



Digital Experience Design of Traditional Martial Arts in Intangible Cultural Heritage

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Abstract. It has become a consensus to protect intangible cultural heritage all over the world in the background of globalization. This article mainly discusses protection, exhibition and spread of traditional martial arts that is an intangible cultural heritage, and how to design digital experience system based on computer technologies. Lu Style Xinyi Quan is taken as an example, creating a set of moves and routines boxing animations database based on motion capture technologies; refining its cultural genes, and designing visual readings to demonstrate its essence; designing immersed virtual reality and motion sensing game. Interactive experience enables the audience to better explore for and obtain martial art culture that cannot closely observe and study before, and appreciate exquisite skills of representative inheritors of intangible cultural heritage in person. Virtual reality, argument reality and interaction technologies are utilized to integrate martial arts culture into the audience's experience, thus promoting in-depth interaction between martial arts and audience. The thesis is of great reference value for design practices of digital inheritance and protection to traditional martial arts.

Keywords: Intangible cultural heritage · Traditional martial arts · Lu Style Xinyi Quan · Experience design

1 Introduction

Protection to intangible cultural heritage has become the consensus among all countries in the world in the background of globalization. Development of information technology and digital media technology provides new approaches for protection and inheritance of intangible cultural heritages. Many developed countries pay much attention to digital protection and communication of cultural heritages, and conversion to digital cultural forms on a large scale has become a tidal current. Chinese Kungfu, as intangible cultural heritage, is typical Chinese culture symbols in foreign communication and western recognition. It refers to the traditional martial arts, which takes martial art moves as the main content and routine and wrestling as motion form. The traditional Chinese sports events focusing on getting refined internally and externally enjoys a long history and tradition and reflects Chinese sports wisdom and creativity. According to relevant statistics, The State Council has successively approved and published 4 batches of national intangible cultural heritage, 1372 items in total, wherein 36 of them are traditional martial arts;

among the 1986 representative inheritors of the 4 published batches of national intangible cultural heritages, there are 31 for traditional martial arts [1]. Besides, according to martial art data of the General Administration of Sport of China in the 1980s, there are 129 systematic Chinese boxing styles, and after a long-term inheritance and development, all the styles have been presenting much more inheritors. Inheritance and development constitute the key protection contents of Chinese traditional martial arts.

Protection and innovative development of intangible cultural heritage of martial arts are also the important ways to improve people's health constitution [2]. Healthy China Initiative (2019–2030) released in July 2019 proposed to develop characteristic bodybuilding programs, develop sports activities popular, and promote and popularize Tai Chi, health Qigong and other traditional sports programs. The traditional martial arts in the folk has ushered in an unprecedented development opportunity in this times background. Currently, the traditional martial arts are confronted with the dilemma of inheritance and protection, and gradual marginalization of ecological space for culture, lack of inheritors, narrow communication scope, slow communicating speed, one-sided contents, gradual reduction of practicing people and others. Appearance of digital technologies provides new approaches for inheritance and protection of traditional martial arts. Experience innovation, culture extension and knowledge communication are the inevitable courses for digital survival and sustainable development of cultural heritage [3]. Digitalization of traditional martial arts is based on recording and preservation, and most media forms are pictures and video and still remain in the initial stage of recording.

The digital experience design in this thesis refers to design of digital and interactive contents serving the public in protecting, exhibiting and communicating the intangible cultural heritage, martial arts, based on digital technologies. Taking Lu Style Xinyi Quan (short as Xinyi Quan) as an example, this paper tries to build a cartoon Chinese boxing classic database based on motion capture technologies, aims at extracting cultural genes, designing immersed VR and motion sensing game experience works. Interactive experience enables the audience to better explore for and obtain martial art culture that they cannot closely observe and study before, and appreciate exquisite techniques of representative inheritors of intangible cultural heritage in person [4].

2 Digital Experience Design Method

2.1 Motion Capture Collecting Motion Data

Motion capture is the process of recording the movement of objects or people. The technology originated in the life science market for gait analysis. The technology of creating virtual role animation with motion capture data has become the main trend in producing role animation, and has been applied in numerous fields including video games, film and television special effect, medical analysis, product design, education and military simulation. Vicon optical motion capture system of a British company, Oxford Metrics Limited, is utilized in this thesis. The site is about 500 square meters, and there are 36 T160 Cameras. 3–4 persons can capture at the same time.

