Sensory Room Emulation As VR Game: A Demo Paper

Katie Potts
kmp672@gmail.com
University of Birmingham
Birmingham, England

Mohammed Bahja
m.bahja@bham.ac.uk
University of Birmingham
Birmingham, England

ABSTRACT

There is currently an increased amount of interest in the potential uses of virtual reality outside of gaming, including in therapeutic contexts. This demo paper explores a virtual reality program designed to emulate a sensory room, helping with sensory issues common in people with autism among other disabilities. It discusses the development process, program inclusions, and the program's research applications.

KEYWORDS

Virtual Reality, Sensory Rooms, Emulation, Sensory Therapy

1 INTRODUCTION

One of the growing fields in human computer interaction and psychology is considering how virtual reality can be used to aid in therapy. While there have been a variety of therapeutic methods explored, one of the less well explored is the use of sensory rooms and how that may benefit those with a variety of mental health conditions, including autism. Therefore this paper explores a program built for this purpose and its potential future uses.

2 LITERATURE REVIEW

The majority of VR research for autism has been into the use of virtual reality to make skills based games, such as the work of Lamash et al [3] and Ward and Esposito [7]. However far less research has been done into the use to help with symptoms of autism that affect the person, and this program is designed to fill the gap in that research. The major work in this area is the work by Mills et al looking at the evaluation [6], the perception [5] and the effectiveness [4] of virtual reality sensory rooms for multiple disabilities, including autism. However, due to the lack of research that focuses on autistic people, it was decided to make a sensory room separate to this that could be iterated on for the purposes of aiding people with autism specifically.

The understanding of Dunn's Model used to justify the creation of this program is as described by Dunn [2]. This is a model that says there are two axis on which sensory processing can be measured. These are active to passive, which describes whether the person actively engages with sensory input or passive handles it, and high or low threshold, where the threshold is the amount of sensory input that the person is comfortable and happy with. Development of the program was focused on those classified with sensory seeking in this model, which means they are on the active end of the spectrum and have a high threshold. The concept behind the program was based on the fact that having abnormal sensory thresholds is a common symptom of autism [1], and that by using sensory rooms it could reduce anxiety in the user to enable everyday activities like socialising.

3 THE PROGRAM

This program was built using the Unity game development engine for use on Quest and Quest 2 devices. It uses the QuickVR library to handle user interaction with objects and realistic movement of the model, which builds on the OpenXR library. The main choice behind use of controllers is because the QuickVR library currently does not have documentation on use of hand tracking, and there were incompatibilities with the most common hand tracking software.

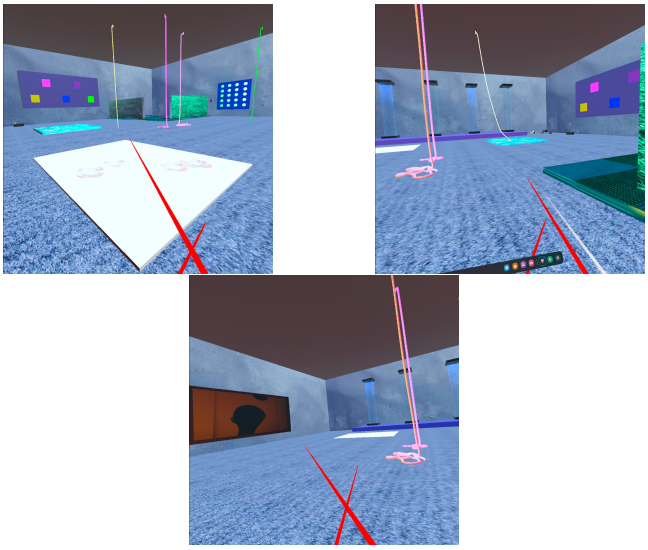
The program uses joysticks for movement – the right joystick for camera and model location and the left joystick for camera rotation. This choice was preferred over teleportation due to the need for precise user positioning. In addition to joystick inputs, the program enables real-life movement for a more immersive experience. This option was not the exclusive method to accommodate smaller play spaces.

