Software

3.1.1. Solidworks

Solidworks is mainly used in mechanical, electronic and aerospace fields, including solid modeling, surface modeling, assembly modeling, and so on. It is based on the windows platform, which makes it easier for users to conduct physical simulation and testing during the design process.

3.1.2. UniGraphics (UG)

UniGraphics is a professional 3D modeling software, which is widely used in mechanical manufacturing and industrial design. UniGraphics is characterized by accurate CAD data and modeling support for complex mechanical structures, but it is relatively weak in convenience and application in other fields. For example, in the construction of virtual exhibition hall, the operation of UniGraphics is relatively complex and often requires professional personnel to operate.

3.1.3. Anim&or

Anim&or is a 3D modeling software mainly used for animation production, which is characterized by easy to learn

and use and excellent animation features. However, compared with other 3D modeling software, Anim&or has some shortcomings in complex modeling and accuracy, resulting in many complex modeling tasks that need to be completed by other software.

3.1.4. ImageModeler

ImageModeler is a 3D scanning software, which is characterized by the real-world scanning data to achieve the effect of 3D object modeling. However, because it uses the scanned data as the modeling basis, it is not suitable for some 3D modeling tasks that need to be manually drawn. For example, modeling tasks such as cars and houses.

3.1.5. AutoCAD

AutoCAD is a 3D modeling software widely used in machinery, architecture and other fields. It is characterized by fast modeling speed and process automation, which can help designers quickly build complex mechanical structures. But at the same time, AutoCAD has a lack of fidelity and detail, so it is more suitable for industrial design and other fields that do not require too much modeling accuracy.

3.1.6. 3ds Max

3ds Max is a 3D modeling software mainly used in games, animation production and other fields, which is characterized by excellent 3D modeling and animation functions. However, there are still some shortcomings in modeling and detail, making 3ds Max not suitable for high-precision 3D modeling tasks.

3.1.7. Unity

Unity is an engine software widely used in games and virtual showroom construction, which is characterized by support for a variety of 3D modeling and physics engine functions, and has ease of use and efficiency. Unity can be used for 3D construction and rendering, and it can help developers simulate virtual scenes for immersive experiences.

3.1.8. Blender

Blender is a free 3D modeling software that is characterized by its wide range of features and ease of operation. Blender has excellent scene simulation and rendering effects, while supporting high-precision modeling and complex animation. Due to its ease of use and the fact that it is free, Blender is widely used in areas such as filmmaking and virtual showrooms.

3.1.9. Brief Summary

Different 3D modeling software has its advantages and disadvantages due to the different application fields, characteristics and deficiencies. Developers need to choose the most suitable 3D modeling tools according to their specific needs in order to better complete the project. For example, in the development of One VR virtual exhibition hall, the team used Blender to complete the tasks of scene creation, mapping and rendering, and Unity to complete the scene stitching, application development and human-computer interaction.

3.2. The Combination and Application of Unity3D and Blender

3.2.1. Advantages of U3D and Blender

Blender has powerful modeling tools for 3D modeling. It has a variety of modeling methods, such as polygon modeling, surface modeling and subdivision surface modeling, which can meet different types of modeling needs. In addition, Blender's text editor supports Python scripts, allowing users to extend Blender's functionality to implement complex modeling operations.

Unity3D has powerful rendering and special effects functions in 3D modeling. Unity3D's rendering pipeline supports the introduction of modern rendering technologies such as high dynamic range rendering, post-processing, and volume rendering, as well as support for physical standard rendering pipelines. In addition, Unity supports a variety of special effects and particle systems, such as flames, explosions, and smoke, making it easy for producers to create realistic visual effects.

3.2.2. The Application of U3D and Blender in 3D Modeling

Both Unity3D and Blender are important tools in the field of 3D modeling. In both types of software, in addition to having tools and features suitable for different use cases, they also have many other advantages.

First, both Unity3D and Blender support a wide range of features and tools during the modeling process. Blender has a complete set of modeling tools that support different modeling approaches like *Sculpt*, as well as plug-in support that makes it easy to add tools and features during the modeling process. Unity has a complete physics engine and animation tools, which can animate and physically simulate objects in the scene, and support a variety of functions and tools such as 3D modeling and material import.