We use motion capture in technique routine exercise of inheritors of martial arts, an intangible cultural heritage and made into animation Chinese boxing classics. 3D

exhibition enables visitors to see and experience martial motions in an all-dimensional ways and from multiple angles.

2.2 Retargeting of Body Motion Data

The plenty of 3D motion data generated from real motion of performers recorded in motion capturing equipment can be re-applied in various virtual roles, thus rapidly generating new role animation. This is the motion retargeting technology. While using this technology, users only need to select the required body motions from the motion database to conveniently control motion of any 3D animation roles, so as to re-use existing body motion data to control new roles and create animation effects [5].

In motion retargeting in Maya, it requires to establish new bone model through Human IK plug-in components to make all bone positions correct, adjust initial postures to the same T Pose (also known as Bind pose, it is a preset pose used in computer animation to bind the bones of a three-dimensional model.) as the initial posture of motion supplementation, set all rotation data to 0 and bind motion capture data to them. Replace Character with the name of one's own model after adjusting and completing body bone data, and replace Source with adjusted data name to complete motion retargeting. Role models can generate animation based on body motion data of motion capture. Then clear all historical and baking animations except for motions, and export geometric role models to documents in FBX format. fbx files contain geometrical information of role animation model, bone model, texture mapping, weighted value of skin binding and key frame animation to provide animation resources for the following interactive experience designs.

2.3 Digital Experience Design

1) Immersed Virtual Reality: VR is a technology which is developing the fastest and the most popular in computer field in recent years. Art design is also one of the frontier fields closely combined with it, and rebuilding of historical sites with virtual reality technology is a representative example. Martial art is a “dynamic” culture, which is of certain instantaneity and requires a series of moves of inheritors to completely express [6]. Exhibition of the dynamic process of martial art routine requires inheritors to “be at present”, and immersed virtual reality has well solved this problem. The highly-simulated scenario simulated by virtual reality and 3D modelling software has greatly improved interactivity, delight and audience participation of martial arts. Building digital experience pavilion for intangible cultural heritage programs with virtual reality technology and establishing 3D digital contents which users can experience reality and whose effects stay close to the original through materials collection, scene modelling and interactive design, so as to comprehensively and fully exhibit martial arts.

2) Motion Sensing Game: Its working principle is to realize human-machine interaction with video motion capture technology and by analyzing body motions or hand motions of players through camera data. People directly use body motions to communicate with surrounding devices or environment, able to interact with contents as they are in such scenery. Kinect is a peripheral identifying motion completely relying on camera. Since

motion sensing games can realize fitness through movement, do good to mental and physical health, and can easily take people into it by directing the characters in the game with actual motions, it gains much promotion and popularity among the users by virtue of its high playability. Motion sensing games prefer more to exploration to the function of body fitness. Design the teaching and learning methods of martial arts by using this game forms. Display of real-time training under control of body on screen can realize intuitive comparison with moves of representative inheritors, correct wrong and inappropriate motions, and also greatly reduce limitations of weather and site.

3) *Augmented Reality Reading*: Traditional martial art books describe routines with words and pictures, which makes it difficult to intuitively reflect connotation of the entire routine and understand the moves. People other than aspirants rarely refer to and read. Contemporary youth prefer more to the reading forms with more technological contents. Digital reading with augmented reality caters to their expectations well. Augmented reality technology applies computer system and sensor equipment to the intangible cultural heritage of martial arts, and perfectly combines its traditional culture, boxing connotation and action essentials. It superimposes the real world and the virtual world through touch, vision, hearing, etc., more intuitive expression of intangible cultural heritage connotation, so that readers can be immersive.

3 Digital Experience Design of Xinyi Quan

Xinyi Quan, starting from animal form, is created by simulating hunting motions of ten animals, which is also known as the ten major forms. These animal forms correspond to different figures of people, and people of different shapes select corresponding motions to practice based on corresponding animals, which reflects the concept of individualized teaching of the boxing. As a body-building sport, it has functions of prolonging life and keeping body strong. It features in simple motions and abundant connotations, integrated with health maintenance, fitness and martial art and is suitable for age groups. Vigorously exploring the boxing is of great importance to carry forward the traditional culture of Chinese martial arts and reinforce people's health [7].

