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Three-dimensional human modeling applications in sport sciences

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Abstract

The purpose of this study is to examine three-dimensional human modeling software suitable for use in the field of sport sciences. Three-dimensional modeling takes place by transferring virtual objects to objects in our real or imaginary world. Virtual objects, which are transferred to virtual environments by a designer or a design team using various software, has been used many important areas such as health, security, education and sports which are using computer technology. There are a lot of computer software for three-dimensional modeling with license-paid, shareware and freeware. Poser, Daz3d and Blender software have been studied in the research. The processes of human modeling, exposure, movement, and their output are explained. It is thought that three-dimensional human models to be used in education and research activities in the field of sport sciences will be useful. The sport skills that are transferred to the computer platform turn into learning objects that many people can access from anywhere. Such as motion analysis can be carried out with detailed and low cost.

Keywords: Three-dimensional human modeling, motion analysis, sport sciences.

INTRODUCTION

Technology; is defined as practical applications used to achieve the specified goals, meet the needs, facilitate the life and organize the proven information(5). In the sport sciences, various technologies are used in various fields such as education and management. Using variety of multimedia tools in physical education lessons is increasing day by day (12). Computers and software's play an important role in the process of content development for multimedia devices.

Computer software's are usually designed to satisfy the emerging needs. These needs are sometimes identified in general, and sometimes in specific areas. The software, which is developed as a result of general needs, focuses on the main problems and produces solutions. Transferring real-world objects to a computer environment by modeling them in three dimensions is aimed at solving a general need. Many software like Blender can do these operations. Three-dimensional human modeling is a specific need for area. It is difficult and time-consuming to create skeletal-muscle system and joint details with software which designed for general needs. For this reason, many software, such as Poser and Daz3d, is developed for three-dimensional human modeling.

There is a lot of computer software available for a license-paid, shareware and freeware. License-paid software is provided by the manufacturer for a certain price. Shareware software is provided by the manufacturer either by disabling certain features or by limiting the time and number of transactions. Freeware software is provided free by the manufacturer. License-paid, shareware and freeware plugins packages for software are being developed. Paid software is usually designed to solve special needs, while free software is designed to solve general needs.

This study examines three-dimensional human modelling software's that is suitable for use in the field of sport sciences. The software's price-performance analysis and the suitability for the need is an important role among the reasons for preference. Poser, Daz3d and Blender software have been selected for these reasons.

Three-Dimensional Human Modeling Software

Poser software is suitable for creating three-dimensional human and animal models. Preset figures, poses, clothes and accessories are used in the system. Animation and simulation tools are available. Outputs of designs are taken by image processing method. Windows and MacOS operating systems are supported. It is a paid software (8). Daz3D software contains preset human figures.

Designs are created by making various changes on the selected figure. There is a large library of clothing and other accessories. Windows and MacOS operating systems are supported. It is a free software. Some features of paid software are acquired by purchasing contents developed by users (9).

Blender is open-source three-dimensional modeling software. It has many features such as animation, simulation, video editing and game creation. Three-dimensional human models can be created by the designer by making modifications to the preset figures through plugins or from beginning to end. Windows, MacOS and Linux operating systems are supported. It is a free software (10).

Modeling Process

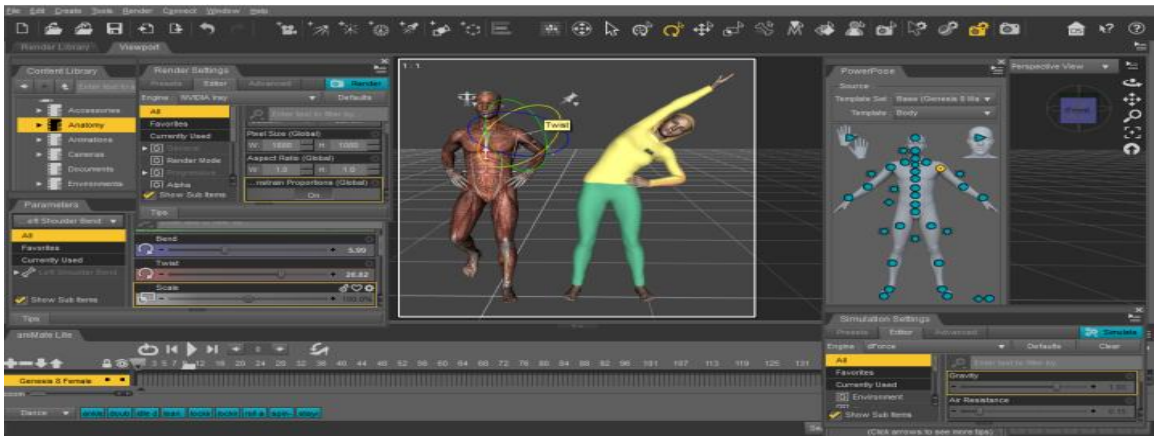
Three-dimensional modeling takes place by transferring virtual objects to objects in our real or imaginary world. Computer software is a tool for transferring models into virtual environment. The Daz3d software includes male and female models called Genesis. This model consists of various versions such as two, three and eight. By selecting any of these, many features such as height, weight and face lines can be changed. The software library contains clothing and accessories to suit the model. In the library, many items are offered free of charge created by designers. The software allows the use of models and accessories designed with a different program through the option of import. Form 1 shows the content library, scene and parameters windows in the interface of Daz3d software.

