

VR as a Tool for Students with Disabilities

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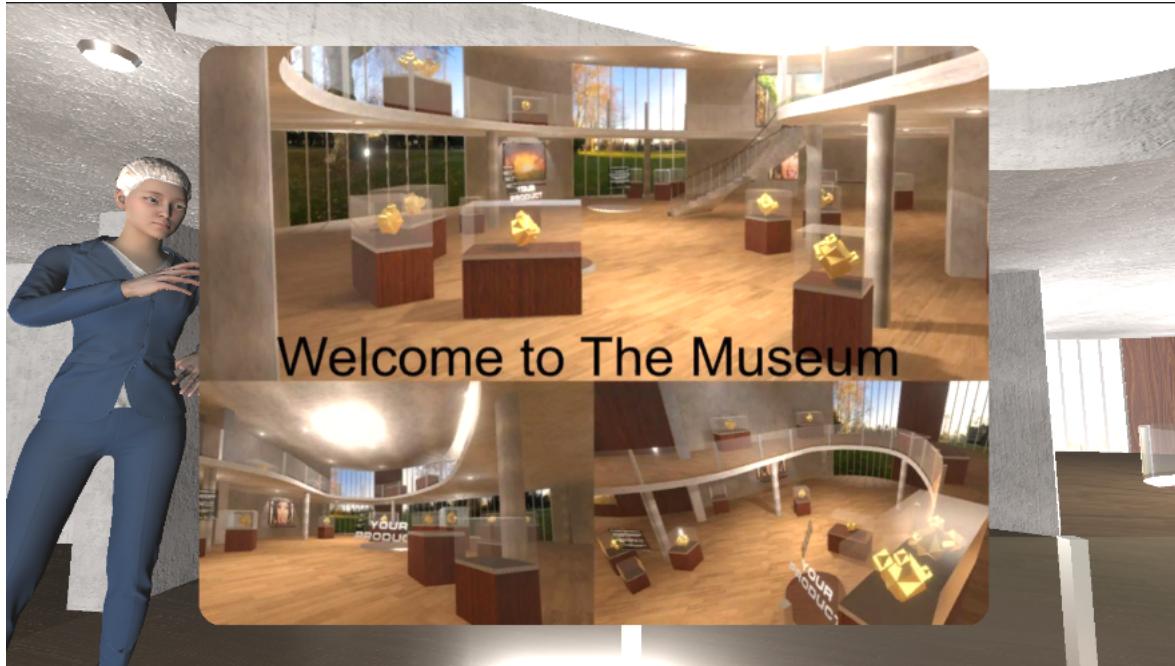


Figure 1: Slide one of the museum scene

ABSTRACT

The purpose of this paper is to explore the use of Virtual Reality (VR) in order to help students on the autism spectrum mitigate social impediments that they face. A museum exemplifies a common place where individuals with autism would face social impediments. Over the past few years, museums have begun to develop programs to increase accessibility for people with disabilities, and specifically for autistic people. One of the programs that are becoming more common is early morning openings at the museum; this allows for individuals to explore and experience a museum without the sensory overload that comes with being at a museum during regular hours. This paper proposes a socially modeled early morning opening at a museum within Virtual Reality.

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CCS CONCEPTS

- Social and professional topics → K-12 education.

KEYWORDS

disabilities, virtual reality, autism, social skills

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1 INTRODUCTION

Autism is a neurodevelopmental disorder that is used to describe a constellation of early-appearing social communication deficits and repetitive sensory-motor behaviours associated with a strong genetic component as well as other causes (Lord et al. 2018). Since Autism is on a spectrum, symptoms vary from person to person; nevertheless, it is common for most people with autism to share difficulty with social interactions. Social communication deficits can be improved through engagement in different methods such as speech language pathology and behavior therapy. The growth of virtual reality and its uses fosters an application to many different disciplines. VR has been researched as a tool for people with

disabilities; examples include: VR as a tool for chronic pain management and interactive museums for people with anxiety, physical or learning disabilities. People with autism often experience sensory overloads in crowded places, my hypothesis is that visiting a museum virtually and learning about the social behaviors practiced in such environments can increase tolerances that come with being physically in the environment. Developing virtual reality programs for people with neurodevelopmental disorders increases accessibility, contributing to projects such as "Museums for All" Garzotto et al. (2018). We investigated the possible effects of the creation of a virtual reality program made for social modeling on students with ASD.

2 RELATED WORK

This research began on a broad scale. First, the goal was to explore different disabilities be it physical, learning, or mental health related. Then it became about what hardships students with different disabilities faced in the school environment and how Virtual Reality could help. Once these things were established we went on to choose Autism as the focus of the visualization aspect. Below is a comprehensive review of how we reached the end goal.

2.1 Physical Disabilities

Students with physical disabilities may have problems related to movement, posture (e.g., sitting, standing), grasping or manipulating objects, communication, eating, perception, and reflex movements [7] This brings the first obvious complication of physically accessing academic environments including buildings and surrounding areas. When thinking of how virtual reality could aid these students multiple ideas came about. In general, it seemed that if a virtual reality program could emulate a class then a student with a physical disability would be able to learn from anywhere.

2.2 Learning Disabilities

Types of learning disabilities include dyscalculia(affects a person's ability to understand numbers and learn math facts.), dysgraphia(affects a person's handwriting ability and fine motor skills.), dyslexia(affects reading and related language-based processing skills.), non verbal learning disabilities(has trouble interpreting nonverbal cues like facial expressions or body language and may have poor coordination.), oral / written language disorder and specific reading comprehension deficit (affect an individual's understanding of what they read or of spoken language. [5] There are virtual reality programs that already exist to aid students with specific learning disabilities. For example, Kobi 360 is a virtual reality program for students with dyslexia; the program fosters an environment that makes learning and improving reading skills fun instead of a burden or a discouraging experience.

