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Exploring embodied social presence of youth with Autism in 3D collaborative virtual learning environment: A case study

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ABSTRACT

This case study explores the experience of embodied social presence while learning social competence of 11 youth with Autism Spectrum Disorders (ASD). The learning takes place in a series of 13 Naturalistic Practice (NP) learning activities which are part of a 3D Collaborative Virtual Learning Environment (CVLE)-iSocial. iSocial is a translation of a face-to-face clinic based curriculum, Social Competence Intervention-Adolescents (SCI-A), into a 3D CVLE for delivery over the Internet. This study developed a direct-observation instrument that built upon the Embodied Social Presence (ESP) theory framework to describe youth with ASDs' embodied presence, embodied copresence and embodied social presence. The findings show that youth with ASD achieved embodied presence and embodied copresence in almost all of the NP activities. However, they achieved embodied social presence in only a handful of NP activities. From comparisons between the learning activities that had high or low percentages of achieving ESP, the results indicate associations of design features (narratives, choosing roles, fantasy settings and ease of use of learning tools) with having a higher percentage of youth achieve embodied social presence. Furthermore, the work of this study provides a method for researchers interested in studying ESP and the results can inform future design decisions in the development 3D CVLE and the structure of learning activities within the 3D CVLE.

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1. Introduction

Three-dimensional virtual worlds have potential to support learning (Bailenson, Yee, Merget, & Schroeder, 2006; Barab, Thomas, Dodge, Carteaux, & Tuzun, 2005; Hideyuki, 2004; Lim, Nonis, & Hedberg, 2006; Montoya, Massey, & Lockwood, 2011). Moreover, many universities and schools have begun to use multi-user 3D virtual worlds for distance education purposes as well as for supplementing traditional classroom activities to promote communication and collaboration among students (Dalgarno, Lee, Carlson, Gregory, & Tynan, 2011; De Lucia, Francese, Passero, & Tortora, 2009; Petrakou, 2010). 3D Collaborative Virtual Learning Environments (3D CVLEs) are virtual environments with objects, landscapes and people and allow users to interact, communicate and collaborate via avatars in ways that simulate real world experiences. 3D CVLEs have the potential to engage learners in a local

context or from around the globe. The power of utilizing collaborative virtual learning rather than simply single user 3D environments is the potential to address learning needs that require social interaction to build competencies as well as the potential to use the power of social learning to motivate and enrich learning. Researchers have begun to explore, with some promising results, the ability of youth with Autism Spectrum Disorders (ASD) to learn social skills via 3D CVLE (Cheng & Ye, 2010; Mitchell, Parsons, & Leonard, 2007; Parsons, Mitchell, & Leonard, 2005; Schmidt, Laffey, Schmidt, Wang, & Stichter, 2012).

iSocial is a 3D CVLE that supports youth with Autism Spectrum Disorder to learn social competence from physically distributed locations (Laffey, Schmidt, Stichter, Schmidt, & Goggins, 2009; Laffey, Stichter, & Galyen, 2014; Stichter, Laffey, Galyen, & Herzog, 2014). To be more specific, iSocial is a translation into a 3D CVLE for delivery over the Internet from a face to face, clinic based curriculum-Social Competence Intervention-Adolescents (SCI-A), which targets deficits of youth with High Functioning Autism/Asperger Syndrome (HFA/AS) in three social cognition processes: theory of mind, emotion recognition and executive functioning (Stichter et al., 2010). For students with high functioning autism,

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they are known to “have a desire to be social but do not yet have the knowledge or skills to successfully perform interactions in a complex and social environment” (DuCharme & Gullotta, 2003). The purpose of developing iSocial was to make an evidenced-based curriculum, SCI-A, available to youth in rural and small schools who typically would not have access to such programs.

The effectiveness of virtual learning environments has often been linked to the learners' sense of presence in the environments (Bailenson et al., 2006). 3D CVLE has affordances for helping learners feel more present and immersed in the context compared to more traditional and common forms of virtual learning environments (Allmendinger, 2010; Bailenson et al., 2006). While there is an emerging body of research exploring the social presence of typical learners, there is little research on understanding the experience of presence of individuals with ASD when learning in a 3D CVLE. Like typical learners, to succeed with communication and interaction, as well as collaborative learning in 3D CVLE, youth with ASD must be able to develop a sense of self, others, the object and the context while learning in virtual environments (Parsons et al., 2005; Wallace et al., 2010). Our general observations of the engagement of these youth while participating in iSocial gave us a sense that the students were immersed in the learning experiences, the social presence framework gave us a systematic way to examine and build our understanding of the learning experience in a virtual world.

