

GNG 2101
Design Project User and Product Manual

Vision Craft B 3.2

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List of Acronyms and Glossary

Table 1. Acronyms

Acronym	Definition
EDI	Equity, Diversity, Inclusion
SEDTI	School of Engineering Design and Teaching Innovation
VR	Virtual Reality
UPM	User and Product Manual

Table 2. Glossary

Term	Acronym	Definition

1. Introduction

Our team was tasked with designing and creating an immersive virtual reality (VR) experience that provides an opportunity for individuals to experience the perspective of someone living with a disability. This tool was created to improve inclusivity by promoting empathy regarding disabilities. Allowing participants to understand another's point of view by demonstrating implicit bias through VR will prove to be educational. Our use of VR will immerse users in a unique, hands-on manner to foster inclusion and introspection.

The purpose of this User and Product Manual (UPM) is to be used by users wanting to learn information on any aspect of the prototype or to try the experience, as well as developers wanting to build upon or reproduce the prototype in Unity. The manual records design aspects of the prototype, how to use the prototype, troubleshooting, and then prototype documentation.

For developers, the following assets are copyrighted property and should not be used/distributed outside of this prototype:

- Modern Library
- XR Hands

2. Overview

Our client had a need to use empathy to train people on implicit bias and inclusivity using a VR environment that will allow the users to immerse themselves in the experiences of someone living with a disability. Often, disabilities are addressed with sympathy not empathy, but it is important to be able to fully understand how someone else lives in order to accommodate them and prevent uneducated judgment. This VR experience allows the user to step into the shoes of someone with dyslexia and experience what an everyday school task is like for them. The goal of this VR is to induce empathy in the user towards individuals that have dyslexia by allowing the user to gain an understanding of how it affects their lives.

Our VR environment creates empathy by immersing the user in a snapshot of the everyday life of a student with dyslexia. The user takes the role of a library volunteer that is tasked with finding certain books under a time limit. There is a timer to implement a sense of anxiety to show how much harder it is to do such a task when you have dyslexia vs not having it. It's a chance for the user to feel how stressful dyslexia can make something that seems so simple to them. Dyslexia is a commonly known disability, so it is beneficial to create an experience that allows the user to gain a personal understanding of how it affects people.

