

DELIVERABLE D: CONCEPTUAL DESIGN

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1. Introduction

This technical document describes the conceptual design subsystems designed by each of our team members for a virtual reality experience for our client, Mines Action Canada. Our design will aim to minimize the production and development of autonomous weapons by people of authority. It will provide users with an emotional yet interactive virtual reality experience that displays a variety of scenarios and consequences that are caused by autonomous weapons.

2. Subsystems

i) *Environment*

ii) *Storyline*

iii) *Coding*

iv) *Audio*

2.1 Analysis of Subsystems

i) *Environment* - Conceptual design of the environment to be featured in the virtual reality experience. The environment should encompass ideas from the user/customer needs and reflect the interpreted needs and subsequently design criteria

ii) *Storyline* - The series of events which the VR experience should follow. According to user needs, a simple and short storyline should be prioritized. storylines should function with any environment and place as few constraints on coding as possible to allow for seamless interchangeability of any given storyline with respect to the other subsystems.

iii) *Coding* - The general form that the code for the VR experience should take. As we currently have little to no knowledge of unity, generated subsystem solutions should provide a general concept of the scope of coding/programming. Things like permissible movement and interactivity with the environment should be described.

iv) *Audio* - The audio and sound that will accompany the VR experience. This encompasses both any potential dialogue and sound effects.

2.2 Brainstorming using Subsystems

In the brainstorming process, each member of the group came up with one concept for the project (5 concepts total). Each member brainstormed a specific environment, storyline, coding plan and audio based on their concept idea. To clarify, comments were added as well. Our concepts were generated based on our problem statement, benchmarking and our list of prioritized design criteria from the previous deliverable. The brainstorming process allowed us to generate our final three concept ideas.

Table 2.2.1 Brainstorming of Ideas for VR Experience Subsystems

Team Member	Notes on Subsystems: 1. Environment 2. Storyline 3. Coding	Other Comments:
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	4. Audio	
Ashna	<p>1. Environment</p> <ul style="list-style-type: none"> - A public school with children playing outside during recess break - Time: noon (around lunch time) - Weather pre-climax: sunny, warm <p>2. Storyline</p> <ul style="list-style-type: none"> - Children are playing outside, looking forward to going back inside to eat lunch - Suddenly, weather changes and sky is swarming with fighter jets carrying autonomous weapons - Children are running away but aren't fast enough (screen cuts black) - Screen rotates around as child is looking around, visuals of what is going on around the child should be clear - A pitchblack scene is shown (child is dead) and background sounds like a funeral taking place <p>3. Coding</p> <ul style="list-style-type: none"> - The code for this concept should be as simple as possible - Motion should only be added to objects where motion is necessary <p>4. Audio</p> <ul style="list-style-type: none"> - Noise of child's emotions (laughter, crying etc.) - To remove the language barriers, no audio but more emphasis on body language and facial expressions - Music in the background depending on the situation being faced 	<p>The goal of this idea is to depict the "incident" happening in the midst of a child living their normal life. The storyline is very straightforward and easy to follow and is meant to be as simple as possible for the viewer to understand. There is less emphasis on the actual violence, and more emphasis on the results post-violence.</p>
Shyma	<p>1. Environment</p> <ul style="list-style-type: none"> - Escape Room type - Nuclear plant power gone wrong - Flight simulator: no pilot plane is fully controlled by killer robots - Realistic places where most people 	<p>Would prefer if there was more than one scene/scenario that illustrates the dangers of autonomous weapons. This would allow for users to have a greater chance of understanding said dangers. Some examples I gave of the</p>

	<p>have been: grocery store, airport, schools, park</p> <p>2. Storyline</p> <ul style="list-style-type: none"> - Simple yet intriguing - Short - Relatable aspects - Emphasis on the main conflict: autonomous weapons and killer robots - 60 secs total <p>3. Coding</p> <ul style="list-style-type: none"> - Again, must be simple - Easy to read, understandable - Efficient <p>4. Audio</p> <ul style="list-style-type: none"> - Dramatic sounds: screaming - Weapons crashing - May be loud at times to demonstrate the fear and horror that may be caused by these weapons - No music 	<p>environments may seem complicated, however they would be great at demonstrating the dangers of autonomous weapons providing a greater impact on the clients.</p>
Bryn	<p>1. Environment</p> <ul style="list-style-type: none"> - Desolate urban environment - No human presence visible - Signs of killer robot presence (i.e signs warning of their presence) - Signs of human adaptation to the new reality (Laser pointers to mess with robot sensors?, etc.) <p>2. Storyline</p> <ul style="list-style-type: none"> - Very simple storyline - Very short (1min or less) - Linear, no deviations - Effectively just the viewer walking through the environment taking in the gravity of the situation - One continuous scene <p>3. Coding</p> <ul style="list-style-type: none"> - No interactivity with objects around the viewer - Movement permissible in all directions but restricted by environmental and storyline 	<p>I placed a large emphasis on simplicity. The client made it very clear that the scope of the project will limit the quality of the final product. As such, I think that we should focus on creating simple subsystems (and thus solutions) and ensuring that the final product is excellent in the areas we have chosen to focus.</p>

