



uOttawa

L'Université canadienne
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Department of Engineering

GNG 1103

Deliverable D - Conceptual Design

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Introduction:

Ottawa is the capital city of Canada, so it is usually filled with political tension that can often intersect into discriminatory and problematic words, behaviours, and movements. Virtual reality (VR) simulations can be possible forms of Equity, Diversity, and Inclusion (EDI) education to overcome this issue.

The purpose of this project is to increase the empathy that a user feels for minority groups through a VR simulation, as assigned by the client, Professor Anis Hanan from the University of Ottawa. This deliverable will cover the conceptual design proposals from each group member and based on the benchmarking from Deliverable C, analyze and evaluate these proposals for the subsystems of the possible solutions. Through a process of elimination, the best

1. Subsystem A: Narrative Content

Subsystem A does not need any diagrams because it is about the narrative content of each team member's proposal. The narrative is important because it impacts the

1.1 Aura

The user will take the role of discriminator, though subtle and appears as subconscious discrimination, against a character who is a friend. The simulation will show the user how certain words and phrases can mean rude and hurtful things by showing the user directly what those words can imply. The user can reconcile with the friend by apologizing and choosing the correct dialogue options, but if the user still chooses options that still have subtle-bias, the friend will hesitantly forgive the user or end their friendship depending on the number of options with subtle-bias chosen. The discrimination topic will depend on what the user chooses in the beginning.

1.2 Leah

Once the user selects a character, the simulation will start. The user will watch their character walk back home after spending their day out in public. The character will be visibly sad and will sit down and start to reflect on the situations they experienced throughout the day. Once the character thinks of a situation, the simulation will flash back to that time, and the user will now become the character (and "walk in their shoes"). The user will now experience the discriminatory events that occurred to their character first hand. When the character comes back to the present, the user will now view their character, as per the beginning, and the user will watch the character reflect on the experience they went through and then learn how the character was affected by it. This process can be repeated with different memories that the character has. During the last memory, the user will be a bystander to their character and will learn how to

intervene during the situation in order to comfort their character. When the simulation flashes back to the present, the user will see their character visibly happy that someone helped.

1.3 Jasen

Presented more as an outsider's point of view on an event, the user experiences a cultural event first hand in order to educate the user on said culture. The user can experience the details, music, etc. A "guide" can also show the user through this event, explaining many aspects of the culture that are usually judged by society (i.e the wearing of hijabs).

2. Subsystem B: Visual simulation

Subsystem B will focus on how the narrative will be visually displayed. This part will focus on the method to immerse the user in the simulation, and it is the most important subsystem in this project.

2.1 Video recording

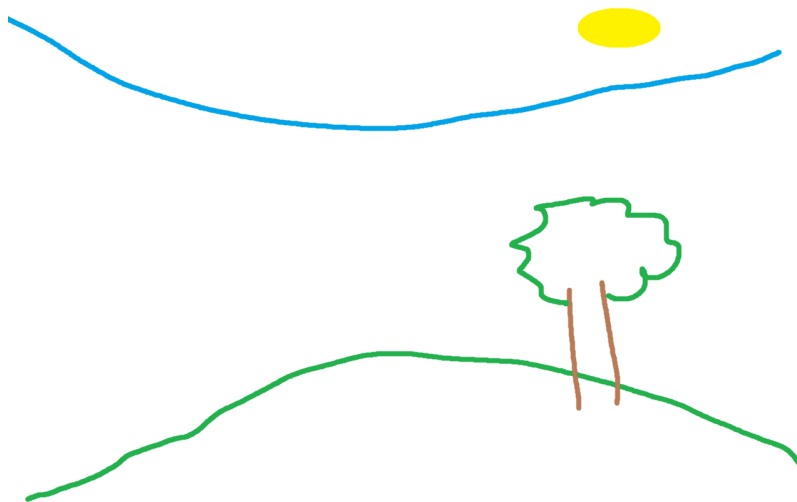


Figure B.2.1: Video Recording

The idea is to use a 360° camera that can be used to film our surroundings in order to incorporate it into the simulation. The 360° view will give the VR user the ability to see completely around them. The video can include real life people playing characters in the storyline. It is easy to use and incorporate, and can create more content to add into the program as long as no editing is needed.

