Project Deliverable D - Conceptual Design

GNG1103

Group F1.1

February 13th, 2022

Abstract

This is a project deliverable for GNG 1103 outlining the ideation process for team F1.1. The project is to create an immersive experience tool using Virtual Reality to assist with diversity and inclusion training. In this deliverable the team has presented its concepts, as well as its top three solutions for the client. The team has also selected a solution to recommend to the client and has further developed this solution.

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1. Introduction

The Client, Hanan Anis, has expressed the need for a library of Virtual Reality (VR) tools to assist with Equity, Diversity, and Inclusion (EDI) training at the University of Ottawa. Based on the project description and first client meeting, the following problem statement was formulated:

A need exists for an immersive, interactive, engaging, and accessible virtual reality experience that fosters diversity and inclusion by imparting another's point of view on users, allowing for them to accurately imagine and reflect on what it is like to be different from everyone else.

In this submission, the team has presented its top three solution concepts for virtual reality experiences which can assist with EDI training. The project team has chosen to focus on invisible disabilities. In particular, the team has developed solution concepts to address the invisible disabilities of ADHD and Anxiety. Previous work on this project, including needs identification, benchmarking, and design criteria, were considered during the creation of concepts.

The first step in this process was to develop subsystems into which the proposed product could be divided. Then, each of the design team members came up with design concepts for each of the described subsystems, and from these concepts, three different complete solutions were formulated. These solutions were scored against the design criteria outlined in the previous report, and the solution that scored the highest was re-evaluated by the design team, who confirmed it as the best solution and selected it to be recommended to the client. This solution has been developed further by the team than the other two and has been presented in greater detail.

2. Defining Subsystems and Generating Concepts

After discussing our project and considering the implications of VR, the project team decided to divide the project into four subsystems: sound design, art design, gameplay, and experience structure. It was agreed that these subsystems would easily divide what we would need to do when creating the experience. Sound design and art design include anything related to what the user is hearing and seeing throughout the experience, respectively. The gameplay subsystem covers all the user's movement and interactions with the world, ie. how they're going to be going through the experience. Finally, the storyboard subsystem describes the structure of the experience, this includes what the user will be doing during the experience and what the experience will look like.

Each team member then generated at least one concept for each subsystem. The table below provides a summary of these concepts, with the team member creator for each concept identified in the appendices section of this report. The appendices section of the report also includes sketches of each team member's concepts.

Table 1: Summary of Concepts Generated by Team Members

Sound Design	**Art Design**	**Gameplay**	**Experience Structure**
Narrated voiceover (Inner monologue and sound of people speaking)	360-degree video turned into simulation	Dialogue choices when interacting with things	Introduction allows the user to become familiar with VR controls
Accessibility options (subtitles of narrated voiceover)	Use of colour to reflect sudden changes	Players interact with virtual people in the experience	Adjustable difficulty level and story progression based on user feedback
Sounds convey aspects of chosen invisible disability	Simple 3D art (polygons), grounded in reality	For ADHD: sit still and listen to instructions while being distracted	Give users a sense of what it is like to get things done with an invisible disability
ADHD: Distracting sounds	Colourful and bright	Interactive objects light up	Guess the disability
Ambient noise/background noise	Use of visual distractions	Periodically assigned tasks	Day in the life / normal everyday tasks
Silly/light/fun music in background	Customizable colour-scheme	Picking different profiles (for different disabilities)	ADHD: distracts the users to stimulate
Echoes to give the user a sense of the space		Energy level that increases or decreases	Narrated inner monologue to reflect the inner struggles of the invisible disability
		Point of reflection indicator	Guiding reflection questions at the end
		More tasks/tasks becoming more complicated as time goes by	Statistics of experience at the end
		Memory retention test	Conclusion includes explanation/more resources about the mental illness
		Mental energy impacting performance	

