

Digital production and realization for traditional dance movements based on Motion Capture Technology

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Abstract: Traditional dance is China's national intangible cultural heritage and is a precious cultural treasure of the Chinese nation. Motion capture technology (Mocap) is a hot research topic in the digital field in recent years, covering the digital fields of physical animation, gait analysis and biomechanics. This paper briefly explains the principle of optical motion capture technology, explores the technical characteristics of motion capture technology, analyzes the advantages of optical motion capture technology in realizing the digital production of traditional dance in combination with the current situation and problems of traditional dance, and designs a technical route for digital production of traditional dance based on motion capture technology. The route is applied to an example production to verify its effectiveness and feasibility.

Keywords: intangible cultural heritage; optical motion capture technology; traditional dance

1. Introduction

Traditional dance is a precious Chinese cultural heritage, and with the rapid development of science and technology in the modernization process, traditional dance also needs to be intelligently developed and digitally produced using reasonable scientific and technological means. In the study of digital production of traditional dance, if users want to truly experience the pure traditional dance, it is necessary to see the realistic and smooth character movements, so optical motion capture technology is essential. With the help of optical sensing equipment, the capture technology can precisely track multiple dancers in the room, capturing the whole body movement data such as head, hands and fingers, recording and extracting the movement trajectory of the dancers in the dance to the motion capture data software, converting this movement trajectory into data information that can be applied, and then constructing the corresponding dancer model in the 3D animation software, and combining the motion capture data information to generate a digital real traditional dance performance. The integration of the two not only meets the public's demand for convenient, multi-dimensional and novel cultural experience, but also is an important way to transform traditional dance production and innovation. The principle and characteristics of optical mocap technology

2. Motion capture technology principles and features

2.1. The principle of motion capture technology

The cutting-edge motion capture technology today is mainly done by light point (Marker) monitoring and tracking, and its operation principle mainly relies on the position of different cameras in a fixed space, as long as the object-specific light point (Marker) is captured and tracked, the object motion capture can be executed. The tracker is set in the key part of the moving object, and the tracker position is captured by the Motion capture system, and then processed by the computer to get the data of 3D spatial coordinates. When the data is recognized by the computer, it can be applied to film and television animation, 3A games, ergonomics, virtual simulation and other fields[1].

2.2. The characteristics of motion capture technology

Broadly speaking, the characteristics of motion capture technology can be evaluated in the

following aspects: positioning accuracy; real-time; ease of use; size of the range of motion that can be captured; interference resistance; multi-target capture capability; and the degree of connection to specialized analysis software in the corresponding field[2].

Motion capture technology has the following characteristics.

1) Motion capture sampling rate is very high, usually 60 frames per second, the background analysis of each frame of dance joint coordinate conversion data and limb posture sequence fragment data to achieve dance action recognition, accurate recording and production[3].

2) The object that needs to be captured in action has a large range of motion, and there are no cables and some complex mechanical devices tied to the object[4], and its performance action is free and resistant to interference.

3) Motion capture computer vision principle, by multiple high-speed cameras from different angles to track the target characteristics of the point to complete the capture of the movement of the whole body, to be able to achieve multi-objective capture; human body in the process of dance, through the optical sensor equipment to simulate the trajectory of the movement in space, a full range of dance demonstration[5].

3. Current situation and drawbacks of traditional dance culture display

3.1. The Current status of traditional dance culture display

Traditional folk dances are attached to the life form of primitive farming society and are the original soil of Chinese culture. However, with the transformation and progress of society and productivity, only a very small number of traditional dances remain to be produced and performed by villagers, inheritors and performing artists in their original flavor, while most of them are stationed in tourist attractions and turned into a kind of tourism product, performed by staff at specific times and occasions to meet the demand of ordinary tourists for mysterious cultural curiosity consumption, and a gap has arisen between art and life[6].

3.2. The disadvantages of traditional dance culture display

It has been found that the drawbacks of the current cultural production status of traditional dance are as follows.

1) Traditional dance inheritors do not have a platform for comprehensive production, and are unable to show the true appearance of traditional dance to the world.

2) The popularity rate of the cultural content behind traditional dance is low, and there is no systematic explanation to match the performance, making most visitors come to watch with only a curiosity, lacking understanding of the human history behind it.

3) Traditional dances are packaged and developed by some commercial teams, and then moved to the stage to become tourism products, focusing on the nature of stage performance, the performance presents false, the performance content has a trend of vulgarity, excessive catering to low interest[7].

4) The overall production mode is traditional and single, and the commercial atmosphere is strong, ignoring people's spiritual and cultural needs.