Secondly, both Unity3D and Blender have excellent scene simulation and rendering effects. Blender offers a variety of rendering methods such as *FreeStyle* rendering, Cycles rendering, etc., which can achieve realistic light and shadow effects and high-quality image rendering. Unity, on the other hand, can achieve high-quality scene rendering and light and shadow effects through the built-in rendering engine, which can build realistic light and shadow environments in different scenes.

In addition, Unity3D and Blender have the advantages of multi-platform applications while having different modeling methods. For example, Unity3D can build a variety of applications for Android, iOS, Windows, etc., while Blender supports import and export in a variety of formats, including 3ds Max, Maya, Autodesk and other 3D design software.

Finally, Unity and Blender have relatively low barriers to learning and using, ease of use and accessibility for developers. This has made Unity and Blender one of the most widely used tools in 3D modeling.

3.3. Application of Unity3D and Blender in Virtual Exhibition Hall Construction

3.3.1. Feasibility Analysis

Unity3D and Blender are both very useful software tools for creating virtual showrooms. The combination of them can achieve a more realistic and efficient virtual showroom establishment.

First of all, Blender has excellent modeling and texturing capabilities for creating virtual showrooms. With Blender, users can build complex 3D models and high-quality texture maps to achieve good visual effects. Blender also supports the creation of animations and physics simulations, which can enhance the interaction and fun of virtual showrooms.

Secondly, Unity3D has strong rendering and interactive performance in the establishment of virtual exhibition halls. Unity3D's rendering pipeline supports high-quality image rendering and supports a variety of special effects and physical simulations, which is very useful in the

establishment of virtual exhibition halls. The interactive performance of Unity3D is also very powerful, and it can build virtual exhibition halls with complex interactions.

3.3.2. Case Analysis

Taking the virtual exhibition of Shenzhen Museum as an example, all 80,000 cultural relics displayed in the exhibition hall are collected by Shenzhen Museum of cultural relics data and restoration map and other data, using Unity3D as the basic development platform, Blender for modeling and art creation. Through high-quality rendering technology and animation technology, the interactive exploration form of multiple media technologies is constructed, so that visitors can understand the history and characteristics of cultural relics more intuitively and interactively.

In the establishment of virtual exhibition hall, the combination of Unity3D and Blender is very important. Taking One VR virtual exhibition hall as an example, in the modeling process of this project, the team used Blender to complete the tasks of scene creation, mapping and rendering, and Unity to complete the scene stitching, application development and human-computer interaction. The wide range of features and ease of use available in Blender and Unity allowed the development team to quickly build this virtual showroom. Therefore, whether in the field of game production, film production, or architectural design, Unity and Blender are important tools to recommend. Create models and design texture images with Blender, and combine these models and textures with Unity3D, adding interactivity and rendering effects. Using these two software tools, users can create realistic virtual showrooms more effectively, and make them more interactive and interesting.

To sum up, the combination of Unity3D and Blender is of great significance and driving force in the establishment of virtual exhibition halls. Through the joint use of these two software tools, users can build virtual showrooms with rich interactivity and visual effects in an efficient and innovative way, enhancing the visitor experience and educational value.

4. The Construction of "Cloud weaving dream" Chu Embroidery Virtual Exhibition Hall

4.1. Design Concept

4.1.1. Cultural Temperament -- Chu Embroidery of Jingchu Land

1) The Cultural Value of Chu Embroidery

When selecting the topic, the author pays attention to the source of Han embroidery - Chu embroidery, which grows in Jingchu land. The characteristics of Han embroidery can be traced back to Chu embroidery in the Spring and Autumn Period and the Warring States period, which was deeply influenced by the Chu people's artistic view of paying attention to decoration. The modern Han embroidery art is closely related to Chu embroidery art, whether it is pattern, color matching or stitch technique. With the development of The Times and social progress, the status and influence of Chu embroidery in the field of Chinese culture are also continuously improving. Strengthening the protection, inheritance and promotion of Chu embroidery culture is conducive to promoting the improvement of national cultural quality, promoting cultural diversity, and promoting the virtuous circle between culture and economy.

In order to protect and inherit Chu embroidery, a treasure of Chinese traditional culture, all localities strive to promote the inheritance and development of Chu embroidery. For example, Yichang city of Hubei Province carries out the inheritance of Chu embroidery skills, and constantly attracts young people for training and inheritance; At the same time, it also actively develops Chu embroidery cultural products and related tourism resources to improve the popularity and influence of Chu embroidery culture.

