A Literature Review on the Practicality and Purpose of Virtual Reality Sensory Rooms

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Introduction

Sensory overload is something that many people on the autism spectrum deal with. It can be more or less impactful depending on the person. A common way to aid with this issue is with sensory tools, which allow the affected individual to calm their nerves and senses back to a non-overloaded state. As of late, many people and organizations have created sensory rooms full of sensory tools for people who may struggle with sensory overload. This paper is a literature review of the practicality and purpose of creating these sensory rooms in virtual reality. It will cover what exactly sensory overload is, certain architectural design decisions that affect people, and the current state of virtual reality sensory rooms. It will end with a discussion as to how to create a generalized sensory room, how effective they are, and how to improve upon them, by finding a way to make them more personalized for each individual.

Background

Sensory overload is a complicated issue that affects more people than what is noticed. Each individual is affected differently. One paper discussed how some individuals use stereotyped movements to help cope when their senses are in overdrive. Stereotyped movement is described as,

> "patterned repetitive movements that share at least three characteristics: a high frequency of repetition, an invariant form, and an inappropriate or odd manifestation such that the movement lacks an obvious goal. Typical SM include rhythmic body rocking, head bobbing, arm or hand flapping, eye rolling, finger wiggling, finger waving (in front of the face), and hair twirling" (Gal, Dyck, Passmore 3).

The authors state that individuals use stereotyped movements- also referred to as stimming- to help cope with the sensory overload they are dealing with. They go on to state how stereotyped

movements are used to create a sense of sensory homeostasis that aids against under- or overstimulation (Gal, Dyck, Passmore 5). SM are a common coping mechanism for affected individuals. It helps bring their heightened senses back down and/or keep them from reaching a heightened state.

If the overload is not dealt with in this way or some other form of coping mechanism, the individual can reach a breaking point, where they shutdown or have fits. Another paper, which gathered real accounts from affected individuals, talked about this. They state,

> "Sensory overload is a prominent feature of autistic accounts of sensory processing. In qualitative studies, autistic people discuss how different triggers are unpleasant and also likely to send them into overload (Elwin et al., 2013; Jones et al., 2003; Robertson & Simmons, 2015; Smith & Sharp, 2013). Implicit in all these accounts is that sensory overload itself is unpleasant and should be avoided beyond the triggers themselves. Without relief or intervention, autistic people report 'shutdowns' and 'meltdowns', experiencing extreme distress and disengaging from the environment" (Millington, Simmons 3).

Keeping the individual from reaching the point of complete disengagement with their environment is the ultimate goal of these coping mechanisms. Without some sort of de-sensory tools, the affected person has no way of keeping themselves from shutting or melting down if the overload gets too high.

As previously stated, there are more people affected by this issue than most would believe. That is because people are affected in different magnitudes. Some people are affected all the time and everything tries to send them into sensory overload, while others only have certain triggers. A paper about the sensory characteristics of Autism Spectrum Disorder found that

parents of children with ASD between the ages of 3 and 13 reported 85% more sensory sensitivities than typical children in the same age range. They state that they believe these findings suggest that sensory experiences of people developing with ASD differs from that of a typical person (Banks, Burak, Miller, Russo, Stewart 2). Thus, proving that there is a problem that requires a better solution than what is currently available. The fact that many people deal with this issue is why better coping mechanisms and tools needed to be developed. This is why people have created sensory rooms. These are entire rooms designated to help affected individuals keep their senses from going into overload. Without their incorporation at certain entertainment venues, such as the new one installed at the Philadelphia Eagles football stadium, people who deal with sensory overload would likely struggle to enjoy the entertainment they came for.

Design Decisions

When creating sensory rooms or even just designing a building, but taking into account how the design will affect those who suffer from sensory overload, there are different design decisions that can be taken. The big question is whether or not sensory rooms actually work. Before delving into whether or not a virtual reality sensory room could be useful, this is an important question to answer. One study, on the effects on certain architectural design decisions to help with sensory overload, found, “The overall results of this study show promising indications of the possible improvement of autistic behaviour, as indicated by increased attention span, reduced response time and improved behavioural temperament,using an altered architectural environment” (Mostafa 197). Thus, there is some benefit to at the very least making informed decisions when making architectural designs. Another study, focusing on the impact of these design decisions on kids, found, “the researchers proved that early intervention in schools,

clinics, and other human service programs practices have a positive impact on the autistic child's life" (Habbak, Khodeir 1). Therefore, it can be assumed that there is some benefit, for people suffering from sensory overload, from having sensory-reducing designs incorporated.

