Chapter 47
Integrating Virtual Worlds and Mobile Robots in Game-Based Treatment for Children with Intellectual Disability

Franca Garzotto
Politecnico di Milano, Italy

Mirko Gelsomini
Politecnico di Milano, Italy

ABSTRACT

In recent years we have witnessed a rapid growth of learning applications for children with different kinds of disabilities. These tools exploit different learning paradigms and employ a gamut of "beyond the desktop" interaction modes and devices, including haptic controllers, (multi)touch small and large displays, digitally augmented physical objects, robots and motion-sensing cameras. Our research explores novel interactive solutions for children with intellectual disability who have significant limitations both in intellectual functioning, i.e., general mental capacity such as memory, attention, reasoning and problem solving, and in adaptive behavior, i.e., social and practical skills related to daily living (interpersonal relationships. social responsibility, ability to follow rules/obey laws, personal care). Our goal is to provide intellectually disabled children with game-based learning tools that integrate motion-based touchless interaction and interaction with mobile robots. In this chapter, we discuss the above issues and exemplify them by describing a set of games based on the above mentioned interaction paradigm that we have designed for IDD children in order to promote social and cognitive skills.

INTRODUCTION

In recent years we have witnessed a rapid growth of learning applications for children with different kinds of disabilities. These tools exploit different learning paradigms and employ a gamut of "beyond the desktop" interaction modes and devices, including (multi)touch small and large displays in Hourcade (2012), digitally augmented physical objects in Zalapa (2013), robots in Cabibihan (2013) and motion-sensing cameras in Bartoli et al. (2013, 2014).

DOI: 10.4018/978-1-5225-0034-6.ch047

Our research explores novel interactive solutions for children with intellectual disability, or Intellectual Developmental Disorder (IDD). IDD children have significant limitations both in intellectual functioning, i.e., general mental capacity such as memory, attention, reasoning and problem solving, and in adaptive behavior, i.e., social and practical skills related to daily living (interpersonal relationships. social responsibility, ability to follow rules/obey laws, personal care). Our goal is to provide IDD children with innovative *game-based* tools that promote new forms of behavioral therapy for this target group.

From a learning and therapeutic perspective, our work is grounded on theoretical and empirical research in psychology, pedagogy, and neuro sciences that highlight the relationship between physical activity and cognitive processes, with the formative role of "embodiment" (the way an organism's sensorimotor capacities enable it to successfully interact with the physical environment) in the development of cognitive skills such as in Dourish (2004), Lee (2012), Morgan (1986), Bianchi (2007). Sylva (1976) also pinpoints that play is the most natural way for any young child to express him/herself, to experience and make sense of the world, to connect with other human beings, and to exercise and develop the core cognitive functionalities that are a prerequisite for any higher level skill, e.g., imagination, language development and abstract reasoning. In addition as proved by Bouvier (2014), Csikszentmihalyi (1997), Schoenau (2011), play is fun, and fun accelerates learning processes by inducing a state of flow that promotes attention, increases the capability of selecting relevant information, and augments the willing to complete the required tasks. Integrating digital play into educational and therapeutic routines offers opportunities for encouraging social interaction, developing communication and imaginative thinking, and increasing children's ability to perform a variety of activities needed for daily life.

Our design and technical approach (Figure 1) integrates *motion-based touchless interaction with large displays* and *interaction with mobile robots* as shown in Bonarini, Garzotto, Gelsomini et al. (2014).

Figure 1. Moments of interaction with the integrated robot + touchless large display system. Top left: a child personalizing the robot; Top right: Social play with on-screen contents; Bottom left: social play with the robot; Bottom right: the child and robot's representations on screen

Teach Less and Learn More: Enhance the Student Learning Experience Through an Innovative Curriculum
Ratneswary Rasiah, Sotheeswari Somasundram, Kelly Pei Leng Teeand Jason James Turner (2021). *International Journal of Curriculum Development and Learning Measurement (pp. 29-42).*
www.irma-international.org/article/teach-less-and-learn-more/269746