

# Research on the Digital Protection of “Huangzhou Dongpo” Cultural Heritage

## From the View of the Creation of 3D Animation

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**Abstract**—Huangzhou Dongpo Cultural Heritage is an important cultural resource of celebrities in China. Today, under the multiple pressures of media, commercialization and urbanization, the cultural heritages of celebrities are severely damaged. The digital protection of Huangzhou Dongpo Cultural Heritage has a real economic value for the promotion of local economic and social development and an exploratory meaning on the construction of public cultural information resource sharing. The paper is written according to the connotation and characteristics of Huangzhou Dongpo Cultural Heritage. With application of three-dimensional digital technology and animation creation, the paper has made a comprehensive research from the view of animation script and Dongpo cultural spirit, modeling design and 3D modeling, color texture and three-dimensional material, action design and performing arts, visual arts, and light rendering.

**Keywords**—Huangzhou Dongpo cultural heritage; digital protection; 3D animation

### I. INTRODUCTION

The cultural resource of celebrities is an important part of national culture. In the long historical process, it has developed with a unique charm and rich connotation system. Today, under the multiple pressures of media, commercialization and urbanization, the cultural heritages of celebrities are severely damaged, even disappeared. It is very urgent to protect the digital cultural heritage of celebrities. It is also pressed for sustainable development of society and economy.

Foreign countries have applied the digital technology in the field of cultural heritage protection long before. In the 1990s, the EU countries signed the “Launch Plan of Content Creation” jointly. This plan determined the basic position of digitization in the cultural heritage protection and transmission. In 2010, France launched the “digital protection and transmission plan of historical and cultural memory” with a total budget of 750 million euro. UNESCO launched the project of “World Memory” worldwide to promote the digitization of cultural heritages. The United States, the United Kingdom, Japan, Italy and other countries have set up specialized agencies to study the functions and methods of digital technology and network technology in the protection and transmission of cultural heritages. They have made some

effective explorations on digital museum, digital cultural relic preservation and digital animation. Successful cases include the digital project of Le Louvre Museum, the digital plan of Michelangelo, the digital project of Rome Grand Theater and etc.. We started late in the research and practice of the digital protection of cultural heritage. Our research fields are mainly concentrated in the digital replication and virtual reconstruction of ancient sites, buildings, murals, folk and other material cultural heritages. For example, Zhejiang University developed and realized the virtual visit tourism system of Dunhuang Mogao Grottoes, and finished the construction of digital virtual exhibition hall of National Art Museum of China. CRYSTAL CG first restored the historical relics of Ancient Beijing City, Ancient Chang’an City of Tang Dynasty, Ancient Suzhou City and Mausoleum of Emperor Qin with the application of three-dimensional animation technology.

The above research results show that the digital technology can be organically combined with the protection of cultural heritage. However, the scholars and digital technology engineer at home and abroad mainly focus on the study of digital museum, simulation of cultural relics, ancient architecture virtuality, digital experience museum and the digital reproduction of other material cultural heritages. They have less research fruits on the digital protection of celebrity culture heritage.

### II. “HUANGZHOU DONGPO”

Huangzhou is located at the southern foot of Dabie Mountain. It is a humanities center of Huanggang City. Huangzhou is a small insignificant town in the south. Yet, the arrival of Su Dongpo established its character and status in the history of Chinese culture. In 1079, Su Shi was banished to Huangzhou as deputy chief of military affairs. “Huangzhou Dongpo” refers to the stay of Su Dongpo in Huangzhou (1079~1084). According to historical records, Su Dongpo has wrote “Two Fu and One Poem”, “Record of a Nightout at Chengtian Temple”, “Cold Food Observation” and other world famous literary and artistic works during his stay in Huangzhou. What’s more, he has reached new heights in Buddhism, philosophy and other ideological fields. Yu Qiuyu said: “Su Dongpo has made a great achievement in Huangzhou,

and Huangzhou helped Su Dongpo achieve his achievements. The masterpiece of Su Dongpo written in Huangzhou declared that Huangzhou has entered into a new level of aesthetics, and also declared that Su Dongpo has entered a new stage of life". Su Dongpo wrote a poem before his death to sum up his life. It says: "My heart now is like burned-out wood, and my body is like an untied boat floating around. All my lifetime achievements are made in Huangzhou, Huizhou and Danzhou" (Self-description on Jinshan Portrait). Su Shi was very depressed during his stay in Huangzhou. But it was his prolific period. Meanwhile he also absorbed, processed and transformed the thoughts of Confucianism, Buddhism and Daoism, and made them more mature. He faced his hard life with a broad mind, good cultivation and an optimistic attitude.

### III. THE MAIN STRATEGY FOR THE DIGITAL PROTECTION OF HUANGZHOU DONGPO CULTURAL HERITAGE

Huangzhou Dongpo cultural resources are the cultural heritages of celebrities in a specific historical period. They are rare treasures of Chinese traditional culture.

