

Chapter 38

An Overview on the Use of Serious Games in Physical Therapy and Rehabilitation

Tiago Martins

University of Minho, Portugal

Vítor Carvalho

University of Minho, Portugal & Polytechnic Institute of Cávado and Ave, Portugal

Filomena Soares

University of Minho, Portugal

ABSTRACT

As a significant number of individuals have severe motor disabilities due to neurological and musculoskeletal conditions, it is important to provide them with an appropriate rehabilitation program in order to improve their quality of life. Several study results suggest that many elements of the interactive games have tremendous potential as rehabilitation tools. Serious games can entertain the players, while rewarding and reinforcing healthy movements. As these technologies create a pleasant environment, they motivate the patients to perform the necessary exercises with satisfaction and total relaxation, even forgetting that they are conducting therapy. In this sense, various serious games are being applied in healthcare settings, namely in many physical therapy and rehabilitation situations. This chapter discusses the different potentialities of several serious games when used in physical therapy and rehabilitation of patients with problems in motor skills.

INTRODUCTION

Video games are generally regarded as a form of entertainment. However, they are much more than a mere recreation. Just by having to memorize the rules and evaluate the strategies to reach the field

of play, the players already promote their learning, developing the attention, the discipline, the self-control, the self-perceptual and the motor abilities.

Today, there are even games that, involving a challenge and using a reward system, are designed to solve problems in several areas. Although not putting aside the entertainment, this is not their main purpose and therefore they are called serious games.

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Among the problems that can be solved or at least mitigated with the help of serious games, are highlighted by their frequency, those involving health care, rather the mobility impairments, a lot of them severe, due to neurological and musculoskeletal problems (Barreto *et al.*, 2000). One of the causes of such deficiencies that can be mentioned is the multiple sclerosis. Indeed, this is a chronic progressive neurological disease that affects the communication capacity of nerve cells in the brain and the spinal cord. Thus, among other its consequences can be identified by disorders in the motor system, leading to serious limitations in day-to-day activities (Vanacken *et al.*, 2010). Similar difficulties in the movement of limbs and also the loss of balance can result from the occurrence of a stroke. The sequels of the stroke can be so severe that the patient becomes completely dependent on others to perform any daily life task (Burke *et al.*, 2009).

Disorders of the blood supply to the brain after a stroke lead to a loss of brain functions, and the affected area of the brain stops working (Di Loreto & Gouaïch, 2010). So, a stroke can have consequences such as loss of range of motion, decreased reaction times, disordered movement organization and impaired force generation. These consequences will result in deficits in motor control that affect a person's capacity for independent living and economic self-sufficiency (Merians *et al.*, 2002).

As people age, their strength decreases and the bones structure become weak. The poor balance increases the incidence of falls, which can result in serious damages, namely in motor problems (Ryan *et al.*, 2009). Other causes exist that may endanger the independence of the person with respect to activities that he/she has to perform. Whatever they are, it is significant the number of individuals who have severe physical disabilities, being important to provide them with an appropriate rehabilitation program, to optimize their quality of life.

Knowing, a priori, that these patients require regularly physical therapy and sometimes they are far from treatment centers, their lives could be improved with a technology that would allow them to perform the appropriate exercises, at home, avoiding them the fatigue caused by the travels. Moreover, the adherence to the rehabilitation programs is frequently poor because the tasks can be tedious and repetitive resulting in a quick loss of interest of the participants, principally when the improvement is not immediate (Ryan *et al.*, 2009). Therefore it is necessary that the physical therapy and rehabilitation programs are developed in environments that can encourage the patients to perform them with pleasure, so that the dedication is not compromised and the positive results can be achieved quickly.

The results of several studies show that many elements of the electronic games have a fabulous potentiality when used in rehabilitation (Szturm *et al.*, 2008). The serious games can amuse the patients, while gratify and reinforce healthy exercises (Ryan *et al.*, 2009). As these technologies create a pleasant environment, they motivate the patients to perform the necessary exercises with satisfaction and total relaxation, even forgetting that they are conducting a therapy.

Multimodal rich virtual environments can be created with programmable systems support. These environments are an excellent way to encourage the person to keep up more and more motivated, involved and absorbed in their rehabilitation. Usually, the games integrate forms of feedback such as numerical scores, progress bars, character dialogue, controller vibration/force and sound. Constituting a rewarding incentive, the feedback can provide the increase of the motivation and satisfaction, encouraging the engagement, leading to a wish to complete specific tasks and achieve certain purposes (Burke *et al.*, 2009). In this sense, various serious games are being applied in healthcare settings, namely in many physical therapy and rehabilitation situations.

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