Character Design of Somatic Game from Perspective of Intangible Heritage Digital Protection

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Abstract. Due to the development of the times and the progress of society, many traditional cultures are gradually disappearing, and the protection of intangible cultural heritage has become the focus of social attention. With the continuous innovation of science and technology, computer somatic games are also constantly developing. Due to the mode of human-computer interaction, it is suitable for all ages and is loved by the majority of players. This paper takes Lu-style Xinyi Quan as the research object, which is popular among Shanghai, and explores the artistic style, modeling design and three-dimensional model creation of character design based on the digital protection of intangible cultural heritage. Players can watch the action demonstration teaching of characters and imitate learning, while feeling the charm of the Quan, stretch their limbs and experience the fun of fitness and Chinese traditional martial arts indoors, thus promoting the digital protection of intangible cultural heritage.

1. Introduction

Character design is an indispensable element in various movies, animations, and digital games, and needs to be designed differently according to the script. Characters need to have a rich personality and unique personal characteristics in order to generate highlights in the work and attract the attention of the audience and players. In the history of character design, Pac-Man became one of the most classic games of the 1980s, and was named the "most successful arcade game" by Guinness in 2005, with a 94% high rate among American players. Part of the reason is its representative Pac-Man image. Simple circles, small eyes and big mouths, bright yellow, suddenly caught people's eyeballs and became their favourite games. Whether the characteristics of the characters are eye-catching is also an important factor for the success of games. The role image of "Pac-Man" and the life attitude he advertises "I eat so I am" are very catering to the appetite of the young people at the time.

There are many types of early foreign game characters, most of which are cute and lively, such as Mario in Super Marie, the image of a repairman with bib, red hat, big nose and beard. From the pixel image in 1981 to the two-dimensional to the three-dimensional in 2008, from simple jumping to avoid eating mushrooms, to the current Mario racing games played on a gamepad, this game has always been loved and without being outdated. This shows that the role design is very successful. The current games are mainly role-playing and first-person design. There are also formation games and business games. Their Characters are gradually being optimized, from third-level to eighth-level, with different images, but all play an important role in the game.

However, most of the impressive games in China are fairy-tale role-playing, such as "Legend of the Ancient Sword" and "Sword Heroes Fate", which have added traditional elements of our country. The
costume design and story script are very interesting, and players enjoy it. Many of them think that this type of domestic game design focuses on plot setting, scene and character design, but weakens the design of gameplay. The domestic character design attracts everyone with exquisite clothing, buns and patterns. The wind blows gently, the long hair flutters, the sleeves swing, and the fallen petals are combined with the ancient tiled streets, making players feel like shuttle back to the king era and has ideals of beautiful love and career. They can learn history, experience and appreciate the life of ancient people in games. [1]

The somatic game uses gesture recognition technology. Players use various body movements to operate the game. It is beyond the mode of the handle or keyboard keys, and directly uses the body to control the characters. They originated in European and American countries, and then spread in Asia and Europe. At first, most of them existed in the form of arcade games, such as the popular Nintendo ufos, which required a physical game pistol. The somatic game is a human-computer interactive, and players can compete online or fitness online, so that they can enjoy games in a simulated environment without leaving home. Moreover, somatic games are suitable for a wide range of games, and players aged from 8 to 80 can find their favourite types, so they have extensive development prospects. There are three types of devices: Wii from Nintendo, PS Move from Sony, and Kinect from Microsoft. This article selects Kinect which is a 3D somatosensory camera, and has functions such as real-time motion capture and image recognition. It completely overturned a single game operation and proposed a new concept of human-computer interaction when it first appeared. It mainly captures 3D images of the human body through optical sensors, and can also capture bone data for human motion recognition. [2]

Traditional martial arts, which is an intangible cultural heritage, is facing the predicament of inheritance. There is a phenomenon that the cultural ecological space is gradually marginalized, there are a few of people who inherit it, the spread is narrow, the spread speed is slow, and the number of trainees is gradually decreasing. [3] The advent of digital technology has provided new means for the inheritance and protection of traditional martial arts. Lu-style Xinyi Quan (Hereafter referred to as the Quan) is one of the Martial Arts that was formed and developed in Shanghai, and flourished there. It is also an intangible cultural heritage project in the city, so its digital protection and inheritance are of great significance. [4] In this paper, somatic games are adopted to enable players to experience the practice process of the Quan in an immersive way, and promote the spread of traditional Chinese martial arts.