From the view of digital protection time period, it can be divided into the following three stages.

The first stage: digital acquisition and storage "Table 1".

TABLE I. DIGITAL ACQUISITION AND STORAGE

The first stage	Digital acquisition and storage	Fruits
Digital investigation and analysis of Huangzhou Dongpo Cultural Heritage	Literature collection and digital acquisition	Systematizing the connotations, values and protection methods of Huangzhou Dongpo Cultural Heritage
	Investigation, excavation and data acquisition of cultural relics	Concluded data: sorting, archiving, and cataloguing; included in database for accurate measurement, analysis and etc.
	Digital story arrangement and oral history	Establishing the spiritual connotation of Huangzhou Dongpo with stories
achieving	Analysis of feature and scale layout of cultural relics	Laying the foundation for the digital rebuilding of cultural relics
	Digital information classification and archiving of relics	Sorting and archiving relevant data

The essence of digital protection of Huangzhou Dongpo Cultural Heritage is to record data, archive and collect and transform text, documents, relics, images, sound and other content through scanning, video and other ways, and lay a foundation for the development of relevant products in the second stage and relic restoration.

The second stage: The digital product development of Huangzhou Dongpo Cultural Heritage "Table 2". It is an important stage to achieve the sustainable development of Huangzhou Dongpo Cultural Heritage. The digital product

development is an important and core content in the digital protection stage.

TABLE II. THE DIGITAL PRODUCT DEVELOPMENT OF HUANGZHOU DONGPO CULTURAL HERITAGE

The second stage	Digital product development of Huangzhou Dongpo Cultural Heritage	Values
Content and method of digital protection	Relic restoration and reconstruction (material)	Restoring relics and developing relevant tourism projects
	Developing 3D animation series	Spreading and transmitting Dongpo cultural spirit
	Developing online games of mobile phone, network and other new media	Strengthening the education of Dongpo culture on the youth
	Interactive multimedia e-book	Carrying out "classroom" education
	Digital museum, digital virtual exhibition hall, digital experience museum	Realizing researcher group sharing and public exhibition; permanently preserving these objects for future generations
	Smart tourism system development: smart tourism cloud computing center, smart tourism public information service platform, digital interactive marketing platform for smart tourism and tourism data monitoring and analysis system and etc.	Constructing a tourism informatization service system integrating tourism publicity and marketing, tourist guide service, tourism product reservation, tourist service guarantee, tourism market supervision and other functions

The third stage is the stage of professional protection and inheritance. Digital heritage protection needs a lot of interdisciplinary talents with knowledge and skills. With respect to the specific work of the first two stages, it is the precondition of the digital protection and transmission of Huangzhou Dongpo Cultural Heritage to build a complete work team. We also need to strengthen the protection of intellectual property rights of cultural heritages, and thus enrich Huangzhou Dongpo Cultural Heritage with new artistic and cultural values. It has an important meaning to build Huanggang into a "City of Chinese Celebrities", promote local economic development, effectively protect the research fruits of Huangzhou Dongpo culture and avoid the predatory exploitation and destruction.

Research case—3D animation creation of Huangzhou Dongpo

#### A. The Cultural Characteristics of 3D Animation

3D animation is the product of the development of computer information technology. It is a new art form integrating painting, film and television, digital technology, music, literature, and many other disciplines. In 1995, Pixar Animation Studio completed the first piece of 3D film "Toy Story" in the world history of animation. With perfect creativity and vivid image, it has brought a new visual enjoyment to audiences. And it quickly caused a sensation in the world. Later some 3D films, such as "Shrek", "Finding Nemo" and "Up", were on show gradually. These films not only won the Oscar Award repeatedly, but also created the

box-office hit again and again. Even Disney had to purchase Pixar who has focused on field of three-dimensional computer animation with high price to recover his glory in the animation kingdom.

In 2015, the 3D animation film “Monkey King: Hero is Back” has earned more than nine hundred million yuan. The film is directed by Tian Xiaopeng. It has refreshed the box-office record of animated film in our country. This 3D film is adapted and performed according a Chinese fairy tale “Joumal to the West”, so it is full of strong traditional cultural elements. The yield of “Happy Sheep and Grey Wolf”, “Bonnie Bears” and other domestic animation works are in an explosive growth. However, compared with Europe, America, Japan, Korea and other developed countries, our domestic animated films still does not have the competitive advantage. For the reason of this phenomenon, an old director of Shanghai Animation Film Studio, who has been work for 30 year, pointed out: “our present animation films are short of ‘root’. The “root” refers to Chinese culture”. Mr. Lu Xun has ever said: “What belongs to the nation belongs to the world”. Looking back on animation works of “Chinese School”, they all sourced from our national traditional culture. The puppet film “Magic Pen” describes a story that the vulnerable groups suffered from government’s bully, and Ma Liang fought against the wickedness with a magic pen. It reveals the wisdom of civilian, and their longing for goodness and virtue. In the animated film “Havoc in Heaven”, the protagonist broke through the stone and created a tremendous uproar in the heavenly palace. It highlights the folk’s strong desire to fight against oppression. The puppet animated film “Tales of Avanti”, the large historical legend film “Zheng Chenggong” and other works are classic cases with the combination of “celebrity culture” and animation creation. However, there are only a few 3D films with the cultural heritage of the celebrities as theme. It does not conform to the trend of the times. It is not conducive to the healthy development of China’s animation industry.

