Operation Silo:

A Procedurally Generated Puzzle Adventure

A Major Qualifying Project

submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfillment of the requirements for the

Degree of Bachelor of Science

in

Interactive Media and Game Design

by

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APPROVED:

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Abstract

Operation Silo is a 3D first-person adventure game set in a Soviet-era ICBM silo. Developed in Unity, the project explores procedural generation for environment layout as well as puzzle placement. Drawing inspiration from era-accurate references as well as other games within the genre, the goal was to combine intriguing replayability with a gripping narrative and distinct artistic design. Multiple rounds of user testing suggested that the project's experience goals were partially fulfilled, but further development is needed to achieve its full potential.

Acknowledgements

This project was completed thanks to the extensive guidance from Professor Brian Moriarty. His knowledge of game development and relevant period piece media was essential. We also wanted to thank WPI as a whole for creating a transfer path for us when Becker College closed. We could not be more grateful. One last thank you to everyone who playtested our project. Your responses helped us find important issues as well as give us points to improve for our player experience.

Contents

1. Introduction

This report has been written to document the creation of *Operation Silo*, a game designed by the authors of this work under advisement from Professor Brian Moriarty. The primary goal of this project was to utilize random generation in the making of a 3D adventure puzzle game developed in the Unity game engine.

This report begins with the Background, where the inspirations of the *Operation Silo's* style and setting is described, as well as the software utilized in the construction of its various aspects. The Design section details the collective experience of creating the video game and building the mechanics, all done to engage the desired audience of players.

Artistic implementation discusses the utilization of art resources, from the visual inspirations to the actual models and textures used in the game. Programming is described under the Technical Implementation section, where the programming team explains the development in Unity and the various programs used to run the game. Sound design work applied to the game is described in Audio Implementation, where the music and sound effects are conceived based on research and fine-tuned audio editing.

The various student responses from testing a prototype are analyzed in the Testing section, and their collective information is expressed in detail. The report concludes with a Postmortem of the project, dissecting what went into the game and reflecting on the results.

2. Background

2.1. Historical/media inspirations

The setting of *Operation Silo* was inspired by the aesthetics and culture of the Soviet Union during the Cold War period of the 1950s-60s. Most critical to the setting was the accuracy as it involved actual history and a very grounded setting. Cinematic references included Hollywood dramas such as *Fail-Safe* (Columbia, 1964; Figure 1), a movie that made excellent use of pacing to describe a perilous nuclear confrontation between the US and the USSR. Additional inspiration came from documentaries about Soviet bomb tests and other military operations, which helped the team develop an authentic artistic vision for the game, and to organize the architecture and hardware used in level design.

Figure 1 - Fail Safe *advertisement. Source: URL*

2.2. Gameplay inspirations

Many video games were used as inspiration for *Operation Silo*, specifically in terms of the puzzles in relation to the setting. A major inspiration was the competitive game *Among Us*, from which some of the puzzles central to gameplay were adapted as depicted in Figure 2. Puzzles and ideas from *We Were Here Together,* a stylized 3D puzzle game, were also used as inspiration as they make use of technology while using a control scheme similar to the one adopted for our project.

In early versions of the game, the puzzles would match certain puzzles found in the aforementioned titles, which were used as a layout for the critical parts of the game. In particular, a puzzle from *We Were Here Together* that involved matching sine waves as seen in Figure 3 was prototyped. This puzzle was eventually scrapped due to time constraints.

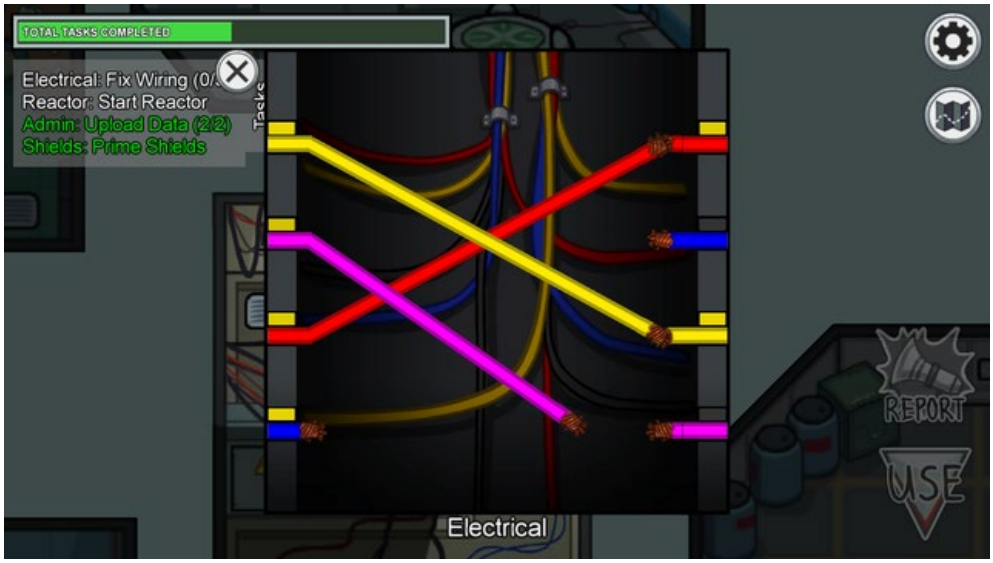


Figure 2 - Among Us *wire task. Source: URL*

Figure 3 - We Were Here Together *wavelength puzzle. Source: URL*

2.3. Artistic inspirations

The artistic style of *Operation Silo* evolved over the development period from softer shapes and a more colorful palette to a more realistic one with a stylized low-res shader. The initial goal was to have a medium- to low-poly build with exaggerated silhouettes and a vivid color palette. With this style, the lighting and sound effect would be heavily relied upon to create the overall mood.

As the story and nature of the game developed, the team decided to pursue a slightly different aesthetic involving more realistic textures and shapes. This included a heavily stylized shader to replicate the visual distinction of early Playstation 1 (PS1) games. To inform the development of this look, the team referenced several video games and accurate period pieces.

2.3.1. Stylized games

Video games with a visual style similar to what the team was originally aiming for included *Sea of Thieves* and *We Were Here Together*. Both of these games have distinct styles utilizing a medium- to low-poly modeling workflow, with vivid color palettes, and rely heavily on detailed and well-baked textures as seen in Figures 4 and 5. However, the team felt this artistic style did not represent the atmosphere we were aiming for.

Figure 4 – An environment from We Were Here Together. *Source: URL*

Figure 5 – An environment from Sea of Thieves. *Source: URL*

The current style of *Operation Silo* took more inspiration from PS1 games including *Metal Gear Solid* and *Resident Evil.* In order to still have a distinct visual style for the game, the team decided to keep a low-poly modeling workflow with more realistic textures and utilize an in-engine shader to emulate the low-resolution style as seen in Figure 6.

Figure 6 – A scene from Metal Gear Solid. *Source: URL*

2.3.2. Historic influences

Due to *Operation Silo* being based on a historic time period, the team consulted visual references from the era for inspiration. For the journal pages, Soviet-era military manuals as seen in Figure 7 were utilized to maintain consistency between the story and visual aids. In addition to the journal, the time limit feature utilized an accurate design based on radiation detectors called dosimeters. The team decided to use the visual representation of a dosimeter depicted in Figure 8 as the time limit indicator instead of a clock to add a more distinct visual aid compared to other games involving time limits.

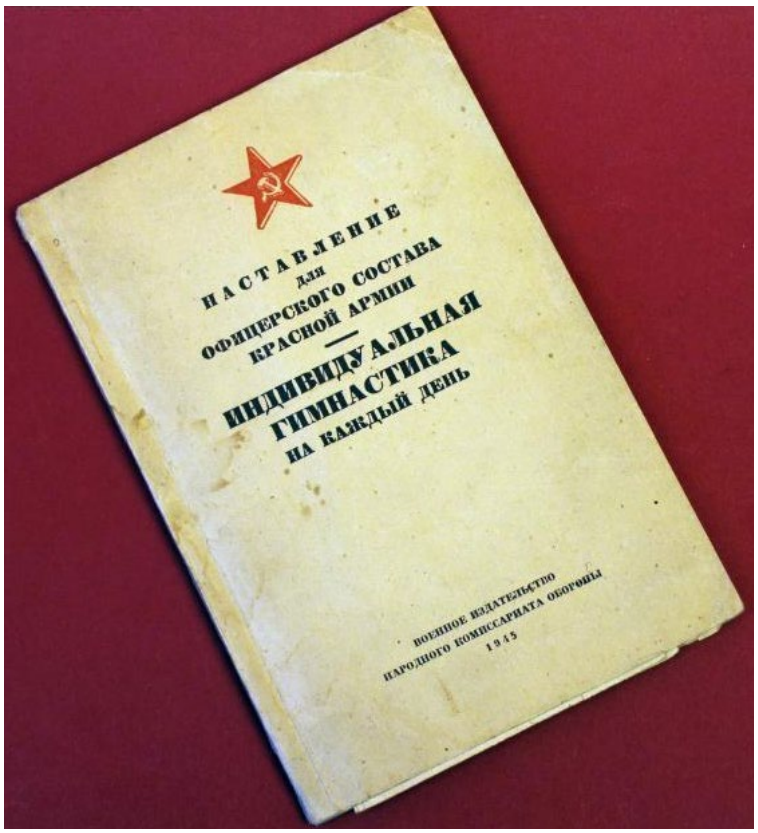


Figure 7 – Soviet-era military manual. Source: URL

Figure 8 - Soviet radiation dosimeter. Source: URL

2.4. Tool choices

2.4.1. Game engine

In the early stages of the project, the team planned to use the Unreal Engine, as some members had experience with it. After work on the idea and story for the game was completed, work began in Unreal. However, after a few weeks of working on the project, the team came to a consensus that it would be prudent to switch to the more familiar Unity engine to save time. Looking back at the decision, this was ideal as the team was having too much trouble trying to create a testable build on a new game engine.

After switching to Unity, free assets were found on the Unity Asset Store to assist with early stages of development. Being able to use premade assets was another fantastic reason to use Unity over Unreal. Source control was also significantly easier to use with Unity. The only downside to switching was losing progress and time on what we already had for the game.

A recommendation would be to stick with what the team is most comfortable with when making a playable game in a highly restrictive amount of time.

2.4.2. Source control

Various source control solutions were available to the team when beginning collaboration on *Operation Silo*. Professor Moriarty had a couple of source control solutions that were recommended, but would be difficult to access.

Early in development, when the team was still using Unreal Engine, the Perforce source control solution seemed to make the most sense. This was due to its built-in functionality with the game engine. As development for *Operation Silo* continued, the team eventually made the switch over to SourceTree. This source control manager is a popular one used by developers around the world. SourceTree has powerful safety features that would help protect from encountering merge conflicts or accidentally overwriting files. Since not everyone on the development team was equally well versed in the use of source control, the team believed that SourceTree would help maintain the stability of the project's development.

After the switch to Unity, the final decision to use GitHub was made. Due to its simple learning curve, and the teams' preexisting familiarity with GitHub, the process of switching files began. This source control solution would be where the project files lived for the duration of the game's development. GitHub has served the needs of the project and allowed the team to create branches for art, programming, and master builds of *Operation Silo*.

2.4.3. Artistic software

The tool decisions were made by the art team based on overall proficiency. Multiple programs were used throughout development for each stage of the process. These programs each have advantages that make the workflow easier and more streamlined.

2.4.3.1. Blender

Blender was utilized for the entire 3D modeling process. This program was used in the gray boxing stage and allowed for accurate measurements based on real missile silo schematics. It was continuously used to create modular environment pieces and any unique assets. Trim Sheets were planned, and high-poly models were created within this program as well.

Blender was also used for all UV mapping and was vital in the trim sheet workflow. The process of texturing for this project was untraditional, especially in terms of UV mapping due to the usage of trim sheets. Blender also provides plenty of plugins and non-destructible modifiers that speed up multiple processes and is incredibly easy to use.

2.4.3.2. Substance Painter

Substance Painter was utilized for all texturing and baking of all 3D models. Painter is an industry-standard texturing software and a familiar program for the art team. The program's main advantage is its texture baking capabilities that allow for extra detail without the use of polygons. This process was also particularly important in the trim sheet workflow. The allowance for multiple levels of detail and procedural generators to leverage the use of baked detail are what make the process incredibly intuitive and quick.

2.4.3.3. Adobe Creative Suite

The Adobe Creative Suite is a collection of industry-standard software that covers all processing of 2D media. It was utilized to make all of our 2D graphics including UI, logo/intro screen, and journal pages. Illustrator was used to make UI elements, including the dosimeter and the project logo. Photoshop was used to create the journal pages and the intro screen.

2.3.4. Audio software

Operation Silo encouraged many upgrades in the manner audio was addressed. As a student that never specialized in audio, the audio designer was used to using simplistic but effective tools to generate music. However, this project prompted him to go above and beyond with his music, implementing effects the team had never gracefully applied to music in previous years. Such goals would be achieved using Reaper (Figure 9), a free but surprisingly sophisticated application that allowed the music to improve beyond its expected limits.

