Guest editorial: Applications of virtual reality in autism research

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This special issue of the Journal of Enabling Technologies aimed to examine virtual reality (VR), augmented reality (AR) and extended reality (XR) and autistic experiences within a multitude of contexts, such as accessibility, sensory processing, education, teaching and living skills. Specifically, we have six articles that evaluate these topics. We have included papers on AR and XR in the special issue because VR is a spectrum in and of itself, allowing for varying levels of immersion and intractability. Until the taxonomy problem is resolved (or at least, clarified), we recommend exploring a broad spectrum of immersive technology applications in autism research. We have also written two opinion pieces as part of this special issue. We believe these two papers illustrate two main challenges researchers currently face in the interdisciplinary field of VR applications in autism research. We will highlight how the participatory action research (PAR) piece fits with the articles in our special issue later in the text. Our second opinion piece discusses current trends and challenges in the taxonomy. We can no longer deny that VR has established itself in autism research. As the number of studies continues to grow, it is a perfect time to reconsider and update our notion of definitions of immersion and its reliance on hardware.

The special issue begins with Lukava and colleagues from the Department of Computer Science at the University of Central London who conducted a survey and semi-structured interviews with neurodivergent participants and XR developers. This paper explores the barriers for accessibility for neurodivergent individuals in the use of XR experiences. The paper states that neurodivergent individuals experience sensory overload whilst using XR technology, often resulting in negative experiences. The authors therefore state that “XR developers lack awareness of accessibility requirements and struggle to integrate them into current software developments”. The most important point of the paper is that future research needs to allow for customization of sensory settings to limit negative experiences and encourage the creation of inclusive XR experiences in accordance with neurodivergent individuals’ sensory processing patterns. In addition, a key challenge highlighted in our opinion piece, titled “Neurodivergent Participatory Action Research (PAR) for Virtual Reality (VR)”, was that research requirements and the needs of the autistic community are both important and require consideration. However, this is accompanied by its own challenges, which are further explored in the PAR opinion piece.

The next paper by Lorenzo and colleagues from the Department of Developmental Psychology and Teaching at the University of Alicante, Spain carried out a systematic and thematic review of AR papers focused on the learning of autistic students between 1996–2020. They found that the average sample size of the papers was three participants and that the most researched area was developing social skills using tablets. Notably, this suggests a need for the development of new AR activities for autistic students and increases in sample sizes so that new, robust insights can be gained to help the development of other skills within educational settings. For example, the use of

AR to support autistic individuals with organizing their school bags or helping guide autistic children with social interactions by providing likes, dislikes and mood.

Continuing the topic of education, Newbutt and colleagues from the Institute of Advanced Learning Technologies at the University of Florida, USA carried out a head mounted display (HMD)-based VR study across four schools in the United Kingdom. The authors used three different types of HMDs, gathering inputs from autistic students on possible negative effects, and how HMD-VR may be useful to them in developing both academic and life skills. It was found that HMD-VR had many positive effects, such as providing a safe and predictable environment where the consequences of real-life situations are removed. It also helped support autistic children in feeling more relaxed and able to explore environments before visiting them in the real world. These findings are also applicable within the context of the workplace (i.e., preparing for interviews and living independently). Within the context of school education, the use of HMD-VR can help reduce the stress of school visits or tours of geographic and historical spaces, art and science projects. This paper highlights the importance of involving the input of autistic users in their experiences and maintaining this as a top priority to improve the lives of autistic students.

Lastly, Newbutt from the University of Florida, USA and Bradley from the University of Birmingham, UK examined spherical video-based virtual reality (SVVR), which is a less immersive version of VR where users can move their head around to view 360-degree videos. This paper highlights the methods used to set up the design of the study with a specific objective of supporting autistic individuals. It also discusses the advantages of virtual environments in that it allows for a space to test, replicate and explore environments before experiencing them in person. This paper highlights the importance of listening to autistic needs and including solutions to problems that they experienced in real life, resonating with the messages presented in our opinion piece on PAR.

Overall, this special issue includes a broad variety of research from collaborators focused on the techniques and methods to improve accessibility, sensory processing, education, teaching in virtual environments and living skills of autistic communities. This issue has focused on both VR and autism research within different contexts and can be applied to further contexts, such as the workplace. A very big thank you to all the authors for their significant inputs, in which new discoveries, concepts and implications can be investigated accordingly