3. Solutions

3.1 Solution (A) - Recollection Quiz

One of the tell-tale symptoms of ADHD is that a person has a difficult time staying focused during tasks that require sustained attention [1]. Another is that the person does not pay close attention to details [1]. This first solution would highlight these two issues by having users attempt to recall information conveyed to them while they were subjected to a myriad of distractions. The user would be placed in a virtual world full of distractions, while a virtual person read them a series of instructions or details on which they would later be quizzed. Distracting the user with sounds, sights, other conversations, the user can have a sample of what it's like to have ADHD and perform this same task during lectures, conversations, and while reading. The challenge they experience will teach them of the difficulties of living with ADHD, and they will come out of the experience with more empathy for those afflicted. The art design for this would be bright and colourful, grounded in reality, but also simplistic and cartoonish. The art design would also feature very distracting lighting effects to steal the user's attention. The sound design would include voice-overs, foley, and distracting sounds like music, horns, background conversations and more.

3.2 Solution (B) - A Day in the Life

A shift in perspective is one thing that the client has highlighted as crucial to evoking empathy. "Put the user in the shoes of another" is a phrase that was repeated several times by the client and their colleagues. With this solution, users would experience a condensed version of a day in the life of a person with an invisible disability. This option wouldn't necessarily focus on one disability; several different disabilities could be experienced with further development. The user would be placed in the perspective of someone with a given disability, and within about five minutes they would experience several different situations throughout an average day that emphasise the challenges faced by the person in everyday life. The user would come out of the experience with a better understanding of those daily challenges, and hence more empathy toward those forced to face them. The art design for this solution would be more realistic to capture the feel of everyday life. It would still not aim to be photorealistic due to technological and time constraints. The world would be as colourful as real life, but colours would not be exaggerated for effect. The sound design would aim to mimic real life, featuring foley, voice overs, background noise such as birds, conversations, and traffic. Music, however, would not be featured, unless there were some music playing device as part of the experience.

3.3 Solution (C) - Task Completion

With this solution, users would be given a list of tasks to complete within the allotted time. Examples of these tasks include, but are not limited to, conversations with virtual characters, grocery shopping, moving and interacting with objects, and memory retention tasks.

This solution would allow the project team to focus on more than one invisible disability by choosing different profiles, which would provide multiple perspectives and allow the

experience to meaningfully address various challenges faced by marginalised groups. In particular, the project team would like to focus on ADHD and Anxiety for this solution. Although the struggles faced by each character while completing the tasks would be different, the environment and overall structure of the experience would be the same. Users would be able to switch characters in the introduction screen, as well as toggle accessibility options. However, users will not know the invisible disability of the character they pick at the beginning of the experience but would rather "learn by doing" and guess the disability at the end. The project team believes that this would keep users more engaged as there is a clear end goal in mind and would limit pre-existing biases.

A message that was emphasised in the first client meeting was that the virtual experience should incorporate reflection in some way. This reflection may not occur right in the moment of the negative experience, but rather hours, days, or even years after. The project team's way of addressing this is by creating a "point of reflection" system. Throughout the experience, there will be "point of reflection" indicators that appear in the corner of the user's view at key points that the user should pay attention to. At the end of the experience, there will also be a short reflection module that provides some statistics of the experience (ex. "You took ___ minutes to complete ___ tasks"), guiding reflection questions (ex. "How could you change your behaviour to help people with ____?"), and an explanation/further resources specific to the invisible disability covered.

Keeping the time and budget constraints in mind, visuals will be simple 3D art, but grounded in reality to ensure that the experience still feels immersive and realistic. The sound design will include narrated voiceover and subtitles, with ambient noise in the background during tasks where the user is not engaging in conversation with others. The sounds may also convey aspects of the chosen invisible disability, through distracting noises, changing the speed of the sound, or changing the volume of the sound.

