

Impact of augmented reality on sports performance of disabled

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ABSTRACT

Physical inactivity is a major 21st century public health problem for people with disabilities. The practice of sport in an augmented reality environment appears to be an interesting alternative to promote physical practice for people with disabilities. In this article, our research study will be based on the one hand on the impact and the capacity to increase motivation in rehabilitation by augmented reality (AR) with this population, and on the other hand on the degree of acceptability of physical activity (PA) using avatars modeled in three dimensions (3D).

Keywords: disabled, augmented reality, motivation, physical activity, 3D

INTRODUCTION

Augmented reality is a field of mixed reality, which combines real and virtual environments. The main criteria of augmented reality are: the integration of the virtual on the real, a 3D environment and real-time interaction [1]. Augmented reality tools can therefore be a computer, a projector and a headset like the HoloLens [2]. These technologies bring very important contributions to the sport of the disabled: the creation of an immersive environment and the real-time superposition of real and virtual objects, applicable in various sports applications.

Sports federations are interested in the advantages of this technology in the context of training disabled athletes (Figure 1).

With new training methods, specialist trainers, the disabled always seem stronger, faster, and more efficient.

Augmented reality and the practice of sport

The AR market has recently taken over the sports sector, we believe that this technology is related to the video game industry, but it has also brought great benefits to sports for the disabled. This technology is used to immerse the disabled in a virtual training environment. Augmented reality makes training more



FIGURE 1. - First attempt

fun and more effective, we can follow the movements of the body and interact with the 3D modeled objects that are in the environment of the experiments (Figure 2).

These movements performed during experiments and an increased sports session, for example, allow you to burn calories as in a classic fitness session. AR makes this activity fun, it encourages to start again and again. According to recent research, augmented reality exercises are not only helpful physically; they are also good for the mind.

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FIGURE 2. - Movements performed during the experiments

OBJECTIVES

The working hypotheses are:

- Immersive augmented reality associated with the practice of physical activity has good acceptance in populations with disabilities.
- Level of physical activity promotes acceptability.

The objective of this research is to:

- evaluate the impact of an immersive sports session in augmented reality for a population far from the practice of physical activities.

METHODS

Participants and study design

This is an observational study. The experiments are done in a Rehabilitation Establishment at the Higher Institute of Specialized Education. This Establishment is created to help people with disabilities. The participants are children who have various disabilities and who assist their learning within the Higher Institute of Special Education.

Physical activity in augmented reality (AR)

Published scientific articles confirm a high level of enjoyment for the disabled during various games incorporating physical activity [3]. AR technology has been successfully introduced into many rehabilitation programs. The results observed, for example, that a rehabilitation program supplemented with AR training is a beneficial intervention to improve the physical condition of patients with disabilities [4]. AR experimentation has been shown to improve training in this population (Figures 3 and 4).

The use of AR in the rehabilitation care of the disabled has already proven useful for the recovery of motor skills [5] as well as for reducing anxiety and depressive symptoms in this population [6].

DISCUSSION

How does augmented reality help people with disabilities?

AR generates the combination of real and virtual environments that breaks the usual space-time relationships and facilitates the generation of movements. In our case, it even allows the user to be captured in their movements by projecting them into the