4. Advantages and characteristics of digital production of traditional dance based on motion capture technology

4.1. Expanding dissemination channels

The traditional way of transmitting traditional dance is to pass on the ancient dance movements and cultural contents to the future generations by the traditional dance inheritors who are exquisite in their dance skills. With the advancement of technology, digital media as the carrier of communication has risen, digital technology has begun to be widely used in China's cultural production, and has received relevant recognition and innovative development, using digital as the core means to disseminate traditional traditional dance is imperative[8].

The digital production of traditional dance is both a multi-dimensional cultural demand of the public and a new direction for the dissemination and innovative transformation of traditional dance. Through the digital processing of optical motion capture technology, the potential of its dissemination and development can be explored, and the digital transformation of traditional dance can be effectively promoted in order to find its own path of cultural dissemination in the rapid development of society[9].

4.2. Accelerating the process of protection

At present, the age of the older generation of traditional dance inheritors is high, difficult dance technical movements have been difficult to complete, the length of high-intensity dance performance also makes the old artists unable to cope. For the younger generation of traditional dance inheritors, along with the social progress of the rise of high-tech industries, affected by the high cost of learning time, weak publicity, lack of market competitiveness and other factors, more and more young people go to the city to join the new industry, the enthusiasm of young people to inherit traditional dance is declining year by year, traditional dance is facing the crisis of loss of heritage[10].

The combination of optical motion capture technology and traditional dance can ensure the restoration of traditional dance through the accuracy and real time of optical motion capture technology, but also can effectively digitalize the dance movement data reserves, for the digital production of traditional dance to continue a strong vitality[11]. It is not only conducive to the production and protection of traditional dance, and enhance the digital value of traditional dance, but also can provide users with diversified, deep and high-quality viewing experience, thus stimulating the people's attention to traditional dance and protection awareness.

5. The technical route of traditional dance digital production based on motion capture technology

5.1. Dance movement design

Through the motion capture technology to collect the above dance movement data, it is necessary to consider the digital processing method, and the focus should be on the overall rhythm and movement normality. Motion capture technology to achieve the entire dance movement production, need to support Maya, MotionBuilder, Axis and other software. Then, according to the historical data, choreographing dance movements, the formal folk dance choreography process is divided into the following points: dance opening, movement preparation, dance movements, dance formations, the

5.2. Motion data acquisition

In the first step, a professional traditional dancer wears an optical motion capture costume with a sensing device for sensor positioning. 17 sensors are attached to the joint nodes of the human body, and 17 sensors are in green, indicating successful data transmission (see Fig.1).



Figure 1: Traditional dance inheritors collect dance movement data through optical motion capture equipment

The current traditional dance performance is the basic traditional dance movements, divided into three: "running and jumping", "kneeling and squatting", "sweeping the floor" and "flapping", etc. After the inheritor performs the dance movements, the optical motion capture system collects all the movement data, as shown in Figure 2.



Figure 2: Digital dance movement data acquisition in optical mocap system

5.3. Motion data synthesis

When the motion capture data are all captured, data synthesis is needed. Apply the latest skeleton animation process, import the action data BIP file into MAYA software for inspection, build the whole skeleton system, and carry out skeleton skinning and binding operations. As shown in Figure 3.

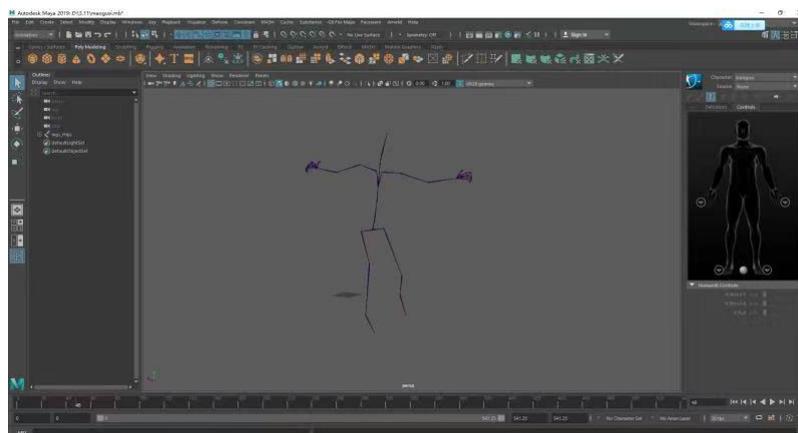


Figure 3: Digital movement check of "sweeping the hall" dance in MAYA

The smoothness of the motion is crucial, so the details need to be gradually fine-tuned. The third step is to import the entire data source into MotionBuilder software, as shown in Figure 4.



Figure 4: MotionBuilder software import and testing

Use the tool components in MotionBuilder software to trim and fine-tune the skeletal movements to ensure the smoothness and rhythm of the overall movement, as shown in Figure 5.



Figure 5: Motion Builder skeletal motion refinement

The skeletal data is filtered through Filters to filter out the extra subtle movements captured, making the overall movement more refined, as shown in Figure 6.

