

Deliverable D – Conceptual Design

University of Ottawa

GNG 1103: Engineering Design

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Abstract

The following deliverable contains information regarding the development, analysis and settlement of an early conceptual design of Mines Action Canada VR product. The document outlines the individual ideation process of the team members, generated within the constraints of a series of subsystems derived from the design criteria (derives from interpreted client needs). The chosen subsystems include robot design, audio, environment, storyline, adaptations, accessibility, user experience & message/themes. Three global concepts were then derived from said individual ideations process, one of which was chosen, through a tabular analysis process, to then define the foundation of the project moving forward.

1. Introduction

Based on our problem statement, user benchmarking, technical benchmarking and the list of prioritized design criteria we need to come up with conceptual designs. Each group member will come up with a conceptual design for each of the subsystems. Later we will meet to categorize, condense, combine, refine, and reconsider each of our sub-systems. Our goal is to produce a completely new or modified concept for each sub system. We then choose the three best concepts and evaluate them against each other to choose the best global concept.

Problem Statement

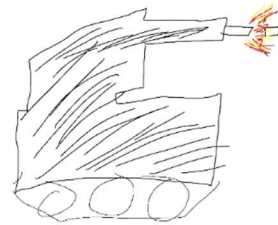
Killer robots are a readily available technology that could be deployed in warfare any day, but raise ethical, moral, and humanitarian concerns. A concise, catered, and potent VR experience can demonstrate to decision-makers on the national and international stage the negative impacts that these robots could pose, ending the possibility of killer robots in its tracks.

2. Ideation

2.1 Mitchell

Robot Design

A large robot with tank tank-like appearance. Shoots large projectiles/bullets. Can run over things and crush them. [00]



Audio

The audio should be fast paced and scary/frightening; something that would cause your heart rate to increase to add to the atmosphere and help draw out the desired emotional response from the user.

Environment

The environment should be the remains of a city where the autonomous weapons have attacked. The user will tour the environment witnessing the ruins of a once flourishing city. Will be 1 to 2 blocks of buildings.

Storyline

The story line follows a man who was working in a factory when his home and city was attacked. He explains how since the autonomous weapons were set loose to keep the area safe, they have only caused more problems, attacking civilians and non-military buildings. The ai in the weapons is not sophisticated enough to distinguish friend or foe 100% of the time. This has been the most devastating mishap the autonomous weapons have caused thus far.

Adaptations

The civilians will start making bomb shelters/reinforcing their homes to stay safe. The city might convert the subway tunnels to shelter to those that don't have a place to go.

Accessibility

The video should have both English and French subtitles, there shouldn't be any flashing lights that can cause epilepsy. Can't be too jarring for those who tend to "shut down" when if the simulation is too much.

User Experience

The user should be able to move around by teleporting from place to place. There will be a narrator explain the devastation around them as they progress through the scene.

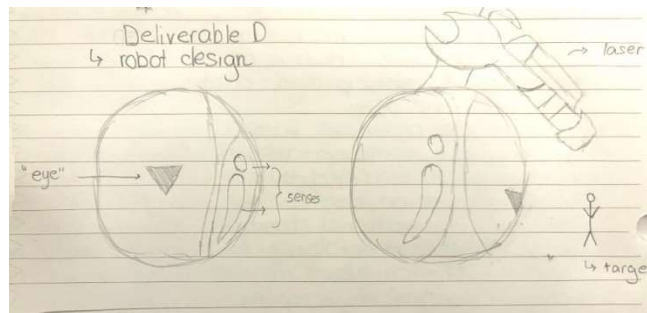
Message/Themes

The message/theme is that autonomous weapons have no humanity in them and can attack innocent people. They aren't sophisticated enough they make mistakes and even one mistake is devastating because of how much damage they can do.

2.2 Anna

Robot Design

The robot, resembling a sphere with sensors lining its sides and a triangular eye, conceals weapons within its structure. When detecting a threat, it swiftly deploys its armaments and opens fire with precise efficiency. Its design, characterized by sleek simplicity and deadly functionality, epitomizes the ominous potential of autonomous weaponry.



Audio

The VR experience starts with a calm atmosphere, then abruptly shifts to chaos with a loud crashing noise. Suspenseful background music adds to the tension as the protagonist's heavy breathing intensifies, creating a sense of urgency and suspense

Environment

The video shows the man's home, initially portrayed as elegant and tidy, gradually transforming into a chaotic and cluttered environment filled with heaps of belongings. As the scene transitions outdoors, the setting takes on a stark contrast, depicting a dark and dystopian landscape littered with trash and debris, reminiscent of scenes from action movies.