The team intended to use free but high-quality instruments, which was made easy thanks to Reaper. Once our team figured out the functionality of Reaper and how to integrate these instruments, the goal diverted from understanding the program, and became a mission to find the best instruments possible.

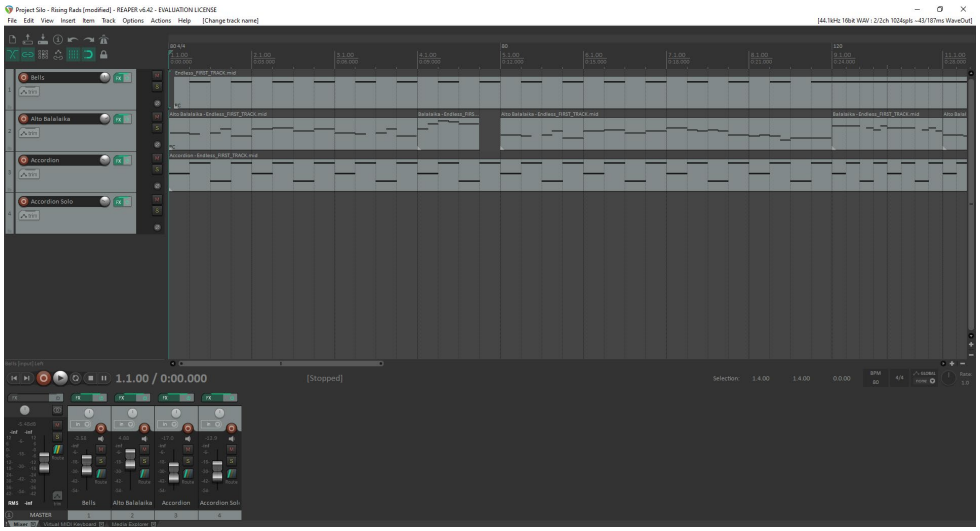


Figure 9 - Reaper audio software interface. Source: Screen capture.

Several options would be found, tested, and then removed before a consistent and effective set of instruments was found. These instruments were a part of Spitfire (Figure 10), an app that gives access to a collection of themed instrumental sets, which made it easy to switch the instruments between one of multiple types. This gave authenticity to the intended Russian theme of the music, while also providing rich musical quality.

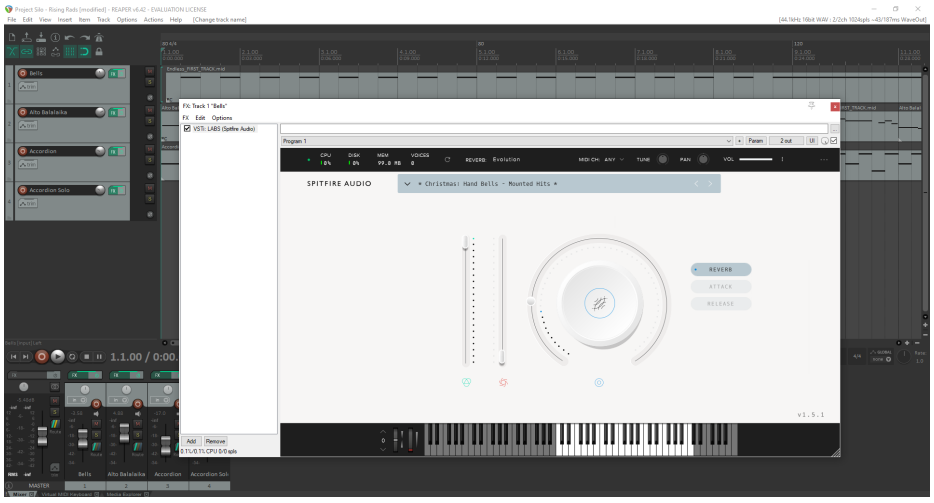


Figure 10 - Spitfire UI displayed in Reaper. Source: Authors

Once this task was taken care of, the team would make painstaking efforts to ensure each instrument balanced properly, adjusting audio levels, pitch settings to put emphasis in each note, and other effects to make the music hollow and echoing. This last feature was designed to give the illusion that this music was coming from a distant speaker, furthering the rather grim and lonely tone the Project had been developing.

2.5. Project management

Project management was based around a scrum ideology, with individual members of the team giving a report of their work over the past designated time period. Significant portions of work were done independently. That being said, we did meet rather frequently in smaller groups or as a team. We took advantage of WPIs “Tech Suites” frequently, convening almost all team meetings outside of our weekly meeting with Professor Moriarty in them. We also had weekends where we would meet for extended periods of time as a group to meet specific goals.

Communication was done through various channels. We had a Slack server that Professor Moriarty set up for us. This was where most official and important communication was done. We would record any and all meeting notes in a specifically designated channel in order to maintain those details accurately. We also had a Discord server that allowed us to meet remotely in a format that was familiar and reliable. Most communication here was unofficial and nonvital.

As mentioned previously, we used GitHub as our source control solution. Justin was primarily in charge of managing source control. Any changes that needed to be made would be made by the individual in other branches and merged by him. This was done to prevent any erroneous merging from multiple parties. We also used Google Drive in order to manage the sharing of a majority of files including the management and organization of this paper.

3. Design

3.1. Experience goal

From the beginning, we set about a few goals for *Operation Silo*. Chief among these was to develop a fair puzzle game with a time limit, where the shifting corridors and rooms of the Silo would make each playthrough unique. We balanced the puzzles several times to make sure the average player could wrap their head around them, because we didn't intend to scramble the minds of players. We wanted players to acknowledge the time limit, and respond accordingly when solving puzzles. This led to adding hint sheets in the game itself, which provide possible solutions to the puzzle written in red, giving the puzzles a jumble of uncertainty. In this game, there are times when trying out every possibility is the only way to beat a puzzle, especially when tension is in the air.

3.2. Target audience

Operation Silo is a game intended for general audiences, though some of the mature subject matter would be best suited for teenagers. Further, this game is meant to appeal to fans of puzzle games and challenging gameplay, because the puzzles have to be solved under a time limit. From the inception of this game, it was designed to be played on the PC platform, and due to the precise camera movements that aid the hasty solving of puzzles, it will likely stay exclusively on this platform.

3.3 Original scope

With lofty goals and a period of time that felt long, the group had many ideas that exceeded what we could feasibly implement. The original line up involved around four floors, each of which contained a few puzzles that had to be completed before moving onto the next level. The first three floors gave simple puzzles, which required exploration, memory, or the use of notes that could be found in the level itself. The final floor, and the final puzzle, was a medley of the puzzles found throughout the game, compiled into one. This last puzzle would've tested the skills of the player, and ensured that they learned from the previous experiences.

Another feature in the game's original scope was voiceover, specifically narration from the main character, and a narrator character with an outside view of the game's events. Both of these concepts were eventually abandoned due to time constraints, and the inability to prepare any voice actors for the intended role.

Another major goal of the project was a complete and coherent story, which evolved slowly over the course of production, going from a parody of spy thrillers to a darker and more serious theme over time. By the end of development, the story couldn't be implemented at all because of how much the gameplay and mechanics took precedence. The progression of the team's brainstorming can be seen in the meeting notes presented in Appendix F.

3.4. Narrative design

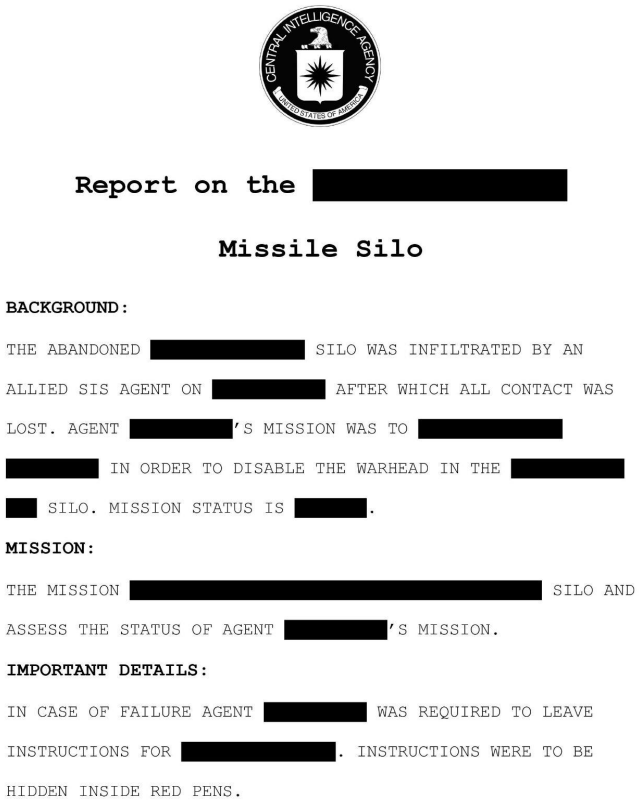
Writing for this game started out in a confusing manner, mostly because the tone for the game wasn't clear from the start. All our writing team knew was that the game used random generation, and that it took place in a Soviet missile silo. They figured that a serious story would be ill-fitting, especially considering the less realistic art style we had agreed upon.

We first developed a silly story, which would be about the main character entering an active missile silo and diverting the launch. Making this task difficult was the spy's incompetence, as he had no knowledge of the Russian language, and less of an idea how to tamper with a missile launch. Initially, the final puzzle would determine whether the launched missile would land in the ocean, or if the missile struck its target, blowing up the moon.

As more aspects of the story changed, the tone took a somewhat darker approach, which would affect some of the gameplay options, (such as a dosimeter that would track radiation levels), and the story itself (explaining what happened to the silo before it was abandoned.)

In this new version, the context would be altered while the main character would remain the same. Instead of a Missile ready to launch, the missile silo was mysteriously abandoned. Additionally, a Saboteur character was added, only represented by occasional letters hidden

within red pens, whose notes expand upon what exactly happened. Namely, his intervention accidentally caused a leak, which filled the silo with deadly radiation. Now, the two choices made by the Spy centered on whether he would die from the radiation while saving others or save himself at great expense. In order to establish this story, a fictional CIA dossier was created (Figure 11) to give a baseline understanding to the player.



Report on the [redacted]

Missile Silo

BACKGROUND:

THE ABANDONED [redacted] SILO WAS INFILTRATED BY AN ALLIED SIS AGENT ON [redacted] AFTER WHICH ALL CONTACT WAS LOST. AGENT [redacted]'S MISSION WAS TO [redacted] [redacted] IN ORDER TO DISABLE THE WARHEAD IN THE [redacted] [redacted] SILO. MISSION STATUS IS [redacted].

MISSION:

THE MISSION [redacted] SILO AND ASSESS THE STATUS OF AGENT [redacted]'S MISSION.

IMPORTANT DETAILS:

IN CASE OF FAILURE AGENT [redacted] WAS REQUIRED TO LEAVE INSTRUCTIONS FOR [redacted]. INSTRUCTIONS WERE TO BE HIDDEN INSIDE RED PENS.

Figure 11 - Fictional CIA Dossier. Source: Authors

Sadly, much of this couldn't be implemented into the game itself, as the programming and art facets were given precedence. This is expected, since the story aspect of a video game is often one of the last factors added into a game, followed only by flavorful audio like voiceover, and visual flair to make the game look even more appealing. The stories have been written and

cataloged, and as the game develops more thoroughly, we plan to implement the story and all the factors that come with it.

3.5. Modular environment pieces

The project began with the use of procedural random generation in mind. To achieve this, the team would need to build our game's main level using a modular environment. This modular environment would require many different 3D meshes built out of different parts that could be put together to create a new and unique environment every time the game was played. The art team modeled and textured various hallways, hallway turns, and stairwell segments that served as the navigation elements of the level. Different rooms where the player would complete puzzles and progress through the game were created as well. The rooms also featured randomly spawning collections of furniture and interactable objects. These elements of the team's design philosophy helped to craft a level that could rearrange itself in different ways to provide the player with a unique gameplay experience every time they played.

The major element that held the level together were the wall segments of the missile silo. These modular walls could be spun in any direction, allowing the level's hallways to branch out in any direction as the level built itself around the player. The team felt as though the goal of random procedural generation that was originally envisioned was achieved.

Early in the planning phase of development, the decision to utilize trim sheets was made. Trim sheets are often utilized in environment art as a way to speed up the workflow. The ability to utilize one or two texture sheets for a majority of the environment models greatly sped up

development time. Combining this workflow with modular environment pieces allowed the team to create full, dynamic environments with greatly reduced development time.

3.6. Gameplay flow

Figure 12 is a flow chart representation of the planned gameplay progression. It represents a linear progression through the floors and of each task to be done. The final Control Room works as an accumulation of previous puzzles where the player can utilize learned skills.

