THE STRUCTURE DESIGN ON BIOMECHANICAL APPRAISAL SYSTEM FOR THE TECHNIQUES OF SHOT PUT

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The purpose of this study is to set up the biomechanical appraisal system for the techniques of shot put. With modern computer technology and the platform of the three-dimensional video analytical system, the appraisal system will construct knowledge database that based on the three-dimensional information and kinematics parameters of athletes' movement. The thought of systems theory is used to analyze the athletes' technique through the relation of input and output of the motion behavior. To solve a series of the critical theoretical and empirical problems from the retrieving, reasoning to decision of multiple aims parameters. In this study, the author narrated the theory frame for the biomechanical appraisal system of the techniques of shot put.

KEY WORDS: computer, the appraisal system, shot put

INTRODUCTION: Through the visual continuous pictures to get information for coaches and athletes, it is a kind of most effective means and method to analyze the movement techniques. (Zhou, Jiaying,. 1997).

Since the eighties, the level of shot put for women in our country sport rose rapidly, and it has ranked among the advanced international standards. It has become one of pillar projects in track and field in our country. Shot put for women has experienced several generations' efforts. Not only the level of it is world-class, but also its techniques have the outstanding characteristics.

In order to excavate the data materials in the sport picture maximum to serve for the sports work accurately and quickly, the author used the shot put as the breakthrough point to design the theoretical frame of biomechanical appraisal system for shot put, and to expect to solve the difficulties in the real work effectively. The success of this system will have great advantage for the shot put.

METHODS (ANALYSIS AND DESIGN):

Demand Analysis: Through gathering the pictures of technique and analyzing the pictures with three-dimensional analysis system or inputting the athletes' kinematics parameters directly, the appraisal system will obtain the kinematics parameters of human motion and find out the law of the techniques quickly and accurately, and then to evaluate the quality of motion techniques. So the system may offer some theoretical foundation to improve technique and promote the level of techniques.

The Construction of the Appraisal System: The construction process of the appraisal system and its application are summarized in Figure 1.

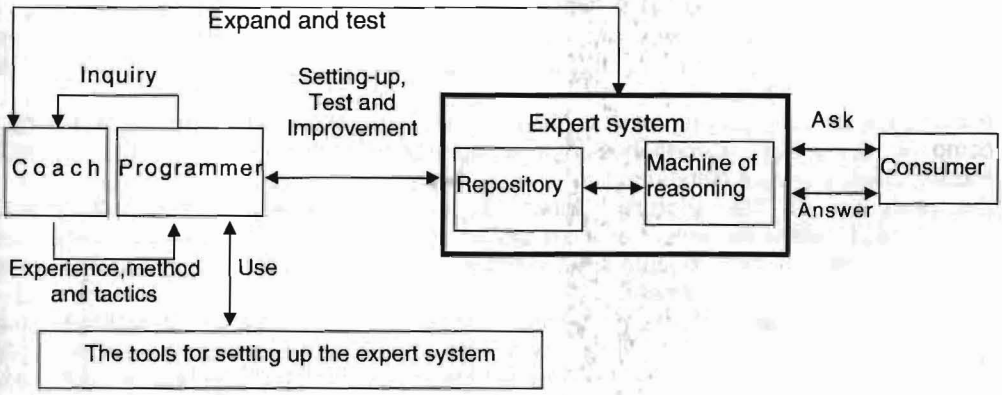

Figure 1 Systematic construction course and using.

From the Figure1, we can find the basic attribute of the system includes two respects:
First, the function of consciousness storage, Through talking, putting in order and organizing knowledge, the knowledge engineer (the personnel with knowledge of the computer) input one or multiple expertise, methods and tactics knowledge into computer with the tools (program language) for setting up expert system, the information is known as 'knowledge base'.
Second, reasoning function, appraisal system is built up for user (input message of inquiring to the system, the reasoning machine is passed and dealt with, and search for and inquire in the knowledge bases search for, inquire about) to find out rapidly the solution of the question, and offer to users in time.
From the function of it, we can find out that knowledge base can deposit a certain information and rules, reasoning machine is looked for its object to match the knowledge base with the information that users offer. In running actually, new knowledge may be supplemented into the knowledge base in order to meet demands of reasoning machine. During the process of developing and setting up 'expert system', should test, expand and improve constantly. (Xiangchen, Li & Jinhai, Sun. 2001)
Analysis of The System: According to working processes and every functions of biomechanical appraisal systematic for shot put, the content of this system was divided seven following parts: picture-gathered; broadcasting of technological picture of sports; The joint was abstracted; analysis of the picture data; Result output; the function of analysis and appraisal and helping.
And the module structure figure of this system is summarized in Figure 2.