Storyline

The video starts with a wealthy man waking up in his luxurious home. His butler brings him breakfast in this beautiful and spacious place. Suddenly, a loud noise interrupts the calm scene. The next moment, we see the same man, but now he looks dishevelled, and his once-elegant apartment is in ruins with piles of belongings scattered around. He appears sad as he searches for his medicine, only to find there's none left. With no other choice, he ventures outside to find it himself. His mission to get medicine highlights how humans adapt to the challenges posed by autonomous weapons. As he

arrives at the drugstore, he discovers the cost of the medicine is sky-high due to inflation, unable to afford it. The video ends.

Adaptations

In the presence of autonomous weapons, humans would resort to a series of adaptive strategies to ensure survival. They would tiptoe silently to evade detection, minimise outdoor exposure to mitigate risks, and employ camouflage techniques to blend into surroundings, forming essential tactics in this struggle. The ironic necessity of acquiring weapons to defend against creations of human origin would underscore the dire circumstances. Decoy tactics would be employed to divert the attention of relentless robots, allowing for escape to safety. Embracing analog over digital, traditional systems like maps would replace reliance on vulnerable technologies. Window coverings would serve as a basic yet crucial measure to prevent visibility from outside threats. However, beyond the immediate peril posed by robots, there would be challenges that would threaten the fabric of governance. Economic crises would breed inflation and instability, exacerbating societal tensions. Internal discord would simmer, as interpersonal conflicts escalated societal breakdown. The foundation of democracy would tremble under the weight of shifting power dynamics, with the emergence of alternative governing structures such as gangs having control, posing a profound threat to established norms and principles.

Accessibility

This VR would prioritize accessibility, ensuring that everyone can easily engage regardless of language barriers. By eliminating narration, it removes linguistic obstacles, allowing users to navigate seamlessly. Moreover, it incorporates music to enhance mood, aiding comprehension and immersion. With these design choices, this VR platform becomes inclusive and user-friendly.

User *Experience*

The VR experience will be streamlined, focusing solely on specific adaptations. For instance, the window blockage will be prominently featured, while less relevant details will be minimised. Users will observe the action from a third-person perspective, primarily focusing on the protagonist. This approach ensures a clear focus on the man's journey, minimising unnecessary distractions while highlighting key survival strategies

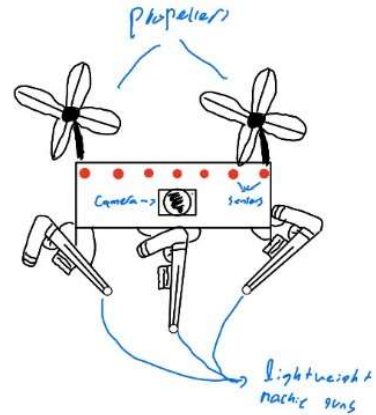
Message/Themes

The video, tailored for diplomats and governors, conveys the message: the pursuit of autonomous weapons jeopardises even the mightiest of powers. It underscores that no amount of wealth or authority can shield against the catastrophic consequences of unleashing such technology. By depicting the man's downfall despite his previous affluence, the video serves as a stark warning of the grave risks posed by autonomous weapons. Ultimately, it urges leaders to prioritise ethical considerations and international cooperation in preventing the devastating outcomes of autonomous weapons.

2.3 Qassim

Robot Design

In this concept, autonomous weapons are flying drones that are equipped with light machine guns which are used by the military. The drones use software that has a list of targets with physical descriptions and has sensors and cameras which help identify these targets and eliminate them. Rebel groups have hacked this software and are now using them to eliminate targets of value such as diplomats, government officials and civilians to cause chaos.



Audio

To have the user be more immersed in the VR experience, there will be a lot of audio queues and background noise. As the user walks around the scene, there will be footsteps that follow them, a narrator that will be speaking in the background and slow piano music to give an ominous dystopian vibe.

Environment

The user will be able to explore multiple environments. First, they start in a bedroom and can move around the second floor of a house. They can then move downstairs and explore the main floor of the house and finally, they can walk outside and look at the environment outside. Outside, they will be exposed to the harsh living conditions the people have to endure since the attack from the drones.