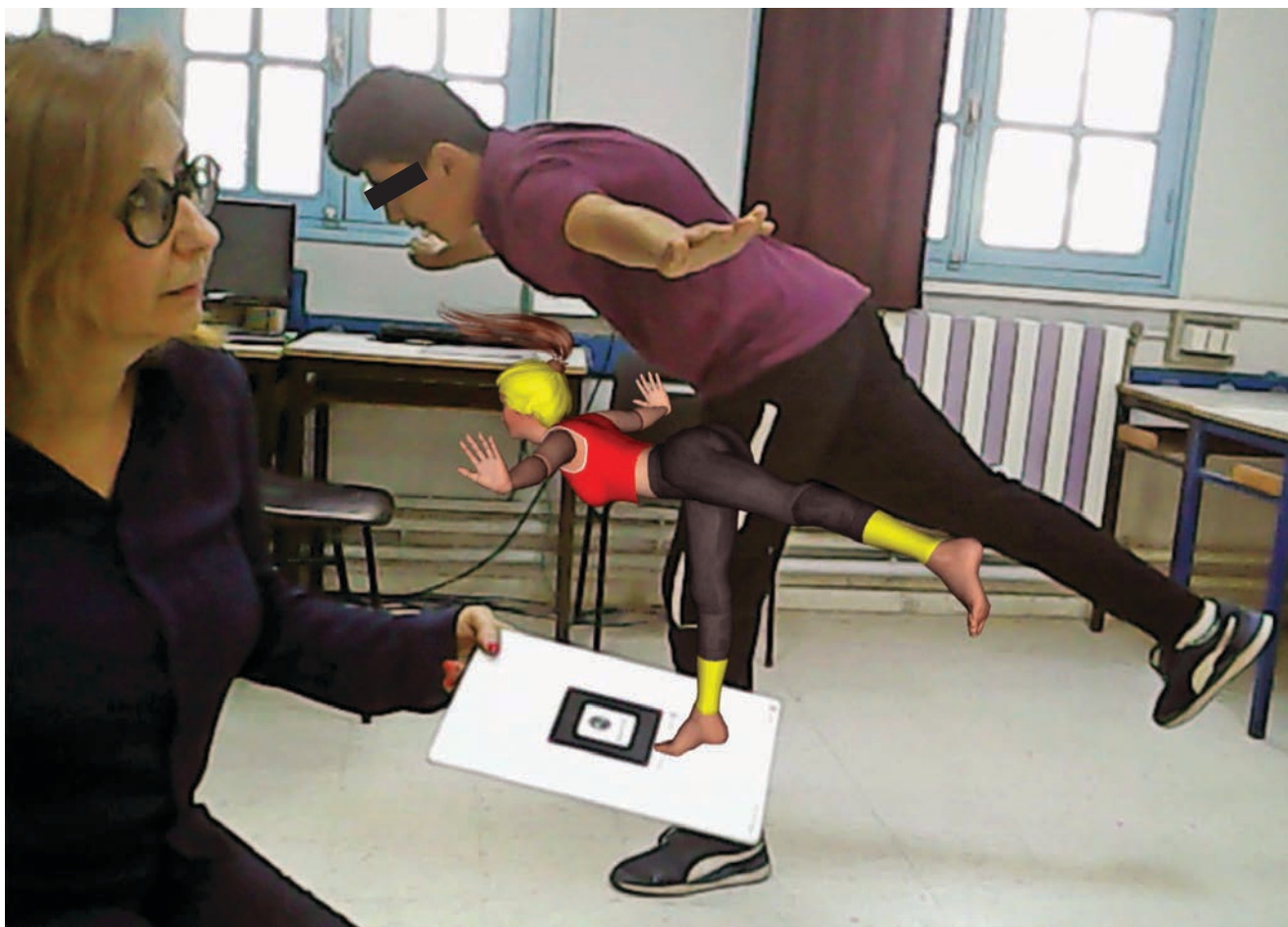


FIGURE 3. - First attempt



FIGURE 4. - Second attempt

virtual world, in such a way that they do not exist in the real world.

But without a doubt, the important advantage of augmented reality applied to disability lies in the emotional aspect. The possibility of experiencing certain sensations stimulates the senses and capacities of this population.

AR adds new sensations and emotions and promotes more motivating and practical learning for people with disabilities.

The possibilities of AR in the field of disability for therapeutic purposes are explored worldwide. We have developed a program that contains sport gestures through AR intended for the handicapped, allowing this population to perform actions that they could not do in the real world (Figures 5 and 6).



FIGURES 5 & 6. - Do things they couldn't do in the real world

RESULTS

Acceptance and pursuit of Physical Activity (PA)

The use of immersive and interactive real-time AR in sport could thus be an innovative approach for the disabled capable of making this population usually distant. The evaluation of these devices is necessary to adapt these new technologies. This innovative technology has been used to measure acceptance on a small number of children with disabilities [7]. Our study is based on the automatic effectiveness of computer skills and attitude to show a good acceptance of AR for this population [8]. In another pilot study, the technology acceptance model was used to assess the acceptance of AR to promote physical activity [9]. Our research is built from several models, analyzing AR and its influence on the individual behavior of this population [10].

Physical inactivity is a major public health problem of the 21st century. The World Health Organization identifies it as a risk factor for global mortality [11]. Physical inactivity has the ability to prevent a

This initiative allows people with physical disabilities to live the real experience and experience what it feels like “outside” of their own body, the disability learns to control these gestures.

AR is an interactive system that works with a camera with computer vision, an overhead projector and a marker that creates a virtual/real gym. They can extend this digital barrier in order to carry out experiments. Interactions with this marker can be done in different ways: with a kick of the legs, by a swing of the arms or by pressing a button.

The end result is a very interesting AR experience that allows all disabled people, even those with serious physical and mental impairments, the chance to compete at some level of sport in a virtual gym.

wide range of diseases, diabetes and cardiovascular disorders [12]. For people in good health, the WHO recommends a minimum of 30 minutes of moderate-intensity physical activity 5 days a week. In developed countries, the reality of physical activity is far from achieving the objectives. The most recent global estimates show that, for physical exercise, 81% of people with disabilities do not meet the recommendations [13]. 90% of disabled Europeans have never done any physical activity or sport. National data consistently shows inequalities in participation by age, gender, disability and geography. Among the new technologies with the potential to improve the physical and mental preparation of the disabled: AR, which has benefited from significant advances over the past decade. Its dazzling progress, particularly in the development of 3D and 360-degree virtual environments, offers athletes the possibility of training differently, in addition to their traditional practice.

Augmented reality makes it possible to “cheat” with the environment, to isolate the sub-skills that the athlete will need to excel in order to train them



FIGURE 7. - Objective to be achieved

individually. A real asset for the disabled, who can thus repeat certain movements in isolation, in an environment close to reality or everyday life, while minimizing the risk of injury.

The equipment made available for the project allows certain activities (see Figure 7).

For participants with disabilities, the game is played in a closed space. The virtual environment presents an avatar in a physical activity position.

CONCLUSION

The practice of sport for the disabled in AR can be a very interesting alternative to facilitate movement by relying on better motivation thanks to a virtual environment close to everyday life. The ac-

ceptability of these devices is very good and no major obstacle was mentioned by the participants. Disability has no obstacle to the practice of sport in RA. The main motivations for this population are the usefulness of the exercise, the ease of use and the pleasure with these new methods of physical training. Further research on long-term follow-up is needed to measure changes in motivation and possible criteria for maintaining initial motivation.

Finally, for AR to occupy the great place it deserves in the sports sector for the disabled, certain obstacles still remain to be overcome. Some issues related to the sports field by AR, which does not allow to move to infinity and to have an exact vision of reality.

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