2.3 Mental Health

Mental health is extremely stigmatized in today's society, despite various efforts to reduce this. The fear of stigma as it pertains to mental health carries over into academic settings. Students are afraid to look for help, therefore, they struggle to keep up with their school work, their friendships and relationships in general begin to suffer, and their grade point average begins to suffer. Some

of the impediments that students face in higher education are staff not dealing with students correctly, barriers to seeking help, coping with school and attending classes, lack of knowledge about the services available, fear of stigma, and appropriate resources not being available. [6] In light of there being barriers to seeking help, on a larger scale university funding for support services can look different for every institution. Lack of funding causes certain mental health issues to be downplayed to fit what mental health services can offer.

2.4 VR as a Tool for Students with Autism

Various studies have been conducted into Virtual Reality as a tool for people with Autism Spectrum Disorder (ASD). The studies have found that the use of VR can aid those with autism in their social behaviors. Many of the studies focus on broader contexts of social interactions so specific environments such as a museum setting have been researched on a smaller scale.

2.4.1 Social Emotional Aspect. Existing research papers focus heavily on the social and emotional aspects of being on the Autism Spectrum and therefore look to create virtual reality models to mitigate interactions with neurotypical people. These aspects are particularly relevant seeing as those with ASD process emotions in a different way than their neurotypical peers. Neurotypical people often do not understand this way of processing information, and this can lead to negative interactions for those with ASD. This could indicate that a VR model showing neurotypical people the experiences of those with ASD may be helpful. Virtual reality for students with autism has been studied in many contexts including enhancing emotional skills [4], neural mechanisms [8], communication skills and problem solving [1], and social cognition training [2][3]. Lorenzo et al. (2016) found that an immersive virtual reality system is a useful tool to gain and strengthen emotional abilities in students with ASD through the identification of emotions through facial expressions and the understanding of the implications of those emotions in social situations. Yang et al. (2018) further develops these ideas on the social side showing that even short term social cognition intervention can benefit those on the spectrum by strengthening social skills and strengthening the underlying brain networks that increase the capacity for social interaction. It is also important to note that while the social skills of participants in these studies have generally increased, there is a learning curve that must be surpassed when engaging in neurotypical social interactions in the virtual environment (Ke et al. (2020)). A popular approach to this research is to allow a group of participants with ASD to be immersed in the virtual environment and note their progression with the program over time. The VR program developed in this research will open the door for studying the application of virtual reality in a museum setting for individuals with ASD.

3 METHODOLOGY

Modeling behaviors has been proven to be effective in the acquisition of everyday skills for people with autism. This led to the idea of creating a social modeling virtual reality program where students with disabilities could learn social behaviors in different settings. In this case, the setting will be limited to a museum. The

main idea is to emulate an early morning opening in a virtual museum where the user will be able to experience an early morning opening without having to leave their homes. With the repetition of a social situation individuals with ASD can better understand how it works. With the complexity of teaching social skills in mind, I planned to use the outline of what a social skills teaching package should allow for. As outlined by Parsons, S. and Mitchell, P. (2002) the VR program will allow for repetition of the target task (visiting a museum), verbal explanation of the social skill, practice of skill in realistic settings (in virtual reality), role play of target behaviors (practicing the behaviors in the virtual reality program without the guided audio). Early morning opening at museums are becoming more common for museums to have for children with autism. After beginning to implement the program in Unity 3D the methodology began to change. The possibilities for interactive parts were slim and since we were not professionals in developing tools for autistic people we did not want to attempt to teach social skills, especially because they already change for neurotypical people so teaching one set of social skills wouldn't necessarily transfer to every social situation. The project began to focus more on telepresence and simply experiencing an early morning opening.

4 RESULTS AND DISCUSSIONS

4.1 The Implementation

The virtual reality program was developed within Unity 3D. The program takes the user through an explanation of an early morning opening with both visual and audio components. There is an avatar stationed in the beginning, middle, and end of the program to emulate a tour guide.

4.2 Uncanny Valley

The Uncanny Valley is a theory that has not been heavily discussed in previous research on virtual reality for people with autism. Most papers mention that the characters in the VR programs should be as realistic as possible but the theory denies this for some people.

4.3 Limitations

Time played a key role in the development of this project. The museum asset that we purchased had a locked script which made it so that the user would be unable to actually explore the museum which would make this program more interactive and heighten the immersive aspect. This could not be changed according to the developer of the asset. In addition, adding code to attempt to play a certain audio at each slide caused the visual aspect to decline looking slow and buggy; therefore, it was necessary to play the audio as one on a loop which caused us to anticipate the problem that not every person will get to the next slide at the same time every time. Finally the asset stores online did not have many sensory objects or toys to include in the "Take a Break Space" portion of the program, therefore, it looks emptier than it should.

5 CONCLUSION

In researching how virtual reality could aid students with autism, it became clear that that this would require more time than we had allotted. The project became less about teaching social skills and

more about creating a space for students with autism where they could experience a place without physically being there.

5.1 Future Work

In the future, it would be beneficial to further develop the visualization aspect of this research. Based on prior research, the program should be more interactive, contain a more realistic looking avatar, and be deployed to a virtual reality headset. Finally, the future work should look to have user studies if time permits.

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