

The application of VR and 3D printing technology in the development and inheritance of intangible cultural heritage

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Abstract:

Under the background of the new era, the inheritance status of Wuhu iron painting is faced with the challenge of brain loss and stumbling industrialization. As one of the first batches of national intangible cultural heritages, this traditional art form has a long history and unique skills, but it faces the dilemma of inheritance and development under the impact of modern society. This paper explores the use of modern science and technology to innovate the intangible cultural heritage of Wuhu iron painting and give it a new connotation of The Times, aiming to promote the creative transformation and innovative development of Wuhu iron painting.

Key words: Wuhu iron painting; intangible cultural heritage; VR; 3D printing.

1. Introduction

Since ancient times, Wuhu has developed iron smelting industry and has the reputation of “iron makes itself into steel in Wuhu”. The iron painting production technology of Wuhu is developed on this basis. Wuhu iron painting with the hammer as the pen, forged iron as the painting, uncanny workmanship, natural charm, superb skills. Iron painting began in the reign of Emperor Kangxi of the Qing Dynasty by Tang Peng, an iron worker in Wuhu, and Xiao Yun, a painter in Wuhu. It has a history of more than 300 years. “With hammer as the pen, iron as ink, stock as paper, furnace as inkstone”, both the charm of Chi-

nese painting, but also the three-dimensional beauty of sculpture, enjoy a place in the traditional Chinese art [1]. In 2006, “Wuhu Iron painting forging technology” was included in one of the first national intangible cultural heritage lists in China. The representative works of Wuhu iron paintings, “Yingkesong”(Fig. 1) and “Meishan Reservoir”, are displayed in the Great Hall of the People. After the founding of the People’s Republic of China, Wuhu Iron Painting has successfully traveled abroad in nearly 30 countries and regions such as Japan, Italy, Saudi Arabia and Nigeria, etc. Its unique artistic style and charm are unique in the art world.



Fig 1 Wuhu iron painting “Yingkesong”[2]

2. The value of the intangible cultural heritage of Wuhu iron painting

2.1 Special production process

Wuhu iron painting is “a thousand hammers, forging iron for the painting,” is the art of hammer and fire, is the art of steel, is the art created by the working people in practice. One needs to go through the “draw”, “forging”, “welding”, “plastic” four steps to create a painting [2]. Iron painting artists regard a charcoal fire as an ink stone, iron as ink, hammer as a brush, and anvil as a desk. In the production of seeds, heart, hand, and force should be integrated, combining wisdom, skills, and physical strength together to create exquisite works of art. In drawing composition from the Chinese painting pen and composition, on techniques to absorb the paper cutting, woodcut, stone carving technology, the works of black and white contrast, reality, and unique modelling not only bring visual and spiritual enjoyment, also touch the experience, when people touch the iron painting, can deeply feel the strong steel texture, more can feel the creator of the bearer and effort, and the creator into iron painting deep emotion.

2.2 Spiritual culture

Chinese culture is extensive and profound. Behind each intangible cultural heritage contains the crystallization of the wisdom of the working people of different ethnic groups, which is a rich cultural resource in China. As one of the first intangible cultural heritages in China, Wuhu Iron Painting is also the same. After more than 300 years of precipitation and accumulation, it has made today’s achievements. Iron painting is an original creation by Tang Peng, a blacksmith in the Qing Dynasty, combined with the painter Xiao Yun. It is forged by the working people to forge iron in the red furnace with creative thinking. Since the moment of the birth of iron painting, the character of iron as the soul marks the spiritual and cultural brand of perseverance, which is the character of our Chinese nation, and iron painting shows our strong national pride and cultural confidence [3].

2.3 Economic value

Wuhu iron painting has a high economic value, and its works have been given as national gifts to international friends, with high popularity. Now, as a card of Wuhu, it has a certain role in promoting the development of the local tourism and cultural industry. Iron painting works,

as a kind of handicraft, break the original display works and create modern young favorite cultural and creative products, Design, production, publicity, sales, and other formation of a certain industrial chain, can solve a part of the local employment problems, but also inject new impetus into the local economic development.

