Digital Exploration of Sports Cultural Heritage of Guangdong People's Stadium

Wenwu Mao1,*, Jie Zhang2,a, Xingtuan Dong1, Nannan An1, Kexin Zhang3, Zewen Zhang3, Siyuan Wu1, Jiang Che4

1College of Engineering Science and Technology, Shanghai Ocean University, Shanghai, China
2College of Foreign Languages, Shanghai Ocean University, Shanghai, China
3College of Food Science and Technology, Shanghai Ocean University, Shanghai, China
4Guangdong Provincial People's Stadium, Guangzhou, Guangdong, China

*Corresponding author e-mail: wenwumao@126.com, a jiezhang@shou.edu.cn

Abstract: Guangdong People's Stadium, known as the “living fossil of sports culture in the South of the Five Ridges”, is one of the most ancient stadiums in China. It was earliest found as the “Yuewutang” in Tang Dynasty in 618AD, and has left abundant sports cultural heritage. However, many precious sports cultural heritages have been damaged and lost over time. This paper makes a digital exploration of sports cultural heritage of Guangdong People’s Stadium based on image processing technology, 3D modeling technology, 3D scanning technology and action simulation technology in combination with software such as Photoshop, SolidWorks, Geomagic and CATIA. It may help protect and carry forward the sports culture of Guangdong People’s Stadium and even the South of the Five Ridges.

1. Introduction

Guangdong People’s Stadium, known as the “living fossil of sports culture in the South of the Five Ridges” and other honorable names, is one of the most ancient stadiums in China. It was earliest found as the “Yuewutang” in Tang Dynasty in 618AD according to documents; before it became Guangdong People’s Stadium in 1950, it was “Yanwuchang” after expansion in the fifth year of Jingtai Period in Ming Dynasty, “Dong Jiaochang” after repair in the 22nd year of Kangxi Period in Qing Dynasty, “Guangdong Public Sports Field” in early years of the Republic of China, “Guangdong Provincial Stadium” in 1932 and “Zhongzheng Stadium” in 1947. It represents sports development history of the South of the Five Ridges some ancient to Modern time, records emerging and development of military sports, military examination, and modern and contemporary sports, and interprets conflict, integration and mutual promotion of the traditional Chinese sports culture and the Olympic culture[1]. However, many precious sports cultural heritages have been damaged and lost ceaselessly as time goes by after space compression and frequent damage and reconstruction of the venues. This paper makes a digital exploration of sports cultural heritage of Guangdong People’s Stadium based on image processing technology, 3D modeling technology, 3D scanning technology and action simulation technology in combination with software such as Photoshop, SolidWorks, Geomagic and CATIA. It may help protect and carry forward the sports culture of Guangdong People's Stadium and even the South of the Five Ridges.
2. Long history of Guangdong People’s Stadium

The recorded history of sports activities in Guangdong People’s Stadium is long. From the Tang Dynasty, the place was the venue for military drill of people in Guangdong, including martial art practices, military review and military examinations. In the first year of Wude Period in Tang Dynasty (618AD), the “Yuewutang” was built; the place was the site for military examination in the South of the Five Ridges in the second year of Chang’an Period (702AD), Tang Dynasty. During Song and Yuan Dynasty, the head of the imperial guard imparted Wushu skills in Yuewutang. In the fifth year of Jingtai Period, Ming Dynasty (1454), Yuewutang was expanded, and renamed as “Yanwuchang”. In the 22nd year of Kangxi Period (1683), Qing Dynasty, Yanwuchang was further repaired and renamed as “Dong Jiaochang”. In the 27th year of Guangxu Period (1901), Qing Dynasty, the Qing Court released the “new policies” to end the history of the place as the military examination site for 1200 years. In 1916, as Zhu Qinglan, the Governor of Guangdong Province at that time called people to keep fit and healthy by sports exercises, this place was approved as the “permanent public sports site”, and renamed as Guangdong Public Stadium. In 1930, Chen Mingshu, the Chairman of Guangdong Province assigned Jin Zengcheng, the Head of Education Department and Deng Yanhua, the Head of Construction Department to prepare and construct Guangdong Provincial Stadium. In 1932, this stadium was completed and put into use. In 1947, after the victory of the anti-Japanese War, the government of the Kuo Min Tang took over and restored the stadium. Later, the stadium was changed to “Zhongzheng Stadium” from “Guangdong Provincial Stadium”. In 1950, Guangdong People’s Government officially named it Guangdong People’s Stadium and it has been developed up till now. [1]