Figure 1: Librarian Introduction



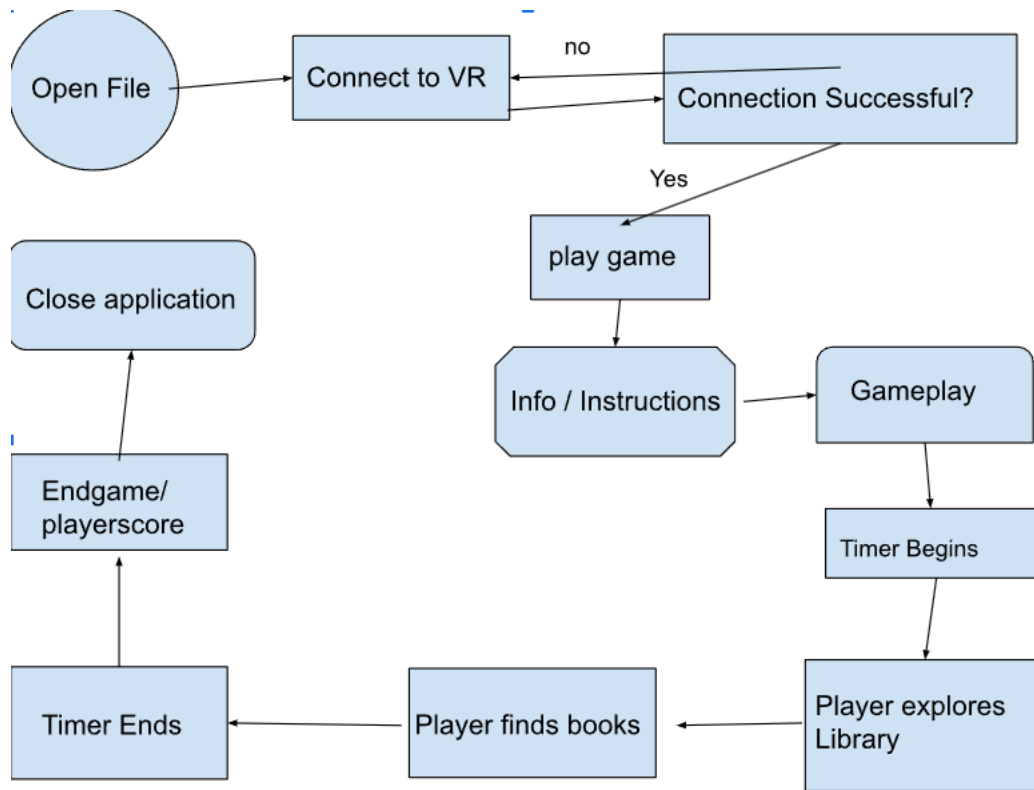
Figure 2: Library



Figure 3: Finding Books



Figure 4: Detailed Design



3. Getting started

To start using the prototype, first you will need to plug in and turn on the VR headset and a computer. Once everything is on, open unity and connect your headset to the computer using a cable. The virtual reality game will start, and you will begin the game. You start in the library and will have to walk to the librarian who will give you the instructions for the game. The librarian will give you the codes of book to find and once you finish talking to the librarian, a timer for 5 minutes will begin counting down. Now you must walk around and collect as many books as you can in 5 minutes. The codes are labelled by the section the book is in and the codes will change throughout the game to simulate how dyslexia can jumble numbers and letters, making it harder to read. When the timer ends you will be given a score based on the books you found and then the game is over.

3.1. User Access Considerations

This prototype was designed for students at the University of Ottawa who don't have dyslexia to promote empathy and be used for EDI training. However, this prototype can be for anyone who does not have dyslexia to get a better understanding of the challenges dyslexia can add to your life. The only restrictions for this prototype are that the user must be able to run unity on a computer and have a virtual reality headset compatible with the computer they are using to run unity.

3.2. Accessing/setting up the System

To start using the prototype, first you will need to plug in and turn on the VR headset and a computer. Once everything is on, open unity and connect your headset to the computer using a cable that works for your computer. The virtual reality game will start, and you will begin the game. There is no login required to use the game aside from having an account in unity and some virtual reality headsets require an account to be logged in.

3.3. System Organization & Navigation

The layout of the prototype is quite simple considering at this point we have no main menu or settings. When you run unity on your computer the only game available is this one so once you open unity you just hit start and begin the game.

3.4. Exiting the System

When you have finished the game, you will receive a score and then you are able to quit and close the application. All you must do is take off the virtual reality headset, go to the computer and close the game in unity then you're done. Lastly disconnect the virtual reality headset from the computer and put away the equipment.

4. Using the System

The following sub-sections provide detailed, step-by-step instructions on how to use the various functions or features of the Vision Craft VR environment.

4.1. Start Game

Once the Vision Craft file is connected to the VR the user will right-click on 'Play Game' which will then take them to the start of the game. The user will then use the be instructed to navigate towards the librarian using the joystick, and the librarian will give them instructions of how to play the game through text boxes appearing on the screen. The user can right-click through the instructions.

Figure 5: Getting Instructions From Librarian



4.2. Timer Begins

Once the user has gone through the instructions, they right-click 'Continue' which makes the first book code appear on the screen and initiate the 5-minute timer.

Figure 6: First Book Code and Timer Starts



4.3. Picking Books

The user will find the books corresponding to the code on the screen and right-click on the book they want which will make them pick up the book. If they pick up a book with the wrong code they will left-click to drop the book and continue looking for the right book.