	<p>considerations</p> <ul style="list-style-type: none"> - All assets used are copyright free <p>4. Audio</p> <ul style="list-style-type: none"> - Very simple audio (footsteps, etc.) - Lack of audio emphasizes desolate nature of environment - Audio does not hamper experience and offers viewer a chance for reflection - No copyrighted audio 	
Manoel	<p>1. Environment</p> <ul style="list-style-type: none"> - Show something familiar but uneasy. - Regular city/town area but with the new influence of killer robots - Face scanning centers - Robots roaming around with the humans as security <p>2. Storyline</p> <ul style="list-style-type: none"> - A walk around the dystopian city/area - Simple story. - Something relatable by all people around the world. - Best to have something that seems normal begin to break, to build some kind of creepiness - 2+ min epic. <p>3. Coding</p> <ul style="list-style-type: none"> - Add code to all the objects so that they function as expected in real life. - The human character is easy to control - Add the ability to move objects using your hands in the VR world. - Have the game is running <p>4. Audio</p> <ul style="list-style-type: none"> - Best to have no audio, this will help not confuse people in the EU that don't understand english. - The environment should have music in the background for the mood. - Footstep sounds when the 	Less than 2 mins is hard to do correctly.

	<p>character moves around</p> <ul style="list-style-type: none"> - Make the world seem real with realistic audio when the character interacts with objects. 	
Keegan	<p>1. Environment</p> <ul style="list-style-type: none"> - Inside of a mall during an AI caused power outage. - Hospital setting which is mistaken for a terrorist hideout. - Common housing complex with AI police roaming around - Environment with warning signs/symbols of killer robot zones. <p>2. Storyline</p> <ul style="list-style-type: none"> - Needs to be simple and plausible - Client wants the user to have little to no options, the story is just what we make - A relatively normal surrounding which gives hints to what's happened then followed by one big last scene, maybe the player has to hide from incoming robots. - Something simple like a stroll around a broken new world, setting could be anything that exists now. <p>3. Coding</p> <ul style="list-style-type: none"> - Little to no actual interaction, essentially the rollercoaster VR experience - Make sure any in game sound is fairly realistic and copyright free - Needs to be realistic, most of the group haven't coded with unity - Consider enclosed settings so we don't have to add outdoor environment things. <p>4. Audio</p> <ul style="list-style-type: none"> - Not allowed to be copyrighted - Mostly used for ambiance, so music, sound effects - Little to no audio in any language 	<p>The overall project must be simple and cheap but it needs to convey the clients desired message. It would be nice to have no character dialogue as it seemed to take away from the experience from last year's projects. Coding is difficult to talk about as I still lack knowledge related to unity. I like the idea of using a high tension hiding scene, we could include lights to infer there's a robot chasing, but just never have the player turn to face it, then just cut to another scene. I think it would take roughly one minute to convey this idea.</p>

Table 2.2.2 Benefits and Drawbacks for each VR Experience Subsystem

Members	Benefits	Drawbacks
Ashna	<ul style="list-style-type: none"> Provides specific weather, time and location 	<ul style="list-style-type: none"> Less detail for coding
Shyma	<ul style="list-style-type: none"> Provides a variety of environment ideas that can be used against different subsystems 	<ul style="list-style-type: none"> Less detail for coding Not specific, does not stick to one idea → too abstract
Bryn	<ul style="list-style-type: none"> Emphasis on simplicity 	
Manoel	<ul style="list-style-type: none"> Simple concept 	<ul style="list-style-type: none"> Provides generalizations → not descriptive enough
Keegan	<ul style="list-style-type: none"> Great storyline with balance of simplicity 	

3. Consolidation

3.1 Tables

In order to select the optimal solution for each particular subsystem, we will adopt a table that will evaluate each idea based on our design criteria from deliverable C. The grading/point system is outlined below and will evaluate each brainstormed concept based off of how well it fulfills each design criteria

Table 3.1.1 Grading Point System for Brainstormed Ideas:

