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Article

Social Virtual Reality: Neurodivergence and Inclusivity in the Metaverse

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Abstract: Whereas traditional teaching environments encourage lively and engaged interaction and reward extrovert qualities, introverts, and others with symptoms that make social engagement difficult, such as autism spectrum disorder (ASD), are often disadvantaged. This population is often more engaged in quieter, low-key learning environments and often does not speak up and answer questions in traditional lecture-style classes. These individuals are often passed over in school and later in their careers for not speaking up and are assumed to not be as competent as their gregarious and outgoing colleagues. With the rise of the metaverse and democratization of virtual reality (VR) technology, post-secondary education is especially poised to capitalize on the immersive learning environments social VR provides and prepare students for the future of work, where virtual collaboration will be key. This study seeks to reconsider the role of VR and the metaverse for introverts and those with ASD. The metaverse has the potential to continue the social and workplace changes already accelerated by the pandemic and open new avenues for communication and collaboration for a more inclusive audience and tomorrow.

Keywords: virtual reality; introversion; neurodivergence; ASD; autism; metaverse; future of work



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1. Introduction

With the pandemic leading colleges to move rapidly to online and asynchronous learning in March of 2020, a new paradigm for education emerged, replacing traditional face-to-face classes. Instead, instructors rushed to record video lectures for online, distance education, and hybrid learning to address the challenges wrought by COVID-19. Whereas they were seen previously as boutique options, emerging technologies were turned to in order to meet these new challenges. As such, immersive realities—augmented reality (AR), virtual reality (VR), and mixed reality (MxR)—previously restricted to computer science programs, became household terms, especially with the announcement that Facebook would move to establish the “metaverse” [1]. In addition, the advances made in head-mounted displays (HMDs) that allow for both audio and visual immersivity and expanding libraries of educational applications, coupled with a lower price point, have removed many barriers that had previously prevented widespread adoption in academia.

With the increased accessibility of virtual reality (VR) and associated hardware (head-mounted displays or HMDs) and software (applications), specialists, secondary education and industry are all beginning to develop resources to address mental health issues in portions of the populations. More specifically, applications, such as Ovation, a public speaking application, have been developed to help reduce anxiety associated with 77% of the population and improve performance. While all demographics report being at ease in engaging with avatars in immersive social environments, introverts, and their potential contributions in a wider set of industries and roles, may gain confidence, and practice public speaking [2,3]. Other applications have been developed for mental and behavioral health with autism spectrum disorder (ASD). Examples such as Floreo VR have been developed to improve social, behavioral, communication, and life skills for individuals on the spectrum.

These applications have been created to treat or modify specific characteristics and behaviors in these populations. Both autism spectrum disorder and introversion have been the subject of research and have been treated as conditions that need to be treated like other mental disorders. For instance, Jacobs [4] noted how introversion is often stigmatized, especially in Western society, and Barnard [5] has written on the “Crisis of Autism”. Furthermore, as studies have demonstrated, teachers prefer extroverts in the classroom as do employers in industry for many obvious reasons [6]. However, what is often (ironically) overlooked in the scholarship of teaching and learning is that the very individuals who prize the qualities of extroversion in the classroom and in industry are often themselves introverts or on the spectrum [7].

The perception of individuals that are considered introverted and/or diagnosed with ASD, as well as the prescribed use of virtual reality (VR) for them, disregards the societal impact the metaverse and this new technology will have. The impetus behind creating the applications above, such as Ovation and Floreo VR, is that these populations are considered in need of intervention and are in turn provided with tools to ensure that engagement in socially prescribed activities along with the general population may be possible. What has been overlooked is that immersive reality and virtual learning environments (VLE) provide the ability for this population to leverage their existing skills and talents in ways that face-to-face interaction or even virtual engagement through video conferencing could not. Instead of using the technology to train those considered unable to operate within social norms on how to conform, researchers should be considering how to leverage the technology of the metaverse to level the proverbial “playing field” and allow an equal footing for a more inclusive audience. Additionally, with the future of work becoming hybrid and remote, we will see fewer introverts being passed over for advancement and promotion given the psychological effects of this technology.

Our daily interactions are changing and will continue to do so as the metaverse expands. A new digital body language will emerge to replace analog, face-to-face social exchanges [8]. Extroverts are now grappling with how to engage in the same way in the new virtual environment. More cases of depression and anxiety have been noted in the extrovert population during the pandemic [9,10]. In essence, the introverts of today will become the extroverts of the virtual tomorrow. With the rise of the metaverse and democratization of virtual reality (VR) technology, especially, post-secondary education is poised to capitalize on the immersive learning environments social VR provides. Moreover, instead of considering introversion or ASD something that needs to be mediated or accommodated, VR technology allows the skills and insights that these individuals possess to be accessed and shared, not just for a greater life experience for the individual but for society as a whole. With more perspectives and insights will come more solutions to the wicked problems that will continue to increase in this century.