3. Overall digital construction plan for sports cultural heritage of Guangdong People’s Stadium

The overall digitalized construction plan for sports cultural heritage of Guangdong People’s Stadium can be seen in Fig.1. In the first stage from the ancient time and modern time, the sport cultural heritages of Guangdong People’s Stadium are surveyed, sorted out and dug up by years. As shown in Fig.2, the sports cultural heritages in the second stage are proved and classified: antiques, relics and ancient books with regard to military sports and military examination cultures are dug up by classifications before 1840 in Tang, Song, Yuan, Ming and Qing Dynasty; photos, videos, papers, anthems, stamps, medals and awards regarding sports movement are dug up by classifications from 1840 to now. In the third stage, digital construction is applied to sports cultural heritages. Image processing technology is mainly used for 2D sports cultural heritage, 3D modeling technology and 3D scanning technology are adopted for 3D sports cultural heritage, and action simulation technology is mainly used for action sports cultural heritages.

Fig. 1 Overall digital construction plan for sports cultural heritage of Guangdong People’s Stadium
4. Digitalization of 2D sports cultural heritage

For digitalization of 2D sports cultural heritage of Guangdong People’s Stadium, digital camera and image processing technology are used to take digital photos and process ancient books, relics and news report regarding Guangdong People’s Stadium to images so as to form electronic image resources and make images distinct.

In December 1906, the first sports games of Guangdong Province with features of Olympic game was held in Dong Jiaochang at that time, which is today’s Shandong People’s Stadium. Totally 17 schools including Jiangbian, Lujun, Lingnan, Nanwu, Suihuan, Qiushi, Jinqu, Shiwu, Shimin, Shushan, Zhongde, Jiaozhong and Nanhai attended the games. The games contained three-legged race, loaded footrace, high jump, long jump and pole jump, etc.. [1] [2] [3] In the end of Qing Dynasty, due to restriction of domestic economic level and photographical technology, sports resources with images regarding sports are rare. At that time, a student studying in France took a photo of the sports games, and published on the 18th page of Vol.2 1907 of Weltbild, and released in the Vol. 129 OF Shanghai “Liangyou Picture Album” in 1937 with the theme of “Looking back the Past 30 Years”. [4] This photo is one of the earliest modern and contemporary photos of sports in China, and deemed as an important historical witness for emerging of modern sports in China. The photo can be seen in Fig.3.
5. Digitalization of 3D sports cultural heritages

For digitalization of Guangdong People’s Stadium 3D sports cultural heritages, high precision mapping and surveying approaches such as 3D coordinate meter and 3D scanner are applied to map, survey and scan spatial dimensions and structure of sports heritage according to entity or ancient books, construction drawings and photos of sports heritage, relics, sports game trophy and medals with regard to Guangdong People’s Stadium, and build digital 3D model of 3D sports cultural heritage in combination with color, pattern and other information of antiques.

Fig. 4 shows the digital 3D model of the silver model of Guangdong the 12th Sports Games held from May 10 to May 17, 1933 established by SolidWorks software according to photos; Fig. 5 shows the digital 3D model of trophy established by laser 3D scanner and Geomagic software based on reversal prototyping technology.

Fig. 3 Photo of the First Sports Games in 1906 in Guangdong

Fig. 4 Digital 3D model of the silver model of the 12th Guangdong Sports Games in 1933

Fig. 5 Digital 3D model of trophy based on reversal prototyping technology
6. Digitalization of action-type sports cultural heritages

For digitalization of action-type sports cultural heritages of Guangdong People’s Stadium, the computer 3D technology is applied to digitalization display of action-type sports cultural heritage regarding Guangdong People’s Stadium. From Tang Dynasty, Guangdong People’s Stadium was the place for military drill, review and military examination of people in Guangdong. In the 34th year of Guangxu Period (1908), Qing Dynasty, the first Wushu Competition was held in Dong Jiaochang. In recent years, it actively carries out training and promotion of Guangdong’s intangible cultural heritage – Yong Chun Fist \(^{[5]10}\). Fig.6 is the digital simulation surface model and institutional model of Yong Chun Fist’s short-bridge and near punch moves based on man-machine engineering design and analysis model of CATIA software.

Fig. 6 Digital simulation surface model and institutional model of Yong Chun Fist’s short-bridge and near punch moves

This paper carries out digital construction of sports cultural heritage of Guangdong People’s Stadium, and digital modeling and simulation of 2D sports cultural heritage, 3D sports cultural heritage and action-type sports cultural heritage respectively based on image processing technology, 3D modeling technology, 3D scanning technology and action-simulation technology in combination with software such as Photoshop, SolidWorks, Geomagic and CATIA. It plays an important role in displaying, protecting, inheriting and carrying forward the over one thousand years’ sports culture of Guangdong People’s Stadium.

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