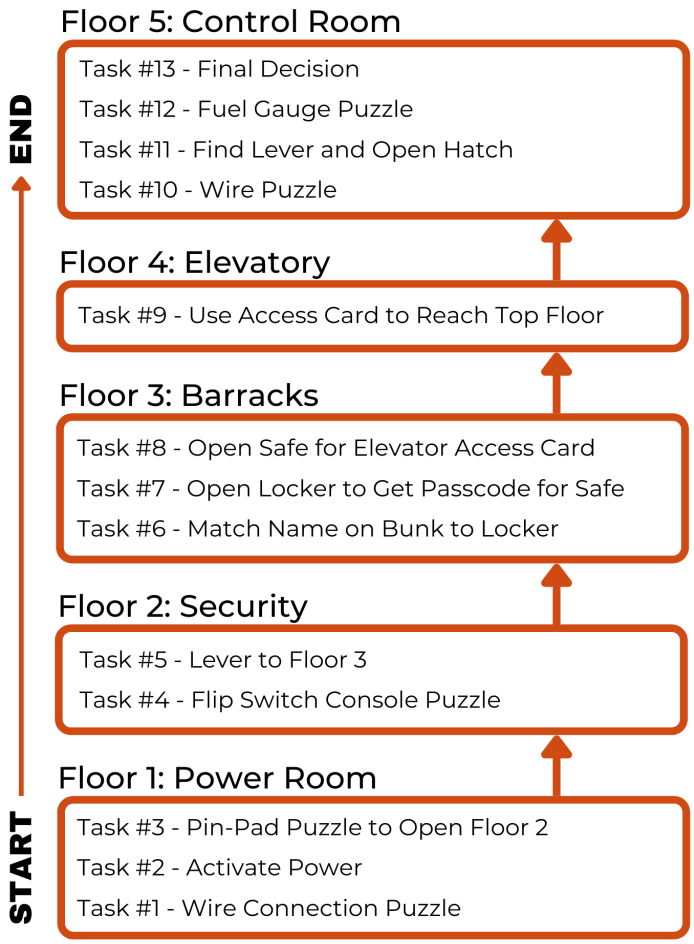


Figure 12 - Gameplay Flowchart. Source: Authors

3.7. Puzzle Design

3.7.1. Floor 1

The first floor, referred to as “power,” contains a room with fuses scattered around the space and a fuse box with empty sockets mounted on the wall. The idea is that the cluttered room would make it a sort of scavenger hunt. As shown in Figure 12, there is the task listed as “wire connection.” The original intent was to have a puzzle in which the player is connecting severed wires, but that idea became a bit of a stretch for based on time constraints. Instead, a fuse-based puzzle was utilized as shown in Figure 13. Once the player has found all the fuses and placed them into the fuse box, the lights would turn on and an audio cue would play with the intent of the player naturally heading to the stair to see what else they can do.

Figure 13 - Fuse Puzzle environment. Source: Screenshot

3.7.2. Floor 2

Figure 14 - Mastermind. *Source: URL*

The second floor, referred to as “security,” was meant to represent a situation where the rest of the silo is still locked down. This is due to the power having cycled and the security needing to be “reset.” The idea of this puzzle is based on the game *Mastermind,* shown in Figure 14 above. The player must input a code using levers and then confirm their entry in the switch box at the end as seen in Figure 15. The player is given a journal page that is meant to guide them. Once successfully completing the puzzle, the player would move to the next floor.

Figure 15 - Lever Puzzle environment. Source: Screen capture.

3.7.3. Floor 3

The third floor is a bit different. This floor contains the barracks. The player will find bunks with names, in Russian text, and lockers with matching names. The player will also find a locked safe next to one of the bunks. The goal is for the player to explore the space and find the code to the safe. The code will be in the locker that bears the same name as the bunk next to the safe. This safe will contain a keycard for an elevator.

3.7.4. Floor 4

The fourth floor is very simple. The player uses the keycard they found in the barracks to take the elevator up to the control room.

3.7.5. Floor 5

Floor 5 or the control room is the final space the player will see. The goal for this floor is to use skills that the player has already learned along with some new ones to reach the final decision. As seen in Figure 12 above, the control room has the “wire connection” listed again. This would no doubt be replaced with our alternative of the fuses, pending final decision. Once that is completed the control panel would be operational again.

The player would need to find a broken-off lever in order to open the roof of the silo. Then there would be the “fuel gauge puzzle,” which would be a different take on the security puzzle. Entering the right code for the two corresponding fuels will allow the missile to be fueled. The final decision is contingent with the dosimeter shown to the player in the UI, indicating that they are getting close to a deadly level of radiation exposure. The player must choose to either launch the missile to an unknown destination to save themselves, or sacrifice their own life to save many others.

4. Artistic implementation

4.1. Overview

This section describes the artistic techniques and processes used in developing *Operation Silo*. This covers the entire pipeline starting with conceptualization and grayboxing, followed by 3D modeling, UV unwrapping and texturing with trim sheets, in-engine lighting and post-processing, and ending with UI design and graphics design.

4.1.1. Concepting and grayboxing

The environment and prop production pipeline began with gathering reference images from real Cold War-era missile silos and other media. This was done to get an idea of scale and the type of space the team wanted to create. A collection of reference images used can be found in Appendix E. The schematic in Figure 16 indicated the approximate scale of a Cold War-era US Titan II missile complex, and was used to create an early concept of the in-game silo as seen in Figure 17. (Titan II Missile Silo)

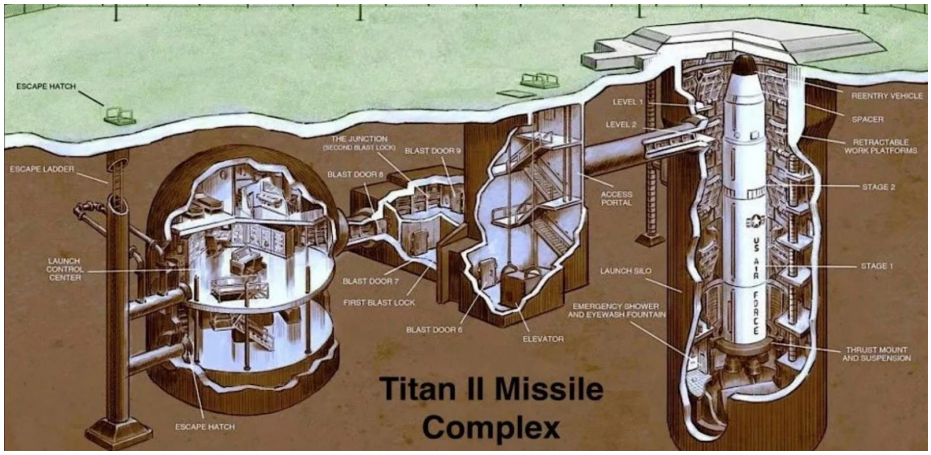


Figure 16 - Titan II missile complex. Source: URL

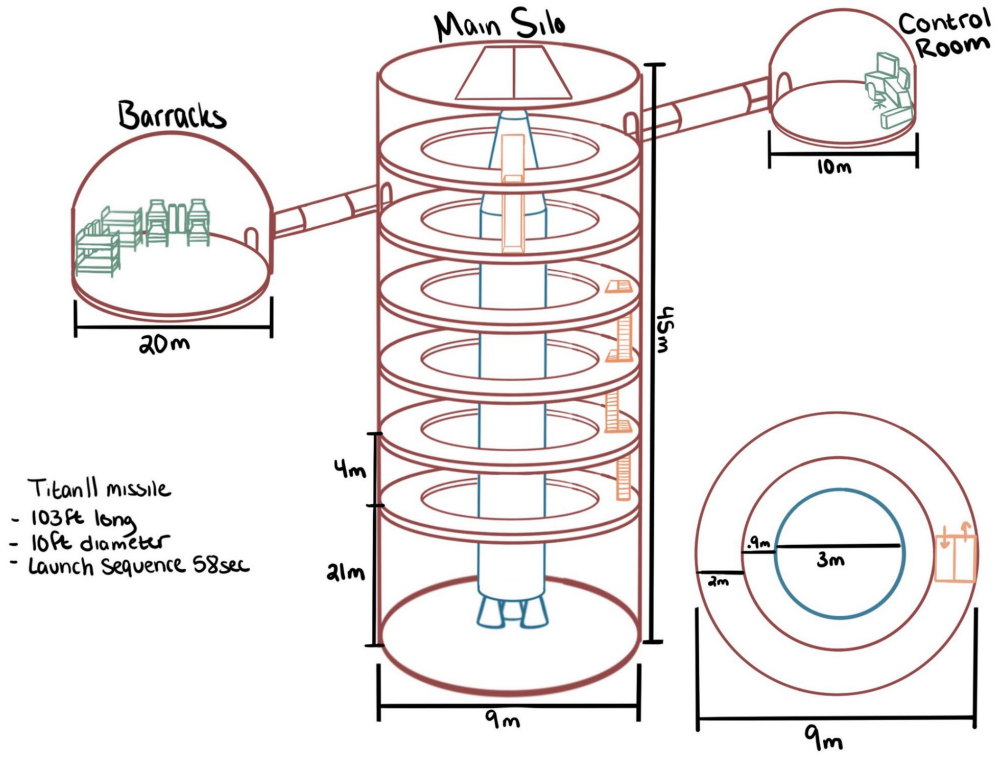


Figure 17 - Operation Silo *concept art. Source: Authors*

The concept in Figure 17 was then utilized in the grayboxing stage executed in Blender. A simple model was created and tested in Unity to see if the scale would work with the player controller, as seen in Figure 18. From there, the design was iterated to account for the modular assets and procedural environment. Free assets were utilized in the engine to create additional visual references (Figure 19). A list of these assets can be found in Appendix D. Finally, placeholder textures were applied to the gray-box models to test if the trim sheets worked.

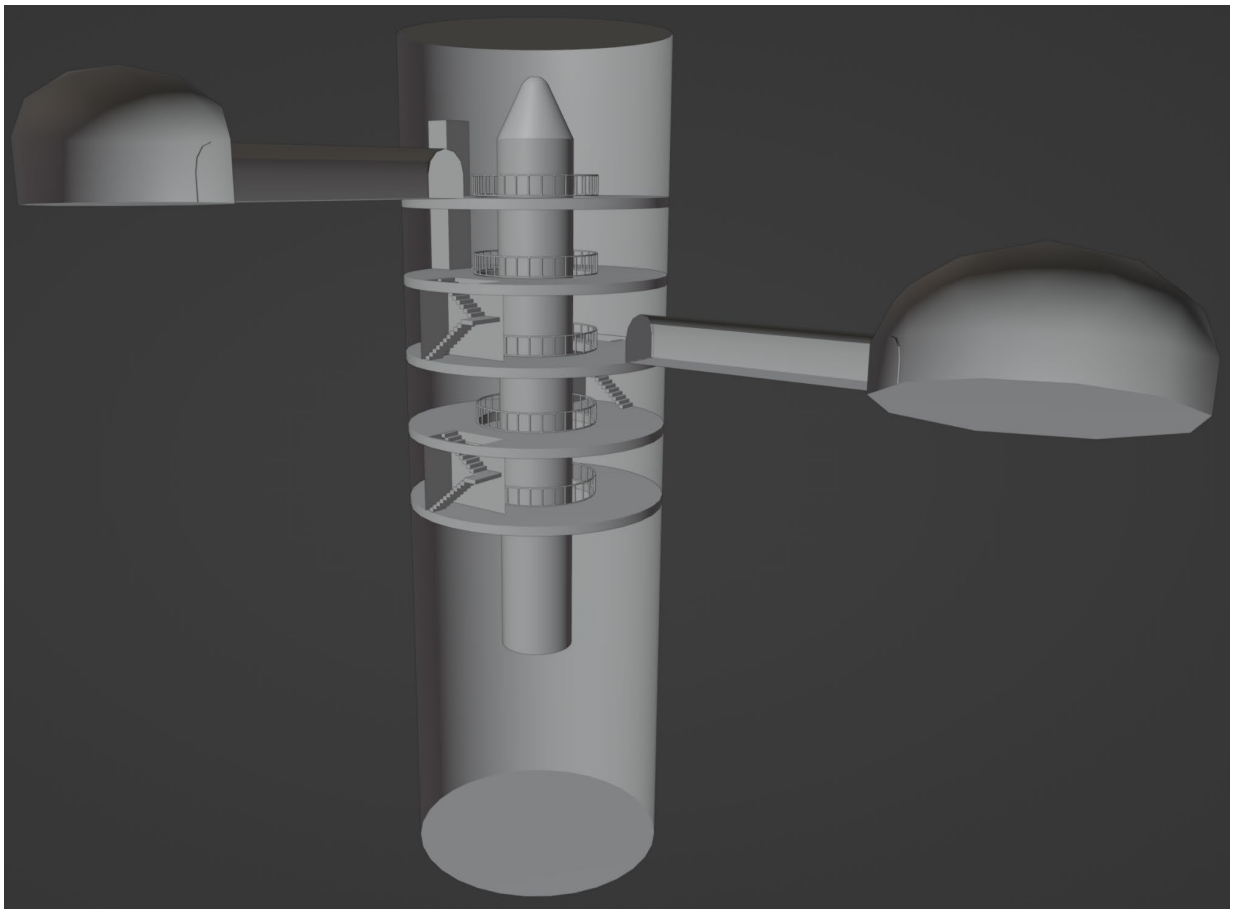


Figure 18 - Early grayboxing for the silo environment. Source: Screen capture.