**B. 3D Short Animation Film— “Night Tour in Chibi”**

“Night Tour in Chibi” was created from two aspects, material remains and non-material culture. It strengthens 3D copy and virtual reconstruction of sites, building, literature and art achievements, murals and other material cultural heritage, and it also restores the life state of Su Dongpo in Huangzhou with 3D animation performance means. Therefore, it fully reflects aesthetic taste, values, philosophy and other cultural values of Huangzhou Dongpo.

1) *Animation script and Dongpo cultural spirit:* The 3D short animation film “Night Tour in Chibi” mainly highlights the following two aspects. First, it shows Su Dongpo’s poetry, Ci, calligraphy, painting and other art achievements. Second, it describes Su Dongpo’s sadness and farming life when he was banished to Huangzhou at the beginning. He called himself “Dongpo Hermit”, manifesting the “Dongpo spirit”. According to above ideas, the script draws materials from the textual research of “Dongpo Chibi”. It says: “The original name of Huangzhou Chibi was Chibi Mountain. A river flows through here, so it is convenient for visit. Su Dongpo has

written some Fu when he visited here. He perfectly knew that Chibi was not a place with fierce fighting any more. But he poured out his complaints in the guise of the implied meaning of the war between Cao army and Zhou army, so all under heaven knew his name”. With this paragraph as original material, the short film is named as “Night Tour in Chibi”. Real cartoons are real or possible things, even the things that are going to happen, plus fantasy and exaggeration. Thus, the collection of materials is only a prerequisite for creation. Animation artists need to reprocess the materials to increase the interest of animation story. According to the historical background and personal feelings of the protagonist (Su Dongpo) at that time, four modules, including beginning, development, climax and ending, are made to tease out the story line and story structure “Fig. 1”.

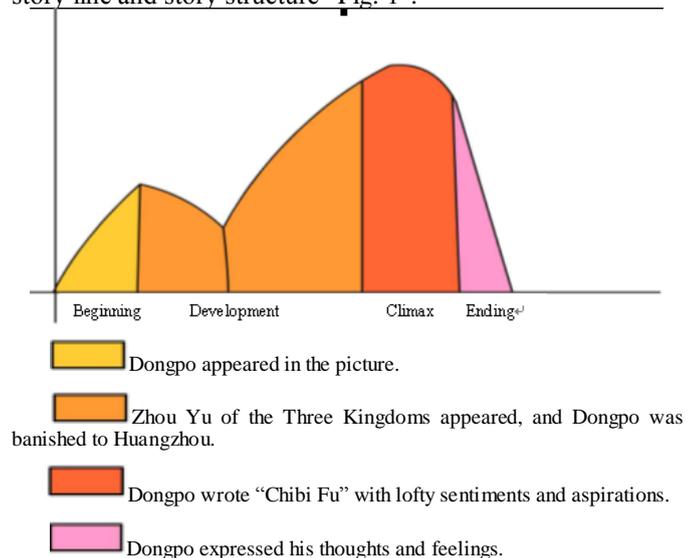


Fig. 1. Plot development structure

**Beginning:** Describe the environment of Chibi. Under the dim light of night, a boat floated on water. Su Dongpo appeared in the picture. Then mainly portray Su Dongpo’s expression, demeanor and dress and explain the beginning of the story. **Development:** With moonlight and goblet, Su Dongpo began to express his feelings. He looked around, and was moved by what he saw. With lofty aspirations unrealized, the scenery conjured up his memories. It promotes the development of the plot. The conflict has been promoting gradually. **Climax:** Climb Chibi. It is difficult to control his emotions. Su Dongpo looked at the moon, and wrote “Chibi Fu” swiftly. The plot reached the climax. **Ending:** Describe Su Dongpo's excitement and frustration. Finally, according to characteristics of animation script, delete some historical events or add some folk anecdotes, so that the whole story is endowed with affinity and legendary sense. It can enhance the ornamental value and interestingness of the film.