2) The Crisis Facing the Inheritance of Chu Embroidery

Chu embroidery is a traditional Chinese embroidery art, originated from the culture of Chu, and has a long history and cultural value. However, with the changes of The Times and the diversification of market demand, Chu embroidery is facing a certain crisis.

First of all, the inheritance and development of Chu embroidery is facing difficulties. Due to the long-term accumulation and inheritance of traditional skills, the fast-paced life of modern society and the constant changes in market demand have caused a blow to the inheritance of traditional skills. At the same time, the rapid development of modern production technology, the widespread application of machine manufacturing and other factors have also made the hand-embroidered Chu embroidery gradually eliminated by the market.

Secondly, there are certain difficulties in the market and brand construction of Chu embroidery. Due to the fierce market competition and the complexity of brand building, many small enterprises or individuals in the Chu embroidery industry are difficult to maintain competitiveness or carry out effective brand building, resulting in insufficient marketing channels, product publicity and other aspects.

Thirdly, the inheritance and dissemination of the cultural value of Chu embroidery need to be strengthened. Chu embroidery is not only one of the representatives of Chinese traditional crafts, but also contains the profound connotation of Chinese history and culture. However, in modern society, there are certain deviations in people's cognition and understanding of traditional culture, and the inheritance and dissemination of Chu embroidery cultural value are facing great challenges.

3) The Significance of Chu Embroidery Virtual Exhibition Hall Construction

Chu embroidery has rich cultural value and transmission value. With the development of The Times and social progress, the status and influence of Chu embroidery in the field of Chinese culture are also continuously improving. Strengthening the protection, inheritance and promotion of Chu embroidery culture is conducive to promoting the improvement of national cultural quality, promoting cultural diversity, and promoting the virtuous circle between culture and economy.

In order to solve the crisis facing Chu embroidery, we need to start from many aspects. On the one hand, it is necessary to strengthen the inheritance and innovation of the traditional skills of Chu embroidery, pay attention to technological innovation, explore the organic combination of Chu embroidery with modern fashion, fine arts and other fields, enrich the product line, and improve the market competitiveness. On the other hand, it is also necessary to pay attention to brand construction and market publicity, make reasonable use of emerging media channels, and enhance brand awareness and market share.

For example, we can use 3D modeling technology to realize virtual exhibition hall interaction space, and expand

the range of inheritance and dissemination of Chu embroidery cultural value through virtual exhibition hall and other means in combination with scientific and technological means, so that more people can understand and understand the history and culture of Chu embroidery and its influence, enrich the three-dimensional visiting experience of visitors, and develop Chu embroidery innovatively. At the same time, the government and social groups can increase support for the inheritance and development of Chu embroidery, strengthen the standardization and market-oriented management of the Chu embroidery industry, and enhance the overall competitiveness of the industry and the value of cultural inheritance.

4.1.2. Demand Analysis -- User Classification of Chuxiu Virtual Exhibition Hall

In the design and development process of Chuxiu virtual exhibition hall, the analysis of user needs is a very key step. According to the needs and expectations of users, the virtual exhibition hall can be designed to better meet the needs of users, and improve the participation and user experience of the exhibition hall. From the perspective of user demand analysis, Chuxiu virtual exhibition hall users can be roughly divided into the following categories:

1) Lovers of Chu Embroidery Culture

This is one of the main user groups of Chu Embroidery virtual exhibition hall. These people have a strong interest in and love for Chu embroidery culture, they hope to get more detailed knowledge of Chu embroidery culture in the virtual exhibition hall, and can personally experience and feel the artistic charm of Chu embroidery.

2) Art Students and Practitioners

These people are engaged in the art industry students and practitioners, they hope to be able to learn and master the representative Chu embroidery and detail skills through the virtual exhibition hall, in order to improve their technical level and artistic creation ability.

3) Tourist Crowd

As a cultural tourism city, some tourists come to the exhibition hall hoping to deeply understand and experience all aspects of Hubei culture through the virtual exhibition hall of Chu Embroidery, so as to better understand the local cultural connotation.

4) The General Public

This is a user group that includes people of all ages, who may be ordinary Internet users, students, educators, etc. They hope to have a more comprehensive understanding of Chu embroidery culture and interact with each other through the virtual exhibition hall.

