Get the job! An immersive simulation of sensory overload

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ABSTRACT

This paper presents our solution to the 2020 3DUI Contest Challenge. We aim to provide a compelling virtual reality experience that helps users experience the daily challenges of people with sensory issues. In the story we designed, users need to catch a taxi and get to a job interview on time. To achieve this goal, they must deal with hypo- and hypersensitivity symptoms, and interactively overcome them. Our demo encourages empathy and awareness of the challenges faced by people with sensory issues.

Index Terms: Human-centered computing—Human computer interaction (HCI)—Interaction paradigms—Virtual reality; Human-centered computing—Human computer interaction (HCI)—Interactive systems and tools

1 INTRODUCTION

Sensory overload is characterized by distortions in the perception of sensory information. It is frequently encountered by individuals with conditions such as autism spectrum disorders, PTSD, and schizophrenia. Studies suggest that as much as 90% of autistic individuals have atypical sensory experiences, including taste, touch, audition, smell, and vision [3].

People with such conditions can misinterpret everyday sensory information through a combination of both sensory hypersensitivity or hyposensitivity [1]. For instance, lights can be perceived as uncomfortably bright and irregular, and specific sounds such as voices may not be accurately distinguished. When multiple sources of information are overlaid, they compete for the person's attention and processing capabilities. This overload can lead the person to discomfort, difficulty focusing, and even meltdowns.

Symptoms usually peak at 6-9 years of age [1]. As time passes people learn accommodations and coping mechanisms that can be used to reduce the effects of these distortions. For hypersensitivity, strategies include dimming lights, using incandescent lights instead of fluorescent (due to the flickering of light), sunglasses, earplugs, noise-canceling headphones, and avoiding products with strong tastes and scents. For hyposensitivity, strategies include visual aids for people with difficulty in understanding spoken information, strong tastes or scents, and firm grips. The combination of sensitivities that each person is susceptible to varies, and is unique to that person.

We propose the creation of a sensory overload simulator in virtual reality (VR), that allows a person to experience some common hyper- and hyposensitivity issues while trying to complete a mundane task. We also provide some means of minimizing the issues through the use of known coping mechanisms. Our intent is to provide the user with a means of understanding and empathizing with people that suffer from the condition, while also providing an opportunity for some reflection on considerations for universal design.

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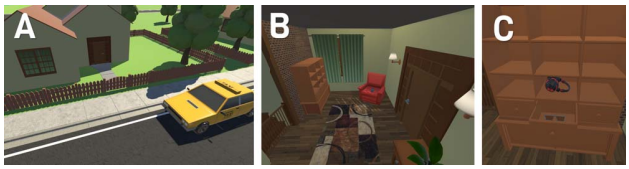

Figure 1: Environment where the experience takes place. *A. the outside environment where the user will face sensory overload; B. the inner hallway where the user starts the simulation, and the environment is controlled; and C. the cabinet where the user needs to locate the items they need.*

Our work is inspired by a 360-degree video that was created to raise awareness about autism. Too Much Information [4], created by The National Autistic Society in the UK, demonstrates how a child with autism feels inside a mall, demonstrating some visual and auditory elements that lead the viewer's character to a meltdown. While our work follows the same principle, we decided to focus on the specific problem of sensory overload, which applies not only to autism, but also other conditions. We also provide a fully interactive environment, which we believe could raise the sense of embodiment and empathy towards the issue, as the user is no longer a mere spectator with an egocentric viewpoint, but an embodied agent with a problem to solve.

2 EXPERIENCE DESIGN

We designed a prototype with the Unity3D Engine that uses a VR head-worn display to immerse the user in a scenario from the life of a person with sensory issues. Since our focus was to expose the user to sensory distortions, our focus in this work was to recreate those stimuli in a meaningful way, through a thought-provoking narrative. We opted for realistic and natural input techniques, namely real walking and virtual hand [2], since we wanted to portray a relatable experience. The HTC Vive Pro headset and Steam Lighthouse 2.0 devices were used to achieve this objective.

2.1 Environment and Narrative

The narrative follows the story of a character who is going to a job interview. The simulation starts with the user sitting in the hall of his house, waiting for a taxi to arrive. Once it does, the user will be urged to go outside to meet the driver, through the use of notifications on his virtual phone. As the user opens the door and steps outside, they are overwhelmed by numerous pieces of sensory information. Outside is a neighborhood of houses and the path to the front door leads to a car waiting on the curb. The scene outside, which can be seem in Figure 1A, is vibrant and very open, and it is meant to contrast with the small, quiet room inside. After the initial shock, we guide the user back to the house, where the overload stops.

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As for the scene setup, it was important for the player to be comfortable when entering the experience. A familiar environment would help set a baseline for them before they experience the onslaught of hypersensitivity symptoms as soon as they walk outside. To accommodate for a small testing area for our VR experience, the setting is in the entryway of the home of our protagonist, which can be seem in Figure 1B. It is cozy, with a few pieces of furniture and a living room and set of stairs visible but not accessible to the player. It has dim lighting with the windows covered by curtains to immerse the player early on in an environment where even natural sunlight is too severe to look at in certain circumstances.