2.2 Stitched pictures



Figure B.2.2: Stitched Pictures

It will be a more interactive simulation with Google Street View mechanics. The user will click arrow buttons to navigate and move to different areas of the simulation. Encounters can happen where a video can play or dialogue can happen and the player needs to make a choice. This can be a very interactive and comprehensible method for the user, yet the developer needs to agree to spend more time making the scenarios.

2.3 Three-dimensional Models



Figure B.2.3: 3D Models

Another option is to do the project with completely three-dimensional (3D) model parts of a scene or characters. This gives a higher level of fidelity to the simulation as the objects will be seen in 3D, compared to the two-dimensional (2D) images and videos, and it can give a slightly cartoony feel which could be good for children. Animations can be made with various softwares [1], and there is a program called Audio2Face that can turn audio files into simulated facial expressions. However, animated 3D models take the longest to make and are the most complicated option we have. Furthermore, the target users will mainly be students from the University of Ottawa, who are adults, so the cartoonish appearance might worsen the users' experience.

3. Subsystem C: Communicative Element

3.1 Text dialogue

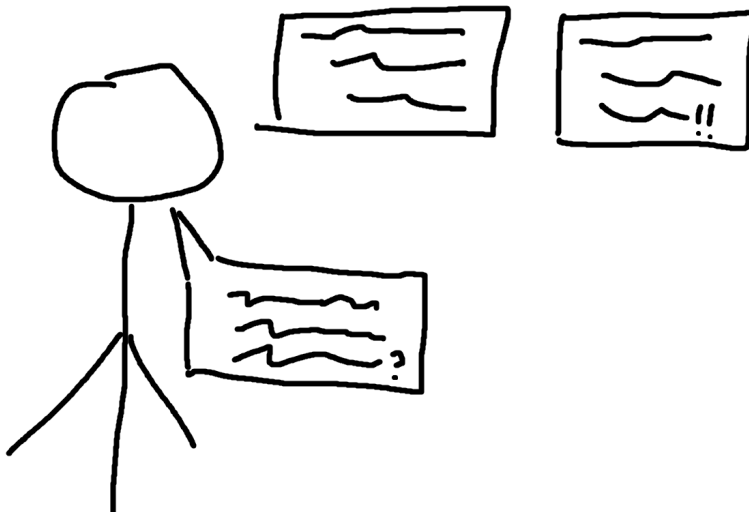


Figure C.3.1: Text Dialogue

Throughout the simulation, the user will be presented with dialogue options in order to interact and communicate with other characters. Different responses will be shown and the user will be able to read and then select the best fitting option. This allows the user time to think, reread, and evaluate their options. Characters' thoughts may also be displayed through text dialogues.

3.2 Recorded voice speech

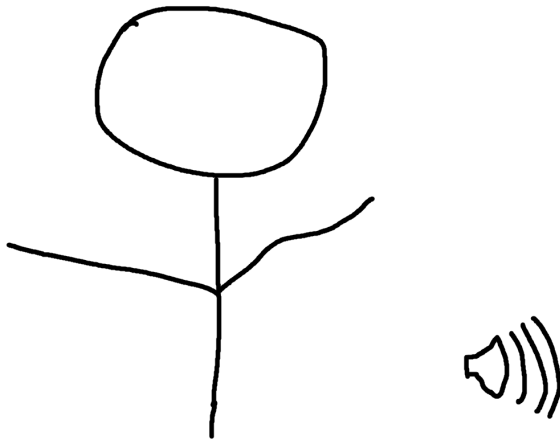


Figure C.3.2: Recorded Audio

The characters' voices will be created by recording our own. This audio can play alongside a video. The benefit to recorded audio is that it is more immersive than some of the other alternatives, while still having control over the course and direction of the program.

4. Subsystem D: Main Menu

4.1 Aura

The main menu has a basic design with a start and exit button to start the simulation or leave. There will be a button about the project, and it will explain the purpose of our project and what we are trying to achieve. After pressing the start button, a window will pop up and show different experiences that the user can try, as shown in Figure D.4.1. When the user clicks a topic, the simulation will begin. This window will have a button that will take the user back to the main menu.