5) Summary

From the perspective of the needs of the above groups, the needs related to the virtual exhibition hall of Chu embroidery mainly include: detailed introduction and knowledge popularization of Chu embroidery culture, display of Chu embroidery works and physical simulation, strong interactive experience of Chu embroidery, in-depth exploration of the cultural value of Chu embroidery, and participation of Chu embroidery experts in the exhibition hall. Based on the above requirements, Chuxiu virtual exhibition hall needs to design comprehensive display content, optimize interface experience, enrich interaction methods, provide excellent after-sales service and other aspects of demand, in order to meet the needs of various users, and create a prominent and influential Chuxiu virtual exhibition hall.

4.1.3. Exhibition Purpose -- Design, Display, Interaction and Education

First of all, the exhibition design should highlight the artistic characteristics of Chu embroidery, and provide diversified and systematic artistic information and knowledge for the audience through images, texts, audio and other means. Design should pay attention to the expression of Chu embroidery theme, style, skills and other aspects, reflect the cultural connotation and aesthetic value. At the same time, it is also necessary to pay attention to the appreciation and interest of the exhibition, in order to attract and maintain the interest and participation of the audience.

Secondly, the display needs to pay attention to the production of high-quality, high-resolution pictures and videos, so that the details and colors of Chu embroidery can be clearly displayed. At the same time, the use of multi-angle observation technology and 3D restoration technology, in order to let the audience more comprehensive understanding of the artistic charm of Chu embroidery.

Third, virtual exhibitions need to provide a variety of interactive ways to enhance audience engagement and interaction. For example, VR/AR technology, touch screen and other interactive means, so that the audience can freely browse and understand Chu embroidery, but also can learn and create their own works.

Finally, virtual exhibitions are not only one-way displays, but also need to focus on education and interactivity. Through the provision of educational courses and interactive activities, in order to let the audience understand and experience the skills, culture and values of Chu embroidery, promote the audience's awareness and understanding of traditional Chinese culture.

4.1.4. Design Process -- The Construction of Virtual Exhibition Hall

1) Construction Process

Determine the overall structure and design concept of the exhibition hall. You can use the characteristics of Chu embroidery culture to conceive the scene layout and exhibit arrangement that meet the requirements of display, and use Blender to design and render different kinds of exhibits.

Use Blender to create 3D models and textures related to the virtual exhibition hall. Through the use of Unity, combined with Chu embroidery pattern, highly restored Chu embroidery pattern scene modeling.

Design an exhibition hall in Blender, including layout, color matching, lighting, special effects, etc., to present a beautiful, concrete showroom effect. According to the requirements of Chu embroidery culture, Blender is used to draw shapes, materials and textures to maximize the original appearance and characteristics of objects.

Unity3D was used to construct and display the scene of the exhibition hall. Use Unity3D to import the finished model made by Blender and build the interactive library scene. Unity3D has a wealth of plug-ins and resource libraries, which can quickly realize the dynamic effects of the scene (such as light flicker, super magnifying glass display details, etc.), making the exhibits dynamic and vivid. Using the code script of Unity3D, a large number of details processing, dynamic interaction and other functions can be realized. At the same time, the cross-platform characteristics of Unity3D enable virtual exhibition halls to run on multiple platforms (such as PC, mobile, etc.), which is convenient for users to use and participate in. Using Unity3D, including but not limited to camera, light, material, texture, etc., to construct the

scene and import the model, and combine to realize the final virtual exhibition hall.

Consider user needs and experience feedback. Based on user feedback, make corresponding adjustments to achieve a better user experience. For example, for VR experience, the user is inspired to visit the Chu Embroidery exhibition Hall as the protagonist, and timely strengthen or weaken the link stickiness according to user feedback in the process of continuous interpretation and virtual environment interaction experience, so as to improve its sustainable experience.

2) Character Modeling

First, image data, including photos and videos, are obtained for different people, and then 3D reconstruction algorithm in Unity3D vision technology is used for processing, to extract key feature points in the image, to differentiate the depth map, and to convert the 2D image into a 3D model. Then, through the use of artificial intelligence algorithms and machine learning technology, the 3D model after processing is optimized and running-in, and more realistic model performance and action effects are obtained. Then, Unity3D was used to perfect and refine the texture and details of the optimized character model, and to plan and draw the color matching, expression, hairstyle and dress of the character. Finally, in the virtual exhibition hall, the character model, texture and other elements that have been established and optimized are integrated to form a high-precision and realistic virtual space, providing a richer viewing experience.