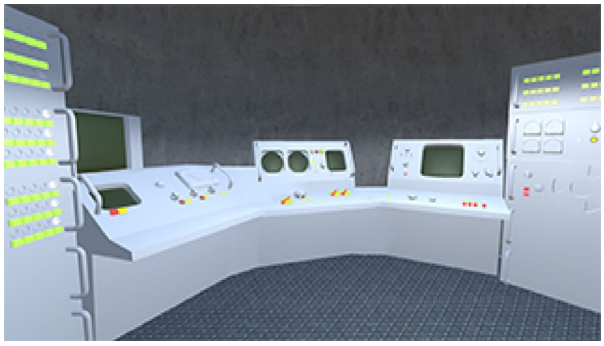


Figure 19 - Operation Silo *environmental mockups. Source: Screen capture.*

4.1.2. Modeling

The next step in implementing the art was to replace the gray-box models with the final, more detailed models. The final models used for the environment art can be seen in Figure 20.

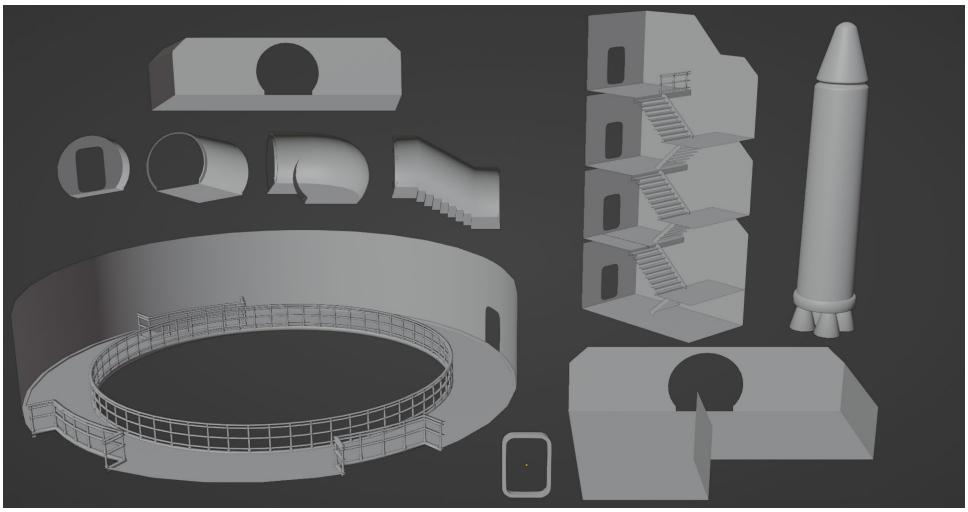


Figure 20 - Grayboxed environment models. Source: Screen capture.

The team utilized the graybox models to further iterate and create the final versions. As seen in Figure 21, the team kept the polygon count very low to maximize performance. Once modeled, each modular piece was imported into Unity as an FBX file and used to begin building the environment. A full list of assets used in-game can be found in Appendix D.

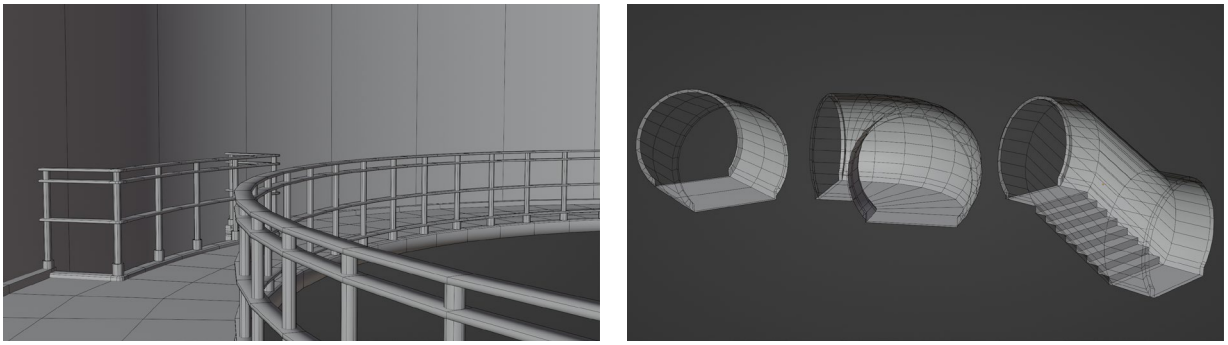


Figure 21 - Environment model wireframes. Source: Screen capture.

4.1.3. UV unwrapping and texturing

The workflow for UV unwrapping and texturing was done using a different process than typical. The art team decided to use trim sheets as a way to cut down development time and resources. The trim sheets were planned early in development and iterated on as progress was made in the modeling process. Visual reference for the two trim sheets can be seen in Figure 22.

Figure 22 - Trim sheet mockups. Source: Screen capture.

Once the trim sheet was planned, the design was modeled in Blender from a flat 2-meter square plane. Different sections were separated and extruded as necessary, and detail was added using modeling. A high-poly model (as seen in Figure 23) was then exported along with a simple flat plane of the same size, and imported into Substance Painter. The high-poly was then baked onto the low-poly to transfer the modeled detail as a flat image at a resolution of 2048x2048. This was done to reduce the overall poly count and still have the flexibility of displaying small details.

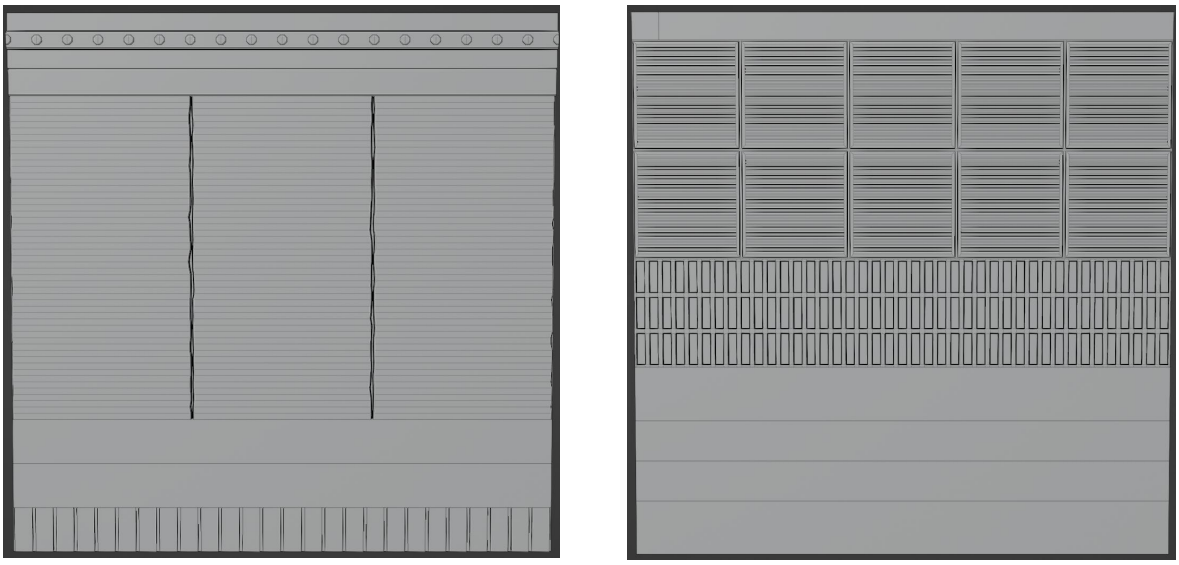


Figure 23 - Trim sheet for high-poly models. Source: Screen capture.

Substance Painter was further used to texture these trim sheets. Baking the high-poly onto the low-poly created multiple texture maps including ambient occlusion and curvature maps. These were used in mask editors to create procedural details, such as edge wear and dirt buildup. The final versions of the trim sheets can be seen in Figure 24.

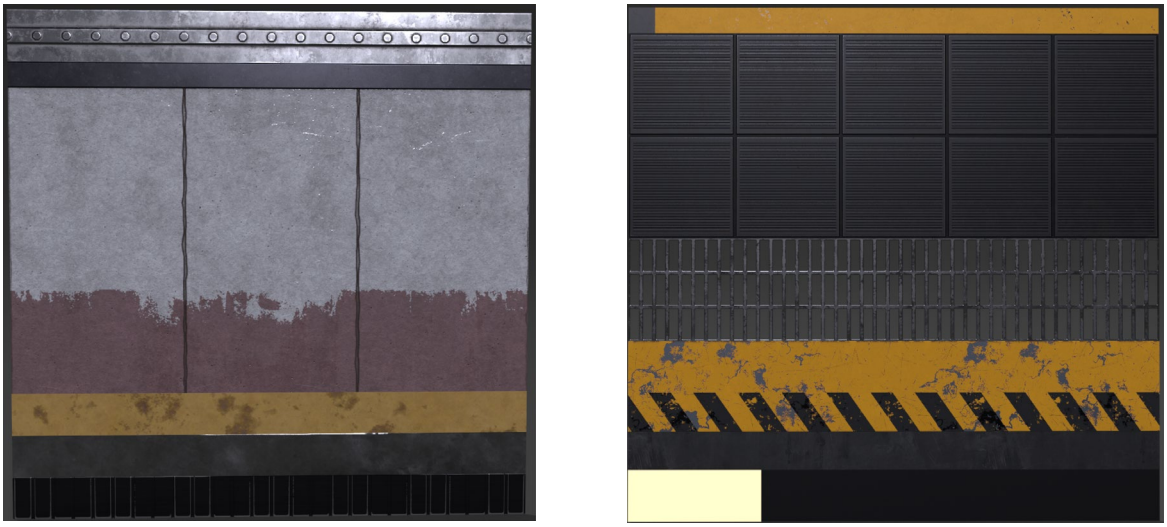


Figure 24 - Trim sheet final textures. Source: Screen capture.

The textures were further exported into Blender and applied to all the models that the team was intending to use. The environment models were UV unwrapped manually by the art team and aligned so the texture mapped correctly to the model. This process can be seen in Figure 25. Once all models were textured, they were reimported into Unity along with the new textures to be made into materials. All of the walls, floors, stairs, and railings were textured using only two trim sheets.

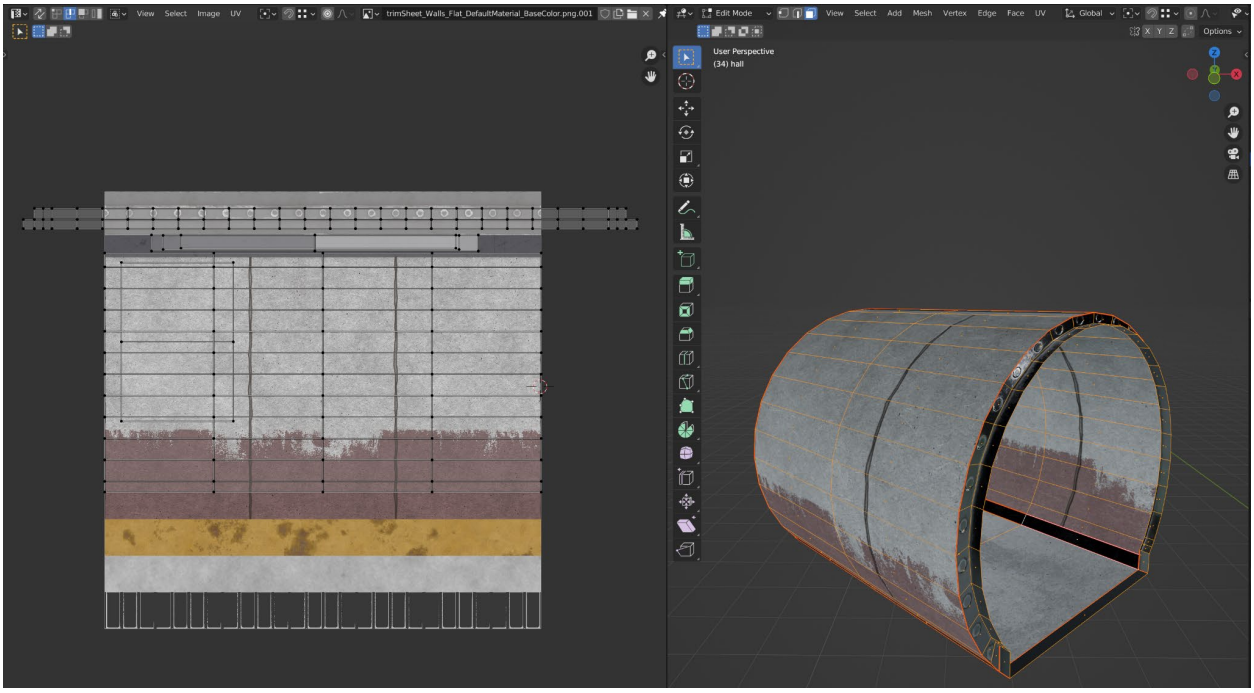


Figure 25 - Blender trim sheet UV mapping process. Source: Screen capture.

An atlas of the final modular environment pieces, fully textured, can be seen in Figure 26. All of these assets are the core components used to fully construct the environment.