The current study sought to extend prior work by investigating how youth with ASD with an opportunity to learn and participate in a 3D CVLE develop sense of self, objects, and others in the environment during learning activities in a 3D CVLE. Furthermore, we sought to inform future design of collaborative learning activities in 3D CVLE based on analyzing results of youth with ASD's experience of embodied social presence across Naturalistic Practice Activities (a component of the curriculum where students are given challenges and expected to apply competencies they have developed) in iSocial.

2. Theory of embodied social presence framework

2.1. Presence and copresence

The concept of presence (Draper, Kaber, & Usher, 1998; Sheridan, 1992), is most often defined succinctly as the sensation of “being there” in the virtual or mediated environment (Heeter, 1992). Goffman (1963) explained that copresence exists when people report that they actively perceive others and feel that others actively perceive them. Further, in its true meaning, “copresence renders persons uniquely accessible, available, and subject to one another” (Goffman, 1963, p. 22). Within human–computer interaction, social presence theory studies how the “sense of being there” and “sense of being there with another” are shaped and affected by interfaces. In 3D CVLE, “there” represents the virtual reality created by the environment and “the others” that users experience are primarily technologically mediated representations of remote humans via text, images, video, and 3D avatars (Biocca, Harms, & Burgoon, 2003).

2.2. Embodiment and social context

Johnson, Lakoff, et al. 2002 highlighted the role of the body in mediating all stimuli and, by extension, cognition and thus emphasizes the importance of embodiment in framing perceptions and understanding (Johnson et al., 2002). In 3D virtual learning environments avatars act as virtual bodies. As technology advances and makes possible more expressive interfaces the avatars will increasingly approach the affordances of ‘real’ bodies and produce

realistic face-to-face communication (Dalgarno & Lee, 2010; Donath, Karahalios, & Viegas, 1999). Like physical bodies, avatars are not mere objects manipulated by their human owner; instead, they are also subjects in a socio-cultural world of meaning (Bailenson et al., 2006; Gerhard, Moore, & Hobbs, 2004; Wolfendale, 2007). Besides the uniqueness of embodied interactions of 3D virtual worlds, researchers who focus on 3D collaborative virtual learning have introduced the notion of “place” to emphasize that the virtual space has a social impact (Bulu, 2012; Mennecke, Triplett, Hassall, Conde, & Heer, 2011). Places are “settings in which people interact”. (Dieberger, 1999) “While virtual spaces take the users' sense from configuration of brick, mortar, wood and glass, places take their sense from configurations of social actions. Places provide what we call appropriate behavioral framing” (Dourish, 1999). 3D CVLE also act as social context where individuals and communities participate in collaborative activity, interact with the context, internalize and use tools and symbols embedded in the digital culture, and regard and transform social rules and divisions of labor (Mennecke et al., 2011).

2.3. Embodied social presence

Mennecke et al. proposed a theory of “Embodied Social Presence” for 3D CVLE based on grounded research. According to Mennecke et al., “ESP is premised on the notion that certain communication acts and interactions take place in the context of embodied states that create a sense of presence that is derivative of human cognitions associated with physical, real world Body to Body interactions” (Mennecke et al., 2011, p. 425).

Mennecke et al. did a qualitative analysis of factors associated with ESP theory to identify the process(es) by which the experiences of ESP are derived and examined the results of this phenomenon on social engagement, collaboration, and interactions. Fifty-seven students enrolled for a graduate level e-commerce course were to participate in business activities, socialization, and collaboration, which involved using the virtual environment of Second Life to hold team meetings, engage in social and task-related activities, and participate in class lectures and discourse. Student reflections were collected and analyzed in the tradition of linguistic anthropology (Sapir, 1949; Whorf, 1956), which asserts that the physical and social environment of a community can be understood through an examination of the vocabulary used by members of that community. Content analysis was used to analyze the text, as it has been described as a multi purpose technique for studying communication artifacts (Berelson, 1952; Holsti, 1969; Krippendorff, 1980; Weber, 1990) and has been used to discover the psychological, attitudinal, and behavioral states of individuals and groups. The researchers analyzed the collected data by conducting focus analysis, followed by theme development and then operationalized ESP development. Three categories (ESP achieved, neutral, not achieved) were identified based on the distinction between the narrative mode of first-person, and third-person. ESP was achieved by 68% of the students. In addition, a step process model, focused on the conditions needed to achieve ESP, was developed.

According to Mennecke, to achieve ESP, one must first achieve sufficiency of levels of embodied presence and copresence. In 3D CVLE, the learner is presented with stimuli representing the virtual learning environment, the objects in that environment, and their own avatar's representation. If the learner engages with these stimuli he or she will experience, to one degree or another, embodied presence.

Interaction in a 3D collaborative virtual learning environment is a joint activity that requires a sense of presence between two or more learners. Once a learner develops a sense of presence in a

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