3. Wuhu iron painting encountered in the development of modern society dilemma

Wuhu iron painting technology has been inherited for more than 300 years, and its forging technology basically depends on the ancestors to teach orally, worship and apprentice is the main form. Due to the limitation of historical conditions, the competition in the same industry, "technical barriers" and other reasons, and the inheritors of the old generation have entered the age of 70, the new generation has not been cultivated, which has a certain impact on the inheritance of iron painting technology. Although after the founding of new China, the government units organized cultural relics rescue work, sorted out the relevant iron painting process records, lecture recording, forging craft photography, production of real video and other materials, but the lack of systematic file management [4].

The pursuit of maximum economic efficiency has affected the iron painting industry. Because the iron painting process is more complex and are all hands. As a result, it takes a long time to complete each operation, which leads to the pursuit of economic benefits, and the quality of art works cannot be guaranteed, and with the influx of other forms of art varieties, iron painting is facing the crisis of being eliminated by the commodity society.

4. Outlook of the development of Wuhu Iron painting in the new era.

4.1 Using VR technology to create an iron painting learning system

VR has three basic characteristics: imagination, interaction, and immersion, or 3I features for short [5], while the immersive learning mode created by VR will show the 3E characteristics of enhanced, evocation, and evidence [6]. Learners can use VR devices to enter the virtual scene to feel the production atmosphere of iron painting.

Its learning system can be divided into three theme areas: experience area, iron painting resource area, and individual center. The experience area can be divided into three sections: 1. Iron painting introduction: including the development history of iron painting, famous art appreciation; 2. Introduction of forging technique: display according to the four process steps of iron painting

manufacturing, adopt VR technology; shape 1:1 scale to show the complete real reality of iron painting forging, combining traditional technology with modern technology; 3. The interactive section. Through VR interaction, learners can choose different manufacturing tools in the virtual scene. The iron painting resource area can display all kinds of iron painting products, and the \ users can also directly purchase online. In the individual center, there are knowledge tests, ratings of iron paintings produced in the interactive version, MEDALS, and orders.

This learning VR system can use Blender for virtual scene modeling, import the made 3D model into the game engine, and script it on Visual Studio and other tools based on the C # language to realize the interactive functions in the learning system. The virtual reality device used in the system application is Oculus Oquest2. Oculus Oquest2 includes VR handle and VR head display one to distinguish left and right and provides an immersive for learners through wearing [7].

For the works of iron painting, we can first conduct three-dimensional scanning, digital photography, and then use Reality Captureff for photographic image processing. 3D software Unity3D modeling, plus material, lighting and other simulations, show the texture of iron painting should be, multi-directional, multi-angle display of iron painting works, to achieve digital permanent non-destructive preservation.

The UGUI plug-in in the Unity engine is used in the system to implement the interface interaction function. The UGUI provides rich UI controls by mounting scripts on the corresponding controls and inserting VRTK _ UI Canvas and VRTK _ UI Pointer components to emit rays to interact with the interface through the handle.

4.2 Wuhu iron painting and 3D printing

At present, laser cutting and etching have replaced the "cutting" process in the forging process of iron painting. In the production of some iron paintings, iron painting artists first use the CNC laser cutting machine to make blank cutting, and then forging, which has greatly improved the production efficiency of iron painting. Nowadays, the application field of 3D printing technology is very wide(- Fig. 2 and Fig. 3), and it also provides new ideas for the innovation of iron painting. Iron painting designers can explore their ideas, break the traditional expression form of art, design more changeable shapes, and combine traditional technology with new technology, so that Wuhu iron painting can play a new brilliance.



Fig. 2 3D Printing vase



Fig. 3 3D Printing Ashtray

5. Conclusion

With its unique craft and profound cultural connotation, Wuhu iron painting is listed as one of the first batch of intangible cultural heritage in China, making an important contribution to the inheritance and development of Chinese culture. Intangible cultural heritage is to the Chinese

nation, innovation needs to follow The Times, innovation is the best inheritance of intangible cultural heritage. Only under the guidance of science and technology, Wuhu iron painting can follow the pace of The Times and grow new.

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