Character modeling technology can realize the accurate restoration of the real character image in the virtual space, providing the audience with a high degree of visual simulation and immersive experience. However, in order to achieve a good character modeling effect, it is necessary to continuously adapt and optimize various modeling techniques and algorithms, and at the same time, more technical and human resources need to be invested.

3) Interactive Model

VR/AR Interaction: Through virtual reality and augmented reality technology, the audience can personally experience and feel the artistic charm of Chu embroidery. Design a virtual embroidery workshop, so that the audience can learn Chu embroidery skills in the virtual workshop, and personally make Chu embroidery works.

3D display projection interaction: The projection display is set up in the exhibition hall, so that the audience can freely browse and understand the history, culture and skills of Chu embroidery.

Interactive games: Design interactive games in which the audience can learn the history, culture and skills of Chu embroidery. A variety of interactive ways can be set on the touch screen, such as dragging, zooming, rotating, etc., in order to let the audience have a more comprehensive understanding of the artistic characteristics and details of Chu embroidery.

4.2. Design Scheme

4.2.1. Space Layout and Tour Route Design

The first floor includes the preface hall, the boutique hall, the Hall of Fame and the cultural and creative center. The second floor includes two craft pavilions, special pavilions and experience pavilions. (As shown in Figure 1 and 2)

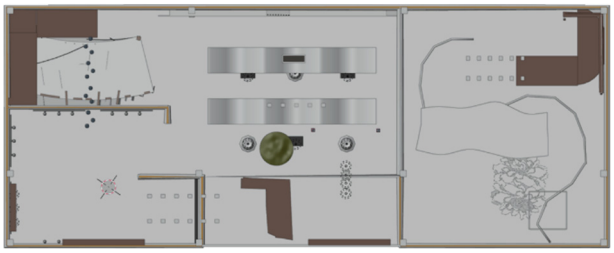

Figure 1. First floor space layout

Figure 2. Second floor space layout

Figure 3. Tour map

4.2.2. Exhibition Space Design

1) Preface Hall:

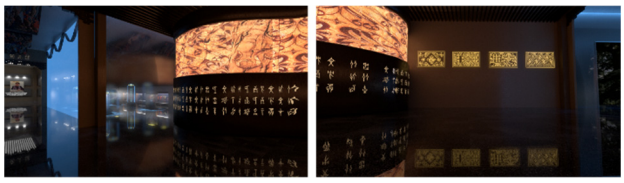

Figure 4. Preface Hall

The Preface Hall is located on the first floor and is the first exhibition hall in the tour route. It is mainly a curved display wall showing the development of Chu embroidery as well as the historical warp and weal. (As shown in Figure 4.)

2) Craft Hall:

Figure 5. Craft Hall

The Craft Hall is located on the second floor, and visitors arrive from the first floor. A 3D projection display screen is set up in the art museum to play animation, which mainly includes detailed introduction of patterns, digital demonstration of specific techniques, simulation and construction of textile space. (As shown in Figure 5)

3) Delicate Artistry Hall:

Figure 6. Delicate Artistry Hall

The Delicate Artistry Hall is located on the second floor, displaying fine Chu embroidery from ancient times to the present. Through VR technology, visitors are shown the details of embroidery in a full range, giving people the feeling of "at their fingertips". (As shown in Figure 6)

4) Experience Hall:

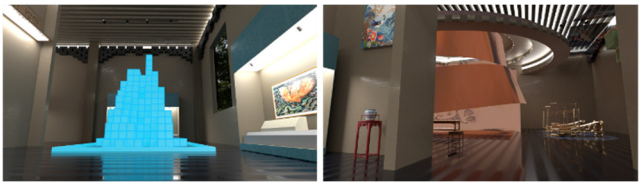

Figure 7. Experience Hall

The experience hall is located on the second floor. Through small games (as shown in Figure 7), the static display in the past is transformed into a living display mode of intelligent interactive experience, which increases the fun of edutainment and narges the distance between the audience and serious culture.