Figure 7: Wrong Book Code



Figure 8: Correct Book Code



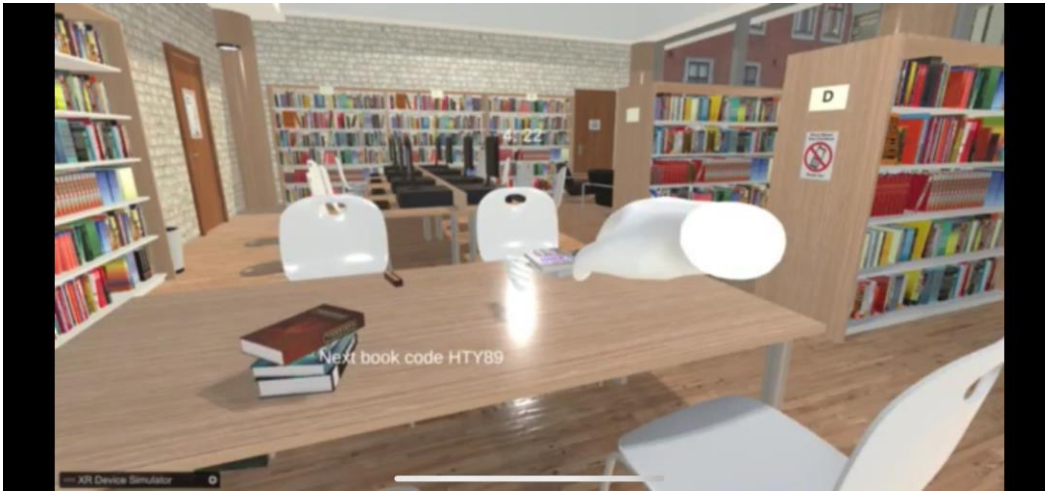
4.4. Dropping off Books

The user will bring the book to a designated table and right-click on the table to drop off the book. Then the next book code will appear on the screen.

Figure 9: Dropping Off Book



Figure 10: Getting Next Book Code



4.5. Finish Game

Once the timer runs out the user will be brought back to the front of the library and given a score of how many books they got correct. The user will then right-click on 'Finish Game' which will then bring them back to the initial 'Play Game' page.

5. Troubleshooting & Support

5.1. Error Messages or Behaviors

Common errors that a user may encounter:

- Error: Issues loading assets while in Unity
- Solution: Verify that all asset packages are fully imported, then restart Unity.

- Error: Unable to detect Quest headset
- Solution: Ensure that all Unity packages are installed, check that the headset is properly plugged in. If the issue persists, restart Unity and the headset.

- Error: Character lags/gets stuck
- Solution: Restart the game, verify USB connection and check battery percentage.

- Error: Timer doesn't start
- Solution: User must ensure that they have interacted with the librarian to receive instructions. If the timer still does not start after this interaction, restart the game.

- Error: Loading game from computer is not functioning
- Solution: Download the Unity file as an app onto your headset directly.

5.2. Special Considerations

- Verify in Unity that all packages have been properly imported/installed.
- Check that the VR settings correctly align with the headset being used.
- Ensure that all Unity and Oculus latest updates have been installed.

5.3. Maintenance

- Regularly check for updates from Unity and Oculus
- Ensure that the headset is in good condition
- Assess and clear any errors received in the console log

5.4. Support

Contact *Meta Quest Help Center* if you experience any issues with your Oculus Quest headset.

Contact *Unity Support* regarding any issues with using their software.

Contact us if you experience issues with our VR experience and send feedback to our company email: visioncraft@gmail.com.

6. Product Documentation

6.1. Project Setup

This system entails the project setup such as installing and configuring the unity editor and necessary unity plugins for the final prototype. It also entails the creation of the project. This system is the necessary step to ensure development goes without error.

The instructions assume the user has not installed unity and has not made an account with unity.

6.1.1. BOM (Bill of Materials)

Item	Description	Cost	Link
Unity Student Plan	For game development engine	\$0	https://unity.com/pricing#plans-student-and-hobbyist
Oculus VR Plugin	Unity package to allow oculus device compatibility, such as meta quest	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.oculus@4.1/manual/index.html
OpenXR plugin	Unity package to allow XR development	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.openxr@1.8/manual/index.html
XR hands plugin	Unity package that allows for hand tracking for VR headsets	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.hands@1.3/manual/index.html
XR Interaction Toolkit	Unity package that allows interaction with objects in VR	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.interaction.toolkit@2.5/manual/index.html

XR Plugin Manager	Unity package that manages other XR plug-ins	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.management@4.4/manual/index.html
Total Cost (without tax & shipping)		\$0	
Total Cost		\$0	

6.1.2. Instructions

- Go to <https://unity.com/>
- Click “download” and download the latest version of unity hub
- From the unity hub or while it is downloading, create a Unity ID
- In the unity hub click the icon on the top left to sign into your unity ID
- From there you can also click “manage licences” and select your desired unity licence (any is allowed) if you haven't already.
- Go to the installs tab on the right, install the editor with version 2022.3.12f1 that is compatible with your system.
 - If it's no longer available, any other similar or slightly newer version would also work. However, other versions of unity editor are outside of the scope of this manual and may contain different troubleshooting that is not covered or slightly different code.
- When install is pressed, a list of modules will appear. If you want to build the project to a specific device install the module “<device name> build support”. Besides that, all modules are optional and can be install if desired.
- After the editor is installed, go to the projects tab, click new project, and select 3d core.
- Once you are in the editor, click windows>package manager

- Import the following packages from the unity registry:
 - Oculus VR
 - OpenXR
 - XR Hands
 - XR Interaction Toolkit
 - XR Plugin Manager

6.2. Environment

This system entails the environment model that the player is placed in, as well as all of the grabbable books that can be interacted with. This section instructs how to import all required assets and then construct the scene.