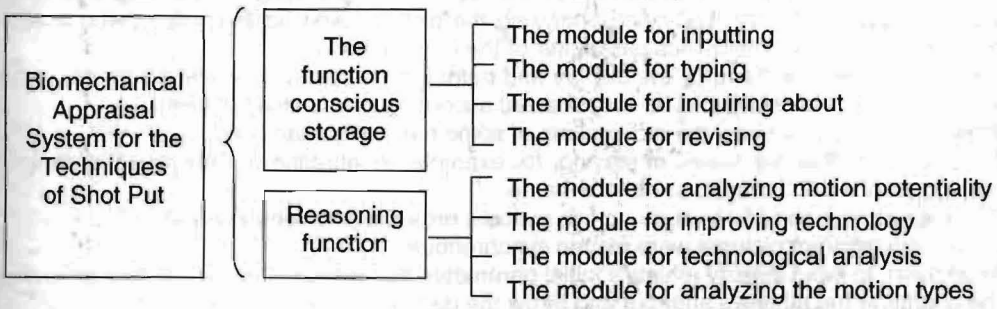

Figure2 The schechematic diagram of the structure of the basic character in the system.

RESULTS (THE DESIGN OF THE SOFTWARE):

Gathering of Picture: Camera was linked up with computer built-in picture gather card (CPE-3000) video input end, to choose the useful part and gather in the memory of the computer and hard disk.

Picture Card: This picture card of the system was gotten from Chinese Academy of Sciences, really high performance, PCI of high-fidelity, automation develop (CPE-3000), black-and-white picture gather card.

Pre-treatment of The Picture: Under VC development environment, with OpenGL technology, to utilize movement analysis system to fiction people editor of movement revise and video software, then to input sport video into computer (Its form is. avi) to change into the series of picture of movement.

Playing of The Video: Playing of the video, like collection of the picture, is realized through 'Windows API' and dynamic link library (DLL) offered by the drivers of picture-gathering card, which can control the playing speed. For example, put forward, put upside down, put, put up, put down, plying frame by frame, stop frame; then there are the following function at the same time: First, to enlarge and show the movements of some part of the body; Second, to set up two windows to broadcast two pictures comparatively.

Identification of The Point of Joint: Under VC ++ development environment, based algorithm on the basis of pieces of sport that match to use, the two methods of computer automatic identification and artificial identification of frame identification point or of human joint point in pictures will be combines. The computer automatic identification is the major methods.

Analysis of The Data From Picture: This part includes mainly: DLT calculation, kinematics of parameter, and treatment of datum. The collection of data from coordinate were obtained through picture element computer of screen, usually regard left upper corner of the computer screen as the origin of system of coordinates, such as display mode being 800*600, indicate the horizontal direction is 800 pieces of picture element, 600 pieces of picture element of vertical direction, the frame picture selects the node, the human motion picture selects the joint.

The data were treated in advance, transfer and draw the curve course. This course is comparatively simpler. Control variables in a half part of left deviation or half a part of right deviation to show the curve through, exploit 'Tcanvas' method which include 'LineTo' and 'MoveTo' to appear a lot of line segment at the surface of the form. And the two parameter of method are 'LfMargin + (i-1)×Setp_H' and 'Round (DataArray [i]). Among them, 'LfMargin' and 'Setp_H respectively is that the distance and horizontal step on the left confirmed are long in the pretreatment, I is the variable of serial number of the frame. DataArray is the data to be shown after pretreatment.

We adopt the Chinese human parameter model, through gathering the technique picture of movement of the human body and analyzing the pictures with he three-dimension analysis system to obtain the kinematics parameter of the human motion.

The Output of The Result: The display and output of the result: Includes the figure, picture and data form. The result can be broadcasted according to four kinds of forms:

First, to enlarge and show the movements of some parts of human body.

Second, to control the speed of playing, for example, to increase or decrease the speed of playing, or chase the frame, or halt the frame.

Third, set up two window to carry on two pictures broadcasting comparatively.

Forth, The different pictures were played synchronously.

In addition, to input directly athlete's initial parameter, through varying the parameter, to show the course of the athlete's shot put and throw the distance in the computer.

Analysis And Appraisal: Through the analysis and treatment the parameter data, to find out the law of technique faster and more accurately, then to evaluate the quality of athlete's movement technique, so it can offer the theoretical foundation for the fact that the athlete improves technique.

The Function of Help: This system is one more comprehensive biomechanical appraise the system about the shot sport technique, it has the overall function and can define independently, so there had made overall, careful helping files for each function.

CONCLUSION: With this system, the coach can analyze and appraise the rationality of the athlete's movement in real time to raise the sport achievement by a large margin. On one hand the research can promote the research level of movement biomechanics in an all-round way, on the other hand it can carry off the gold medal and contribute on Beijing Olympic Games for the shot-putter of our country.

It is a quite complicated job to set up a set of feasible shot sport biomechanical appraisal system of shot put. It needs to concern numerous new and high technologies. In this study, the author narrated the theory frame for the biomechanical appraisal system. The realization of this system needs sports and scientific research workers of other disciplines to could improve the function of this system.

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