After the user presses the button to begin using the program, they are put in the sensory room where they can move around freely, and can spend as much time as they wish interacting with any item in the room. There are a number of elements within the room that the user can interact with freely. The bubble tubes provide a relaxing visual stimulus. The video floor, featuring swimming fish, and video wall, showing 'lava' bubbles moving up and down offers passive visual engagement. The bubble floor encourages active movement and meets vestibular needs. The wall lights reward interaction, with one set changing colour when interacted with and the light-up pattern wall lights having three modes: scatter, row, and column. The cushion corner offers a space to take a break where the cushions can be moved to suit the user. A variety of balls and cubes provide visual and tactile stimuli as they can be picked up and moved at will. Ropes hanging from the ceiling and bubbles offer proprioceptive input. The music adds auditory stimulus and can be stopped via the stereo for user preference.

4 POTENTIAL BENEFITS AND FUTURE WORK

The research aims to demonstrate that virtual reality can create more accessible sensory rooms. By linking human computer interaction with psychology in this way, the goal is to expand the understanding of how sensory therapy can be applied to virtual reality.

Furthermore if it is proven that such a program is effective, as is planned via futher pre-post testing experiments, it could be used in places that don't have the money or space to commit to a sensory room. This is to be done with with autistic adults who demonstrate sensory seeking behaviours as symptoms of their autism, both in the short term and long term. The hope is that by enabling people with autism to access tools to reduce anxiety, this can lead to them feeling empowered to go out and do activities they would otherwise avoid, increasing their ability to engage with social events.



5 CONCLUSION

In conclusion, this paper justifies the use of virtual reality to create a virtual reality emulation of a sensory room, and has explained the design process and final design of a single prototype of this form of program.

REFERENCES

[1] [n. d.]. Sensory processing in adults with autism spectrum disorders. https://doi.org/10.1177/1362361309103794

[2] Winnie Dunn. 2007. Supporting Children to Participate Successfully in Everyday Life by Using Sensory Processing Knowledge. *Infants & Young Children* 20, 2 (June 2007), 84. https://doi.org/10.1097/01.IYC.0000264477.05076.5d

[3] Liron Lamash, Evelyne Klinger, and Naomi Josman. 2017. Using a virtual supermarket to promote independent functioning among adolescents with Autism Spectrum Disorder. In *2017 International Conference on Virtual Rehabilitation (ICVR)*. 1–7. https://doi.org/10.1109/ICVR.2017.8007467 ISSN: 2331-9569.

[4] Caroline Mills and Danielle Tracey. 2021. *Exploring the Benefits of the Evenness Virtual Reality-based Sensory Room.* Technical Report. Western Sydney University. https://doi.org/10.26183/ZXMB-FY52

[5] Caroline Mills, Danielle Tracey, Simone Nash, and Robert Gorkin. 2023. Perceptions of a virtual reality sensory room for adults with neurodevelopmental disabilities. *Disability and Rehabilitation* (Feb. 2023), 1–10. https://doi.org/10.1080/09638288.2023.2169773

[6] Caroline J. Mills, Danielle Tracey, Ryan Kiddle, and Robert Gorkin. 2023. Evaluating a virtual reality sensory room for adults with disabilities. *Scientific Reports* 13, 1 (Jan. 2023), 495. https://doi.org/10.1038/s41598-022-26100-6 Number: 1 Publisher: Nature Publishing Group.

[7] Deborah M. Ward and M. C. Kate Esposito. 2019. Virtual Reality in Transition Program for Adults with Autism: Self-Efficacy, Confidence, and Interview Skills. *Contemporary School Psychology* 23, 4 (Dec. 2019), 423–431. https://doi.org/10.1007/s40688-018-0195-9

Received 4 November 2023; revised 28 November 2023; accepted 28 November 2023