Poor	Satisfactory	Excellent
1pt	2pt	3pt

Table 3.1.2: Grading of Brainstormed Ideas Based on Grading System - Environment

Specification	Ashna	Shyma	Bryn	Manoel	Keegan
Realism	3pt	2pt	2pt	2pt	2pt
Relatability	2pt	2pt	1pt	2pt	1pt
Emotional Impact	3pt	2pt	2pt	3pt	2pt
Understandability	3pt	3pt	3pt	3pt	2pt
Human Adaptation	1pt	1pt	3pt	2pt	2pt
Risk Depiction	1pt	2pt	1pt	2pt	2pt
TOTAL:	13pt	12pt	12pt	14pt	11pt

Table 3.1.3: Grading of Brainstormed Ideas Based on Grading System - Storyline

Specification	Ashna	Shyma	Bryn	Manoel	Keegan
Video Length	3pt	3pt	3pt	2pt	3pt
Realism	2pt	2pt	3pt	3pt	2pt
Relatability	2pt	1pt	3pt	3pt	3pt
Emotional Impact	3pt	3pt	1pt	1pt	3pt
Understandability	2pt	2pt	2pt	2pt	3pt
Human Adaptation	1pt	1pt	1pt	1pt	1pt
Risk Depiction	1pt	1pt	1pt	1pt	1pt
Copyright	3pt	3pt	3pt	3pt	3pt
Violence/Gore	2pt	2pt	3pt	3pt	2pt
Story Complexity (Lower is better)	1pt	2pt	3pt	3pt	3pt
TOTAL:	20pt	20pt	23pt	22pt	24pt

Table 3.1.4: Grading of Brainstormed Ideas Based on Grading System - Coding

Specification	Ashna	Shyma	Bryn	Manoel	Keegan
Character movement	2pt	2pt	3pt	1pt	2pt
Interactive objects	2pt	2pt	1pt	1pt	3pt
Complexity	3pt	3pt	3pt	2pt	3pt
TOTAL:	7pt	7pt	7pt	4pt	8pt

***Note:** all the above specifications should be low in order to meet the expected standards

Table 3.1.5: Grading of Brainstormed Ideas Based on Grading System - Audio

Specification	Ashna	Shyma	Bryn	Manoel	Keegan
Copyright	2pt	3pt	3pt	2pt	3pt
Character dialogue	1pt	1pt	1pt	1pt	1pt
Included languages	3pt	2pt	2pt	2pt	2pt
TOTAL:	6pt	6pt	6pt	5pt	6pt

3.2 Top Three Solutions

Based on the tables above, we are able to identify which member's design concept meets the standard design criteria set based on our user needs. We are able to mix and match the subsystem ideas to generate three fully functional solutions. The top three solutions are the following:

Table 3.2: Top Three Solutions and Corresponding Subsystems

	Environment	Storyline	Coding	Audio
Solution #1: Optimal	Manoel	Keegan	Keegan	Everyone
Solution #2: More Ambitious	Shyma	Ashna	Manoel	Everyone
Solution #3: Middle Ground	Ashna	Bryn	Bryn	Everyone

The first solution is the optimal (which is to say preferred) solution and emphasizes simplicity. It is further described in section 3.3. Secondly, the team decided upon a more ambitious solution as the second potential solution. It encompassed Shyma's more diverse, but complex environment concepts, along with Ashna's very fleshed out, but potentially complex and difficult narrative. It also encompassed Manoel's ideas for the code, which placed emphasis on interactivity with any and all objects/surroundings. It featured everyone's ideas for the audio subsystem as detailed below in section 3.3.

The final solution was somewhat of a middle ground between the simplistic approach of the optimal solution and the more ambitious second solution. Ashna's environment was selected, as it was still rather simplistic, but more specific and could be worked into the other selected subsystems. As for the storyline, Bryn's was selected, as was his code, which emphasized freedom of movement, but was much stricter in terms of interactivity.

3.3 Best Global Concept

Based on our analysis and evaluation of the top three solutions, our global concept is clearly the first solution. It is optimal and it meets all/most of our design criteria. The client emphasized the importance of simplicity and this is demonstrated best through the first solution. Manoel's environment consisting of a desolate looking city was the simplest and Keegan's idea of a simplistic series of events followed by a climactic event balanced simplicity and ambition well. Furthermore, Keegan's coding ideas emphasized simplicity with simple, but realistic character movements and levels of interactivity. In terms of audio, the team all had very similar ideas, thus a collective agreement was forged. It was decided that the audio should be copyright-free, have little to no dialogue and not be hampered by language barrier, (no dialogue could help in that situation) for all solutions.

