Chapter 8

The State of Virtual and Augmented Reality Therapy for Autism Spectrum Disorder (ASD)

Sinan Turnacioglu
Floreo, Inc., USA

Joseph P McCleery
Saint Joseph’s University, USA & Children’s Hospital of Philadelphia, USA

Julia Parish-Morris
University of Pennsylvania, USA & Children’s Hospital of Philadelphia, USA

Vibha Sazawal
University of Maryland, USA

Rita Solorzano
Floreo, Inc., USA

ABSTRACT

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition affecting a growing number of individuals across the lifespan. It is characterized by observable impairments in social communication, as well as repetitive behaviors and restricted patterns of interests. Early, intensive behavioral interventions improve long-term outcomes in ASD, but are often expensive and hard to administer consistently. This chapter describes a new approach to autism intervention, using highly motivating virtual reality (VR) and augmented reality (AR) technologies that could soon support traditional autism therapies across ages and ability levels. The chapter begins by reviewing the ASD phenotype, followed by a review of the current landscape of research on VR and AR in ASD. A discussion of ASD-specific benefits and risks is followed by a presentation of new, harnessed immersive VR technology from Floreo, Inc. Finally, we propose a series of future research directions.

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INTRODUCTION

Autism spectrum disorder (ASD) is a heterogeneous neurodevelopmental condition characterized by variable degrees of impairment in social communication and restricted and repetitive patterns of behavior (American Psychiatric Association, 2013). ASD prevalence is growing, and recent estimates range from 14.6 per 1000 children aged eight years (Christensen et al., 2016) to 2.24% in children aged 3 to 17 years (Zablotsky et al., 2015). It is a lifelong disorder, and the majority of adults with ASD continue to experience significant difficulties with socialization, independent living, employment, and mental health. A recent survey of young adults with ASD found that 24% reported social isolation, as well as high rates of anxiety, depression, and attention deficit hyperactivity disorder. In addition, 4 in 10 young adults with ASD were described as disconnected from work and continued education through their late teens and early twenties. Less than 20% of young adults with ASD lived independently (Roux et al., 2015).

Despite extensive research focused on behavioral and pharmacological treatments for the core symptoms of ASD, there remains a clear need for treatments to support social and emotional development and functional life skills in individuals with ASD which are both effective and cost-efficient. Reviews and meta-analyses have suggested that interventions for ASD as a whole show limited effectiveness, with few exceptions such as early intensive behavioral intervention and related types of applied behavior analysis-based programs. For example, a 2010 review evaluated the existing research base on comprehensive treatment models for ASD and found that such treatment models were weak in evidence of efficacy as a whole (Odom et al., 2010). A Technical Expert Panel developed guidelines for evidence-based interventions for ASD, with a primary finding that greater intensity and greater duration of treatment led to better outcomes (Maglione et al., 2012). Comprehensive intervention programs, such as applied behavior analysis-based interventions, are among the most effective for treating the core symptoms of ASD; however, these interventions as currently designed require significant clinical/educational oversight and tend to be both labor-intensive and costly, placing significant pressure on both human and financial resources related to serving this population. Other intervention programs have showed a lower strength of evidence. Furthermore, a 2015 review of evidence based practices for ASD found that the majority of intervention studies had focused on preschool-age and elementary school-age children. The authors recommended that research on interventions should expand to include an increased focus on adolescents and young adults with ASD (Wong et al., 2015).

The most recent National Standards Project from the National Autism Center, based in the United States, describes “Technology-based Intervention” as an Emerging intervention, warranting additional research (National Autism Center, 2015). Advances in immersive virtual reality (VR) and wearable augmented reality (AR) technology have provided new opportunities to design interventions targeting the core deficits associated with ASD and supporting optimal functional outcomes. The main objectives of this chapter are to: (1) Describe the autism phenotype, with a particular focus on domains amenable to intervention using VR and AR technologies; (2) Review what is known about using VR/AR in ASD; (3) Outline risks and benefits of AR/VR in ASD; (4) Present a new immersive VR platform developed by Floreo, Inc.; and (5) Describe future research directions in AR/VR intervention for ASD.