Chapter 63
Interactive Games with Robotic and Augmented Reality Technology in Cognitive and Motor Rehabilitation

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ABSTRACT

Over the years, robotics have become technological service tools in different application domains. This chapter presents a direct application of games and robotics as therapeutic tools in the healthcare of patients. These strategies are used in ACROSS project, involving more than 100 researchers from 13 Spanish entities. The main objective of this project is to modify the current perspective of the therapies, taking advantage of the game properties that will be implemented in social robots, which are blocked in providing predefined services. These new systems are able to self-reconfigure and adapt autonomously. In order to provide an open framework for collaboration between universities, research centres, and the Administration, ACROSS will develop Open Source Services available to everybody. This chapter aims to contribute a new overview of treatment therapies with elderly and paediatric patients that present cognitive and motor impairments as well as present the methodology of evaluation to determine the effect of games and social robots as a means to carry out a therapy.

INTRODUCTION

Games have been widely proven to contribute to integral development and learning in humans and their socialization. Piaget considers 'play' as a mean to develop thought and to learn about the world. Vygotski emphasizes that games contribute to social development because the socio-cultural framework will be trained in 'play'. Bruner adds that games help to resolve conflict, acquire and recover language. This is applicable in the cognitive rehabilitation of people with cognitive loss or dementia, because it permits to stimulate residual functions and, in some cases, acquire compensatory cognitive strategies. Dementia is a clinical syndrome characterized by an overall cognitive impairment, usually chronic and progressive, that represents decreasing functional activities and social relations. Sometimes, it is associated with a behavioural disorder, which affects the patient, his relatives and friends. (Moyles, 1990; Dorado, 2008)

Games can also be used as a tool for rehabilitation of motor functions in paediatric patients with upper-limb impairments, cerebral palsy and obstetrical brachial paralysis. Cerebral palsy is a neurological disorder of the brain that can be accompanied with other possible clinical signs such as muscle tone disorders, movement and posture disorders, mental disability, and so on. Obstetrical brachial paralysis is a mechanical lesion of the brachial plexus.

Innovative treatments of cognitive and motor rehabilitation, such as the introduction of robot caregivers, multi-sensory systems, augmented reality, and so on, have not been implemented in Spain due to difficulties in the segregation of service network resources. The discontinuity of care and the lack of rigorous research and knowledge affect the development of non-pharmacological strategies. In this project, we aim to break down such barriers and demonstrate with our experience, the benefits of using these technologies in rehabilitation programs (Woods, 2003; Svansdottir et al, 2006).

The Spanish national project called ACROSS (Auto-Configurable Robots for Social Services) proposes cognitive and motor rehabilitation through games. ACROSS has been funded by the Ministry of Industry, Tourism and Trade belonging to Plan Avanza2. The consortium of the ACROSS project is composed of thirteen organizations. Broadly, the project is part of the development of intelligent environments, in which, through sensor network tools, communication and computation enable a new paradigm in social robotic platforms.

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