The “How Can I Help” button from Figure D.4.1 will then open another window where the user can see links to websites that can give them more information about the topic, as shown in Figure D.4.1. This window will have a button that will take the user back to the main menu.



Figure D.4.1: Aura's Main Menu

4.2 Leah

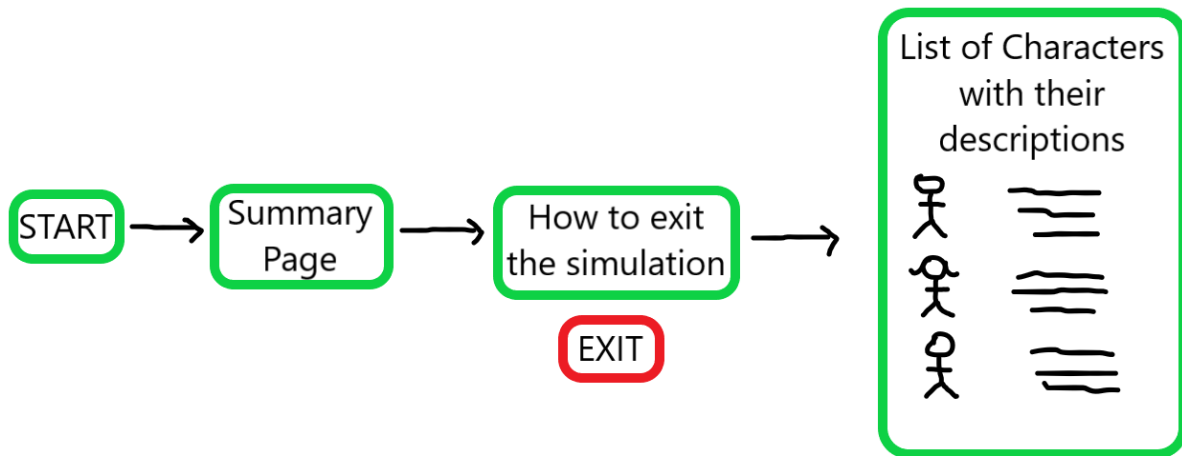


Figure D.4.2: Leah's Main Menu

The user will begin by clicking start. Then a summary page will appear explaining what the simulation is, why it was made, and what to expect throughout the experience. After

the user clicks “Continue”, another page will appear and will describe to the user how they can exit the simulation if they ever feel uncomfortable (but clicking the “EXIT” button). After the user clicks “Continue”, a list of characters with their descriptions will appear for the user to select. Once the character is selected, the simulation will begin.

4.3 Jasen

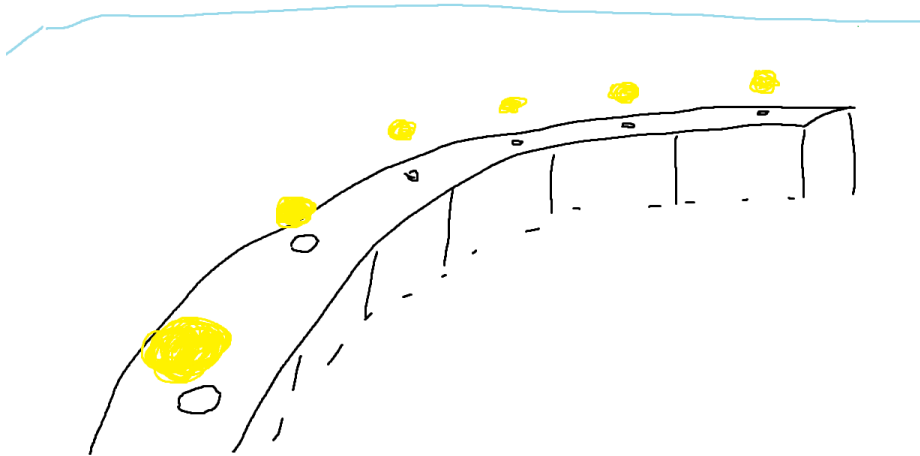


Figure D.4.3: Jasen’s Main Menu

Simple and intuitive menu where the user picks up an orb which represents a “memory” or scenario. Information about that scenario will then be displayed, the user can then enter that scenario and start.