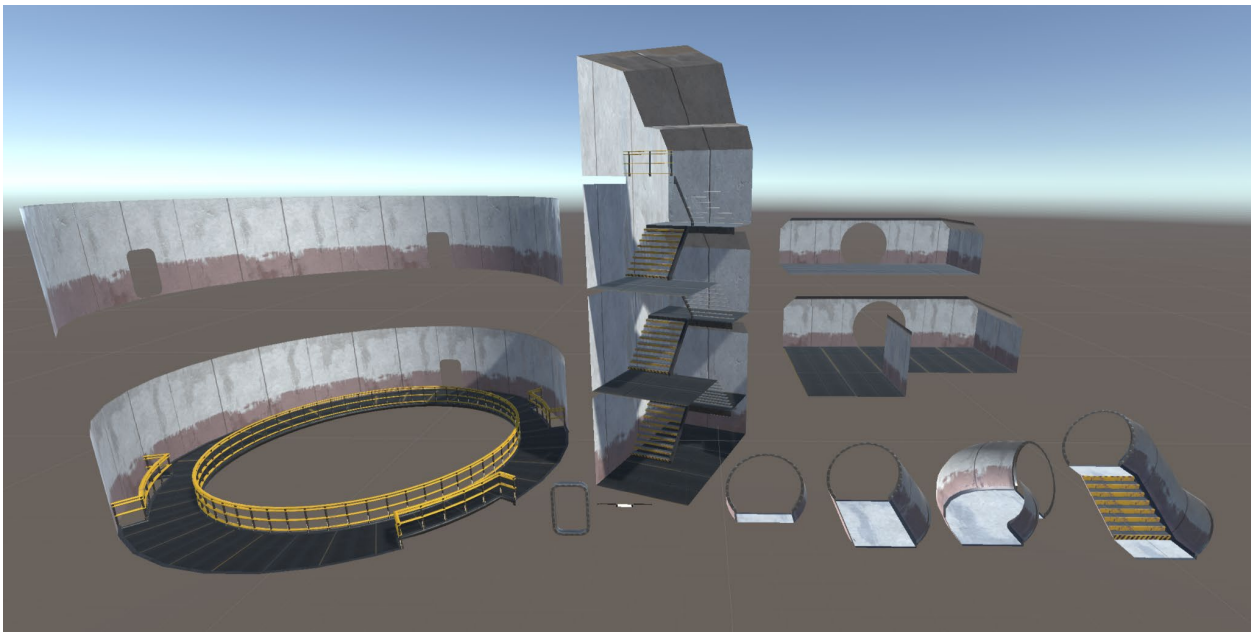


Figure 26 - Finished environment models. Source: Screen capture.

All other models, including the missile, were textured using a traditional UV workflow. The model was unwrapped and positioned in Blender manually, then imported into Substance Painter to be textured. The model and its textures were imported into Unity (Figure 27).

Figure 27 – Full-textured missile. Source: Screen capture.

4.1.4. Lighting and post-processing

The last steps for implementing the environment art were adding lighting and post-processing in Unity. The art team wanted to utilize lighting to enhance the atmosphere of the game. A modular light prefab was created in the modeling and texturing portion of the workflow and included an emissive texture. From there, a Unity light was attached to the prefab and allowed the team to adjust brightness and color temperature as needed. A comparison between reference material and an in-engine screenshot of the game's main level is shown in Figure 28.

Figure 28 - Lighting reference vs. in-engine lighting. Source: URL and screen capture.

The art and technical team worked together in optimizing the lighting, deciding real-time would look the best. Further work would be done to disable any lighting not currently seen by the player as to reduce resources taken up by the game.

The final piece of the environment art implementation was the post-processing. As mentioned in the Artistic Inspiration section, the goal for visual stylization was to emulate the look of a PS1 game. In order to do this, the art team referenced a video from Comp-3 Interactive, How to Make a PS1 Style Game in Unity (Comp-3 Interactive) as a method to achieve this stylization. This feature is to be included in a later build.

4.1.5. UI design

The UI for *Operation Silo* was intended to be simplistic and take up minimal screen space to avoid distracting the player from their sense of immersion. The use of a time limit was a crucial part of the gameplay, but the team wanted to create a visually distinct UI element in place of a traditional timer. The decision to use a dosimeter, a Cold War-era radiation level detector, as a 'timer' was made. This UI element can be seen in Figure 29. The intention was for the red line to slowly scroll across the scale until the player either completed the game or it reached deadly radiation levels and the player perished.

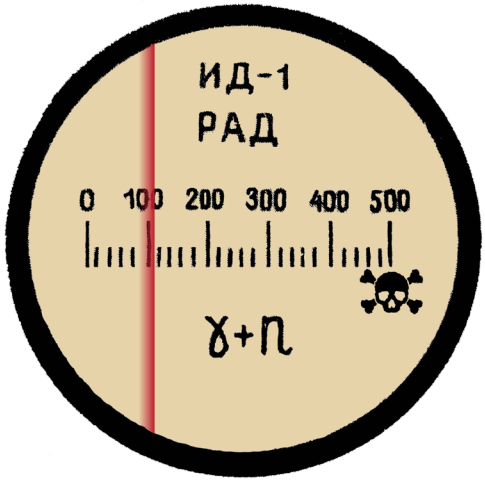


Figure 29 - Dosimeter UI. Source: Screen capture.

For other UI elements, like inventory and collectable journal pages, the art team took heavy inspiration from *Escape Simulator.* This game's inventory system is visually very simple, allowing the player to have constant visual confirmation of what items they hold (Figure 30). This feature is to be implemented in a future build of *Operation Silo*.

Figure 30 - Escape Simulator *inventory display. Source: URL*

4.1.6. Graphic design

A logo for *Operation Silo* was created using a combination of Adobe Illustrator and Photoshop. The design took inspiration from Soviet propaganda posters like the one depicted in Figure 31. This was done to provide an early visual indicator of the time period the game is intended to take place in. Further design was done to create the look of the image being on a CRTV by adding scanlines and a fish-eye lens effect. This graphic as seen in Figure 32 was used as the intro screen for *Operation Silo*.

Figure 31 – Soviet-era propaganda poster. Source: URL

Figure 32 - Operation Silo *intro screen. Source: Screen capture.*

Another important aspect of the game was the use of instructional journal pages. These would be items the player collected and could refer to when completing puzzles. The art team took inspiration from *We Were Here Together* and the methods of page instructions depicted in Figure 33. The first of four journal pages, shown in Figure 34, was created to assist players in solving the lever puzzle. The intention was to have instructions be mostly visual and loosely guide the player without fully explaining the puzzle. Considering the game is in a Soviet missile silo, instructional material would be entirely in Russian. The art team was consistent with that idea and used the story elements as leverage for explaining certain artistic decisions when designing these pages, like the scribbled lever codes.

Figure 33 - We Were Here Together *instruction page. Source: URL*

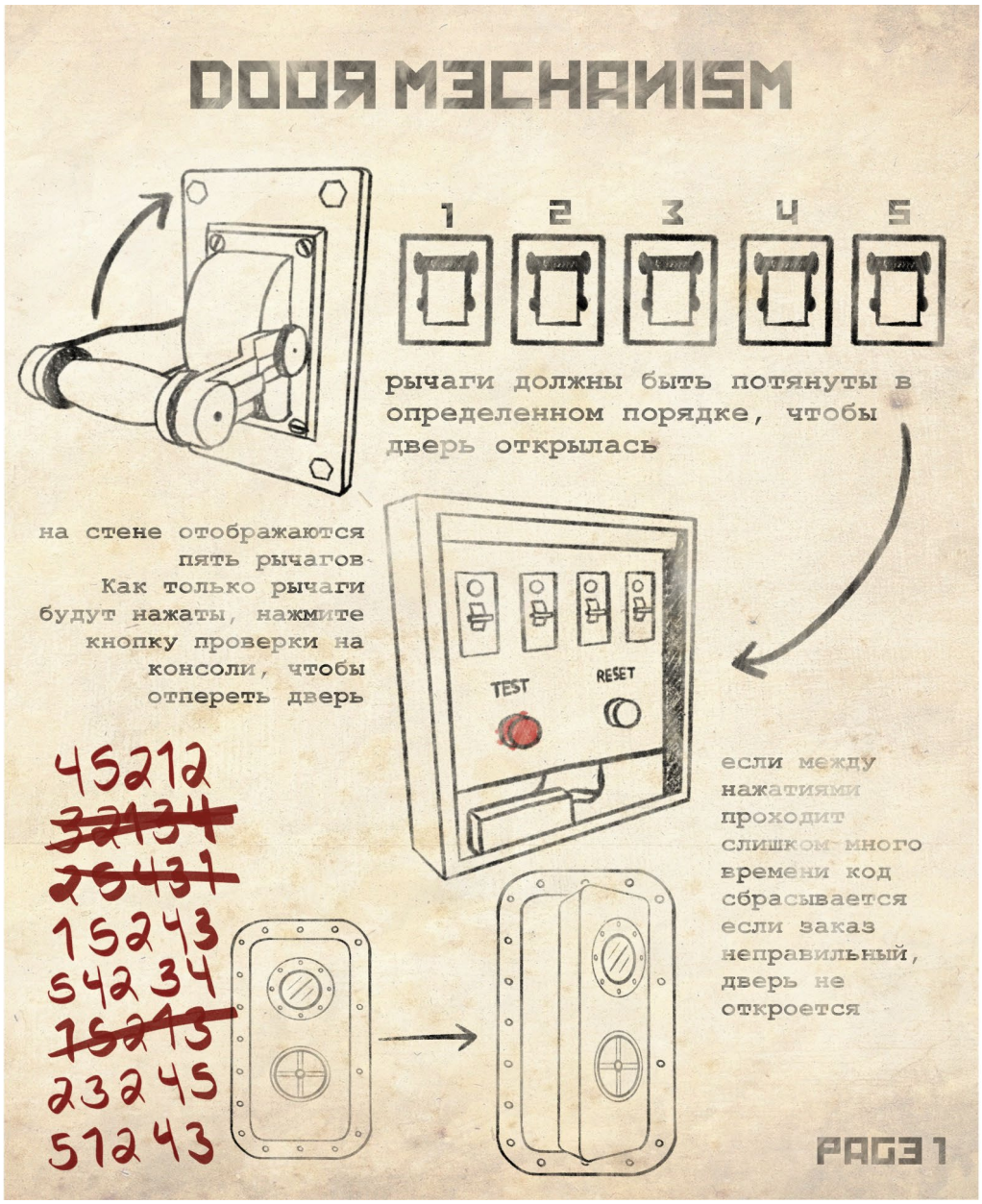


Figure 34 - Journal Page 1. Source: Screen capture.

5. Technical implementation

5.1. Random generation

Developing the procedural/random generation code for the project was a relatively straightforward process. The game's level contains a series of scripts that are automatically triggered to run once the game starts. These scripts work by loading the level's prebuilt segments into a list and then choosing a random segment from that list to spawn into the level. This method of random generation creates a chain reaction that populates the game level with areas for the player to explore. This same principle of list-based random generation is also applied to furniture and interactable objects found throughout the levels various rooms. Once a level has been fully generated, it creates a unique experience for every player.

5.2. Player Experience

We spent a lot of time at team meetings discussing how the player would experience the story throughout the game. We wanted the events to also be accurate to the historical era. It was also important to the team that the player could replay the game and have the experience be slightly different each time. We wanted the player to have to work out the ways to progress through the story by solving puzzles in order to progress to the next floor. On the last floor, the team wanted the player to use the knowledge they obtained from previous puzzles to help them complete the game.

As a team, we had a straightforward vision for the experience we wanted players to have with our game. We knew that we wanted procedural generation in our level, which would ensure that each player would have a different experience when playing. We also knew that we wanted our character in the game to control very realistically. This would provide both a sense of immersive realism and an element of simulation to the player experiencing our game. In-game, the player can move in many of the basic ways that a person can in real life. Players can run, walk, jump, and crouch below objects if they want to. Players also have the ability to walk up to interactable objects and study them the same way you might study an interesting object in the real world. All of these different immersive factors work together, to deliver the unique simulation-style experience that we originally set out to create as a team.

5.3. Player guidance

The team always wanted the player to be able to figure out the puzzles on their own to start. Each puzzle makes sense in the sense of how a real silo may work. Each puzzle should progress to feel more and more challenging. Having a way for players who are not understanding the puzzle to have a hint was important because we did not want players to become so frustrated that they give up on the puzzle and therefore the game. The team wanted to have the player be guided by reasons that made sense to the era that the game is portrayed in. The story helps the player to understand why they are in this silo, and why they need to figure out the real-life based puzzle in order to progress. The team did not want to just give away the answers to the puzzle making them far too easy for the player, and therefore making the game present no challenge.

5.4. Puzzles

It was important for the team that the puzzles the player needed to complete to progress made sense not only to the soviet era, but also to a real silo. For the first two floors the main puzzles to progress made sense to help assist in telling the story. The first puzzle the player must complete is powering the fuse box to power the lights and turn on the power for the PIN pad to the next floor. On the second floor the player uses the manual page to try a code on the lever puzzle. The lever puzzle allows for the next door to the third floor to open.

The puzzles are different variations in the puzzles are set to a number that chooses which objects are spawned in for each puzzle. Using the Unity asset pack that was purchased for this project, the team adjusted code for the implementation in order to allow the objects from the pack to be able to be utilized for individual puzzles.

