Department of Engineering

GNG 1103

Deliverable C - Design Criteria and Target Specifications

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Introduction

Due to the current pandemic, tensions amongst people have erupted into hateful and discriminatory behaviour and actions towards everyone. As a potential solution to this issue, Professor Anis Hanin from the University of Ottawa, as a client, has requested for a Virtual Reality (VR) simulation that will increase a user's empathy towards everyone but mainly minorities.

In this deliverable, we will focus on the design criteria and target specifications of the project. Based on the needs analysis from Deliverable B, we can derive a few primary design criteria as well as a list of functional and nonfunctional requirements.

Design Criteria and Specifications

Table 1: Design Criteria/Metric

Metric	Value	Unit
Duration	10	minutes
Cost	50	Canadian dollars
Number of perspectives	3	none
Set-up time	10	minutes
Program size	1	Giga Bytes

Table 2 will help to determine which idea has the best features to be a plausible solution by listing out constraints, functional requirements, and non-functional requirements that are based on the list of needs from the previous deliverable. This table can have both qualitative and quantitative specifications.

Table 2: Design Specification for Functional, and Non-functional Requirements of the Solution

Rank	Design Specification	Relation	Value	Units	Verification
Functional					
5	Tells a story (user experience)	=	yes	N/A	analysis
5	Conveys a message (user experience)	=	yes	N/A	test
3	Varied perspectives (perspectives)	=	yes	N/A	analysis
4	Has to use virtual reality (technical)	=	yes	N/A	analysis
Nonfunctional					
5	Non-disorienting (user experience)	=	yes	N/A	test

4	Intuitive to navigate (user interface)	=	yes	N/A	test
4	Bug free and reliable (technical)	=	yes	N/A	test
2	Short duration (duration)	=	yes	min	test
Constraints					
1	Cost	<	50	$	analysis
4	Provided in English (technical)	=	yes	N/A	test
	Age	>	18	years	analysis

The most important needs that are from Deliverable B are having an experience that causes the user to feel empathy and the solution using VR. Having the VR be more realistic will help immerse the user in the simulation and potentially have them feel more empathetic for characters in the VR simulation. More perspectives will not impact how immersive the simulation is for the user, but the objective of the project is to foster empathy towards everyone, which is why it is given a mid-rank of 3. The non-functional requirements are not necessary for the solution to technically work, but are important for the solution to be more effective. Having it be easy to navigate, being free from technical errors, and being non-disorientating can increase the immersive effect of the simulation. Ideally, the duration should be short because the lead users are the people on the university's campus, so they will usually be students or employees who are busy. However, the duration of the simulation is not a constraint, so it is not ranked as highly important. A new requirement to implement into our VR is an easy way for the user to exit the simulation if they ever feel uncomfortable. This can be done by having a clearly visible exit button on screen at all times. This is an important requirement as our VR will portray sensitive topics which may not be suitable for all users.

The main constraints for this project are that the project should be in English because this is the English section of this course and it should be fifty dollars or less. The project will not likely exceed fifty dollars because the main component is dependent on how well the VR simulation is programmed, which is dependent on our skills and not the budget. That is why the cost constraint is given a rank of 1. It is assumed that the user understands English because this project was assigned to the English section of this class, so it is given a high ranking for its importance.

It is difficult to quantify the amount of empathy and the type of empathy a user should gain after experiencing the simulation. Ideally, the user should feel greater amounts of emotional and cognitive empathy to the extent that they recognize situations of subtle discrimination and become more proactive in prevent those situations. However, empathy needs to be practiced or often used to effectively increase, and we are assuming that the goal of the project is to maximize the amount of empathy a user will feel with the least amount of uses [8]. To overcome this challenge, we will have to base our measurement of the simulation being able to invoke empathy based on a multiple use basis. We can also provide a mini test afterwards to the user that will have multiple scenarios and ask the user if they could find anything that could cause conflicts.