Storyline

The story starts with a boy waking up in his room and getting ready by putting on his reflective mask and clothes. He makes his way downstairs and grabs a mirror which is located at the entrance of the house. There will be narration that the user can hear, and this narration will be the thoughts of the boy as he goes along his day. As he walks outside, he looks at posters describing the fatalities in the area and the upcoming protests. The kid looks at the destroyed roads and the pile of garbage on the street corners and wonders how he will ever enjoy his life.

Adaptations

There will be many adaptations that the people would have done to not be targeted by the drone:

- Reflective cloths and masks – to avoid being noticed by drones as these reflections reduce the camera quality
- Having mirrors while being outside – if they found themselves beside a drone, they face the mirror in the drone's direction to not be seen
- Ropes hanging from windows – so people can climb up for safety in the event of an emergency

Accessibility

- There will be subtitles in English and French
- Narrator will speak in a clear and slow voice
- No loud noises or big bangs
- No flashing lights or bright lights
- Slow movement speed so people don't get nauseas

User Experience

The user will be watching from the POV of the boy, and can they move using the right analog stick by pushing it in the direction they want to go. To interact with an object (pick up/open) they can press “A” and they can talk with these human figures that will give an automatic voice-over by pressing “B”.

Message/Themes

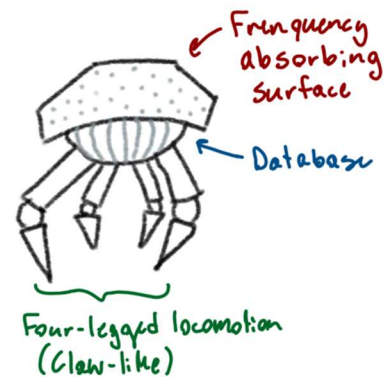
This concept shows how bad life is with the threat of autonomous weapons and gives a sense of urgency to avoid this concept at all costs. The themes are as follows:

- Dystopian gloomy world
- Environmental disaster
- Cataclysmic decline in society

2.4 Reina

Robot Design

The robot design constituents of a, animalistic stature equipped with new sense-hypersensitive technology. The four-legged robot is equipped with claw-like feet optimal for catching and injecting poison into targets. The robot obtains environmental input from acoustic location and smell and finds its target using previously inputted suspect information.



Audio

The audio will consist of narration from a child’s perspective.

Child’s voice will show little emotion, yet will convey a sense of innocence and purity, to evoke a sense empathy. Narration will be coupled with a slow, slightly eery piano track. Note eeriness must be limited as to make vide digestible for general audience.

Environment

There will be two environments shown during the video. The first environment will be a dull and mundane city, with cloudy skies, dead grass, and concrete, industrial infrastructure. This city should convey a sense of abandonment, with unkept streets, and graffiti, and should include environmental adaptations to the siege. The second environment will be the refugee camp, in which civilians must reside. The camp will be a large factory building with rows of small metal beds and dim lighting, who’s entrances are lined with checkpoints and security guards.

Storyline

A high-status family is put to live in a protective community living after a string of recent killings of innocent civilians within their neighbourhood. The killings are suspected to be robot malfunctions, however, lack of action from the manufacturers raises concern as to who will be targeted next. Leaving all their belongings behind, the family is faced with an uncertain future of having to start over, wondering if they will ever be able to return home.

Adaptations

Due to the acoustic location capacities of the robots, civilians must wear special shoes which hit the concrete ground at a specific frequency. This frequency allows the robot to identify the suspects as not a threat. Civilians must also wear smell-masking suits as to prevent potential misidentification from the robots.

Accessibility

In terms of accessibility, the VR experience will include non-walking functions to ensure accessibility of VR use to chair users. Instead of natural VR locomotion through mirroring (walking in real life = walking in VR), locomotive function will be enabled through command buttons on controllers.

User Experience

The VR simulation will be fully functional, with objects and character which the user can interact with via controller commands. The interactions it will lack the complexity of a video game but will resemble a learning simulation.

Message/Themes

The overarching message of the project will consist of evoking a sense of urgency amongst the public, by showing them a plausible future. This message could be amplified within the video by adding in the narration script, "How could we have let this happen (referring to the disaster), but it hasn't yet. Stop Killer Robots". This line implies anticipation for the illustrated reality and therefore instills a sense of urgency to prepare for its prevention.

2.5 Marcel

Storyline

A boy from a rich environment arrives to a less wealthy sector due to the death of his father. Since his father lost his company recently due to the autonomous weapons, they lost everything and were forced to move out. The story will follow the kid as he learns his way to his new lifestyle. The user plays the role of the kid that discovers that his life has changed for the worst.