Image Processing - Render Process

Rendering is the process of preparing the output of the model that is suitable for the two-dimensional environment. As the designs are developed in three dimensions, many features such as light, shadow and reflections affect the rendering process of image processing. In the Daz3d software, the Render Settings window is used in the rendering. The size, quality, various filters, environmental factors, and shadow density of the image are all set here.Due to the lots of variables affecting the render process, a high-performance computer and time are required for quality output.Form1 shows the Render Settings window in the interface of Daz3d software.

Animation - Simulation Process

Three-dimensional human models can be used to simulate various events or movements. In the model design phase, there is only one frame. Animations occur when multiple frames created within a scenario are shown in succession. Each frame is prepared step by step by the designer moving the model through the joint regions. Power Pose and ani Mate Lite windows in Daz3d serve for animation creation process. Simulations consist of process that interact between the objects in real time during movement. The process is prepared before in animations, but in simulations, objects behave according to the current situation. The fluctuation of dress during walk can be given as a simulation sample. In daz3d software, dForce and Simulation Settings windows are used in the simulation creation process. Form1 shows the PowerPose, aniMate Lite and Simulation Settings windows in the interface of Daz3d software Form1.Content Library, Render, Scene, Parameters,PowerPose, aniMate Lite and Simulation settings windows in the interface of Daz3d software



Form 1. Content Library, Render, Scene, Parameters,PowerPose, aniMate Lite and Simulation settings windows in the interface of Daz3d software

RESULT

It is thought that the use of three dimensional human models in the field of sport Sciences will provide many benefits to education and research studies. When sport skills are transferred to the computer environment, they become learning objects that everyone can reach. Biomechanical studies and motion analyzes can be performed with detailed and low cost. Computer games are interest of to all age groups and increasing the effect on our lives day by day. Three-dimensional modeling and techniques have been used in this area, which continues to develop using the most trend technologies (7). Computer games can be developed in many areas such as health, education, security and sports. Computer games allow for a variety of experiences in these areas. Experiences in Computer Games contribute to education and training. It is thought that using three-dimensional human models in sport-based computer games will have positive effects. Ögenler et al. (6) the questionnaire applied to the lecturers in 2014 found that studying on cadaver was more effective than applying three-dimensional modeling. The psychological effects of cadaver use play an important role in the emergence of this situation. Although working with three-dimensional models has some limitations, the use of technology support in combination with traditional methods increases student success (3). The contribution of technology to education cannot be ignored in terms of eliminating time and usage limits. The lack of education that may occur due to the deterioration in cadaver tissues can be solved with the support of three dimensional human models. The experiences gained by participating in the design processes of three-dimensional human models are thought to provide significant contributions to the field of sports anatomy and physiology. In the field of sport sciences, three dimensional models of bones have been created and various studies have been carried out on them (11). Two-dimensional computerized tomography images are made three-dimensional through various software. The data obtained by this method can be used as a source in three-dimensional models. It is possible to create designs that are closest to reality with three-dimensional human modeling software by entering some measurements such as length and width. The realism of the designs can be enhanced by utilizing color and texture coating properties. Various software is being developed for the analysis of biomechanical movements (2,1,4). These developments aim to minimize the risk of injury and to ensure that athletes can do the movements correctly. The data obtained through Motion Analysis can be transferred to three-dimensional human modeling applications and the results can be visualized effectively. It is thought that the use of these models will be positive effects on the feedback sent to athletes and coaches in the reporting phase. It is possible to transfer real-world motion data directly to three-dimensional human modeling software's without the need for any Motion Analysis program. It is preferable to use reference points and reflectors to increase reliability when data are collected. As a result of the transfer of the records made by high resolution cameras to three-dimensional human modeling programs in the appropriate file format, real-world movements are achieved in virtual world. Biomechanical examinations of movements transferred to the virtual environment can be performed in detail and cost-effective.

There are many three-dimensional modeling software's such as Poser, Daz3d and Blender which are examined in the study. Each software has its own unique features. Therefore, in professional studies, it is appropriate to use several different software instead of a software.

It is thought that it will be beneficial to give trainings on three-dimensional human modeling software in Sport and Health Sciences faculties. Students who are involved in the design phase will learn human anatomy and movement processes closely Outputs produced with three-dimensional human modelling applications will generate resources for technologies such as Z-books, augmented and virtual reality. It will be useful to increase the number of studies exploring the use of these technologies in areas such as health, security, education and sport.

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