The following sketches were designed with the final solution in mind:

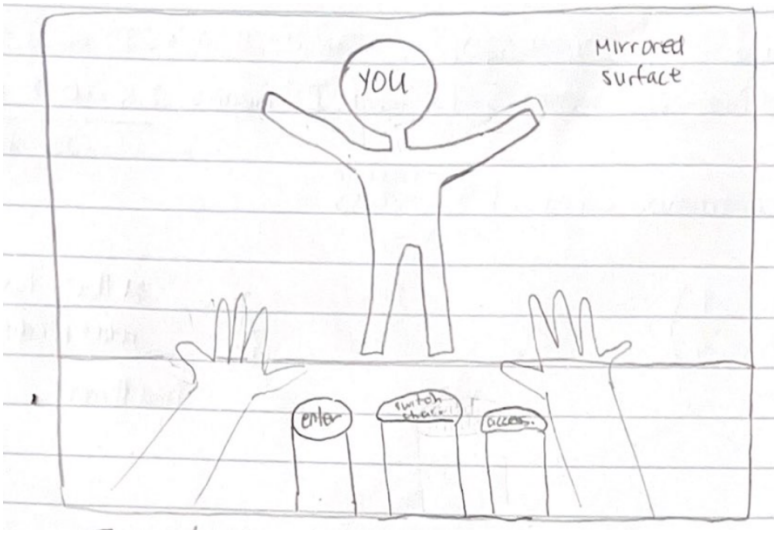


Figure 1: Introductory Experience for Solution C

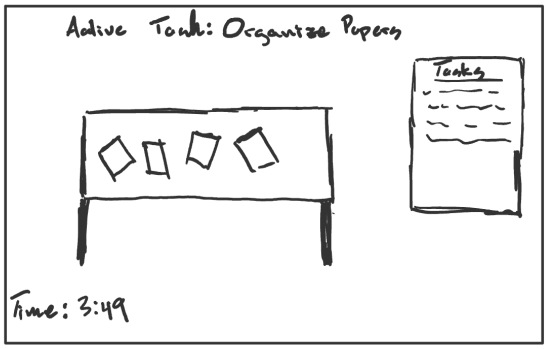


Figure 2: Active Tasks Screen

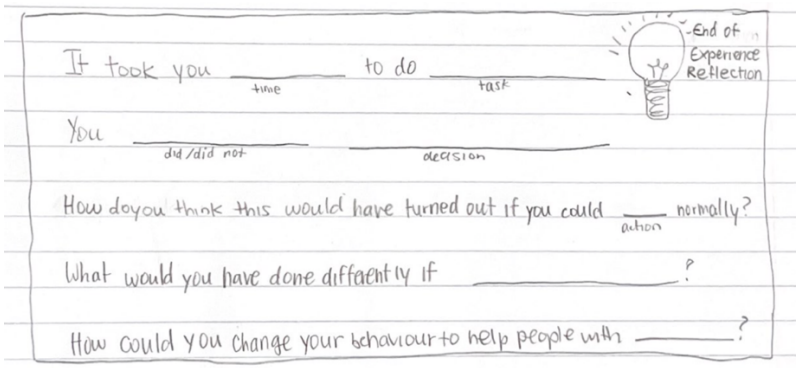


Figure 2: End of Experience Reflection Screen

3.4 Scoring the Potential Solutions

Once three potential solutions were generated, the project team analyzed and evaluated each of these by scoring them against the selection matrix using the design criteria created in deliverable C. From this, it was clearly seen that solution C was the best global concept and the one that will be further developed.

Table 2: Selection Matrix Evaluating Potential Solutions Against Design Criteria

Criteria	Importance	Solution A	Solution B	Solution C
Level of Interactivity	**3**	2	3	5
Relatability to Marginalized Groups	**4**	2	3	4
Effectiveness of fostering diversity and inclusion	**5**	3	2	4
Effectiveness of empathy elicitation	**5**	3	3	3
Change in POV	**4**	2	4	4
Conveyance of otherness	**3**	3	3	3
Opportunities for reflection	**3**	2	3	3
Level of immersion	**3**	3	3	4
Ease of Use	**4**	4	3	3
Level of User Engagement	**3**	2	2	5
Accessibility	**1**	5	2	3
	Total	**88**	**109**	**142**