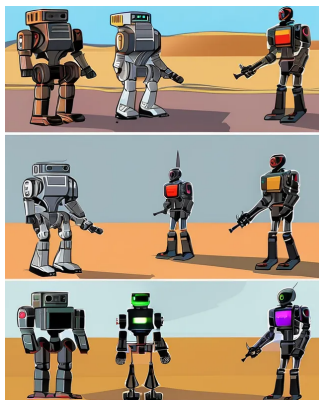
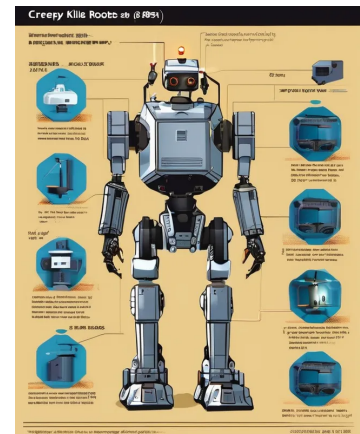
4. Conclusion

In conclusion, each of our team members came up with their own individual ideas of a conceptual design for each subsystem. We fairly rated each of our team members' ideas for each subsystem provided an aspect of each team member.

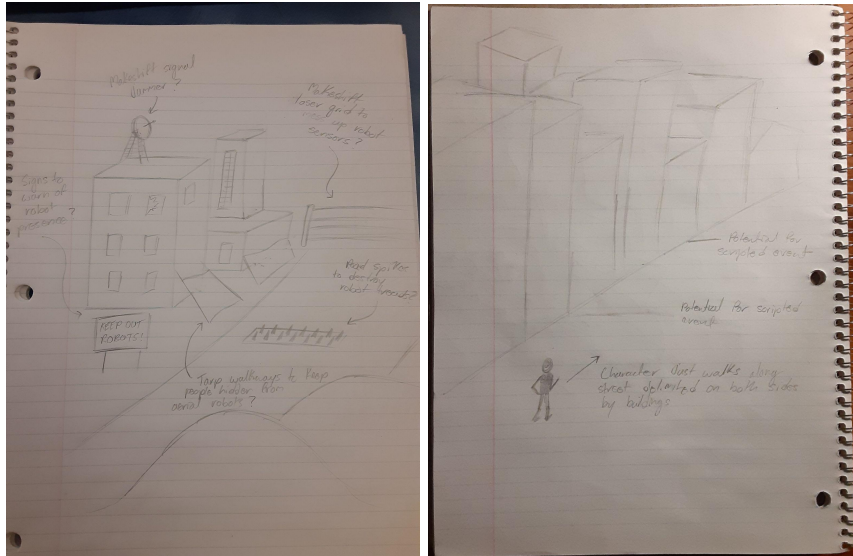
It should be noted that there were a select few aspects/specifications of given subsystems that all team members were given a singular point for (storyline: human adaptation and risk depiction, Audio: character dialogue). This implies that no team member properly made any considerations to address this particular specification. This could mean one of two things; the specification is irrelevant, or the subsystem proposition must be fleshed out further. In the case of character dialogue, the team unanimously agreed that omitting dialogue of any kind would simplify the final project and potentially eliminate any language barrier, thus it fell under the former condition, as did risk depiction (the purpose of this criterion was not well understood - an indication that it was perhaps irrelevant). In the case of human adaptation, it was determined that this specification was of great importance and relevance, and thus subsystem ideas/propositions should be further fleshed out in order to ensure a solution of higher quality and overall relevance. There is potential to somewhat remedy this issue as solutions are proposed in greater depth (now that the general concept/form of a solution has been decided).

5. Appendix

5.1 AI Generated Images for Environment (Manoel):



***L*) and Storyline (*R*) (Bryn):**



AI Generated Image for Environment (Shyma):