The next thing to consider is what kind of sensory rooms work the best. Two studies emphasize the importance of individualising the designs of the sensory room. As each person is affected in a different way, the designs for their sensory rooms need to be specific to them. The first study concluded that there is a fair and considerable amount of diversity between participants and how they interact with the environment they were put into. Each person had specific preferences and shared little in common with the other participants. They concluded that the preferences were extremely "person specific" (Hutchinson, Loetscher, McCabe, Newbutt 2). They found that there was a high level of diversity and that each person has their own coping mechanisms, as well as being affected more by different types of stimuli. The second study found, "The findings indicate that sensory room intervention needs to be individualized in order to be effective in decreasing target behaviors among autistic children and young adults" (Malaney, Stadele 217). Thus, it is important to individualize the room for each individual. There are better results when the room or environment the individual is in, is personalized to best fit their specific sensory requirements.

The final question to answer is whether there are any shared characteristics. If there are, then perhaps a generalized sensory room can be created and used. A study on this very idea found that there were 3 main sensory factors to consider when creating a sensory room. These factors are color, lighting and glare. When it comes to color they found that the colors chosen for a sensory room should be low-saturated and high-saturated and stimulating colors should be avoided. Certain colors that create a "safe, comfortable, and soothing" feel should also be used,

such as blue or green. They feel the best coloring for a sensory environment is, as they state, "[...] the suggested colour for the quiet room is muted colours. Meanwhile, blue and green may give a more calming atmosphere to the room" (Aisyah, Dewi, Marwati, Wiguna 74). Therefore a decent generalized sensory room should have low saturated or blue/green colors. On the subject of lighting they state,

> "Based on its sources, at least there are two kinds of lighting, which are natural lighting and artificial lighting. Natural lighting brings many benefits to individuals with autism spectrum disorders (Altenmüller-Lewis, 2017). However, the use of natural lighting must be controlled to avoid excessive contrast and glare. For artificial lighting, it is not recommended to use fluorescent lamps since autistic individuals usually have high sensitivity to flickering light (Altenmüller-Lewis, 2017). LED lighting is recommended as it is also more energy efficient (Szokolay, 2004). Moreover, warm colour temperature lamps are likeable for autistic individuals' rooms (Long, 2010). Artificial lighting should also be equipped with a dimmable system to adjust the light intensity as needed (Altenmüller-Lewis, 2017). Therefore, adjustable LED lights with less flickering effect and a warm-colour temperature are preferred" (Aisyah, Dewi, Marwati, Wiguna 74-75).

Based on this, a good sensory room should also either use controlled natural light, or warm colored, intensity adjustable, LED lighting to sooth the user. When it comes to glare they state that it should be kept as minimal as possible. They provide multiple methods of doing so, such as a diffuser, shades, etc. Based on all of this, it can be concluded that a useful, generalized sensory room can be created and it will be effective. However, it would be more effective if the individual was able to personalize their own sensory room.

Current Work

The current state of virtual reality based sensory rooms is young. It has not been tested and developed nearly as much as it could be. However, there are some interesting studies that indicate the usefulness of a VR based sensory room. The first study tested to see whether virtual reality sensory integration testing could be used to classify individuals as autistic or not, and also if it can be used as a form or therapy. The focus here is on the therapy aspect of this paper. They state, "[...] all except one of our original participants were able to complete the tasks. There was a significant difference between healthy controls and autistic children. This implies that this program can be used to classify normal and autistic children. But specifically we found that it is possible to apply our system of and therapy for, autistic children" (Lee 156). This means that there is a therapeutic benefit to a virtual reality sensory tool. The second study tested how effective the Evenness virtual reality application was at helping with sensory overload. They focused on multiple themes, including demand for the product, acceptability of the product, and the implementation of the product. They state, "Findings suggest that demand and acceptability was strong, apart from some resistance to the VR Headset, and implementation was largely consistent" (Gorkin, Mills, Nash, Tracey 571). Thus, it is a practical tool. There is demand and acceptability for a virtual reality sensory room, meaning people will use it. However, as they stated, there are improvements to be made, such as adjusting the hardware and the headset so that more people can utilize it. Unfortunately, neither of these papers gave insight into how they designed their sensory rooms, but it can be assumed they took a somewhat conventional approach to the designs.

Future

Overall, the future of virtual reality sensory rooms is promising. There are so many factors to take into account when creating a sensory room. It's difficult to create a system where

each user can create a personalized sensory room, but that seems to be what the goal should be. Personalized sensory rooms are the most effective version of the tool for coping with sensory overload. While current, generalized versions can be useful and have been proven to work in most cases, there are many improvements that can be made, and personalization should be one of them. I personally believe that that is where the future lies for sensory rooms and environments. The ability for someone who suffers from sensory overload, and knows best what their sensory sensitivities are, to create their own virtual sensory room, personalized to fit them best, would help many people and be a more effective form of sensory treatment.

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