The primary benefit of solution A is that it is a very relatable experience, especially those within a university environment. The task of sitting and listening to an instructor is very familiar to all university students. Highlighting the additional challenge in this task faced by those with ADHD would be an easy and effective way of evoking empathy from university students and professors alike. It is also a very low barrier to entry experience, requiring no prior knowledge of VR. However, this experience does not translate well to other invisible disabilities. In addition, it is not a very engaging experience, as users would essentially be standing still and simply listening; the experience does not take advantage of the full capabilities of VR and could just as easily and effectively be developed for different mediums.

Since it is a "Day in the Life" experience with realistic sound and art design, solution B's main strengths come with being immersive and relatable for users. However, it does not include any direct reflection aspects and would be less effective at fostering diversity and inclusion than other options. Moreover, it is less interactive and accessible than solutions A and C. With all this in mind, the project team has not decided to further pursue this option.

Solution C will provide a high level of interactivity and user engagement and will provide a higher level of effectiveness in fostering diversity and inclusion by allowing for multiple perspectives to be seen in VR. While it will be a little more challenging for new users in VR as there will be more interactions with other characters and the environment, the project team will work to make this transition to VR as smooth as possible by providing an introduction screen where the user can see what their character looks like, view themselves in the mirror, and get a feel for the space before entering the main experience. For these reasons, solution C was given the highest score in the solution matrix and will be the solution pitched to the client and used in further deliverables.

4. Conclusion

This deliverable begins the ideate stage in the design thinking process. Four subsystems were identified for the VR experience, and concepts were generated individually before being condensed, categorized, and refined as a team. Then, three potential solutions were created based on the subsystems and concepts and were evaluated against the list of design criteria created in the previous deliverable. Based on what is known right now and the analysis and prioritization of the different design criteria, solution C (Task Completion) was chosen as the best global concept that will be pitched to the client in the next client meeting and used in further deliverables and prototypes for this project.

5. References

[1] American Psychiatric Association, "What is ADHD," July 2017. [Online]. Available: https://www.psychiatry.org/patients-families/adhd/what-is-adhd.

[2] Anxiety Canada, “Generalized Anxiety Disorder,” [Online]. Available: https://www.anxietycanada.com/disorders/generalized-anxiety-disorder/.

[3] Centers for Disease Control and Prevention, “What is ADHD,” September 2021. [Online]. Available: https://www.cdc.gov/ncbddd/adhd/facts.html.

[4] Healthline, “Everything You Need to Know About ADHD,” October 2021. [Online]. Available: https://www.healthline.com/health/adhd

[5] Mental Health Foundation, “Generalized Anxiety Disorder,” [Online]. Available: https://mentalhealthfoundation.org/health-conditions/anxiety-disorders/generalized-anxiety/

[6] Wmforster2001, “Head-mounted display,” February 2018. [Online]. Available: https://xinreality.com/wiki/Head-mounted_display.

6. Appendices

Appendix A - Nicole's Concepts

Sound Design:

- Narrated voiceover and descriptive audio
- Use of sound to convey different aspects of disability. (Changing the speed, or volume)

Art Design

- Realistic video
- Use of visual distractions to convey different disabilities
- Change of colours to reflect sudden changes.

Gameplay

- The user can pick different unknown profiles at the beginning of the game to reflect different invisible disabilities.
- The introduction should include an introduction to the VR space

Experience structure

- User must guess the disability at the end of the simulation
- The conclusion includes a reflection section and explanation of the mental illness/more resources
- User must go through a "day in the life" and complete simple everyday tasks
- More short experiences rather than one long

