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MOTION CAPTURE TECHNOLOGY — BENEFITS AND CHALLENGES

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Abstract

3D animation becomes increasingly popular as its demand grows in many areas, such as in advertising and entertainment market and also in several areas of health and sport. To fulfill this demand, motion capture technology (typically abbreviated as 'mocap') gains strength, creating a new generation of professionals and related jobs; improving the potential value of the business. This article focuses on bringing a motion capture technology overview, including its definition, benefits, challenges and key areas that use it. The development of this paper takes place as follows: the first section investigates the definition of motion capture, their types and most common uses. The second section calls out the main practice areas of this technology nowadays. The third section presents the current benefits and challenges of this technology. Thus, the article concludes with a summary of the concepts presented and suggestions for future research.

Introduction

Definition

The motion capture is a process in which an equipment capable of capturing and determine the location of points in the body of an actor in a given space of time is used. [1] Usually, it happens through the use of an outfit or similar apparatus which should be dressed by the actor. The capture points around the body of the actor can act passively or actively in recording [2]. This suit has markers that are picked up by a series of cameras previously prepared for this function, or is connected to the system of reading through cables. The reference points picked up map the body of the actors, scanning this data in order to translate their movements to a digital model. Unlike other methods of frame-by-frame animation, motion capture is associated with the thorough interpretation of human movement and cost reduction [3]. The excitement generated by the motion capture process is considered digital art. That is because the images generated are numeric data, and the computer is a digital camera. Thus, images, illustrations, 3D characters and animations created in computer are an example of digital art [4].

Types of motion capture

The technology of motion capture, according to Maureen Furniss [4], has been developed since the 70's. From then on, many ways to use this technology have been created. The main types of motion capture can be classified into three major groups: mechanical, optical and electromagnetic [4]. Its peculiarities are seen below.

Mechanical

In the capture of mechanical movement, also known as active tagging technology, the actor wears a structure of metal parts like a basic exoskeleton with sensors. As the actor moves, the structure follows the movements, which are captured and digitized. Other types of mechanical capture involve gloves, mechanical arms and articulated models, used to generate key frames (the key points that will guide the work of animator later). The main point for this type of capture is that it does not suffer any magnetic or light interference. However, it has its negative points, such as the fact that technology has no sense of ground, so that there can be no leaps during the interpretation of the actor. In addition, the equipment needs to be recalibrated with great frequency and is neither able to recognize the absolute position of the figure, nor which way the body is pointing or moving [6].

Figure 1 [8]. Mechanical motion capture equipment.

Optical

Optical capture media, also called passive marking technology, the actor wears an outfit covered in markers that are captured by a series of cameras. A specific software then makes the triangulation of the points raised, reconstituting the movement carried out digitally. The marking points used are small spheres covered with reflective material, but can also be infrared signal emitters. The most positive aspects of this type of equipment are the possibility that the actor can move freely without the need for cables or any connection

between the body and the equipment, the ability to capture the movements of different actors simultaneously and the data captures is very detailed and cleaner than other means of doing it. The negative aspects of this form of record are that he is exposed to interference of light, i.e. the reflexive points may be blocked by the actor himself or other objects, causing data loss (there are already, however, software that estimate and recalculate the position of points missing). In addition, the data needs to be "screened" before they can see the resulting animation of motion made, which takes some time and can make the process slower, depending on the complexity of motion captured.

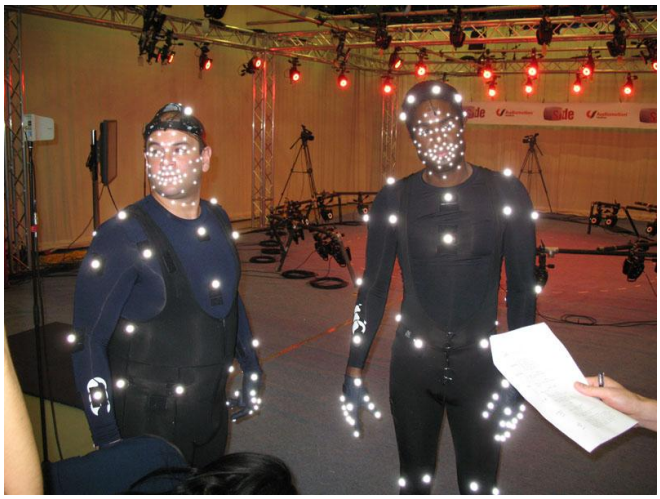

Figure 2 [6]. Optical motion capture equipment.

Electromagnetic

In this type of system it is used a series of magnetic receivers on the joints of the actor. These receivers measure the position in space and send a signal to an antenna that must be connected to the equipment. The major advantages of this system are real time answer, allowing the immediate transmission of motion captured and low computational cost for data processing, in addition to the low cost of the equipment [6]. The major disadvantages of this equipment are the chance to magnetic distortion (concrete floors often have metal, so a proper stage needs to be built) and the large amount of cables that run through the body of the actor and must be connected to the antenna [6].

