

An Overview of Serious Games in Cognitive Rehabilitation

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INTRODUCTION

Serious Games (SG) are an emergent field of research focused on the use of games with other purposes than mere entertainment with applications in many diverse areas. Although the term SG is becoming more and more popular, there is no current definition of the concept. Zyda (2005) was the first author to give a definition of SGs as “a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives” (p. 26). Michael & Chen (2006) define SGs as “games that do not have entertainment, enjoyment or fun as their primary purpose” (p. 21). The authors classify SGs into a number of markets: military games, government games, educational games, corporate games, healthcare games, and political, religious and art games. Susi et al. gave an overview of SGs (Susi, 2005). Despite such classifications, many games could belong to more than one category and nowadays this concept is largely used in respect to computer games. The use of SG in rehabilitation has increased substantially over the past decade. By taking advantage of game technology in order to create more attractive user experiences and increasing playability, the environments and tasks simulated in the SG can be used to teach or train users in various situations (Rego, 2012). In particular, games applied in the field of neurorehabilitation are helping to improve the process of motor learning and recovery from incidents of stroke, traumatic brain injury, and other neuromuscular impairment by increasing user motivation during training (Perry, 2011).

In this chapter we present a review of the state of the art and evolution of SG in cognitive rehabilitation, revealing how they can help in the process of rehabilitation, pointing several advantages of their use, presenting some relevant SG available, as well as technologies and platforms used to their development. Furthermore, it will be also addressed new ways of human interactions and several cases of success applied to cognitive rehabilitation in patients. Lastly, some research opportunities and open problems will be identified.

BACKGROUND

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Rehabilitation could be defined as a dynamic process of planned adaptive changes in lifestyle, in response to unplanned changes, due to disease or traumatic incident (Gunasekera, 2005). Rehabilitation of a variety of deficits resulting from diseases or traumatic incidents is a long term process consuming massive training and social/financial resources (Fok, 2009). The success of a rehabilitation program depends on various factors: appropriate timing, patient selection, choice of rehabilitation program, continued medical management and appropriate discharge planning. This can be achieved in a multidisciplinary way (medical, nursery, social personnel) and with an appropriate equipped rehabilitation department where adequate therapy treatments (physical therapy, occupational therapy, speech and language therapy, clinical psychology and social work) are combined in a planned and coordinated way towards a common goal (Gunasekera, 2005). Traditional rehabilitation therapies are usually considered boring and uninteresting due to their repetitive nature which leads patients to neglect the prescribed exercises (Burdea, 2003). For example, many tests from rehabilitation programs show that patients' function improves with an intensive training oriented to a particular goal but divided in specific tasks. However, the problem with this task-specific treatment approach is the lack of patient interest in performing repetitive tasks and in ensuring that they finish the treatment program (Burke, 2009a). It is important to increase the motivation of these patients in the practicing of the exercises, because an intensive repetition of the exercises is essential for their recovery (Rego, 2012) and it has been used as a determining factor in the outcome of rehabilitation (Maclean, 2002). It has been showed that games contribute to increase the motivation in rehabilitation sessions (Leeb, 2007). Positive results with SG implementation have been reported in several areas, including rehabilitation (Ma, 2008). One of the most promising applications is in fact in this area, in part because the characteristics of this technology help to overcome the difficulties associated with the rehabilitation process, which is often long, slow, costly and demanding (Rego, 2012). The games are more motivating to the patients because they have a storyboard and a set of challenges. Games offer to the patients the possibility of being immersed in a different environment (a virtual situation) where they try to accomplish the proposed goals being distracted from their disability condition and from the fact that they are in a rehabilitation activity. Apart the serious goal of the patients' recovery, the game gives also: immersion, challenge, motivation, enjoyment, sensations that they could not feel in a traditional rehabilitation plan (Rego, 2012). Prensky (2001) elaborated twelve elements of why games engage individuals. Hence, patients remain engaged until the rehabilitation objectives are achieved. Additionally, games are becoming more accessible to people in general. Computer systems are becoming more disseminated and affordable to users in general, in the form of several devices: game consoles, portable personal computers, large display television sets, among others. At the same time, people tend to have more knowledge in information systems and computer technologies, and this promotes the accessibility to computer games. The proximity of the scenarios and activities to real-life environments helps to increase the potential for generalization of acquired skills and consequently to improve the participation of patients in various contexts of life (Rego, 2012). Other reasons that explain this growing interest in cognitive rehabilitation are the limited efficacy of current drug therapies, the plasticity of the human central nervous system and the discovery that during ageing the connections in the brain are not fixed but instead they retain the capacity to change with learning (Smith, 2009). Today, many studies show evidence of neuronal plasticity that support neurocognitive rehabilitation beyond the functional gains (Johansson, 2011). Interventions with computer games have emerged as a valuable tool to promote brain plasticity that positively affect cognitive skills such as memory, attention, perception or

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