2. Game planning
In modern society, most people's lives lack sports. Sitting in the office for a long time is prone to shoulder, neck, and back problems. Therefore, combined with the theme of the Quan, the audience of the game is 35 to 45-year-olds.

The focus of the game is to learn the Quan. It is classified according to the "Shi Da Xing" (Ten Big Shapes) which refers to ten kind of animals corresponding to human stature. This game selects the most representative types: bears, eagles, and tigers for design, and teaches with different characters, which can not only increase the interest, but also can popularize the special content of this intangible cultural heritage. [5] Character design process is here. The first is character setting which gives personality and occupation. Then consider the style, which is a traditional Chinese style as a whole, and matches traditional costumes and accessories based on the occupation. [6] After setting the character, draw the original sketch from three views: front, side and back according to the role description. Details such as weapons and accessories can be drawn in three views separately. After confirming the modification several times to get the final draft, you can perform 3D modelling, unfold UV and texture mapping.

3. Characters style settings
The characters are designed based on the theory of ten shapes. The style is a traditional Chinese warrior, combined with the big ten shapes, so the idea of combining man and animal is adopted. In the beginning, hats with different animal shapes were used as shown in Figure 1(a), inspired by the
currently popular Sony angel dolls on the market. But this idea was later rejected, because there are two pairs of eyes and ears, which caused visual confusion. Therefore, the second scheme, as shown in Figure 1(b), is presented in the form of animal masks, and borrowed the idea of face-changing in Sichuan opera. In this way, people can have a strong vision and directly focus on the facial animal elements. The colour scheme of clothes refers to the traditional colour card.

![Figure 1. Design schemes of bear-shaped character](image)

(a) Bear-shaped character with a hat  (b) Bear-shaped character with a mask

4. Character modelling design
Character modelling design generally refers to the content such as gender, personality, and occupation based on the context of game planning, mainly including shape and costume design. Character design needs to match the style of the game scene, and also needs to fit the theme. The shape design is roughly based on the proportion adjustment and muscle line according to different character types, while the costume design is based on the overall style, adding traditional elements, and also thinks the professional elements in the setting.

4.1. Character shape design
Based on the overall style of the game, a 1: 1 ratio is required for one-to-one learning, so the characters use the ratio of real figures as a reference. Learning the Quan needs to be taught according to the proportion of one's own body, to choose the most suitable animal form for beginning, and to practice it most suitable for the direction of one's own muscles. [5] The animal bear selected in the game corresponds to the fat figure, which is generally very strong, see Figure 2(a); the eagle is a letter-shaped figure, his upper body is better, but his lower body is more slender, see Figure 2(b); and the tiger has the same proportion of upper and lower body, with no waist, see Figure 2(c).

![Figure 2. Three shape characters](image)

(a) Bear-shaped character  (b) Eagle-shaped character  (c) Tiger-shaped character
4.2. Character costume design

The three kinds of character costume settings are different from each other. Due to the martial arts characteristics, they are designed based on the prototypes of ancient swordsmen, nobles and generals, while the colour of costumes refers to traditional Chinese colours.

The bear-shape shown in Figure 2 adopts the combination of the warrior's hat and the panda's ears, face mask uses the pattern of auspicious clouds, eyes for the panda's which surrounded by a ring of black design. Apparel features and tighten cuff buttons can facilitate the role to practice martial arts, clothing patterns take xiangyun, colour collocation choose weak pink, deep red and green.

The eagle-shaped character shown as Figure 3(a) takes the forms of a half mask, covering only the eyes and nose. The mask is dominated by indigo, consisting of eagle eyes and eagle beak. The hat is based on a black hat seen Figure 3(b), with a cloud pattern in Figure 3(c). The clothes are sleeves with wing’s feathers. The feet are designed with eagle claws as the prototype, and the colour is mainly leather and cyan, supplemented by honey yellow.

5. Three-dimensional characters model making

The Three-dimensional character design in this article is based on the above 2D original painting, and the model is built using 3D software Maya, including 3D modelling design, map colouring, bone binding and weight painting.