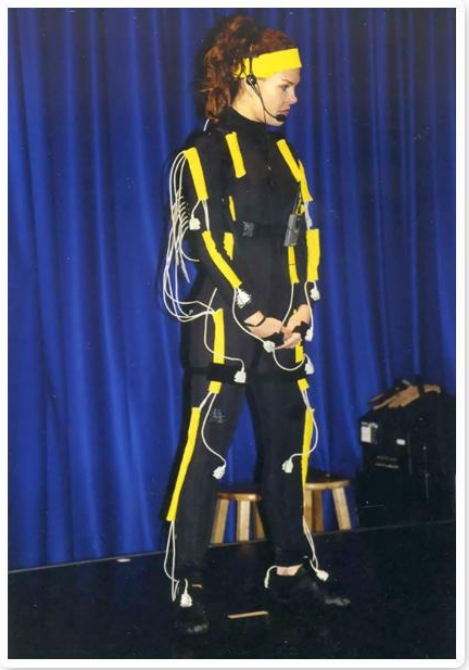

Figure 3 [6]. Equipment for electromagnetic motion capture.

Main uses of motion capture

Advertising

There are many areas that can benefit from the use of motion capture. In 1984, the first animation of a character using this technique was made in a publicity action commissioned by association of the largest producers of canned food of The United States. The animation turned into the ad called *Brilliance*, or *Sexy Robot*, which was broadcasted on the Super Bowl Championship, in 1985 [6]. The use of this technology, although impressive, even took some time to be used widely in the area of communication, gaining strength in the late 90's, when the technologies were more efficient and accessible.

Entertainment

Between the mid to late 80's and early 90's, the technology was being enhanced and applied more often on entertainment projects, being widely used in real-time animations for television — in 1991, a French producer called Medialab, developed for a TV show the character "Mat, the ghost", which was daily broadcasted for more than three years in appearances of a minute. In that same year the Terminator II movie was launched, using the technique to animate the character T-1000, a robot made of liquid metal. Although this would not be the first use of the technique in

the film, it was the first use of motion capture in a relevant character. Currently, the cinema is still one of the biggest industries that makes use of this technique. The videogames also had a representative role in using the motion capture. In the 90's this media was responsible for most of the use of motion capture for animation, keeping its current use for entertainment. Even today, many highly qualified technical and artistically games use motion capture, being also employed in digital games consoles such as Nintendo Wii, Xbox and Playstation EyeToy, carrying the players ' movements into the games.

Health

This field is a largely benefited by motion capture processes. One of the main areas served by this technology is biomechanical analysis, which can be used to verify the conditions of a person requiring prosthesis. The motion capture can analyze how a person performs his movements and where he exerts more strength in order to identify points in the body where any workload is happening, thus providing data for the construction of custom prostheses for each person and an unprecedented analysis on the progress of rehabilitation work.

Sport

The motion capture can be used to analyze the performance of athletes, providing information about the way people move; allowing them to improve their performance by recognizing its gaps. The capture works out in a specific situation, analyzing a certain athlete, and in a general aspect, analyzing the performance data of all athletes involved in a match.

Benefits and challenges of motion capture

The motion capture offers a series of advantages when compared to the frame-by-frame animation and other methods of 3D animation. However, it also presents aspects that may hinder their productions and put themselves as challenges to be overcome by researchers, animators and producers.

Benefits of motion capture

Shortened deadline: the amount of material to be refined does not change according to the complexity or duration of action, being limited only to the person whose motion is captured. It makes possible to perform several tests before you finish the animation completely, which turns out the remaking process much cheaper, if necessary, in comparison to other means of animation.

Quick response: the results of a motion capture can be obtained almost in real time. So, it reduces the costs of animation, due to the short time required to perform the key movement to be animated.

Use of free software: there is potential for the use of free software to bring open solutions by other developers, reducing the cost of system implementation.

Amount of data: the volume of data generated in a motion capture animation is much larger than other means of production. This helps to promote more effective animations, which also impacts the costs of its production.

Accuracy: the movements created by capturing moves are realistic, allowing the capture of secondary movements of the body, such as strength and weight very faithful.

Challenges of motion capture

Variation of limited formats: there is still some difficulty in establishing differences in proportion between the actor and the animated object. A digital character, for example, can be much larger than the body of the actor, generating an overlap of members. There are also not effective ways to transcribe captured movements to a character who has no humanoid form, requiring a lot of correction by the animators. It can even make an animation impossible to be done using this type of capture, thus the animation has to be performed without motion capture.

Real-time visualization: as seen above, only some capture systems allow the visualization of real-time data, so that, in most cases it is easier to redo the scene than trying to edit the data.

Movement and space: only movements that follow the laws of physics can be captured. In addition, the systems have specific needs of space, varying according to the angle of the camera and magnetic interference.

Equipment and cost: equipment and specific software is required for this type of production. In addition, its cost, combined with the cost of professionals to operate it, becomes a deal breaker for small productions.

Need of editing: almost all material captured needs editing by an animator, because the initial data tend to be limited and can cause strangeness. So, it the addition of traditional animation techniques such as anticipation, squash and

stretch is required, as well as, the creation of secondary movements.

Conclusion

This article brings a technology of motion capture overview, such as its definition, benefits, challenges and major applications. The motion capture hosts in itself, new possibilities of action in all areas in which it is used. All the challenges pointed out in this article shall assist organizations and institutions to consider the motion capture as a relevant research area, full of action and research fields, able to bring real benefits in the media in which it is inserted.

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