Placed in the room are various accessories that are a part of the protagonist's routine when leaving the house, but the player will have to interact with them to gain their benefits. Upon returning to the house after the initial exposure to hypersensitivity outside, the user is encouraged to use those objects—namely a pair of sunglasses and noise-canceling headphones, which are in the cabinet shown in Figure 1C. Then, the player can step outside and reach the taxi that is waiting for them.

The environment design was created using Autodesk Maya and the objects were textured using Zbrush's polypaint capabilities. For this initial design, the scene was kept cheerful and simple, going for a cartoon look. While we are pushing for a relatable experience, we do not intend to reach the uncanny valley, as we want the experience to give a taste of the issue but not be aggressive to the participant.

2.2 Sensory Overload

To achieve the core sensory overload experience, we digitally altered the mapping of the stimuli presented to our user in the virtual environment, as a means of delivering an altered perception. By creating amplitude and frequency oscillations on various types of human senses, we aimed to provide a notion of what a person that experiences sensory overload has to deal with in their daily life. We chose these aspects because they are objective properties that are straightforward to represent to someone who does not suffer from the condition. Thus, we avoid a discussion on less clear aspects that are present in disorders such as autism.

We implemented distortions on sight, hearing, and touch. Visual distortions include a much higher sensitivity to sunlight, which is similar to a picture with overexposure, as shown in Figure 2. It also includes an oscillation in the brightness, based both on the physical aspect of eye adaptation, and on the neurological aspect of the processing of this information by the brain. The auditory distortion is implemented by using a higher sound amplitude, but we also tried to play with the idea of pulling the attention of the user to multiple noises constantly, making it difficult to focus on a single source. Haptic distortions are implemented through the simulation of the user's heart pounding through the use of a virtual smartwatch that mimics the heart rate of the character. Also, notifications on the smartphone provide feedback if it is in the user's hand.

2.3 Interaction Design

We provide interactive objects to support the user's navigation in the scene and overcoming the sensory overload. The implementation of interactive objects can be generally divided into two categories: (1) guiding users through the story while demonstrating the routine of a person with sensory issues; and (2) helping users experience and overcome sensory overload. All the objects can be directly touched and grabbed through a virtual hand by pressing the trigger button of the Vive controller.

For guiding users through the story, a mobile phone and a smartwatch are implemented in the scene. Smartwatches have been widely adopted by disabled people to track health conditions in real-time. In our scenario, a virtual smartwatch is worn on the right-hand wrist to inform users of their simulated blood pressure and heart rate. The smartphone shows the tasks to be completed during the scenario. To avoid breaking the immersive experience, common everyday objects in the scene such as doors and drawers are designed to be interactive in high fidelity. The door can be opened by grabbing and rotating the door handle, and then pulling or pushing with the hand. Drawers can be opened by grabbing and pulling the handle. Physics are carefully implemented for the objects to behave in the right way. The controller also vibrates during interactions to provide haptic feedback.

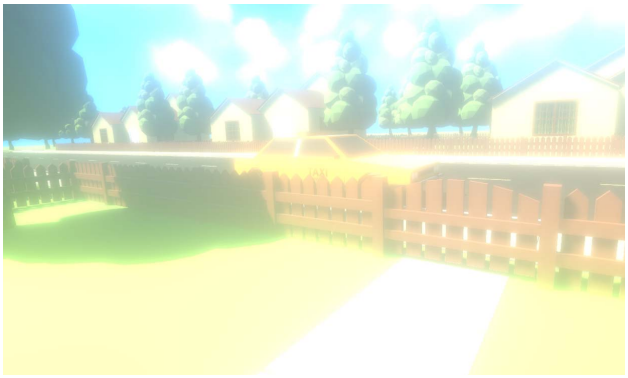

Figure 2: Hypersensitivity to light. *When the user leaves the house they face the brightness of the sun.*

For helping users experience and overcome the sensory issues, we provide two items. One is the sunglasses, which helps alleviate the visual sensory overload. The other one is a pair of noise-canceling headphones, which reduce the auditory sensory overload. The user puts on both items by grabbing and moving them towards his head. To force users to experience the sensory issues by going outdoors without wearing these items, both items are initially placed in locations where they are unlikely to be found. Narrations are provided later to give users hints on how to find these items.

3 Conclusion

We designed an experience that takes advantage of the unique characteristics of virtual environments and 3D user interfaces to bring awareness to the challenges faced by people with sensory issues. By no means do we claim that our implementation fully simulates the experience of this disability, but we believe that it provides an experiential glimpse into some of the issues faced by the large population of people dealing with the issue. We also note that there are many variations to how people perceive these sensory distortions; our experience is only one of many possibilities.

For future work we plan to assess the validity and effectiveness of this experience. There are two fronts here: one is the validity of the experience based on an evaluation with people that have the issue; another is understanding the effects this experience have on awareness and empathy.

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