Environment

It is a dark city because of its net over the city that blocks the light of the sun every day. There are a lot of posters for protestations, masks, and even a sim card that lets you access internet for one hour that is AI proof.

Adaptation

There is a mandatory mask, there is a curfew that makes people stay in their house from 8:00 p.m. until the sun rises because the robot is less effective in darkness and thus are more likely to kill civilians. Everyone has the same clothes, and no one uses social media anymore to reduce the risk for the AI to misinterpret you for an enemy since they scan everything that goes online.

User interface

The simulation will allow the user to have a 360 view. During the simulation, there will be interactive objects, that will have a narrator explain its purpose, and people. The interactive people will be different from each other to represent different points of view of this new society. There will be an



elder, a young woman in her 20s, a single mother and a father. Finally, at the beginning the user will have the option to choose between English or French and add subtitles in the simulation.

Sound/Audio/Music

The music selected needs to create a little discomfort for anyone who is watching the video to make them understand the mood. Sound like alarms, footsteps and military weapons will be added to the presentation to make it more realistic. We are going to try to ask one of our teammate's siblings to do the voice of the kid and for the grown up we will all do a voice each.

3. Global Concepts

3.1 Global Concept 1

For this first concept, we were aiming to instill discomfort, compassion and a little bit of fear in the audience. A boy that goes from having everything to nothing, ever since the drone-like autonomous weapon became widespread. This will not only make people feel compassion towards the little boy, but it'll also make the decision makers such as politicians, be able to identify themselves in this context and thus grasp their attentions by making them fear that this could happen to their families.

In the video a narration of the kid that will show emotions, innocence and purity will be used and coupled with a piano track to captivate the audience. Plus, the story will be straight forward without any ambiguity.

The adaptations will be used to create the same feeling that everybody had in the first lockdown when there was Covid-19: fear that you'll lose your comfort. With tiptoeing to avoid detection, camouflage to blend in the surroundings, decoy tactics, etc. That will make everyone tell themselves: "I don't want to have to do all this just to survive."

To make people feel empathy and fear for the kid, we'll use two environments. The two environments, the dull city and the refugee camp, will make people feel sad for the kid who is completely lost and must live in this horrendous life condition.

Having two environments will be much more demanding for the group and less simple than having a single environment, but the result expected from this will be worthwhile since the project will be complete.

During the VR experience, the user will only experience the most salient part of the project that is deemed very important such as the adaptations from the citizen. By doing so, the user won't be distracted by unnecessary distractions and there will be less, but more quality work.

The VR experience will have a "non-walking" function that will allow disable people to participate. To do so, we will enable the locomotive function through the command at the bottom of the controllers, but by doing so, the realism will be reduced.

3.2 Global Concept 2

The world faces deadly attacks from malfunctioning autonomous weapons shaped like large tank-like robots. One day, a high-status family finds themselves abruptly uprooted from their comfortable existence, forced to seek refuge in a protective community living arrangement. With the safety of their neighbourhood compromised and the threat of further violence looming, civilians' band together, fortifying their homes with bomb shelters and repurposing subway tunnels to provide sanctuary for those without a place to go. As users navigate the immersive VR environment, they are enveloped by a

hauntingly beautiful piano soundtrack, accompanied by clear, narrated explanations that guide them through the devastation around them. The environment immerses users in a house, starting from bed, showcasing a typical household from the second floor to the main floor before venturing outside to walk down the street. Subtitles in both English and French ensure accessibility for all, while the absence of loud noises and flashing lights maintains a calm atmosphere conducive to exploration. Throughout the experience, it evokes a visceral understanding of the dangers posed by unchecked technological advancements. This narrative serves as a stark reminder of the dehumanizing impact of autonomous weapons and the catastrophic consequences of their errors, urging diplomats and policymakers to refrain from further development and deployment of such technology.

3.3 Global Concept 3

Our third proposition we take a more apocalypse approach by having the perspective of an average man working in a factory.

This man will have his city and home destroyed by autonomous weapons that have the form of a huge sphere that uses sensors to detect their target.

By having an average civilian, our aim is for the audience to recognize themselves instead of others like in the first global concept, but the decision-makers won't be able to identify themselves to this storyline. On the other hand, the project is easier to produce due to its simplicity.