6.2.1. BOM (Bill of Materials)

Item	Description	Cost	Link
Unity Asset – Modern Library	Library scene for game	\$25	Modern Library 3D Interior Unity Asset Store
Unity Asset-Books	Models for miscellaneous Books	\$0	https://assetstore.unity.com/packages/3d/props/interior/books-3356
Total Cost (without tax & shipping)	- 5% CA GST - 8% ON HST	\$25	
Total Cost		\$28.25	

6.2.2. Equipment list

- Unity Hub
- Unity editor version 2022.3.12.f1
- A valid Unity ID
- The following Unity Packages installed
 - Oculus VR
 - OpenXR
 - XR Hands
 - XR Interaction Toolkit
 - XR Plugin Manager
- All default packages installed

6.2.3. Instructions

- Go to the unity asset store <https://assetstore.unity.com/>
- Sign into your unity ID from the asset store
- Search for the following assets:
 - Modern Library (costs money), Link: <https://assetstore.unity.com/packages/3d/props/interior/modern-library-51829>
 - Books, Link: <https://assetstore.unity.com/packages/3d/props/interior/books-3356>
 - Alternatively these can be found in the project files
- Go to the unity editor hub and open the project
- Go to Window > Package Manager
- In the packages tab next to the plus, click on it to open a drop-down menu, and then select “My Assets” to show the packages that were got from the asset store.
- Import the “Books” and “Modern Library” assets
- Back in the project, click Assets/Modern Library/Demo and open the scene
- Place all required books

- Place ~50 book prefabs from Assets/Books on the shelves at random
 - Do not place them on the top 2 shelves. These are the books the player will try and find and grab. Make sure they are scattered
- Press the plus on the top left of the hierarchy and create 2 empty game objects
- Name them “Books” and “SpecialBooks”
- Place all books as children of “Books”
- Make ~15 of the books in “Books” children of “SpecialBooks”
 - These will be the books the player is tasked to find. Make sure they’re a random assortment as to not make it predictable to find
- Make all the books grabbable
 - Highlight all the books that were added
 - Add the “XR Grab Interactable” to all books, enable smooth position and track rotation
 - Make the mass of all rigid bodies 2
- Add labels to the spines of all grabbable books
 - Press the plus and add UI >Canvas, and then add UI>Text-TextMeshPro as a child to the canvas
 - Make the canvas a child to any grabbable book
 - In the canvas, make its render mode “World Space”, make its position (0.0144, 0.1313, 0.088), and rotate to be positioned on the spine
 - For the text, make the font size 0.04, and make the text alignment centre middle
 - Copy and paste to add as a child for all grabbable books
- Use the same method to add labels to all bookshelves

6.3. Player Input and Movement

This system entails the player movement in VR, hand tracking, object interaction, and player model. It allows the user to move around the environment and use their controllers to interact with objects. This is a key component of the experience to allow for interactivity.

6.3.1. BOM (Bill of Materials)

Item	Description	Cost	Link
Unity Asset – Hand Model	Hand model for POV player	\$7	VR Male Hand (Left & Right) 3D Humanoids Unity Asset Store
Unity Asset- Starter Assets	Starter assets for Unity XR development	\$0	Provided by unity in-editor
Total Cost (without tax & shipping)	- 5% CA GST - 8% ON HST	\$7	
Total Cost		\$7.91	

6.3.2. Equipment list

- Unity Hub
- Unity editor version 2022.3.12.f1
- A valid Unity ID
- The following Unity Packages installed
 - Oculus VR
 - OpenXR
 - XR Hands
 - XR Interaction Toolkit
 - XR Plugin Manager
- All default packages installed
- The Demo scene with all grabbable books