Benchmarking

Table 3: Listed Qualities of Competitor Products

Product name and product number	Duration (mins)	User interface/ ease of use (1-5)	Cost to use (CA $)	Number of perspectives (characters)	Positive : negative experience/reviews	Product rating (technical attributes) (%)
CJ - 1	12 [1]	No ratings found	0 [1]	1 [1]	Mainly from written, non-rated reviews [8]	No product ratings found
BAHE - 2	7 [3]	1 [2]	0 [3]	1 [3]	7:4 [2]	53 [2]
VRET - 3	8.17 [4][5]	5 [6]	0	4 [4][5]	Mostly positive	No product ratings found

1. 1000 Cut Journey (CJ) is an immersive VR narrative where the user lives the life of Michael Sterling, a Black man, from childhood to adulthood. The user experiences the daily struggles of a Black person in America.

2. Becoming Homeless: A Human Experience (BAHE) is another VR narrative where the user experiences the process of becoming homeless and homelessness itself.

3. Virtual Reality Empathy Training - Schizophrenia and Autism Module (VRET) is a 360 degree VR experience created by Axon to provide training to police officers so that they can properly resolve confrontations with a variety of individuals. In this simulation, users are able to experience two different situations: a schizophrenic individual and the other with an autistic individual. The user can become the officer, as well as the individual with autism or schizophrenia.

Table 4: Qualitative Technical Benchmarking of the Competitor Products

		Product Number					
Specifications for VR program	Weight	1	2	3		Better	
Duration (min)	2	12	7	8.17		Midrange	
Cost (CA $)	1	0	0	0		Worse	
User interface (1-5)	4	N/A	1	5			
Number of perspectives	3	1	1	4			
User experience (review)	5	N/A	Mostly positive	N/A			
Technical attributes	4	N/A	Too many	Not many			

Table 5: Quantitative Technical Benchmarking of the Competitor Products

Specifications for VR program	Weight	Product Number				Better
		1	2	3		Midrange
Duration	2	1	3	2		Worse
Cost	1	3	3	3		
User interface	4	1	1	3		
Number of perspectives	3	1	1	3		
User experience (review)	5	1	2	1		
Technical attributes	4	1	1	2		
	Total	21	30	41		

The specifications listed above were ranked in order of importance, 1 being the least and 5 being the most important. It was decided that the cost and duration were not specifications of high importance as the main goal of the VR is to educate the public and make them feel empathetic towards minorities. This is why the user interface, the technical attributes, and the user experience were significantly more valuable.

Then they were ranked against each other as shown with the coloured boxes, as shown with the legend. All of them are free to use, and were therefore ranked highly for that specification, but this was not a major priority for the client. It can be concluded that CJ lacked most of the needed specifications as there were limited sources of information, but its concept most closely matches what our VR will try to portray. BAHE had ranked second as it had mainly positive reviews and was the shortest VR experience which is something worth considering when creating our VR. It is important that our VR experience is impactful yet short and to the point as the lead users do have busy schedules. VRET had the best ranking as it not only had great technical attributes, but a variety of perspectives that the user could experience.

Our VR experience would be most impactful if the user were able to take on the role of a variety of minority groups, and have the option to select which one they are willing to learn about. One of our clients' needs was that the VR be educational and accessible, therefore it is important that if a person from a minority group chooses to participate in the VR, they would be able to choose a character other than themselves.

Reflection

After reflecting on the client meeting and doing research about Virtual Reality's (VR) capabilities, we have discovered and analyzed that VR potentially may not be the best way to convey empathy to an outside user [8]. Therefore, it may be difficult to convey empathy by directly putting the user directly in the shoes of minority groups in VR. Some alternatives would be to look for a different approach while still achieving the goal to create a level of understanding. We can do this by targeting situational understanding instead of directly through a person's perspective. The user can also take a bystander role and interact with the character who will be facing difficult experiences rather than being the character themselves. Some alternatives like these have been successful in movies and videos, so a VR version

could prove effective. But the best way to confirm these questions would be to pose them directly to the client.

Conclusion

After a few rounds of analysis, the design criteria table was created to give us a clear picture of the needs and specifications for the product. We then compared them to similar products to get a better sense of the necessary criteria to build our product. We also reflected on the client meeting a bit more as well as did some of our own research. With these steps complete, the conceptual design can be accomplished.

Wrike Link

https://www.wrike.com/frontend/ganttchart/index.html?snapshotId=H2cHvdrpbIhT4hEwZApEJLQ2K3gjbY7O%7CIE2DSNZVHA2DELSTGIYA

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[8] Virtual Reality Improves Emotional but Not Cognitive Empathy: A Meta-Analysis · Volume 2, Issue 1 (apaopen.org)