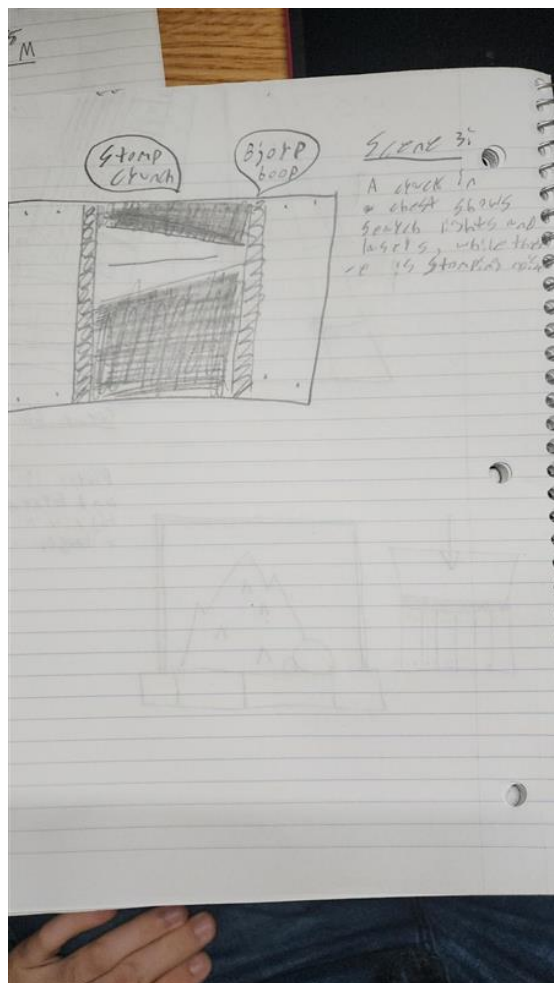
AI Generated Images for Storyline (Ashna):



AI Generated Sketches for Environment (Ashna):



Sketches for Storyline/Environment (Keegan):



CLIENT MEETING:

<https://docs.google.com/presentation/d/15SVRFvmbgVzAaPSwglO67F28hLogFYKgF6Og8akmdDY/edit?usp=sharing>

Potential Design Solutions	Concept
1-Walking in city idea	<ul style="list-style-type: none">• User walking around a normal surrounding (typical city)• At first, everything looks normal and familiar (0 -15s)<ul style="list-style-type: none">→ the environment could include lots of tall buildings to limit the amount of coding that needs to be done to the environment• As the user keeps walking (at x distance), the environment starts changing around them (could include animations?)• The city is slowly evolving into an environment under the influence of autonomous weapons (15 - 50s)<ul style="list-style-type: none">→ warning signs around→ red lasers→ pollution/smoke→ face scanning centers everywhere→ killer robots roaming around with humans as security→ shelters covered up→ other characters in the environment running around, hiding etc. through body language and facial expression• As the user keeps walking down the street, the intensity of the damage increases<ul style="list-style-type: none">→ sound in the background is getting louder and more intense• At the end, audio of someone yelling (50 - 55s)<ul style="list-style-type: none">→ ‘They’re coming!’→ “Watch Out!”→ “Duck! Run!”... and scene cuts black→ maybe indirectly implying that at that moment, the user has become part of the environment• Scene cuts black (55 - 60s)<ul style="list-style-type: none">→ message pops up about the downside of autonomous weapons “If we don’t ban autonomous weapons, this could be our future - is this what you want?” <p>It’s a simple idea that portrays how the influence of autonomous weapons can affect civilians. The user is simply walking through an environment almost as an “invisible person” and is experiencing the environment around them.</p> <p>In terms of coding, there is little to no actual interaction between the user and the environment. There are mainly only interactions between the environment and the objects in the environment. The experience looks fairly realistic and is copyright free.</p>

2-From the machines perspective	<ul style="list-style-type: none"> • Starts from the perspective of a killer robot (first 30s) <ul style="list-style-type: none"> ◦ Thermal vision / infrared vision? • Scene of robot looking around and evaluating targets <ul style="list-style-type: none"> ◦ Show sensor data and text evaluating the target ◦ Why are they dangerous? What are the threats? • Halfway through scene changes to normal human vision (Last 25-30s) • “Threats” now appear as normal humans going about their daily lives • Maybe a message flashes at the end <ul style="list-style-type: none"> ◦ “How does this make you feel”or something to that effect? • Sound effects: Dog barking, kids playing, construction <p>Design solution two would be a considerable amount of coding because it would involve changing views between characters, interacting with items related to the story(“example item”), and visual effects.</p>
3-Children in school	<ul style="list-style-type: none"> • Kids minding their own business, Playing outside • Get attacked by the robots that are supposed to protect the people. • The world gets progressively worse, like depending on distance or in game time. • In the environment there could be Smoke, Smog, Fighter jets/ drones, Kids running around in fear/ crying /hiding. <p><u>Basic story:</u></p> <ul style="list-style-type: none"> • They could start at a school or playground • Pan around and see the kids and their reactions • Cut to black to avoid gore and censoring, maybe some type of sound que. • Then show some form of after effect caused by the robots. <p><u>Additional ideas:</u></p> <ul style="list-style-type: none"> • To avoid showing the robots maybe just show lights and loud noises as the children run away, maybe the user has to hide or help a child in some way. • Sound effects could include: kids crying, running, metallic stomping, some kind of electrical sound or some other weaponry type of sound.