As one of the traditional martial arts, Xinyi Quan is also confronted with the inheritance dilemma. Its representative inheritor, Master Yu Jiang, is an important carrier and passer, and master's abundant knowledge and exquisite skills, being a representative figure of live transmission. He and his community closely follow development of the times and science and technology, and pay much attention to and support digital protection and inheritance, which gains another important advantage to this research.

3.1 Intelligently Analyze Figure and Realize Individualized Teaching

The ten major forms of Xinyi Quan correspond to ten animals, and people of different figures are suitable to practice different routines. For example, tall people are suitable for horse, short people for swallow, fat people for bear, and thin people for monkey. External device Kinect is applied to obtain coordinate information of key bone joints of human body for calculation classification. For example, there are two methods to

measure height: One is to identify joint points of human body. Height is obtained by calculating distance from head joint point to ankle joint point of experiencers. Error of this method is generally 1–5 cm, and can be corrected by multiplying with a coefficient between 1.01 and 1.05 to get a relatively accurate height. The other method is to calculate distance from the highest point to the lowest point in human body area based on human body depth map to get the height. Based on experiment comparison, the first method is used in this thesis to calculate height. The intelligent figure analyzing model lays a foundation for the characteristics, varying from person to person and individualized teaching.

3.2 Immersed Virtual Reality Represents “Presence” of Inheritors

This is an immersed virtual martial club scenario experience based on virtual reality, and Chinese boxing masters present different moves of the ten major forms on site in martial club. Experiencers use virtual reality equipment HTC VIVE to view and emulate masters practicing the routines suitable for their posture characteristics from the first person’s perspective, and interact with contents in the scenario through buttons in the control handle. The entire scenario starts from the outermost courtyard gate, and people choose to skip to move through the handle in it. They can see dynamic boxing routine practices of figure models in room after entering the courtyard. Experiencers can view in 360° with no dead angle in virtual pavilion, thus realizing an all-round, immersed and interactive experience.

3.3 Motion Sensing Experience of Game

The best way to know a routine is to experience by oneself. However, since most people have never contact with Xinyi Quan, the form of motion sensing game can attract more groups, and combine with games by virtue of the technology of motion sensing. Motion sensing game has created a martial club atmosphere of practicing boxing routines, and been integrated with Chinese ink painting elements, which integrates the culture into roles and scene design and brings a sense of being personally on the scene to players. Besides watching animation of masters practicing boxing routines, it also enables players to experience the routines and enhances their interest. The game flow is presented in Fig. 1. Firstly, watch a routine demonstration video after selecting a certain animal model. Then the frozen pose identifying screen appears as in Fig. 3, with image of the routine that we just watched shown on the left and the pose wall to simulate on the right. When the routine demonstration on the left reaches a certain motion, it will suspend and zoom in, namely the frozen pose. Meanwhile, the pose wall will be pushed out from back to front on the right side.

As depicted in Fig. 2, Players move their left hands towards right to simulate after observing the motions, and correctly pose corresponding motions within 6 s to continue to challenge the next pose. If it cannot be successfully identified, they can hold up their right hands over head to re-challenge or move their right hands towards left to the main interface to re-start and select the animal model.

Integration of boxing routine and games meets the needs of “indigenous residents” in the digital era who are used to absorb knowledge from a digital world, and can attract