5.1. Modeling

After the overall design of the 2D character is finalized, we shape the three-dimensional character. First build the basic outline of the human body with simple geometry, and then build the basic form according to the description of the bear, eagle, and tiger figures. The most important thing here is the control of the figure's body proportion and the direction of the muscle lines. The method is the same as that of the human body structure depicted in the sketch. Multiple comparisons and reference to the real person's form are required to shape the details. Then extrude the shape of the clothes on the character model to carry out details.

The cuff of the bear character is tightened, the sleeves are loose, and the material of the clothes is cotton. The waistband is extruded, and the pants are also fitted. The eagle shape is strong on the upper and weak on the lower body, so the costume is designed to be tight on the upper, and loosely handled on the lower to hide the defects. The feet are based on claws, creating a feeling of lightness. The tiger is relatively strong from top to bottom, reminiscent of the image of a general who has been practicing martial arts, accompanied by tight clothing and armour to prevent injuries during martial arts (Figure 4).
5.2. Mapping and UV

After the model is built, it's time for colouring. It is important to select which material for model. First open the UV Texture Editor in Maya, select the model, then the UV appears in the mesh. Click UV Snapshot in the upper left corner of the Polygons to export UVs. Put this UV into Photoshop software for colouring. Please pay attention to the colour while comparing whether the model in Maya corresponds to the UV in the picture to prevent errors, and the outline of the UV edges, so as to avoid the phenomenon of missing colour in the model. After finished, return to Maya and choose suitable materials. For example, the skin texture is more detailed; the reflection is more obvious than the cotton clothes have less reflection. Select the material and the file in the colour, and direct the UV back to Maya to complete the colouring (Figure 5). In order to improve the exquisiteness of the character, a highlight map is added to Specular Shading and a normal map to bump mapping. Among them, the character's mask is the most difficult to expand UV. Pay attention to the details of the mask and the proportion of the texture when the UV is painted. It must not be deformed; especially the turning point of the character's arm and the side of the body is most prone to errors.

5.3. Bones and weights

In Maya Rigging mode, select Human IK in Skeleton to begin binding bones. Because it is a regular scale, adjust the scale value according to proportions. Add a bone node to make the character model move more naturally. Observe the curve of the bones in the side view. In adjusting the knuckle of the finger, you need to be careful and patient. Switch back and forth between the front view and the side view to compare the positions.
After the bones are successfully bound, the weights will be brushed. Click paint skin weights to open the brush weight panel. When brushing the weights, you need to advance from low to high, and continuously rotate or move the joints to verify that there is no meld piercing or strange behaviour.

6. Application of characters in somatic games
The bear-shape, eagle-shape, and tiger-shape characters show their Quan as masters in the centre of the Budokan, at the gate, or in the bamboo forest. After the presentation is complete, enter into the game and perform motion recognition in the form of dual screens. On the left is a demonstration of the role animation. In the key frame of recognition, the lens is cantered on the character and zoomed to the same proportion as the gesture recognition wall on the right. Players need to imitate the action within six seconds, if succeed, they can proceed to the next level, else they raise their right hand to challenge again.

The character model is combined with motion capture data in the game. They needs to be prepared for early bone binding, brushing weights, etc. After binding actions in Maya, export the FBX file into Unity to perform animation logic connection and lens pause adjustment. And the camera pauses need to adjust the frame number in the main interface. Do not check Loop Time to prevent the animation from looping.

The Kinect device judges whether the actions of the player and the game character are consistent according to the position of the player's hand movement. Characters play a decisive role in the game. They are teachers who demonstrate for players. This is the core of the game.

7. Conclusion
This is a Lu-style Xinyi Quan somatic teaching game from the perspective of non-heritage digital protection. In the process of character design, it is very important to control the overall process of the project, the planning of the role setting, and how the personality is displayed in the appearance of roles. How to organically integrate traditional culture into roles and coordinate the game style is also worth serious study. This work only shows three characters in the "Ten Big Shape". The clothes of the model are not soft and real, and there are still differences from the characters in the real environment, thus there is a lot of room for expansion. Players can watch the action demonstration teaching of master characters and imitate learning, while experiencing the charm of intangible martial arts, stretch their limbs and experience fitness exercises without leaving home, thus promoting the digital protection of intangible heritage.

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