A Design-Based Research: An Initial Model of an Embodied Cognition Based Video Game for Children with Autistic Spectrum Disorder

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Abstract: The results of this study will help identify several requirements for games that use embodied cognition technology to provide social skills interventions for children with autism. The data of observations, interviews, and multiple baseline single-subject tests will be employed and two types of analysis including phenomenological analysis and grounded-theory analysis will be employed.

Introduction

Social impairment has been identified as the main problem for Autism Spectrum Disorder (ASD) children (Bauminger, 2002; NIMH, 2012). Wing and Gould (1979) described three categories of problematic symptoms in ASD children: lack of social skills, lack of communication skills, and lack of flexibility in thinking and behavior. Research into the efficacy of social skills interventions suggests that interventions involving advanced technologies support an individualized environment which is standardized, predictable, and controllable (Golan & Baron-Cohen, 2006; Ramdoss, 2011; Wainer & Ingersoll, 2011). In fact, Weinger and Depue (2011) reported that technology-assisted interventions were associated with improved social skills within a relatively short period.

However, several unresolved issues still remain regarding the use of technologies in intervention studies. Specifically, Wong, Chan, Li-Tsang, and Lam (2009) suggested that interface design for children with disabilities requires extensive consideration because computer tasks in interventions demand specific cognitive and sensorimotor abilities. Grynszpan, Martin, and Nadel (2008) contended that if the interface is complicated, children with ASD had problems transferring knowledge gained through training. Within autism research, video games can yield appropriate environments for studies on social skills interventions (Reeve & Read, 2009).

Proposed Method

Participants

The participants in this design-based research project are five children with High Functioning Autism spectrum disorder (a.k.a Asperger's Syndrom, HFA) and five typically developing children. Children with HFA show a high degree of intelligent functioning (i.e. IQ scores above 70) and appropriate language skills (Renty & Roeyers, 2006). Since the current study is intended to provide social skills interventions, the HFA children will be appropriate participants.

Game-Based Intervention

The gameplay will encompass three sessions: an introduction session, an exercise session, and a practice session. In the introduction session, the game will provide an introduction to the game, including a brief warm-up task incorporating a think-aloud protocol interview. In the exercise session, interventions will be provided to enhance imitation, which is considered a fundamental skill for social interaction (Cook & Bird, 2012). An avatar will demonstrate five different physical gestures, and the participant will be reinforced with a token if she imitates the gestures successfully. The participant's movements will be captured using an Xbox Kinect system and will be projected into the game so that the participant can see and interact with her own movements in the game. In the practice session, the avatar will demonstrate five gestures and the participant will be required to imitate them without any reinforcement. Following the principles of DBR, the game will involve three iterative sub-studies in development as follows.

Procedure

In study 1, two participants, a child with HFA and a typically developed child, will interact with OpenSimulator-based virtual game via Xbox Kinect. Based on the study findings, a modified version of the game will be created using Blender (a 3D content creation suite) and Xbox Kinect. Another child with HFA and a typically developed child will play the game to verify its playability and funcationality in Study #2. Based on the information from sub-study #2, a final version of the game will be created using Blender and Xbox Kinect. Three children with HFA and three typically developed children will test-play the game.

Data Analysis

The current study will use a mixed-methods approach to triangulate the findings from each data source. The study will use two types of analysis: phenomenological analysis and grounded theory analysis. In the Phenomenological, this study will address the following additional question: What is the experience of children with HFA and of typically developed children in the game? At the same time, to establish a game model for social skills interventions, the current study will conduct a qualitative data analysis via the grounded-theory approach. Thus, this study will also address the question: How does this game influence the imitation abilities of children with HFA? Finally, the behavior of children with ASD will be scored with the Multidimensional Imitation Assessment (Kleeberger, 2005; Lowe-Pearce & Smith, 2005), with a scoring system from 0 (no response) to 3 (exact imitation).

Significance of study

According to the previous literature, technology-assisted interventions can be effective in enhancing social skills in children with ASD. This study explores and describes an initial game model involving social skills interventions using embodied cognition technology (i.e. the Xbox Kinect system) for children with HFA. The investigator expects that the results of this study will help to identify salient design features for games that use embodied cognition technology to provide social skills interventions for children with ASD.

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