6.3.3. Instructions

- Open the unity project and open the demo scene

- Go to Window > Package Manager, look in “Unity Registry”, click on the “XR Interaction Toolkit” Package, and import the “Starter Assets” under “Samples”
- Go to the Unity Store and purchase “VR Male Hand”, Link: <https://assetstore.unity.com/packages/3d/characters/humanoids/vr-male-hand-left-right-209546>
 - This can also be found in the project files
- Import the package that was just purchased
- Under Assets/Samples/XR Interaction Toolkit/Starter Assets/Prefabs add “XR Interaction Setup” to the Hierarchy. Position it to where you want the player to start and which direction you want the player to face
- Select XR Origin (XR Rig)/Camera Offset/Left Controller/Ray Interactor and disable the game object. Do the same for the right controller
- Add models to the controllers by selecting “Model Prefab” and selecting the hand prefabs you just imported

6.4. Testing & Validation

Our development followed an iterative process; small parts of each subsystem were implemented and tested to ensure it was functional with no bugs. After the build was complete, the cycle would repeat and more features would be added, building on what was added before. Prototype results were recorded by listing which target specifications were complete after each build.

6.4.1 Final Target Specifications

	Target Specification	Unit(subjective value of importance)	Expected Value	Actual Value
1	Quality Storyline and characters	4	Implemented	Implemented
2	Different Types of Dyslexic Experiences	2	Implemented	Not implemented

3	Immersive experience	4	Implemented	Implemented
4	Interactive experience	5	Implemented	Implemented
5	Empathetic Experience	5	Implemented	Implemented
6	Avatar movement	5	Implemented	Implemented
7	Leaves an impression on the player and gives them more understanding	5	Implemented	Implemented
8	Grabbable Objects	3	Implemented	Implemented
9	Audio	2	Implemented	Not implemented
10	Environments	3	Implemented	Implemented
11	Player Models	3	Implemented	Implemented
12	NPC models	2	Implemented	Implemented
13	Object physics	3	Implemented	Implemented
14	Animations	3	Implemented	Not implemented
15	Player input	5	Implemented	Implemented

6.5. Final Bill of Materials

Item	Description	Cost	Link
Oculus VR Plugin	Unity package to allow oculus device compatibility, such as meta quest	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.oculus@4.1/manual/index.html
OpenXR plugin	Unity package to allow XR development	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.openxr@1.8/manual/index.html
XR hands plugin	Unity package that allows for hand tracking for VR headsets	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.hands@1.3/manual/index.html
XR Interaction Toolkit	Unity package that allows interaction with objects in VR	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.interaction.toolkit@2.5/manual/index.html
XR Plugin Manager	Unity package that manages other XR plug-ins	\$0	Documentation: https://docs.unity3d.com/Packages/com.unity.xr.management@4.4/manual/index.html
Unity Asset – Hand Model	Hand model for POV player	\$7	VR Male Hand (Left & Right) 3D Humanoids Unity Asset Store

Total Cost (without tax & shipping)		\$32	
Total Cost		\$36.16	

7. Conclusions and Recommendations for Future Work

In the end, the main objective of our project was to create and design a VR experience that provides an opportunity for individuals to experience the perspective of someone living with a disability. Overall, we were able to do that. However, we had some ideas for our VR that were not implemented. For example, we could not implement all three scenes we had in plan. We also couldn't add another scene where the user could interact with the teacher or students. We could not implement these in not only because our client suggested that it's better to have one scene and enrich that with empathy, rather than stress out on three different scenes.

There were many struggles we faced as a team when designing the VR. At the beginning, we had difficulties making a storyline that would create empathy for the user. We also had technical issues with connecting the VR to Unity to test our simulation.

Looking back at this project, we learned many things that if another group decides to do a project like ours, they can learn from. The first one is we should spend more time researching dyslexia and how it affects the brain. That way, we could have produced a better solution that would create more empathy with the user. Another important lesson we learned as a group is learning how to use Unity and how to use it in a VR environment. If we had the expertise earlier on, we could make the game more appealing and perhaps have given the user more options to choose from. Lastly, we learned as a group the legal implications for developing and selling a product. This will come in handy if we decide to pursue our product and sell it to the public. Our project may have some limitations, but it provides an opportunity for individuals to experience the life of someone living with dyslexia.

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APPENDICES

9. APPENDIX I: Design Files

Table 3. Referenced Documents

Document Name	Document Location and/or URL	Date Issued
PD B	https://uottawa-my.sharepoint.com/personal/aconn099_uottawa_ca/Documents/PD%20B.docx?d=w20aea75523bf471ba1d70f52d98d3295&csf=1&web=1&e=4hZ67O	September 24 th 2023

[1]