The potential of virtual reality technologies for autistic people: A pilot study

Introduction

The role of virtual reality technology (VRT) represents a growing area of research within the field of autism spectrum disorder (ASD) for over two decades. The term, VRT, remains fairly broad and includes:

- Virtual reality head-mounted displays (VR-HMD), (Strickland et al., 1996);
- Virtual environment simulations (VES), (Mitchell et al., 2007; Parsons et al., 2004; 2005);
- Collaborative virtual environments (VE) (Fabri et al., 2004);
- Immersive virtual environments (IVE) (Wallace et al., 2010) and;
- Virtual worlds (VW) (Kandalaft et al., 2013; Newbutt, 2013; Stendal & Balandin, 2015).

All of these technologies involve 3D ‘immersive’ graphics, many involving avatars (representations of oneself), independent controls, and/or communication input/output.

As a result of these endeavors, efforts have been devoted to support the notion that VRTs might provide an effective and engaging space for people with autism spectrum disorder (ASD) to become immersed and develop specific skills supporting their communication needs, community integration and employment-related skills training, such as job interview training (Smith et al., 2014; Smith et al., 2015; Strickland et al., 2013).

What is a VRT and why are these useful for people with autism?

Virtual reality technologies represent a simulation of real world training environments based on computer graphics. These can be useful as they allow instructors, therapists and service providers to offer a safe, repeatable and diversifiable environmental platform which can benefit
the learning of individuals with ASD (i.e., Georgescu et al., 2014; Kandalaft et al., 2013; Newbutt, 2013; Parsons et al., 2004).

As a result of this immersing and developing research field we undertook a study with Michigan State University colleagues (College of Education, Office of Rehabilitation and Disability Studies), with the aim of understanding experiences using head mounted displays (HMDs) by people on the autism spectrum. This involved the use of a recently developed HMD VRT; namely Oculus Rift™, with participants with autism in Michigan. A HMD is a headset worn as a pair of goggles within which a display is presented on two lenses; proving a 360-degree view of a virtually simulated environment.

A participant wearing the head-mounted display.

The hardware used in this study.
Aims and research questions

Due to the potential of VRTs within an academic context (from the late 1990s to date), we were keen to explore the role and potential future of head-mounted displays (HMDs) used by people on the autism spectrum.

However, and before we can start to better understand this, we felt it especially important to ask some basic, even fundamental, questions related to the use of this technology; especially from the perspectives of the users (in this case, the ASD population).

Therefore the study focused on two main questions:

1. Are HMDs and the presentation of a virtual environment acceptable to a person with ASD?
2. What psychological issues are experienced when using a VE in a HMD?
   a. Sense of presence, immersion, ecological validity (feeling natural in the VE space), and negative effects
   b. Anxiety

Methods and context

We set equipment up in a vocational rehabilitation centre in Lansing, Michigan with a view to engage a group of people with ASD and explore their experiences of using the HMD.

The participants’ mean age was 32 with a range from 17-52. They all had a diagnosis of autism, and the mean IQ of the group was 83.6 with a range from 48-135.

We then worked in two phases to address our research questions:

Phase I: Judging the willingness of participants to wear the HMD

Exposing 29 participants to different VE experiences using the HMD for about 7 mins. at a time.

- A 3D VE cinema;
- A VE café sat with another person;
- A safari adventure explored in a Jeep.

The aim was to explore the willingness of participants to wear the HMD.
The view of what a participant would see in the HMD.

**Phase II:** Measuring the presence, immersion and negative effects of the HMD and VE as well as pre- and post- HMD anxiety levels

Longer exposure (20 mins. each) for 11 returning participants to two other VE experiences:

- A space adventure;
- Exploring a Tuscan house inside and out.

Here the aim was to measure the presence, immersion and negative effects felt using the HMD and VE experience, in addition to pre- and post- HMD anxiety levels. We used the State-Trait Anxiety Inventory (STAI) to measure anxiety and the Independent Television Commission-Sense of Presence Inventory (ITC-SoPI) to measure the other effects.

**Results**

Through Phase I of the study we found that 100% of the participants were willing to wear the HMD and experience two of the virtual environments (VEs). A total of 95% were willing to view/experience all three. Through Phase II we found that self-reported anxiety levels were not increased after the HMD VE experience. In addition, we found that negative effects (feeling dizzy, sick, etc.) were low, with sense of presence, immersion and feeling natural in the space reported as high.
These results could be interesting as it appeared, from the group we worked with, that wearing the HMD proved to be not a barrier or issue for engaging with this technology, and while there were some comments from participants feeling a little dizzy, an overall positive picture emerged of the willingness to wear a HMD and engage with a VE therein.

In addition, the participants reported a high sense of presence and immersion; leading us to believe that the experiences from a HMD are potentially highly realistic, and could help the research field in seeking to generalise skills development in VEs to the real world.

**Limitations**

It is always vital to point out the limitations of research and therefore results reported. For this study they included:

1. Despite the positive potential of VRTs for people with ASD we only worked with a very small group. Consequently, the findings should not be generalised; just because the participants in our study reported acceptance of a HMD and VE, it does not mean others would.
2. Comparing this data to people without autism would help to further contextualize the data reported and thus inform us more about the potential for HMDs and people with autism.
3. Due to the exploratory nature of the study (seeking to address some fundamental questions related to VRTs and HMDs), we are hesitant to draw too much a conclusion from these findings other than that they are interesting and might help to add to the evidence-base for the role and potential of technology for people with autism.

With all of this said, there is potential, and with technology becoming more part of everyday life, this study poses interesting questions in relation to how technology can be, and might be, used to support people with an ASD in the future.

Future research should continue to seek input from people with autism as well as caregivers, with a view to target interventions and ask questions of larger samples. It should also test generalisation of experiences from technological contexts to the real world.
References


**Further reading**

[New realities for autism](#)

[The Department of Counseling Educational Psychology, and Special Education (CEPSE), Michigan State University](#)

[The DOCTRID Research Institute](#)

[Institute for Research in Autism, Intellectual and Neurodevelopmental Disabilities](#)