6. Audio implementation

6.1. Overview

Though sadly much of the audio created for this video game couldn’t be implemented, each type of audio served an important purpose as it was being developed. In this section, primarily written by audio designer Garet Hayward-Mildish, the various aspects of audio will be discussed in detail. This includes the background of the music itself, the inspirations, the techniques used, and what sounds would be implemented in the final version.

6.2. Audio inspiration

When we first established the style of the environment itself, that being an abandoned ICBM silo, The audio team immediately thought of certain video games. Most notably, they considered other video games that took place in isolated, or otherwise abandoned areas. *Dead Space* (Figure 35) was the first game the team mentioned, but most of the songs were oriented more towards actions and were too technological to fit the environment.

Figure 35 - Dead Space *cover art. Source: URL*

However, the team considered a small selection of sounds which were little more than nursery rhymes. Arguably some of the most unnerving songs in the game, these songs made use of echoes and reverb to make the singer sound distant, trapped and in danger. With this frightening and unnatural precedent, they could make the soundtrack equally unnerving.

The goal with these reverb effects was to simulate a crude ceiling speaker, which would give the tinny and distant quality to the music that the audio team desired. Ironically, this involved lowering the quality and clarity of the music by a substantial amount, but for the aesthetic, it was necessary.

6.3. Sound effects

Certainly, the most omnipresent and apparent of the game's audio, sound effects were necessary to fill the void of silence should the music be removed or bereft from the game. Lacking in traditional audio recording equipment, the team chose to make use of freesound.org, a website where users can post sound effects they created for any purpose. All sources for sounds used in the production of this game are found in the Appendices.

Frequently, downloaded sounds would exhibit problems that made them less than ideal for the purposes of the game. For instance, a sound that was meant to be a single electrical shock would play multiples of the sound, or in some cases a sound would be poorly recorded, requiring a filter to be applied to it. These were easy enough to fix using audio software like Reaper, and thus they could be implemented to better suit the nature of the game.

YouTube was also mined for sound effects that better suited some of the obscure noises needed, such as a CRT monitor degaussing, or turning off. Here, a wealth of sound effects from royalty-free websites could be found, and entire channels dedicated to appropriate sounds. Even then, the team had to search through a few to find the perfect samples. At times there was an overwhelming number of videos available, and some even showcased a collection of multiple sounds. Overall, these sounds tended to be more professional, but tougher to cut down.

The primary theme for this game was industrial and abandoned, so most of the sounds would be fittingly mechanical to suit the environment. Sounds would occasionally be altered to give them a more metallic sound, such as slowing them down slightly, or applying a "stretch" effect that makes the sound longer, a bit broken, and slower. In the case of sounds like an industrial engine starting up, these effects make the machine sound farther away, but undeniably huge. Although it's better to make these sorts of sound effects using your own resources, making use of sound online can be a quick and efficient way to get the sound you want without the hassle of gathering materials for an original sound effect.

6.4. Music

The audio team's priority when making this project was establishing the style of music. Since this game took place in a Soviet missile silo, the first and most obvious idea was developing a Russian folk music sound. Initially, there was a debate whether folk music or pop music was more popular in the time we wanted to depict. With a definite direction, they worked on implementing instruments, notably the balalaika, as a foundation for the song. Thus, they developed the first song, which is called "Rising Rads."

Sound was another matter, as the game would require sound effects to add some color and engagement to the interactions. Most of the puzzles involved using technology, so they collected a bunch of radar beeps, electronic pings, and whatever else seemed relevant to the setting. Sure enough, a small library of sounds was gathered, and the total expanded each passing week.

Within *Operation Silo*, a few different forms of audio were utilized, with the intent of immersing the player in a way the visuals couldn't. First, would be the soundtrack, which is designed to prepare the player for a puzzle solving environment and establish the setting of the game. Next, there are the sound effects, which give realism to the game whenever the character interacts with the world. Walking, picking up an object and flipping a switch should elicit a reaction from the environment, and sound helps form this connection between the player and the world. Finally, there is voice acting, an aspect of the game designed to give character to the world. While some games don't require the use of voice acting, we intend to add a tone of humor to the game, done through the incompetence of the main character and their engagement with a problem for which they are unprepared.

The soundtrack for this game is an original composition, designed to portray two specific aspects of the game world. First, the music is designed to give the player a sense of urgency, since sections of this game have a time limit. The music is designed to push the player to complete their assigned puzzles, and ensure they complete it within their limits. The secondary purpose is establishing the Russian setting of this game through instrumentation and musical themes. This game is meant to take place in the Soviet Union during the 1950s, and this means the music should reflect the country as it existed during this time.

Analysis of music from this era of Russian history indicates that folk music was quite popular. This made instruments like the balalaika and the accordion more prominent in the score, thanks to their frequent use in the music of this time.

Additionally, Russian folk music has a few interesting characteristics that make it wholly unique. Notably, percussion in these songs is minimal, with the beat maintained by a secondary instrument instead of a drum. The tempo of these songs also tends to increase as the song plays, going from a slow and almost sleepy rhythm to a quick and peppy melody.

7. Evaluation

Operation Silo was tested by 21 people before writing this report. The testing population included Professor Brian Moriarty's IMGD 5200 students, as well as being emailed to the dl-imgd-allstudents tag on Outlook, in order to get as many responses as possible.

7.1. Bugs

Within the survey, the second question was concerning any bugs or issues players encountered. This was done in order to make sure any issues that were fresh in the players' minds got addressed early. Bugs and issues that users reported were typically the same handful of issues. These were issues with colliders, such as certain walls allowing players to fall out of the world, or players getting stuck on the stairs. Very few players experienced certain bugs, such as an inability to enter in the code to move on to the second floor. This issue will be addressed, but there is not a lot of detail due to IRB protocol. The majority of the bugs being collider, model, or player controller related makes fixing them very easy which is encouraging.

7.2. Interactivity feedback

When it came to feedback regarding the game itself there were a lot of positive responses and some criticism as well. For example, a little over 50% of users felt at least somewhat satisfied after completing puzzles in the games demo, as seen in the chart corresponding to question four in Appendix D: Survey Results. As for users that felt less than satisfied, the team is confident this is due to the demo lacking certain features that would enhance the experience.

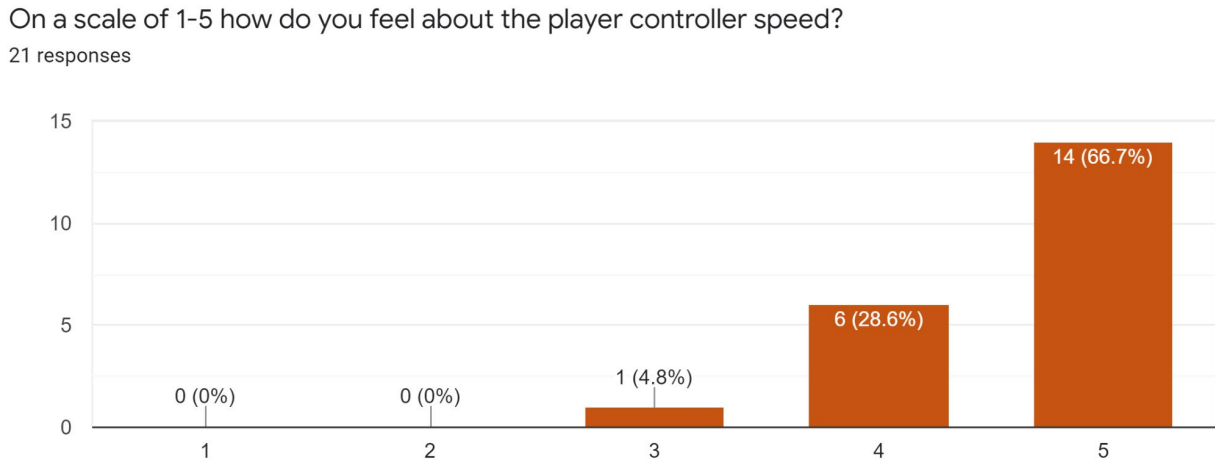


Figure 36 - Likert scale on player controller speed.

Question two on the survey pertains to the speed of the player controller. The team understood the controller moved somewhat faster than desired and used this as a control question to make sure users taking the survey had actually played the demo. The feedback received confirmed the team's belief, with nearly every response saying the controller was far too fast as seen in Figure 36 seen above. Overall, users enjoyed the level of interactivity provided by the features, with some expressing interest in playing a complete version in question ten of the survey where they were given an opportunity for open response.

7.3. Praise and criticism

Of the criticisms the demo received, the most common pertained to movement speed (as expected), some issues with the player controller, issues with colliders resulting in falling out of the playable scene, and calling out lacking content in the game in regards to story/context and audio feedback, such as ambient sound and implemented sound effects. The criticisms of the demo pointed out some important issues that the team did not realize existed before while also reaffirming certain preexisting understandings.

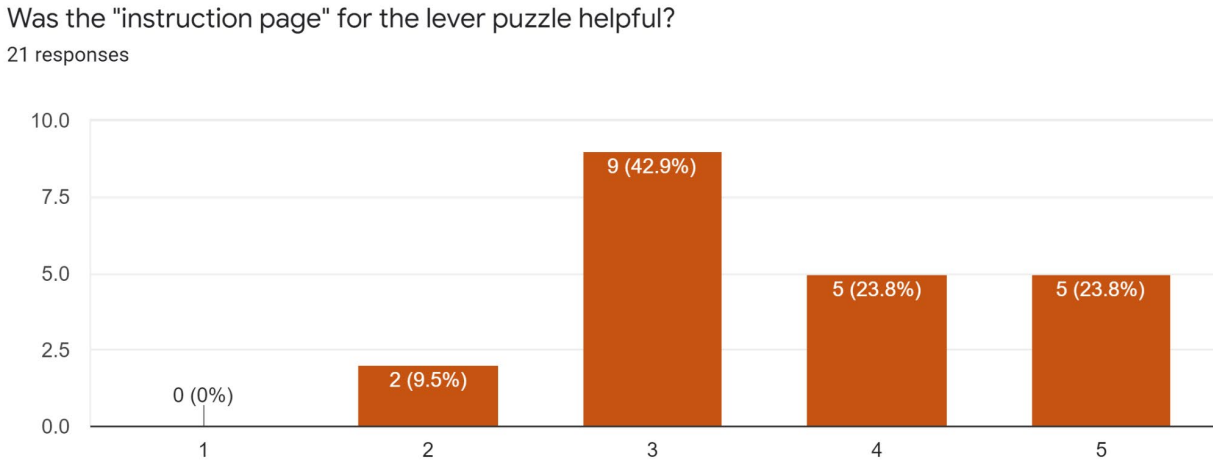


Figure 37 - Likert scale on helpfulness of instruction page.

Users that participated in the demo had many points of praise as well. Figure 37 above, shows an almost entirely positive response to the guiding “journal page” feature of the game, an example of this can be seen in Figure 34. Roughly ninety percent of users felt the feature was at least somewhat helpful. Positive responses in data are helpful, but the open response in question ten was where a majority of praise and criticism came forward. Again, some users expressed interest in the concept of the game and interest in playing a complete version. Meanwhile, some users liked the silo itself as an environment for a game.

7.4. Conclusions

The data received in the feedback for *Operation Silo's* demo was eye opening in many ways. Some served to boost the team's morale in the praise for certain aspects, while some served to point out glaring issues that the team failed to find otherwise. Overall, the team was able to glean a lot of useful information from almost every response to the survey.

8. Postmortem

8.1. What went wrong

The game ran into quite a few issues during the three terms of work. The original choice of using Unreal held the game back more than it should have. The team made a valiant effort to become familiar with the visual scripting and workflow of the engine, but ultimately wasted a substantial amount of time toiling away at it. On top of this, the team was unfamiliar with source control management for Unreal engine. There was an unsuccessful attempt to acquire a Perforce key, which would have supposedly made source control vastly easier. These reasons inspired the decision to switch to Unity.

The decision to switch to Unity put the team in a difficult place as deadlines drew closer. There were other minor incidents that slowed down the production process. These would include unexpected issues presented by COVID-19 and difficulties related to the entire team being made up of WPI transfer students from the recently-closed Becker College. Occasionally, members of the team would test positive for COVID-19, making meeting as a team to work on this project far more difficult.

Academically, the transition to WPI from Becker was rather smooth. However, for some members of the team there were unexpected issues or situations, such as credit transfer issues or being unaware of the dreaded C-Term, that most WPI students agree is the most difficult of the four terms.

8.2. What went right

Despite the above issues, many things went in the game's favor. Professor Moriarty was the ideal advisor for this particular project. He provided knowledge of the period the game is set in that not many others would be able to provide. Decisions to make modular assets alongside finding the Adventure Game Puzzle framework sped up the development timeline in a great way. Most important, the team was able to get a playable build in order to get testing data for this report. This group also had a strong cohesion and shared vision allowing the team to come together despite adversity.

8.3. Future work

The challenges faced alongside the successes found along the way emboldened the team to continue working on the game in order to reach the original scope. Any further updates to this project will be found here on the teams itch.io page.