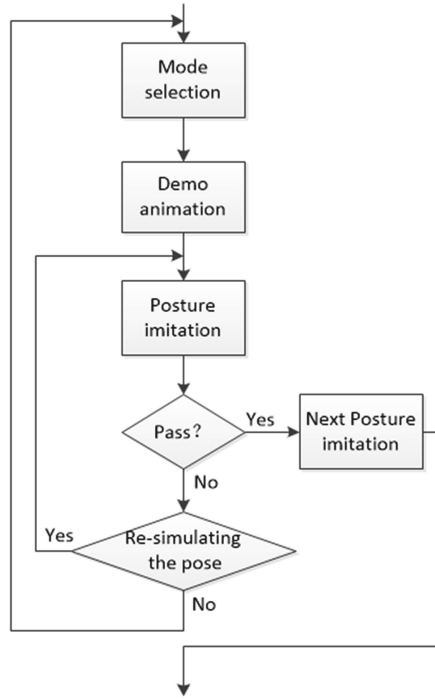


Fig. 1. Flowchart of game

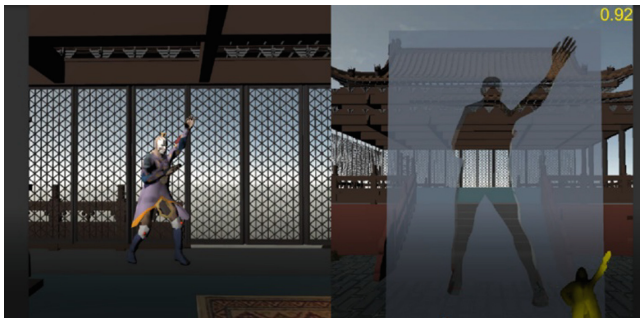


Fig. 2. Frozen pose recognition

more young people, thus extending the intangible cultural heritage of traditional martial arts to a further future.

3.4 Augmented Reality Explaining Essence of Martial Arts

According to a legend, Xinyi Quan was created by a famous general fighting against the Jin State in Southern Song Dynasty to train soldiers to kill enemies for the country. This resulted in an idea to design a unique martial arts cheat, combined with augmented

reality technology, to create a work that can satisfy the user's multi-sensory experience through 3D models, animation videos, pictures, sound effects, interaction, etc. After refining the core boxing and typical moves, the work uses Cinema4D software to present digital art, highlighting the boxing characteristics of animals representing human objects and the performance of special effects to increase the association of the experienter. The content of the work revolves around the connotation and methods of boxing, and shows the differences between Xinyi Quan and other boxing methods in terms of literal interpretation, meaning of boxing methods, historical summary, basic knowledge, and mental methods. Unity and Vuforia SDK are applied as development technologies.

Create scenes, models, interactive events, etc. in Unity3D, and develop AR programs by writing code. Using computer vision technology to identify and track flat images and three-dimensional objects in real time, project the produced virtual objects into the real world, and finally export the file package on the PC side and the Android phone side to read with printed paper books. The display equipment includes a computer, a camera, and an Android phone. The position of the fixed camera is perpendicular to the book, and the added mobile phone can freely explore and read from multiple angles. In order to avoid the dark environment of the exhibition hall, a table lamp can be placed for easy identification. A layer of black cloth is laid on the exhibition stand to make the vision more focused. At the same time, some small props are added to add vitality to the entire exhibition stand and increase the immersive feeling.

4 Conclusions

Recognition of inheritors of intangible cultural heritage and their communities to digitalization of intangible cultural heritage and effective cooperation mechanism play a role of vital importance to smoothly carry out digitalization of intangible cultural heritage. Representative inheritor of Xinyi Quan, Master Yu Jiang and his community can follow with development of the time and science and technology, and believe that it can prevent culture disappearance by taking digital recording measures. Digitalization and multimedia technologies are the important methods and effective communication ways to preserve, inherit and protect intangible cultural heritage, and can be organically combined with the four inheriting modes of master-apprentice, school, martial club and society. Digital experience has expanded inheritance approaches of the traditional martial arts, and promote extensive communication of Chinese boxing, practicing mode, fitness and health maintenance, which has made up for the limitations in traditional protection modes including narrow communicating scope, low speed and one-sided content and is conducive to preserve, utilize and share Xinyi Quan in an all-round and long-standing way.

Technological development is an important drive for digitalization of intangible cultural heritage, and the best advantage of digital technologies lies in being able to break through time and space limitation and physical limitation. As for the technology applied for digital experience design of intangible cultural heritage, currently, there are digital image technology, digital animation technology, 3D technology, virtual reality, augmented reality, and motion sensing technology and motion capture. Appropriate digital technologies shall be selected for experience content design based on characteristics of intangible cultural heritage programs.

The digital experience form is used in this thesis to exhibit the unique charm of traditional martial arts, which is an important exploration of intangible cultural heritage entering the life of common people. Such practical experience has powerfully promoted research on digitalization of traditional martial arts, and has great reference value for design practices in digital inheritance and protection.

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