2. Materials and Methods

The preference for introverts and those with ASD to engage in virtual environments instead of traditional face-to-face interactions was confirmed prior to the broad appeal of virtual reality. Amichai-Hamburger, Wainapel, and Fox [11], for instance, performed a study on the use of chat on the internet and compared two populations. The results found that introverted and “neurotic” people located their self-identified “real me” on the internet in virtual interactions, while extroverts and “non-neurotic” people identified their true self as most authentically communicated through traditional, face-to-face communication and social interaction. Recent studies have confirmed that the use of avatars in virtual reality reduces anxiety in various populations [12–14]. While all demographics in studies reported being at ease in engaging with avatars in immersive social environments, introverts, and those with social anxiety disorders, PTSD, and ASD were better able to engage in social virtual reality more effectively than in person [15–18].

Virtual reality has been proven to promote many positive outcomes with regard to different aspects of learning. Salzman, Dede, Loftin, and Chen [19], for instance, outlined

a model that assists in describing how virtual reality improves conceptual learning and how those factors influence the learning process and outcomes. Such claims are supported by studies that demonstrate how a virtual environment is able to “stimulate learning and comprehension, because it provides a tight coupling between symbolic and experiential information” [20] p. 121. There is a consistent positive correlation between the use of immersive technology and motivation [21–24] time-on-task [25,26], increased enjoyment of learning [27], deeper learning, and long-term retention [25,28,29].

The use of virtual reality (VR) to treat autism spectrum disorder has been extensively studied [30–37]. For instance, Bellani, Fornasari, Chittaro, and Brambilla [38] note the increase in cases of ASD (which has only continued to accelerate) and reviewed the potential for virtual reality to be used as an intervention strategy [39–41]. The researchers begin by identifying the “core deficits” in three domains for those with ASD: social interaction, communication, and repetitive behaviors. Next, the argument is made to develop intervention strategies to support individuals with ASD, along with their caregivers and educators. The main benefit cited for VR is the ability to offer a safe virtual environment (VE) that has simulations that can be repeated and changed as needed for learning. Within a VE, competing stimuli can be removed from traditional social and environmental contexts; there is also the ability to manipulate time during the interaction process, and, finally, a VE allows users to learn while seemingly experiencing “play” [42].

The ability of virtual reality to create a controlled environment to practice various social interactions is touted as beneficial for both introverts and those with ASD to learn a variety of social skills. For instance, Lorenzo, Lledó, Pomares, and Roig [43] presented the results of a study on the design and application of an immersive virtual reality system to improve and train the emotional skills of students with ASD. The example was designed for primary school students with a confirmed diagnosis of ASD between the ages of 7–12. The virtual learning environment designed encourages students to experience different social situations in a visual manner. Computer vision was used to determine the emotional state of participants. The goal of the experience for the researchers was twofold: to align emotional states with social situations and determine if the behavior of a child was appropriate for the given represented social situation. The results confirm a significant improvement in emotional competences when compared to similar systems prior to VR.

Additional studies continue to see how virtual learning environments as a habitation tool can assist children with ASD. Particularly, researchers have been interested in methods to instruct children in appropriate behavior in different social situations and better understand standard social conventions [44,45]. One such example used a virtual café as a VE to teach social skills. Participants improved the speed and execution of particular social tasks after use. Another example reproduced a virtual supermarket and had participants engage in different scenarios in order to better understand the functional, physical, and symbolic uses of specific objects. The performance of those who participated was assessed and an increase in the ability to transfer the skill thus acquired as part of the simulation to a real exchange was found. Other studies researched the use of collaborative virtual environments (CVEs) to allow for multiple participants at the same time. More specifically, the patient and their respective therapist would be in the environment and able to communicate via avatars. The use of CVEs has demonstrated viability in participants to better recognize emotions [46], as well as to encourage social interaction and modulate emotions and understand those of others [21]. Other studies have used VR-based learning environments, such as OpenSimulator to support socially oriented role play, gaming, and design [47]. Taken together, there is ample evidence to support the use of immersive environments to assist in improving skills such as identifying emotions in others and improving social performance.