8.4. Personal experiences

8.4.1. Justin Gaborit

My time devoted to the Operation Silo MQP was mostly spent implementing code and other assorted features of the project's gameplay. Once we had decided as a team to change game engines, I began by working diligently to put together a character controller that had the right feeling for the type of puzzle-solving experience we envisioned. Over the course of a couple of days, I coordinated with my team member Payton to build a character testing level where the player could test out the different functions of the character controller such as crouching, jumping, angle traversal, such as moving up sets of stairs, and a zooming feature for the player to view collectible objects at a far distance. One of the programming challenges that I ran into while developing our custom character controller, was the character's jump registration. Not having a functioning jump registration system on our character controller would allow our player to jump as many times as possible while already in the air. Some games would call this a double jump, but in our game, this would be considered a bug. To fix this problem, I implemented a system that would detect when the player had jumped and when they touched the floor again. The script would implement a rule allowing the player to jump only if they were currently touching the floor.

In addition to my work on the character controller, I provided a series of 3D model designs for the level layout of the missile silo. I modeled these original designs off various hallways and corridors of existing missile silos. When designing the 3D models, I tried to stick to an industrial and prefabricated look complete with rivets and tube-shaped passageways. I believe that the look and layout of the missile silo was one of the areas of this project where I succeeded the most. The look of the silo appears to be accurate to silos in the real world, and while walking around, the player gets the impression that they're in an old missile silo while walking around and completing the game's puzzles.

One of the most important aspects of our MQP project was the planning and execution of the puzzles that players are required to complete. Originally, we had begun with around 14 steps in total. These steps included activities like collecting fuses that were hidden around the missile silo, as well as inserting them into the circuit breaker and restoring power to the silo. After a series of meetings and extended planning, we were able to reduce the number of steps the player would need to complete down to 12 in total. We decided as a development team that this would be more suitable as some minor tasks could be condensed by simplifying the way players interacted with objects such as buttons and keypads. One example of this change could be seen with the elevator we planned to implement on the third floor of the missile silo. The elevator door was originally planned to be opened using a keycard that the player would find after opening a safe on the second floor. As a team, we concluded that providing the player with a code to enter into a keypad would make more sense. By doing this we could leverage pre-existing scripts to save the team some time.

The general plan for the layout followed a simple system of prefabricated rooms that could then be strung together to establish a unified missile silo layout. The silo would have three main floors each with one hallway branching off in a different direction. In addition to the hallways, each floor would have a main catwalk allowing the player to move freely from the stairwell to the side of the floor where the hallways begin. There would also be a stairwell connection on all three floors. This stairwell is where the player would start the game.

The Random generation feature was one of the major elements that we played around with during the development of the game. As a team, we wanted to ensure that the experience we were creating sustained a level of replayability for the players. On the programming team, we also wanted to try and use the elements of random generation in our game to see what interesting level combinations we create. The level generation began as a very complex set of rules, but over the development of the project, we narrowed down a series of features we found to be the most important to the player's experience. Among these features were a random generation of hallways, randomized item placement, and randomized positioning of interactable objects such as fuse boxes and keypads. Hallways would randomly generate by following a chain reaction, in which one section of the hallway would spawn, then trigger another section of the hallway, and so on. This chain reaction would continue until a certain number of hallway segments had appeared within the level. Collectible objects and interactable objects such as fuses, and lever boxes would be put into groups. Within any given room in the missile silo, four or five of these groups would exist but only one of them would appear once the player started the game. This combination would allow for a varying degree of replayability and ensure that each player had a slightly different experience when playing.

8.4.2. Garet Hayward-Mildish

In this project, my work was rarely the focus of attention as it developed. The steps to making a video game require an actual playable game as the first priority. Because my role involved the story and audio aspects of the game, my components wouldn't see much implementation into the game itself. Either way, I worked on my pieces so there would be some audio content present in my game. By the end of this development period, the only thing that could be implemented were the sound effects I had created, which were the easiest to implement and necessary for the game feel. Without these sounds, the game would be eerily quiet, and barely engaging.

The writing was developed while we worked on the overall concept for the project itself, but none of it could be implemented because the development of the actual game was lagging behind. Early on, there were also lofty ideas of adding voice over, which would mostly focus on the main character, establishing who he is and why he's in the silo. Other pieces of lore would be implemented, and this fractured story would make use of the environment as well as the dialogue, making it an intriguing setting for the game. However, gameplay was the priority, and as a consequence these lofty goals had to be set aside, otherwise we'd have no game to present.

Despite not being a primary member of the development team, I would give design ideas to further the game feel and establish what this game should have and what could be changed or removed. These ideas would sometimes be integrated into the game itself, and when a final puzzle was considered for the game, I was primarily in charge of designing and implementing the various parts of it. This puzzle would include elements from every previous puzzle in the game, and would be

8.4.3. Morgan Jones

My contribution to *Operation Silo* was as an environment and UI artist. Most of my work was focused on creating the concepts, finalized environment models, textures, UI, and any other graphical elements. I worked closely with the programming team to ensure any art assets were implemented successfully and materials applied correctly. I was also heavily involved in the processes of puzzle creation early in development.

Going into this project, my main goal was to explore industry standard environment art pipelines, especially trim sheets. I had previously not known of this workflow and understood it would be a necessary skill set for entering the game industry. Over the course of development, I learned the best practices and methods for creating trim sheets and quickly understood the advantages they had. Once the trims were created, development sped up immensely as it would not be necessary to texture each modular environment piece separately. Once seeing the environment come together in-engine, I felt a great sense of pride at how well it all came together. Considering the steep learning curve of trim sheets, I was incredibly pleased with my progress and how they turned out.

I worked alongside Justin in creating and optimizing the modular 3D environment models. After his initial modeling, I then reduced poly count where I could and handled all UV mapping and texturing. We worked together to create and implement the art into the main level. I also modeled and textured all other additional 3D models outside of the ones from the Adventure Puzzle Pack.

Beyond the 3D environment art, I was responsible for UI designs and graphics including journal pages, logo, and intro scene. Although I would consider myself an Environment Artist and spend a majority of my time working on that skillset, I have extensive experience with UI design and logo creation as well as various forms of illustration. I used the knowledge I had from previous projects to create the UI and learned a few new methods when creating the other illustrations.

Overall, I believe my work on *Operation Silo* has strengthened my abilities as an environment artist and I am incredibly proud of my work. Although I was unable to implement all of the artistic elements the team had originally planned for, we still produced a visually appealing product with the limited time we had. While I believe the team spent a bit too much development time in the concepting and planning stage, we did overcome a plethora of roadblocks to create a project to be proud of.

8.4.4. Payton Roche

My time creating *Operation Silo* was mainly spent on implementing features in the game. The majority of my work was once our team decided to switch engines. I soon after worked to understand my team member Justin's work on the player controller. The majority of my work after transitioning to Unity was to implement the features we wanted while working with my team member Justin.

Operation Silo is the first game I have worked on that incorporates puzzles so heavily into the gameplay, which excited me because I really enjoy creating puzzles for other people as well as completing them for myself. Our team wanted to create puzzles that were difficult but not to the point where they were frustrating to try and figure out. There were a number of puzzles

where we cut them in meetings because either they were not original enough, or they were too complex, or they just did not fit in the Soviet missile silo theme.

My goal from the start of this project was to create a game that implements new features and ideas that I have not created in past projects. My goal was to create a unique game that incorporates interesting puzzles for the players, while trying to incorporate new mechanics that I have either never seen, or that I have not worked on yet. I was most excited about working on the randomization idea throughout the game. While working in the programming team, we started working on having randomization be a large part of the game to make the puzzles replayable. The degree of randomization was scaled back due to scoping issues, but my group and I are happy that there is enough randomization of the rooms to allow players to enjoy replaying the game. I am pleased to see the different kinds of randomization for the puzzles we came up with. The hallways spawning different segments randomly, or the codes being different for each playthrough allowed the experience to be a bit more unique for each player.

I recommend meeting more outside of the scheduled class time to increase productivity. I would also suggest working with a game engine that you are comfortable with to start the project. Using asset packs to save time on mechanics or problems that do not need to take up time should have been more of our priority from the start. This is also the first era-based game I have worked on, so creating accurate elements to the story of the game was an important part of making the game feel more immersive. The best trait about working on *Operation Silo* with this team was that everyone could speak freely, and express their opinions at every meeting.

8.4.5. Brendan Horack

My primary contribution to this project came in the form of project management or the role of a producer. I was, just like my teammates, a Becker College transfer student. The inherent difficulty I faced coming to Worcester Polytechnic Institute was the lack of a production track and production-related courses. The MQP project presented a unique opportunity to work within my skill set again. I also contributed to concepting and design of the game.

My role as a producer involved leading our meetings, scheduling, and making deadlines. We would meet at least twice weekly in WPI's Tech suites in order to assign somewhat required time to work on our project together and, if possible, in person. The main thing I tried to accomplish was setting deadlines and holding people accountable. By checking in when we would meet before our class time with Professor Moriarty, I could get a sense of where people were with their tasks and prevent the team from being surprised by issues during those meetings with the professor. This concept is taken from the Scrum ideology, usually referred to as stand-ups, is a way to hold the members of a team accountable. We had also started the project using Trello as a task tracking tool, but that fell out of fashion in favor of just having our weekly notes as well as meeting more often. That definitely is not everything I did from a production perspective, but it's a rough picture of my contributions.

From the perspective of design and concepting, I think it is fair to say the whole team was involved in most of the process of deciding on details in the game such as gameplay flow or certain narrative points.

I remember two particular meetings in which I heavily influenced gameplay decisions. In one, we needed to decide on a puzzle that could relate to the action we wanted the player to take.

This is where the *Mastermind* idea occurred to me. The other was a meeting with just our programmers attempting to create a visual, simple flowchart to show the gameplay flow. We met in a tech suite and illustrated the flow of the entire game on the whiteboard. Another opportunity this meeting presented was to fill any holes we found along the way. One big decision we made was in reference to the final puzzle. We ultimately decided on the different endings.

Having been through the MQP process I really did learn a lot. I would say it was more stressful due to the nature of being a transfer student, but Professor Moriarty was a great advisor to have during this process.

My general advice would be to avoid rushing every major project. It made things much more difficult, especially for those trying to graduate this May. Make sure you have your time, and make that time count. We didn't realize the magnitude of some of the projects we had to do, but WPI's IMGD staff made sure we got what we needed.

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Appendices

A. IRB documents

A1. Study Protocol/Research Methods

Title of Research Study: Procedurally Generated Adventure Game

Investigator: Brian Moriarty

Contact Information: bmoriarty@wpi.edu, 508 831 5638

Title of Research Study: Procedurally Generated Adventure Game

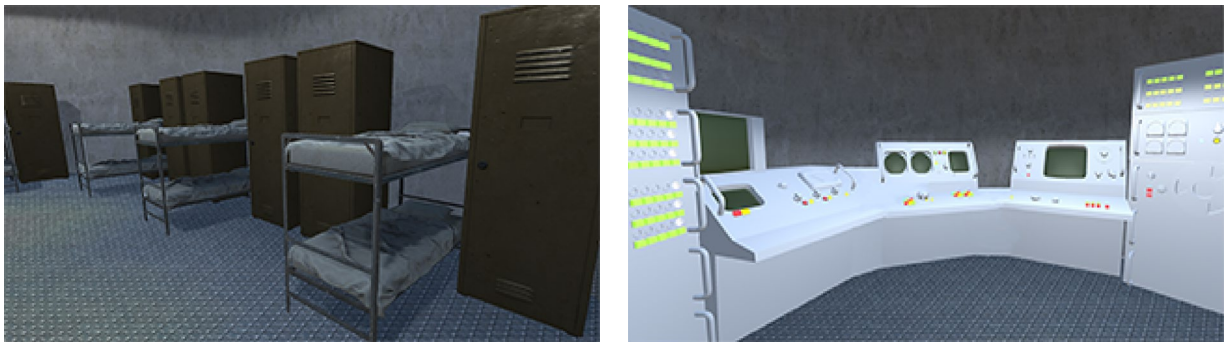
Sponsor: WPI

Purpose of study

Obtain user feedback to determine if experience goals are being achieved, locate operational bugs, and identify opportunities for design improvement.

Project description

This project is a first-person 3D adventure game, with an emphasis on environmental storytelling and puzzle-solving.



Preliminary screenshots of the player exploring a Soviet-era missile complex.

The player assumes the role of a Western spy infiltrating a Soviet-era ICBM silo to sabotage a pending missile launch. To achieve this goal, the player must engage and navigate a procedurally generated environment and solve a collection of critical thinking challenges before time runs out.

Study protocol

Participants are greeted by researchers, presented with an opening briefing (see below), and asked to read and sign the Informed Consent Agreement and COVID Risk Mitigation Protocol forms (attached). PCs equipped with the required controllers and ready-to-play software are provided.

After completing the game, participants are asked to complete a short anonymous survey (sample attached) to characterize aspects of their subjective experience and solicit suggestions for improving the experience.

Opening briefing for testers

“Hello, and thank you for volunteering to test our project. Before we begin, could you please read and sign these Informed Consent Agreement and COVID Risk Mitigation Protocol forms? [Tester signs forms.] Thank you. When your session is complete, we will ask you to complete a brief survey about your play experience. At no point during your test session, or in the survey after, will any sort of personal and/or identifying information about you be recorded. Please begin playing when you feel ready.”