Appendix B - Honor's Concepts

Sound Design

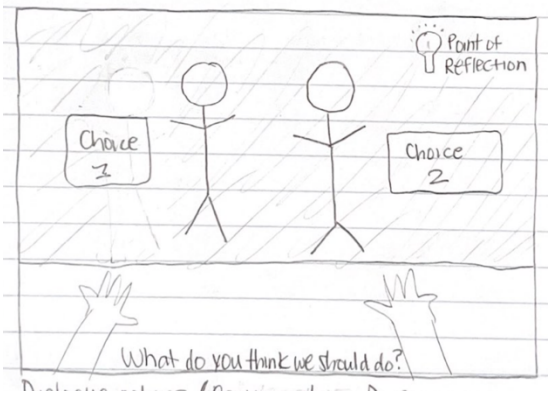
- Narrated voiceovers and subtitles
- Ambient noise in the background if there is no conversation going on

Art Design

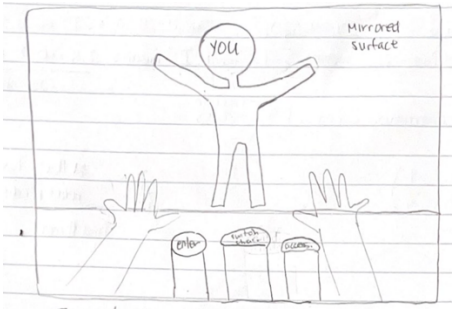
- Simplistic but somewhat realistic (with the cost/time constraint in mind)

Gameplay

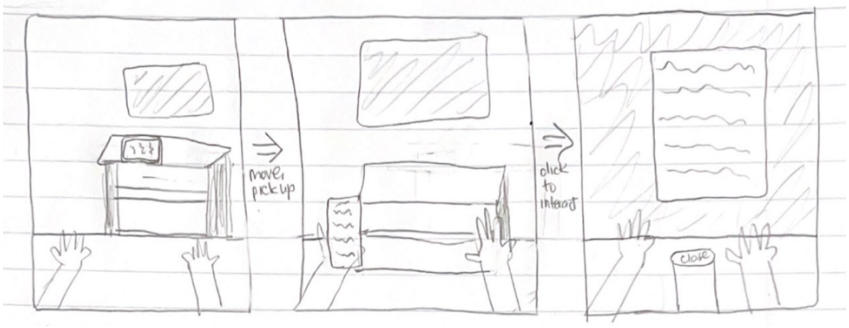
- Users will be able to control their movements at some points, interact with objects, choose dialogue options in conversations, press buttons
- Users can make decisions at some point during conversations by using their hands to "click" on an option. At this point text overlay will appear with the different options and the experience will freeze until there is user input.
- When key choices are made, a point of reflection indicator appears. This may also appear at key points when there is no user input.



- Introduction scene is the user looking in a mirror - this will allow them to be introduced to the controls of VR and the character that they have selected. Here there will be options for switching characters, get accessibility options, and enter the main experience.

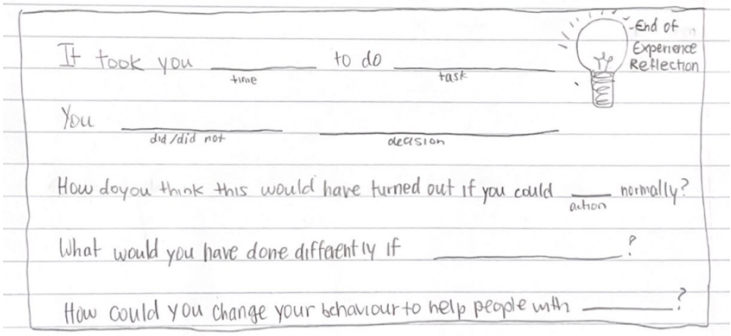


- Users will be able to grab/interact with objects in some settings. An object will light up if it's interactable.