5. Analysis and Evaluation:

Table 1 summarizes the disadvantages and advantages of each option for each subsystem. This table is what will help to assign numerical scores to each option for Table 2.

Table 1: Comparison of Subsystems’ Options

Subsystem	Options		
Subsystem A	Option 1.1	Option 1.2	Option 1.3
	1.1 Aura’s narrative Advantages: → No need to be wary about accidentally portraying an	1.2 Leah’s narrative Advantages → Allows for different perspectives (bystander and character)	1.3 Jasen’s narrative Advantages: → Lighter tone, not as serious. → Gives more freedom

	<p>inaccurate, first-person experience of a minority → Can do more topics since storyline is simple → Simulation will definitely be within time limit (5 minutes) because narrative is simple</p> <p>Disadvantages: → Only has user as aggressor, does not have them in perspective of the discriminated character → Repetitive storyline → Only teaches user to recognize subtle discrimination, not how to interact with bigots and deescalate conflicts with them → Only shows negative aspects of empathy</p>	<p>→ The user can learn how discriminatory acts affects the character by witnessing them reflect → The user can learn how to intervene and comfort their character → Storyline is straightforward and allows for user interaction</p> <p>Disadvantages → Repetitive storyline → User may not feel comfortable playing the character who is experiencing discriminatory acts → The user only experiences intervening once at the end of the simulation</p>	<p>to the user to choose what moral they want to take away from the experience.</p> <p>Disadvantages: → Not as personal, so the user may not be as invested → If too loose, the core message may not get across to the user.</p>
Subsystem B	Option 2.1	Option 2.2	Option 2.3
	<p>2.1 video Advantages: → Allows for the most realistic environment. → Easy to use and replicate for different scenarios. → Flexible in terms of duration and creativity.</p> <p>Disadvantages: → Requires finding places to film which will accurately demonstrate the scene → Finding a place where bystanders will not get caught on camera → Getting permission to film in areas</p>	<p>2.2 stitched pictures Advantages: → Not too difficult to incorporate → Allows coverage of a wider area (achronological movement)</p> <p>Disadvantages: → Too many paths can make the experience long → Editing and stitching can take a long time</p>	<p>2.3 3D models Advantages: → Can potentially be extremely immersive → Can present objects that are more complicated/don't have access to.</p> <p>Disadvantages: → The most time consuming option → Might be too expensive for our budget → Can potentially look bad if not enough development was invested</p>

Subsystem C	Option 3.1	Option 3.2	Option 3.3
	<p>3.1 Text Dialogue Advantages: → User has time to reread their answer options → Less time consuming to insert text boxes</p> <p>Disadvantages: → Less immersive → If text is too small, will not be comfortable for the user to read</p>	<p>3.2 Recorded Audio Advantages: → The simulation is more immersive and allows for a more realistic experience</p> <p>Disadvantages: → More time consuming to record and edit audio clips</p>	N/A
Subsystem D	Option 4.1	Option 4.2	Option 4.3
	<p>4.1 Aura main menu Advantages: → Easy navigate because it is so simple → Easy for user to find more information about topics → Easy for user to leave simulation</p> <p>Disadvantages: → Cannot alter things like speed of character's speech or text size → Aesthetic does not convey serious tone</p>	<p>4.2 Leah main menu Advantages: → User can quickly navigate through main menu → User clearly gets informed about the simulation and how to exit → The character descriptions allows the user to further understand what experiences they will go through (which allows them to make a more informed decision)</p> <p>Disadvantages: → No creative element → Very basic design</p>	<p>4.3 Jasen main menu Advantages: → Simple to use → Easy to expand/modify</p> <p>Disadvantages: → Minimal display of information about each scenario.</p>

Based on the criteria from the previous deliverable, we can assign them to a specific subsystem and give the options a score in Table 2. The previous deliverable also assigned criteria a certain weight based on their importance, which was determined in Deliverable C.

