

# *Research on Sports Dance Teaching Based on Virtual Environment*

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**Abstract:** starting from the concept of virtual environment and the current situation of physical education, this paper analyzes the technology used in sports dance teaching based on the background of virtual environment, how to arrange sports dance movements through these technologies, and finally studies the key module design of sports dance teaching in virtual environment.

## 1. Introduction

In the era of multimedia, virtual reality technology can create a virtual teaching environment for sports dance, make sports dance change from the single type to the comprehensive type, and also make sports dance step on a high-tech comprehensive training field, so that it is no longer monotonous but popular like entertainment. At present, there are still many problems in our country's sports dance teaching, and the innovation of multimedia technology, the emergence of virtual reality technology, just can perfectly solve these problems, virtual reality technology in the future sports dance teaching is bound to play a huge role, therefore, it is very necessary and urgent to study the sports dance teaching in the virtual environment.

## 2. Overview of Virtual Environment

Virtual environment is a simulation environment created by virtual reality technology, which can be used as a new teaching mode in teaching. Using this technology, through high technology for example computer, we can integrate hearing, vision and touch into a virtual environment similar to the real environment. Virtual teaching environment is a multi-dimensional digital information space with spatial and temporal characteristics. It is a perfect combination of virtual reality technology and computer technology, and a new technology derived from computer. In addition, virtual environment can make teaching and students communicate barrier free through simulation synthesis, and make them feel in reality. Virtual environment is a systematic, flexible and open environment, which is based on reality but higher than reality.

## 3. The Technology of Sports Dance Teaching in Virtual Environment

### 3.1 Virtual Human Animation Technology

There are three different ways of virtual human animation: manual point by point annotation, automatic matching and motion capture. Virtual human animation technology is the key technology of sports dance teaching in virtual environment. In traditional sports dance teaching, teachers mainly observe various movements of dancers with naked eyes, and then evaluate and guide students with personal experience and ability. This kind of traditional sports dance teaching has high requirements for teachers. Teachers must pay attention for a long time, observe and record students, and have enough experience to guide students correctly. But in the actual teaching, these two points can not be absolutely guaranteed, many factors will have more or less impact on this aspect. The virtual human animation technology in the sports dance analysis system is to interpret the data in the video, put forward the three-dimensional motion data, and then locate it on the established three-dimensional virtual human model, and then use the virtual human to imitate some technical actions through the computer to indirectly reflect the three-dimensional motion information of the sports dancer, Let teachers and students in the virtual environment for real-time, many times, many aspects of action observation.

### 3.2 Edit Technical Action

In traditional methods, it takes a lot of energy to arrange collective sports dance or change the movements of individual sports dancers. Even if the teacher only changes a single action at a certain time, the other actions involved in the action will be changed, so the workload is very heavy. In addition, the adjustment of joint points in traditional methods is relatively isolated, ignoring the connection of other actions, which will lead to some actions becoming incoherent and lack of correlation. In virtual environment, motion editing technology is to store these different motion fragments and reuse them. However, in the arrangement of sports dance movements, the two movements before and after must be consistent and natural to ensure the whole process is smooth. For the data  $F_i$  and  $F_j$  of the two actions, the center of gravity of the two actions can be measured by formula (1.1).

$$D_R(f_i, f_j) = \sqrt{(x_i - x_j)^2 + (y_i - y_j)^2 + (z_i - z_j)^2} \quad (1.1)$$

In the formula, (x, y, z) represents the coordinates of the center of gravity of human in turn.

### 3.3 Synthesis of Body Movements

How to show the body movements realistically in the virtual environment is the key to the success or failure of sports dance teaching. The synthesis technology of body movement can be divided into three categories. One is the more traditional synthesis through manual operation, mainly through manual code operation, so the workload is very high; The second method is based on devices, which saves a lot of time and energy in data acquisition and collation compared with synthetic method, but it can only be used by experts who know the related devices very well, so it is difficult to promote; The third way is to synthesize action by data and virtual human. This way can fully and systematically combine computer and human, and the effect and efficiency are very good.

## 4. Key Module Design of Sports Dance Teaching in Virtual Environment

### 4.1 Design of Motion Database

Through the motion sensor equipment, the precise and comprehensive track of sports dancers can be obtained. However, these movements can only be displayed by specific people in a specific way, and people will have a strong personal color. It is difficult for computer staff to modify and

reuse these motion data. The design of sports Library in sports dance teaching can include three sports: high difficulty movement, connecting movement and mechanical movement. According to one of the high difficulty movements, one of the jumps, turns, balance and flexibility can still complete a certain continuous action as a key frame.

## 4.2 Sports Retrieval of Sports Dance

After establishing the sports database of sports dance, sports retrieval of sports dance can be divided into two parts: offline part and real-time part. The designers of sports dance can establish the offline part of the sports database of sports dance through a large number of real sports fragments. In fact, the offline part mainly searches some difficult sports dance actions from the real sports database, calculates the time point of the appearance and binding of sports, and then judges the connected actions. Real time motion retrieval only needs to be further searched according to the connection relationship between the point and line surface on the established action graph. In order to locate the high-difficulty actions from the massive original actions, we must determine the similarity between the motion frames. In this paper, the distance between moving frames is defined by the quaternion method:

$$D(x_1, x_2) = \|m(x_1) - m(x_2)\| = \sum_{n=1}^n a_i d(q_i(x_1), q_i(x_2))$$

Among them,  $A_i$ ,  $i = 1, 2, 3 \dots N$  represents the importance of the  $i$ th joint of the human body, which is a positive number.  $Q_i(x_1)$  and  $Q_i(x_2)$  are two quaternions, and  $D$  is the distance between them. The distance between the two can be calculated through the formula, and the distance value is the degree of similarity between the two. If the smaller the value is, the higher the degree of similarity between the two is.

## 4.3 Motion Editor

There are many kinds of motion editing technology, and the range of application is also very wide. In sports dance, this paper mainly studies the motion path editing, motion mixing technology and constraints of motion editing. The technology of motion blending can combine the motion fragments of many kinds of sports dance into a new motion fragment, which is mainly calculated by linear interpolation method.

## 5. Conclusion

Through virtual reality technology, to create a virtual environment, sports dance teaching uses the visual image processing in the virtual environment, to avoid being limited by the site, space and time in real life. In the virtual environment, there is no need to worry about some dangerous actions. Students' learning can be carried out through the actual training ground, and then transferred to the virtual environment, which can greatly stimulate the interest of sports dance learners, and perfectly show the unique style of computer technology in sports dance teaching. Teachers and students can also be liberated from the traditional teaching methods, abandon some outdated heavy body movements, have more energy to pay attention to some details and more beautiful movements, and realize a new sports dance movement.

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