For this storyline, we chose to not include a narrator so that we can immerse the audience in the protagonist's struggle as if they were him. By doing so, some people may be lost in our concept

The VR experience and the story will take place in a destroyed city with many parts of buildings on the ground. Plus, there will be dead body and injured people in the street to represent the despair in the air, but the audience may find it too gore and thus will be too much disturbing for them.

The adaptations found such as cloths, masks, mirrors outside to confuse the robots, propaganda, and ropes on the side of the buildings so that people could climb to safety are good but are a little generic

In the VR, the user will have a 360 view of his environment. In his experience the user will be able to interact with objects such as posters, which they will have a narration to explain its purpose, and characters. This may prove to be a difficult task to create multiple NPCs with our deadline.

The audio and the sound that will be used are those that will make the simulation and the video as realistic as possible since we removed the narration. At first, we'll start with a soft and calm atmosphere and then there will be a loud crashing sound to show how quickly the mood can change with autonomous weapons. In addition to that, there will be footstep and loud breathing from the protagonist that will make it feel real.

The other reason we chose to not add narration for the video is to have it more accessible for anyone in the world since they don't have to understand a single word. With the universal language, the music/audio, we'll make the video comprehensible.

4. Analysis

Table 1: Analysis of Global Concepts against Design Criteria

Design Criteria	Weight	Global Concept 1	Global Concept 2	Global Concept 3
Simplicity	3	Many scenes need to be created and hard to convey the story	Simple environment – minimal interactive activity	A nice simple environment but does not reduce effectiveness
Civilian Adaptations	4	Civilians adapt fully which also leads to consequences	Not many realistic adaptations	Generic but good adaptations
Instil a sense of urgency & empathy	5	Forces users to be empathetic and call for action	Triggers some emotional response	Too gore – make people depressed instead of empathetic
User accessibility	3	Lack of locomotion minimizes realism	Ensures that most users will be accommodated	No narration
Effective storytelling	5	Story is clear and evokes emotions	High status family moved to community living	Story is not interesting
Interactive VR experience	1	Not important object will be blurred	Some but little interaction	Very interactive and immersive
Cater to random people's knowledge	3	Most people will understand what the v	Might not be understood by target audience	Not many people will relate/understand this concept
General video environment/content	3	Two environments, dull city & community living facility	Generic environment	Limited environment
Target audience: Decision makers	5	Focus on child's perspective, with implications of situation	High status family – relates to decision makers	Does not relate much to target audience
TOTAL = weight*points		77	73	47

*Green = 3pts, Yellow = 2pts, Red = 1pt

5. Evaluation

After analyzing the three global concepts and having a lengthy discussion as a group, global concept 1 was chosen as our final concept. This was decided due to the discussion bringing up the drawbacks of the other concepts while highlighting the benefits of this concept. Concept 1 will highlight the many adaptations that people would do to defend themselves against drones. It also tells a story that many people can resonate with but more importantly the target audience. The environment in Concept 1 is realistic and fits with the design criteria while also being interesting and immersive. The drawback is that we will have to create many scenes, and this would be difficult as none of us have experience in creating VR worlds. This affects the overall simplicity of the concept and might be something that we will have to reconsider. Concepts 2 and 3 also have benefits that Concept 1 lacks, such as user experience and accessibility. These are important aspects that the client highlighted, so we are looking at incorporating these benefits into Concept 1. The main drawbacks in Concepts 2 and 3 that ultimately made us scrap them, were that they do not invoke as many emotions as we would like and they lack severely in adaptations, which are very important design criteria. For the reasons above, and the many more that were discussed as a group, Concept 1 was declared as the final concept.

6. Project Plan Update

[GNG 1103 Group 3 | Trello](#)

7. Conclusion

Upon extensive comparison and analysis against preestablished client needs and design criteria, global concept 1# was chosen to be further developed. With a focus on technical adaptations, the VR environment/experience and audience impact, global concept 1# is believed to achieve the most heavily weighted client needs/design criteria (as illustrated in Table 1) most adequately. With consideration into the future, it is equally understood the intricacies of global concept 1# are subject to change upon receiving feedback from the second client meeting, yet regardless defines a framework upon which the project will begin to take form. Furthermore, from the received feedback and further technical and user benchmarking, it is anticipated that high scoring concepts chosen for global concepts 2 and 3 may also be revisited. The information outlined in the document will be presented during the upcoming client meeting, encompassing the insights gained from feedback and the ongoing evaluation process.