Table 2: Assigning Criterion to Subsystems and Ranking the Subsystems' Options

Weighting (1-5)	Criteria	Options
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Subsystem A		Option 1.1	Option 1.2	Option 1.3
3	Duration	3	3	3
1	Number perspectives	1	2	2
4	User experience	1	2	3
Subsystem B		Option 2.1	Option 2.2	Option 2.3
5	User interface	3	3	1
2	Cost	3	3	1
5	User experience	2	2	3
4	Technical attributes	3	2	1
Subsystem C		Option 3.1	Option 3.2	N/A
5	User experience	2	3	
4	Technical attributes	3	2	
Subsystem D		Option 4.1	Option 4.2	Option 4.3
5	User interface	3	3	3

Note. For ranking options: 1 is the worst and 3 is the best. For weighting: 1 is the worst and 5 is the best.

The figures below are a final scoring of each option for each subsystem from the ratings of Table 2. They are categorized into the best, midrange, and worst options. For all of scores in the figures, 1 is the worst and 3 is the best.

Subsystem A					Better
Weight	Criteria	Option 1.1	Option 1.2	Option 1.3	Midrange
3	Duration	3	3	3	Worse
1	Number of perspectives	1	2	2	
4	User experience	1	2	3	
Total		14	19	23	

Figure 5.1: Quantitative Ranking of Subsystem A

User experience in this subsystem was rated based on how positively the user would feel about each storyline. Negative experiences, like ruining a friendship, will likely cause a user to feel negative emotions, which causes it to be given a low score.

Number of perspectives is how many points of view the user can experience in the simulation and because this project's goal is to increase the empathy the user will feel for characters, the more perspectives the better.

Subsystem B					Better
Weight	Criteria	Option 2.1	Option 2.2	Option 2.3	Midrange
5	User interface	3	3	1	Worse
2	Cost	3	3	1	
5	User experience	2	2	3	
4	Technical attributes	3	2	1	
Total		43	39	26	

Figure 5.2: Quantitative Ranking of Subsystem B

User experience in this subsystem was scored based on how immersive and realistic the visuals of each option were. Technical attributes refer to how many possible bugs might come up, making it disorientating for the user and harder for the developer to solve. User interface refers to how easy the simulation will be to navigate for the user.

Subsystem C				Better
Weight	Criteria	Option 3.1	Option 3.2	Midrange
5	User interface	2	3	Worse
4	Technical attributes	3	2	
Total		22	23	

Figure 5.3: Quantitative Ranking of Subsystem C

Technical attributes refer to how many possible bugs might come up, making it disorientating for the user and harder for the developer to solve. It was noted that incorporating text dialogue would be simpler, but audio recordings would be more immersive. User interface in this subsystem refers to how easy the simulation will be to navigate for the user, as well as how clear the audio/ text options will be.

Subsystem D					Better
Weight	Criteria	Option 4.1	Option 4.2	Option 4.3	Midrange
5	User interface	3	3	3	Worse
Total		15	15	15	

Figure 5.4: Quantitative Ranking of Subsystem D

User interface refers to how intuitive the main menu is, and if it is clear and informative to the user.

Table 3 displays the highest scoring options for each subsystem. It will help to determine which options to focus on and modify.

Table 3: Highest Scoring Options for Subsystems

Subsystem	Option
A	1.3
B	2.1
C	3.2
D	Mixture of options 4.1, 4.2, and 4.3

6. Modifications and Final Selection:

Subsystem A

Option 1.2 and Option 1.3, Leah’s narrative and Jasen’s idea, are best suited for this project. Option 2 can contain the necessary negative experiences a minority can face, and Option 3 can portray happier experiences, like festivals or parades, that can introduce the user to joyful aspects of minority identities. Option 2 and 3 can also seamlessly combine together because of their more abstract nature, making them ideal when mixed.

Subsystem B:

Option 2.1, video recording, was chosen for Subsystem B because of its high score. It is easier to navigate compared to 3D modeling, and its technical attributes are better than image stitching because the quality depends on the skill of the developer and the time spent on it.

Subsystem C:

Option 3.2, recorded audio, ranked the highest. Therefore, throughout the majority of the VR, the characters' dialogue will be created by using voice recordings, probably our own. However, text dialogue nearly has the same score as recorded audio, so it will still be used when the user needs to select a response. This way, the user will have more

time to correctly make a choice. By using a mixture of both options, with the project mainly using audio recording, the user will have a more enjoyable experience.