The use of virtual reality has also extended to preparation for job interviews. Artificial intelligence interviewing platforms, such as HireVue, Big Interview, and Humanly.io, are now widely used by companies to sort workers for specific positions. These examples review multiple data sources and include AI-powered video interview software and NLP to search for key terms in resumes. However, the behavior the AI has been taught to look

for (e.g., body language, eye contact, confidence in word choice, and limited use of filler words and sounds) disadvantages those with ASD. The examples cited above assist with the cues that would help in such interviews, but studies have also been conducted on how VR is used specifically for this purpose. Smith et al. [48]. looked at the possible use and efficacy of virtual reality job interview training (VR-JIT) in a single-blind study. The VR-JIT in question was developed by SIMmersion LLC (<http://www.jobinterviewtraining.net>, accessed on 1 April 2022), supported by panels of academic and vocational experts to ensure the training simulation would be appropriate and effective. At the same time, while these studies cite the predominant use of VR for the populations under discussion, they fail to address the potential benefits of using VR as a tool to highlight the different cognitive abilities of the ASD population [49,50]. Whereas the cognitive and behavioral symptoms are foregrounded, the potential benefit of embracing difference is absent.

3. Results

Studies on those who are considered in need of improving their social interaction skills include strategies for socialization and group activities. Flanagan and Addy [51] noted the importance of active learning in postsecondary education and how effective peer-to-peer interactions can be. Their study found that intensive peer-to-peer interaction in group-based active-learning activities did not disadvantage introverted students. Through active learning, there was no difference in performance or learning outcomes for introverts, ambiverts, or extroverts. Jacobs [4] conducted a similar study in both education and the workplace to determine if introverts were disadvantaged. Within the context of cooperative learning, introverts and extroverts actually adapt their behaviors to meet different contexts and requirements. Additionally, Murphy et al. [6] found in their study of undergraduate students who had been given the Myers–Briggs Personality Type Indicator[®], Form M, that there was in fact no difference between introverts and extroverts regarding their preferences for preferred teaching methods. The major difference arose when looking at preferences for engaging in discussions with fellow students and speaking up during lectures. The issue is compounded in asynchronous modalities and online courses where engagement and motivation are a challenge [52]. A number of approaches have been studied to improve engagement for all types of learners, including gamification, utilizing videos, and word clouds [53–55] While these approaches have not reached widespread adoption, the changes in teaching and learning should consider the technology under investigation here. In fact, there have been studies dedicated to the concern over social interaction lacking in online courses, and how social VR can offer socialization and collaboration opportunities. Minocha and Roberts [56] reported the pedagogical benefits provided by 3D virtual environments for socialization and knowledge creation in distance education. Maloney and Freeman [57] furthered the investigation by considering what variables make social engagement in VR so impactful.

4. Discussion

The benefits of social virtual reality have demonstrable psychological benefits for various populations. Barreda-Ángeles and Hartmann [58] studied the relationships between the activities performed by participants and feelings of presence during the pandemic. The psychological benefits of the experience were also studied in relation to enjoyment, self-expansion, and relatedness. Results from the study confirmed that the feeling of spatial presence was indeed a predictor of the three outcomes, but social presence, while predicting relatedness and enjoyment, did not extend to self-expansion. At the same time, the benefits made possible through virtual reality, including presence and immersion, are also crucial to providing a safe and comfortable virtual social environment for the populations under discussion here [59]. The preferences of introverts have been studied and include minimally stimulating environments and the need for additional time alone to regulate. Whereas extroverts are described as being energized by social interaction, the opposite is true of introverts [60,61]. Similar reactions to external stimuli can be seen in the ASD population.

In addition to symptoms such as poor eye contact, repetitive actions or words, and inappropriate social interaction, these reactions include sensitivity to texture and stimuli, including auditory sensitivity and photosensitivity [62]. The benefits of VR and the metaverse will be especially felt by these groups. Virtual environments for collaboration and meetings, such as Spatial, Horizons Workroom, Meeting VR, Rumii, and Engage, have low-key environments as standard with low lighting, little to no music or noise, and participants have the ability to adjust the sound or mute others if desired. Users can select any kind of avatar or digitally embodied versions of themselves that they wish to present to the world. The possibilities of VR are only starting to come into focus with applications and interfaces that support a range of abilities, including vocational rehabilitation (VR), supporting those who are deaf or hard of hearing, as well as spatial training for the blind developed by IIT-Istituto Italiano di Tecnologia. Researchers and developers should refocus efforts on leveraging the existing abilities and strengths of individuals. What was previously used to help those with ASD and social anxiety disorders adapt to the conditions and expectations of the pre-pandemic world should now be repurposed to give these individuals the opportunity to thrive in the metaverse.

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