<u>Experience structure</u>

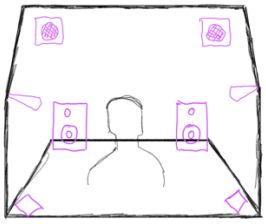
- Structured: Introduction -> Plot/Main Experience -> Reflection/Conclusion
- Plot revolves around a user doing everyday tasks (engaging in conversation with others, using objects)
- Reflection module at the end of the experience will give statistics of the experience and provide guiding reflection questions



Appendix C - Yuteng's Concepts

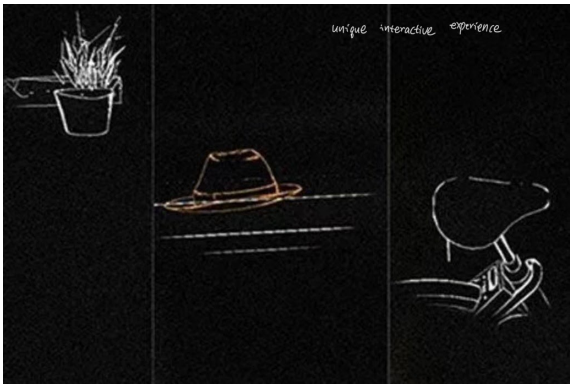
Sounds Design

- Every sound sources in the device is in space, and they are still there when you turn your head (HMD (Head- Mounted Display) tracks the head and renders the sound in the real time)
- The sound forms a series of echoes on the surface of the space, which are continuously diffused and attenuated until the final echo is heard, and the sense of space of the whole sense can be acquired audibly.



Art Design

- The equipment can change the colour of the wall dynamically according to the customer's preference and paste the wallpaper of different materials.
- Transitions between scenes should not have a sense of conflict



Gameplay

- Sit still and listen to instructions

- Energy level indicator that increases and decreases
- How the player feels about where he is in the game space is important. If this is done well enough, players will naturally know where they stand in the virtual world.
- If there are good social features, they can provide players with a stronger social reality, and players can focus on the people they are socialising with and forget about the other bad realities and feel present.

Experience structure

- VR goggles can pick up emotional feedback from the player and adjust the difficulty level and story progression automatically based on that feedback.

Appendix D - Anthony's Concepts

Sound Design:

- Feel: Silly, light fun, nothing too serious. People are more engaged when they're having fun
- Ambient music during gameplay
- Voice-acted talking for dialogue
- Sound effects when interacting with the world
- Option 1 Specific
    - Silly/fun and light music (think Mario Kart, Overcooked) in the background
- Option 2 Specific
    - Distracting sounds and music to take attention away from the person giving instructions
        - Background noise
        - Conversations of other people saying very interesting/scandalous things

Art Design:

- Simple, polygons, step up from Minecraft.
    - Too detailed/realistic art design will be hard on the system and may not run well. Also expensive, or very time consuming for developers.
    - Simple can still be pretty, and very visually appealing. I think that video games have done a really good job at showing that simple, cartoonish art styles don't detract from the immersion.
- Colourful
- Bright

Gameplay/World Interaction/UI:

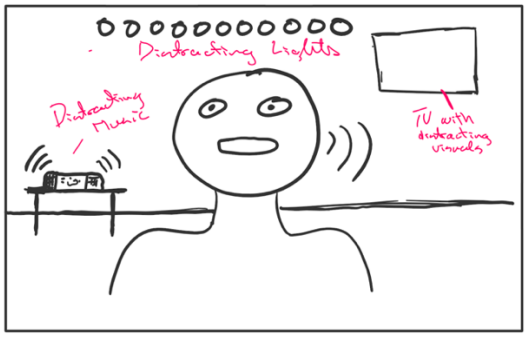
- Option 1: Task completion Game
    - User is periodically assigned tasks and has to complete them.
    - Tasks are often assigned in the middle of other tasks. The new task takes precedence and must be completed before the previous (FILO).
    - The user will be able to focus on and complete tasks at first, while their "mental energy" level is still high. The mental energy level will decrease as users "spend their energy" completing tasks. As the mental energy

decreases, they are more easily distracted, and tasks are assigned more frequently.
    - "Energy decreasing/increasing symbols" to indicate how fast a task is draining mental energy.
- Option 2: Listen to Instruction + Memory Test
    - User must listen to instruction given by a virtual person
    - During the relay of these instructions, user will be hit with a myriad of distractions
        - Background noise
        - Background conversations
        - Music
        - Visual distractions
    - After the instruction, the user will face a memory recollection quiz
    - The person who gave the instruction will get more and more mad as you get things wrong in the quiz
    - Must be a challenging quiz otherwise people won't get it.