Subsystem D

All menu options ranked equally, and therefore a mixture of the three will provide the best option. The creativity of Option 4.3 can be included where the user picks up an orb which represents a “memory” or scenario. The “How can I Help?” button from option 4.2 can be included to provide the user a variety of links to websites that can give them more information about the VR experience and the related topics. The character list from Option 4.1 can be included to provide the user with additional background information about the character(s) before they start the simulation.

Therefore the main menu will look like the following:

1. A message will be displayed on the screen telling the user to press start.
2. Once clicked, a message will appear on the screen telling the user to click the “About Project” button and “How Can I Help” button if they want more information.
3. After clicking continue, a message will appear to tell the user about the “Exit” button which they can click to exit the simulation if they ever feel uncomfortable.
4. When the user clicks continue, a character list will appear with the description of the character(s) the user will be playing throughout the experience.
5. After clicking on the desired character, the orb menu will appear. By clicking on an orb, information about that scenario will then be displayed. The user can then enter that scenario by clicking start.

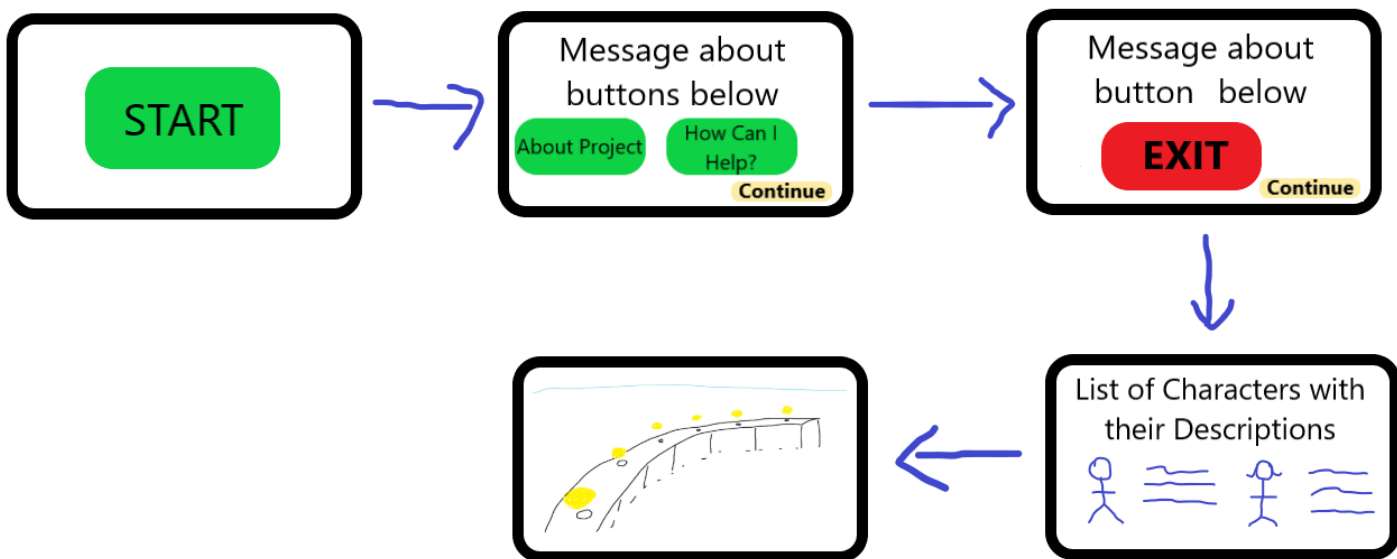


Figure 6: Modified Menu

Conclusion:

After the subsystems of the simulation were created and ideas generated by all team members were ranked, we were able to derive a final, preliminary solution for the project. All the options received a score based on how well they satisfied the criteria from Deliverable C. If the client approves of this final solution, we can move forward with Deliverable E.

Reference:

[1] Brackeys. "Make your Characters Interactive! - Animation Rigging in Unity," *Youtube*, Jun 21, 2020 [Video file]. Available: <https://www.youtube.com/watch?v=Htl7ysv10Qs>. [Accessed: Feb 12, 2022].

Wrike Link:

<https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=rgELW4MO68CCZSneBNc3dazLe5FvPe6i%7CIE2DSNZVHA2DELSTGIYA>