5) Special Exhibition Hall

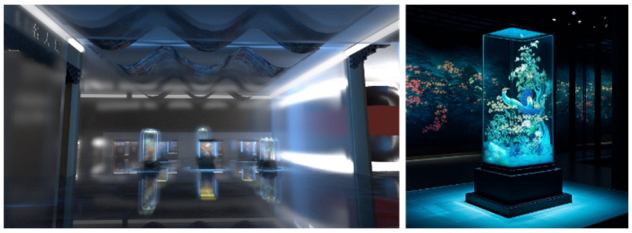

Figure 8. Special Exhibition Hall

The Special Exhibition Hall is located on the ground floor and displays time-limited exhibits on specific topics or seconded from it.

6) Celebrity Hall:

The Celebrity Hall, located on the first floor, Outlines the development of Chu embroidery through the display and introduction of the life and main works of the representative figures of Chu embroidery cultural inheritance. (As shown in Figure 9)

7) Cultural and Creative Center:

The cultural and creative Center is located on the first floor, which Outlines the development of Chu embroidery through the display and introduction of the life and main works of the representative figures of Chu embroidery cultural inheritance. (As shown in Figure 9)

Figure 9. (left) Celebrity Hall (right) Cultural and Creative Center

4.2.3. 3D Projection Interactive Design

Due to the excellent curve-building ability of blender and the ability to create animation shots, a 3D projection curve-screen (as shown in Figure 10) was built in the craft gallery of this exhibition hall, which can play videos and realize the explanation of craft techniques and patterns.

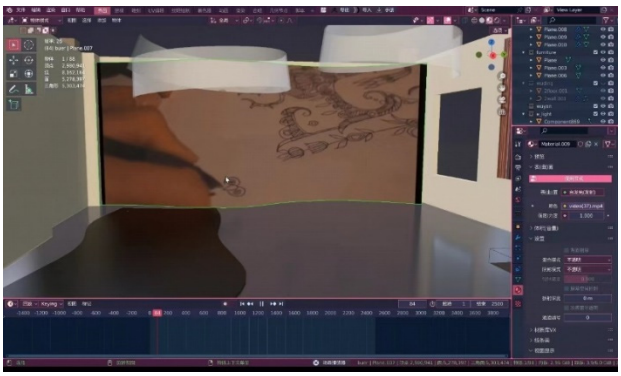

Figure 10. 3D projection of Blender

4.2.4. Chu Embroidery Pattern Exhibition Cabinet Design

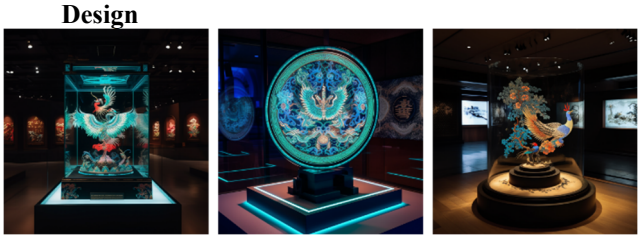

Figure 11. Pattern display

As shown in Figure 11, using the excellent scene rendering capabilities of unity and blender, a virtual Chu embroidery scene with light effect was constructed and made into a display case and placed in the virtual exhibition hall. Use the conceptual advantage of the virtual showroom to attract users to visit.

4.2.5. Interactive Game Design

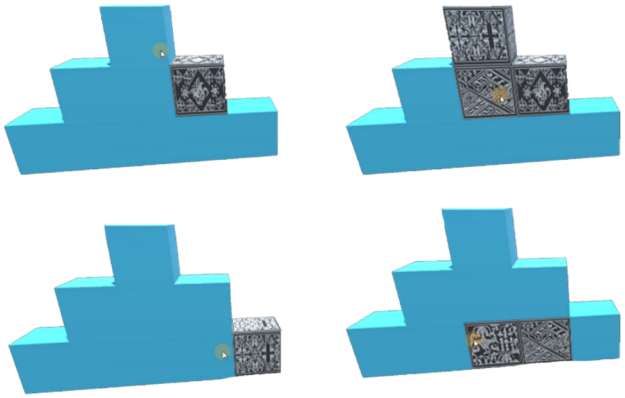

Figure 12. Touch Screen Interactive Game

The experience museum is designed with stacked squares (as shown in Figure 12). Visitors only need to click the mouse, and each square will appear different Chu embroidery patterns. This interactive form has not only increased the interest of watching the exhibition, but also allowed visitors to increase the understanding and memory of Chu embroidery characteristics through the way of games.

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