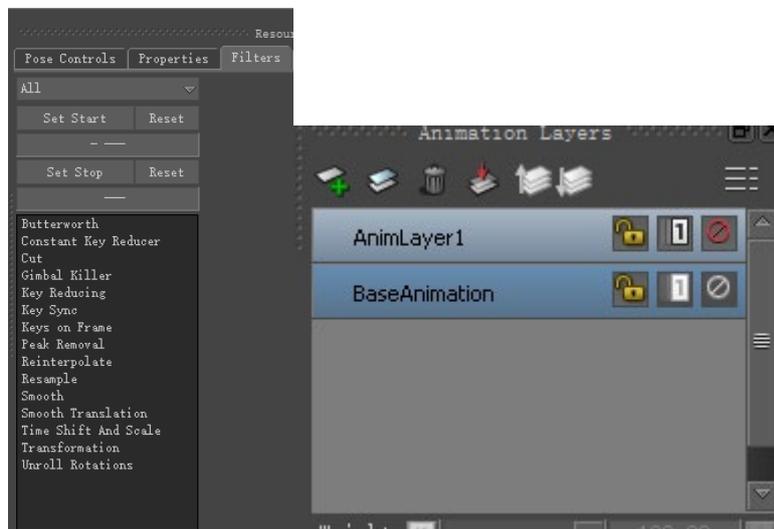


Figure 6: Filters data in MotionBuilder

Use the animation layer and curve editor FCurves to refine and adjust the action data, through frame-by-frame adjustments to enhance the integrity of the dance [10], so that the entire dance data tends to the perfect state, waiting for the next step bound to MAYA Gus character model, as shown in Figure 7.

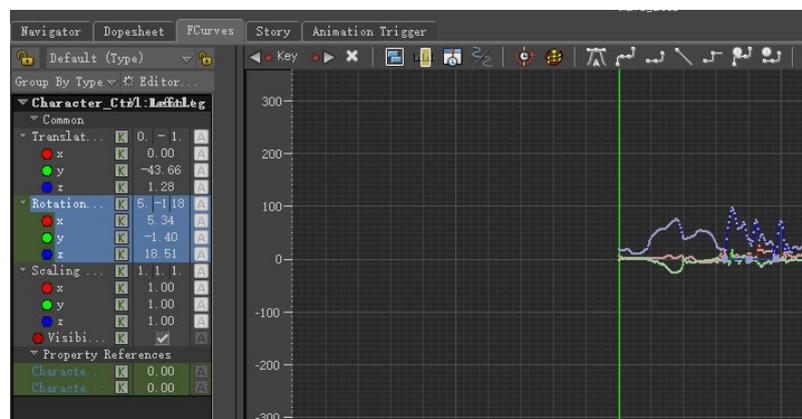


Figure 7: FCurves data adjustment in MotionBuilder

The completed character model will be imported into the software and the complete dance movement data will be fused and bound to realize the virtual character performing real dance movements, as shown in Figure 8.

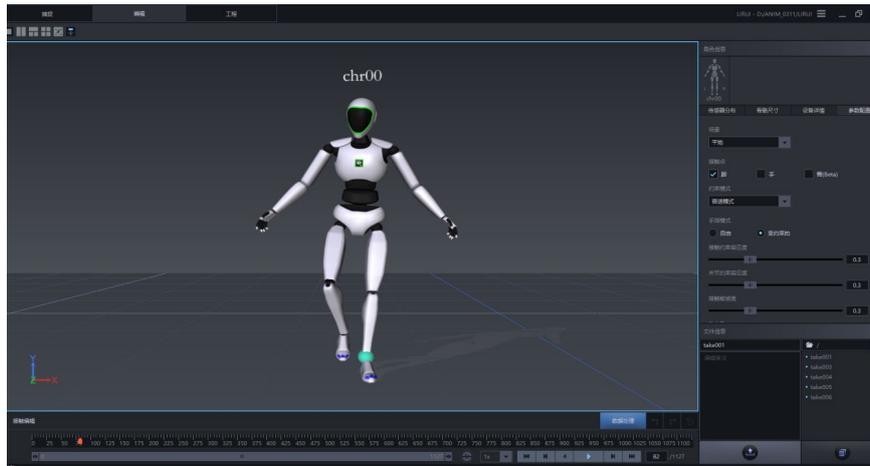


Figure 8: Digitalization of traditional dance movements

6. Conclusion

This paper outlines the principle of the role of optical motion capture technology in digital development, discusses the advantages and characteristics of the digital development of traditional dance based on optical motion capture technology, and summarizes a set of technical routes for the digital production of traditional dance with optical motion capture technology as the core. After verification, the route has high accuracy and real-time analysis of human posture, which enables a new production and dissemination path for traditional dance and provides innovative ideas for the preservation and inheritance of traditional dance.

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