2) *Modeling design and 3D animation modeling:* 3D animation modeling is based on dot, line and plane in the three-dimensional space of X-axis, Y-axis and Z-axis. It uses computer arithmetic to achieve the process of original space

modeling. Role design is a prerequisite for three-dimensional modeling. In this short film, the image of Su Dongpo is presented in Q version of cartoon style, so that it can be close to the times and highlight the interestingness. With reference to costume design at that time, shape design is recreated and finished according to the characteristics of the animation “Fig. 2”. It depends on the relationship between the role model and the model line arrangement to judge whether the three-dimensional model is good or bad. 3D model of Su Dongpo uses polygon production method. Polygon is composed of dot, line and plane. Line is the basic element to support 3D model. Arrangement of lines is focused on the structure of the role, which requires concept designer to give detail notes in structure design, especially wrist, arm, knee and other main joints. Figure 3 is the finished 3D model of Su Dongpo “Fig. 3”.



Fig. 2.



Fig. 3.

3) *Color texture and three-dimensional material:* Material is the process to implement model color and texture presentation. It mainly includes two types, texturing and node. The role texturing painting mainly is to connect design color and pattern information to the visual form of model surface through UV. UV is a unique attribute of polygon model. It is also an important way to associate material and patterns with the role. The UV mode of Su Dongpo is opened through LAYOUT and then input to MAYA in OBJ format. Use material editor to output UV “Fig. 4” for color rendering “Fig. 5”. After finish drawing the basic color texturing, connect

these attribute information to the three-dimensional material ball. Finally, convey the color information to the 3D model through material ball “Fig. 6”.

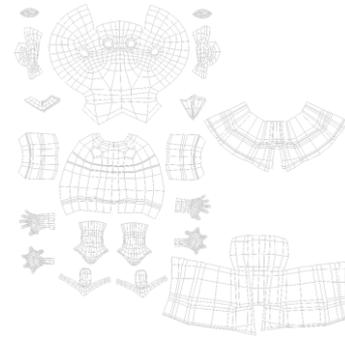


Fig. 4.



Fig. 5.



Fig. 6.

4) *The Action of Role and Performing Arts:* The action design of the role is an important part of shaping the character and promoting the development of the plot. In order to realize the action variation of 3D animation character, the premise is to set up a scientific and reasonable skeletal system. To facilitate the action design, skeletal system shall be made according to body structure “Fig. 7”. Then bound the skeletal system and controller, and skin “Fig. 8”. Carlos Baena, an animator of American famous animation studio Pixar said: “the difference between a good animator and an animation master is the same like the difference between a good actor and an acting master”. It reveals the important position of performing arts in the animation production. Animation performance, just as the name suggests, is to perform with moving cartoon images. This film is also made according to

this program. Action creators first set skeletal system after receiving the document. They designed the performance of role according to the story board. Shoot with DV camera, and then artists decompose and combine actions. Transplant into 3D role models, and use pose-to-pose production method. Adjust keyframe, and then adjust in-between frame. With repeated modifications, the role of animation is basically the same with actions of performer.

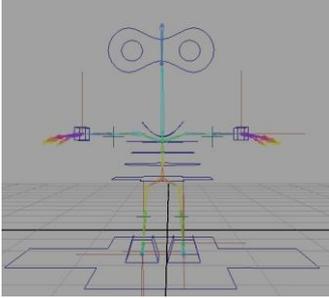


Fig. 7.

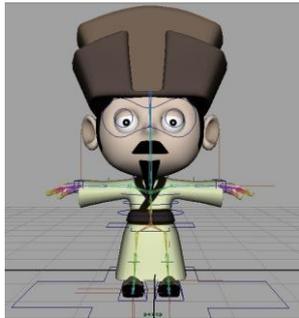


Fig. 8.

5) *Visual arts and lighting rendering*: Light is one of the most expressive arts of 3D animation modeling. Its quality determines the visual effect of the whole work. It can not only simulate realistic visual effect and original appearance of subject, but also determine the color and light tone of the whole film. Lighting setting should take the relation between blankness and actuality, the relation between cold tone and warm tone, and volume relations of model objects, so that the lighting is made layered. Lighting also can make up the defect of the object itself in texturing. Rendering is the process of outputting series of picture information according to the main part of completed 3D animation and shooting design script by computer. In short, lighting, material and rendering are inseparable form each other. They jointly determine the visual effect and form texture of the film.

#### IV. CONCLUSION

The digital protection of Huangzhou Dongpo Cultural Heritage is a trans-space, multi-dimension and multi-discipline research field. The state pays more and more attention on the cultural relics of celebrities. The local governments shall gradually promote the cultural project in a planned way, combined with its own characteristics. The digital protection and application of Huangzhou Dongpo Cultural Heritage has a

real economic value in the promotion of local economic and social development as well as an important significance in the inheritance and development of digital resources of the national traditional culture and the construction of public cultural information resource sharing.

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