<u>Experience structure</u>

- Invisible Disability: ADHD
- **Option 1: Task Completion Game**
    - See "Gameplay" for details on the structure
    - Gives users a sense of what it is like to try and get work done with ADHD. Easily distracted, compulsion to act on thoughts immediately, great difficulty completing tasks that require sustained mental effort.
    - The importance of mental energy and how it relates to overcoming ADHD.

- **Option 2: Listen to Instruction + Memory Test**

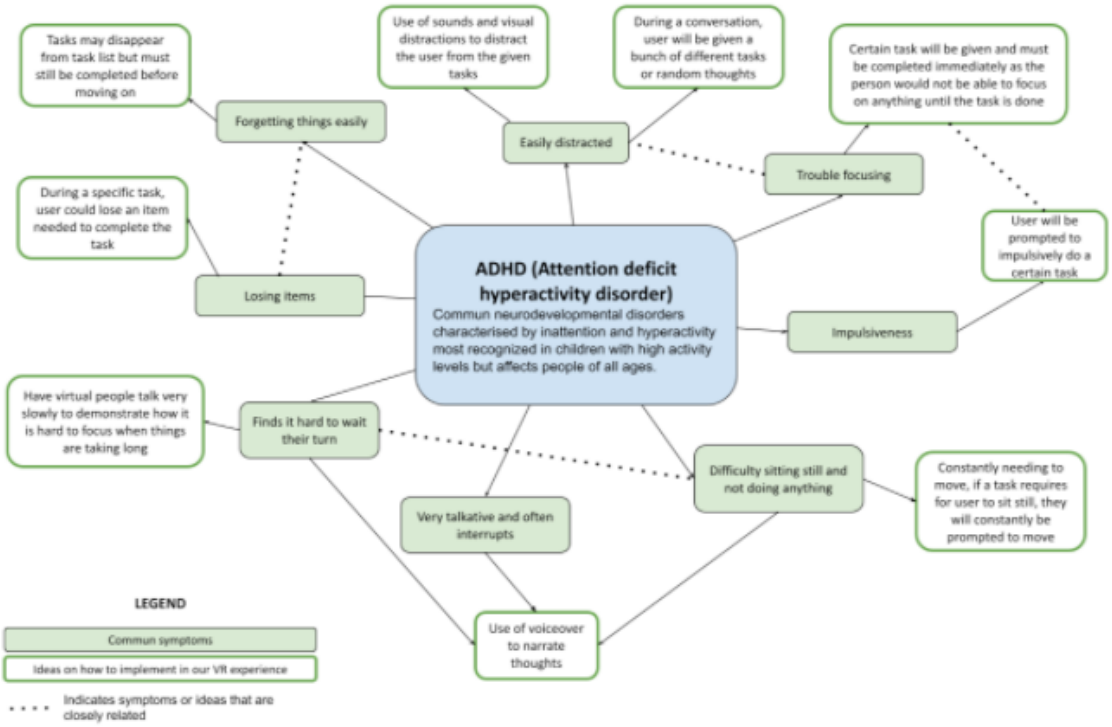


  - See “Gameplay” for details on the structure
  - Highlights the difficulty of sitting and listening / focusing on one, boring task for a stretch of time.
  - Highlights ease of distraction
  - Highlights memory retention issues
  - Would also highlight the stigma of others when they get mad/frustrated that you can’t remember what they said.

Appendix E - Invisible disability diagrams

The following diagrams were done to help come up with symptoms and difficulties that people with ADHD and anxiety face and how we would be able to implement them into the experience.

ADHD (attention deficit hyperactivity disorder):



Anxiety (Generalized anxiety disorder or GAD):