A2. Informed Consent Form

Informed Consent Agreement for Participation in a Research Study

Title of Research Study: Procedurally Generated Adventure Game

Investigator: Brian Moriarty

Contact Information: bmoriarty@wpi.edu, 508 831 5638

Title of Research Study: Procedurally Generated Adventure Game

Sponsor: WPI

Introduction: You are being asked to participate in a research study. Before you agree, however, you must be fully informed about the purpose of the study, the procedures to be followed, and any benefits, risks or discomfort that you may experience as a result of your participation. This form presents information about the study so that you may make a fully informed decision regarding your participation.

Purpose of the study: This study will obtain user feedback to facilitate design improvements and find/address operational bugs.

Procedures to be followed: You will be asked to play a brief game lasting less than fifteen minutes. Instrumentation in the game software will anonymously record your activity during play. After completing the game, you will be asked to complete a brief, anonymous survey describing aspects of your subjective experience.

Risks to study participants: There are no other foreseeable risks associated with this research study.

Benefits to research participants and others: You will have an opportunity to enjoy and comment on a new game under active development. Your feedback will help improve the game experience for future players.

Record keeping and confidentiality: Records of your participation in this study will be held confidential so far as permitted by law. However, the study investigators and, under certain circumstances, the Worcester Polytechnic Institute Institutional Review Board (WPI IRB) will be able to inspect and have access to confidential data that identify you by name. Any publication or presentation of the data will not identify you.

Compensation or treatment in the event of injury: There is no foreseeable risk of injury associated with this research study. Nevertheless, you do not give up any of your legal rights by signing this statement.

For more information about this research or about the rights of research participants, or in case of research-related injury, contact the Investigator listed at the top of this form. You may also contact the IRB Manager (Ruth McKeogh, phone 508 831-6699, email irb@wpi.edu) and/or the Human Protection Administrator (Gabriel Johnson, phone 508-831-4989, email gjohnson@wpi.edu).

Your participation in this research is voluntary. Your refusal to participate will not result in any penalty to you or any loss of benefits to which you may otherwise be entitled. You may decide to stop participating in the research at any time without penalty or loss of other benefits. The project investigators retain the right to cancel or postpone the experimental procedures at any time they see fit.

By signing below, you acknowledge that you have been informed about and consent to be a participant in the study described above. Make sure that your questions are answered to your satisfaction before signing. You are entitled to retain a copy of this consent agreement.

_____ Date: _____

Study Participant Signature

_____

Study Participant Name (Please print)

_____ Date: _____

Signature of Person who explained this study

A3. COVID-19 Risk Mitigation Protocol

Title of Research Study: Procedurally Generated Adventure Game

Investigator: Brian Moriarty

Contact Information: bmoriarty@wpi.edu, 508 831 5638

Title of Research Study: Procedurally Generated Adventure Game

Sponsor: WPI

At WPI, our primary responsibility related to research is to protect the safety of our research participants.

COVID-19 refers to the coronavirus that is being spread across people in our communities. We need to provide you with important information about COVID-19, and to tell you about ways your study participation might change because of COVID-19 related risk.

If you are considering joining a study at this time or are currently enrolled in a study, **it is important that you consider the following information to determine if study participation is right for you at this time.**

How is COVID-19 spread?

COVID-19 is a respiratory virus spread by respiratory droplets, mainly from person-to-person. This can happen between people who are in close contact with one another (less than 6 feet). It is also possible that a person can get COVID-19 by touching a surface or object (such as a doorknob or counter surface) that has the virus on it, then touching their mouth, nose or eyes.

Can COVID-19 be prevented?

Current ways to minimize the risk of exposure to COVID-19 include "social distancing" which is a practice to decrease the potential for direct exposure to others who may have been exposed to COVID-19, for example by avoiding large gatherings or refraining from shaking hands with others. It is important to understand that since study participation may include increased travel outside of your home and increased exposure to others within a research site it may increase your exposure to COVID-19. At this time, there is no vaccination to prevent COVID-19 infection.

What are the risks of COVID-19?

For most people, the new coronavirus causes only mild or moderate symptoms, such as fever and cough. For some, especially older adults and people with existing health problems, it can cause

more severe illness, including pneumonia. While we are still learning about this virus, the information we have right now suggests that about 3 of 100 people who are infected might die from the virus.

Who is most at risk?

Individuals over 60 and with chronic conditions such as cancer, diabetes and lung disease have the highest rates of severe disease from the infection.

What do we do to minimize risk for research participants?

a. All in-person research will take place on the WPI campus.

b. Participation in the study will be strictly limited to WPI students and faculty authorized to attend campus in-person.

c. **Research visits will strictly abide by all official WPI COVID-19 risk mitigation protocols in effect at the time of the test session.** These protocols specify campus-wide standards for minimizing the potential spread of COVID-19, including (but not limited to):

- Visitors allowed on campus
- Required vaccination status of visitors
- Masking requirements
- Social distancing requirements
- Maximum room occupancy requirements

A summary of current WPI protocols is maintained at this URL:

https://www.wpi.edu/we-are-wpi

d. **Regardless of current WPI protocols,** all test administrators and subjects will be required to wear a face mask at all times during the test session.

e. Test subjects will visit the research site only once, and only long enough to review and sign the Informed Consent Agreement and COVID Risk Mitigation Protocol, participate in the test and respond to the research survey.

f. The location where study subject visits take place will have hospital-approved hand sanitizer readily available for use before and/or after the test session.

g. All physical equipment handled by subjects during the test (keyboards, mice, game controllers, headsets, etc.) will be thoroughly sanitized with alcohol wipes before each test session.

If you have further questions about COVID-19 and your participation in research, please talk to your study team.

_____ Date: _____

Study Participant Signature

_____

Study Participant Name (Please print)

_____ Date: _____

Signature of person who explained this protocol

A4. Study Instrument

Study Instrument for Procedurally Generated Adventure (Preliminary)

1. How would you rate the difficulty of understanding the game's rules and instructions?

[Likert Scale, 1-6]: 1 = Difficult, 6 = Easy

2. How would you rate the difficulty of operating the game?

[Likert Scale, 1-6]: 1 = Difficult, 6 = Easy

3. How would you rate the total duration of the game experience?

[Likert Scale, 1-6]: 1 = Too short, 6 = Too long

4. How would you rate the effectiveness of the game's mechanics?

[Likert Scale, 1-6]: 1 = Ineffective, 6 = Highly effective

5. How would you rate the effectiveness of the game's visuals (modeling, layout, color, lighting, etc.)?

[Likert Scale, 1-6]: 1 = Difficult, 6 = Easy

6. How would you rate the effectiveness of the game's use of sound effects and music?

[Likert Scale, 1-6]: 1 = Ineffective, 6 = Highly effective

7. Which of the following terms would you use to describe the game?

Please check all that apply.

[Multiple checkboxes]

- o Tactical
- o Strategic
- o Puzzle-solving
- o Horror
- o Simulation
- o Role-playing

[Optional write-in short answer] Other terms (please specify): _____

8. Which of the following emotions did you experience while playing the game?

Please check all that apply.

[Multiple checkboxes]

- o Anger
- o Anxiety
- o Boredom
- o Excitement
- o Disgust
- o Embarrassment
- o Fear
- o Grief
- o Joy
- o Relaxation
- o Sadness
- o Surprise

[Optional write-in short answer] Other (please specify): _____

9. How likely would you be to replay the game to explore different outcomes?

[Likert Scale, 1-6]: 1 = Not Likely, 6 = Very Likely

10. How likely would you be to recommend this game to a friend?

[Likert Scale, 1-6]: 1 = Not Likely, 6 = Very Likely

11. (Optional) How would you describe the most satisfying way to play the game (if any)?

[Short Answer] _____

12. (Optional) Please add any additional comments or suggestions here.

[Short Answer] _____

B. Playtesting survey

1. What was the first thing you did in the game?

[Open Response]

2. Did you encounter any issues/ bugs?

o No

o Other [open response]

3. On a scale of 1-5 how do you feel about the player controller speed?

[Likert Scale, 1-5]: 1 = Too Slow, 5 = Too Fast

4. Did you find a feeling of satisfaction upon completing puzzles?

[Likert Scale, 1-5]: 1 = Not at all, 5 = Absolutely

5. How did you feel about the Fuze Box task?

[Likert Scale, 1-5]: 1 = Far too simple, 5 = Just right for a first task

6. Do you think the keybinds (controls) make sense?

o Yes

o No

7. Did you find the Lever puzzle challenging?

o Yes

o No

o Somewhat

8. Was the "instruction page" for the lever puzzle helpful?

[Likert Scale, 1-5]: 1 = Didn’t need it, 5 = Very Helpful

9. How many times did you reference the "instruction page" for the lever puzzle?

[Drop Down]

o 1

o 2

o 3

o 4

o 5+

10. Please use this space as an opportunity to give more detailed opinions that were not addressed in the survey.

[Open Response]

C. Playtesting data

These are the results gathered from the *Operation Silo* surveys under their corresponding question with relevant graphs.

1. What was the first thing you did in the game?

- I went down the stairs
- Try and use the keypad the 2nd floor stairs
- I climbed up the stairs to see how far I could go, and tried and failed to interact with the keypad at first
- Tried to go to the second floor
- I went up the stairs
- Went out the door on the first floor
- Tried to enter 1234 to the keyboard
- Walk down the stairs and find the 4 fuses.
- Go down stairs.
- Read instruction on the wall
- Read the small blurb
- Went to the door that had a passcode of "1234"
- Reading the instruction
- Rotate my camera, then move my character.
- Run upstairs until hit the invisible collider.
- I read the text in front of me

- Look at hints on the wall
- I read the instructions on the wall then tried to go up to the next floor
- Walk upstairs and try to open the door
- The first thing I did was try to progress with the instructions as requested specifically.

2. Did you encounter any issues/ bugs?

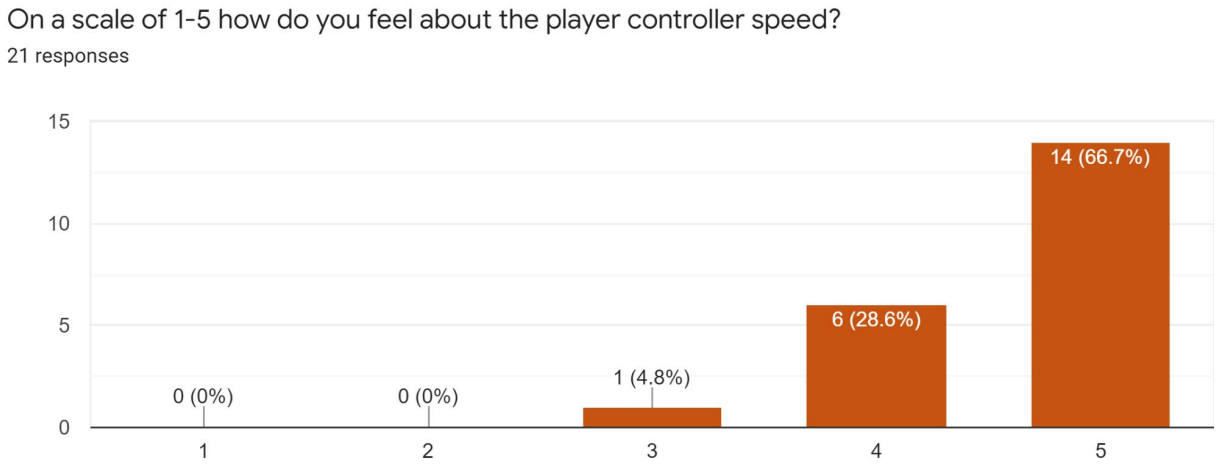
- I had to jump to go up the stairs
- I found a wall without collisions on the 2nd floor inside the silo by the door that leads to the lever room. This let me fall out of the world. I also found the movement to be a bit sticky, if I held keys down they would stick for about a second after I let go.
- No
- On the second floor doors, if you ran into the doorway, you would exit the game world and fall into the void, forcing you to restart your game. Also on the first floor stairs, you can't run up them, you jsut become stuck, so you have to jump over them,
- The walls in the main massive room sometimes lacked collision, causing me to fall out of the world and be unable to continue. The stairs don't work without jumping.
- At one point I clipped kind of through the wall while trying to go through the door.
- double "on the" in the third level
- On the upper floor, I walked through a wall and fell out of the world.
- I couldn't get to the third floor until the door to the third floor was opened. On the stairs from the second floor to the third floor I hit an air wall. Because I couldn't get to the third floor, I didn't know there was a door on the third floor.

- The wall near the center hole on the second floor doesn't have colliders, and can walk through easily
- I had to jump up the stairs
- I could not enter a code to get through the first door... could not play the rest of the game.
- No
- A lot...The circular room on the second floor has the problem of model clipping (passing through), and I guess it's because of the collider. And, the rubberbanding issue and the stuttering issue happened occasionally. Besides these, there were also issues with the collider on the stairs, so the character had to jump to get upstairs.
- When I was facing the keypad puzzle, I clicked KeyCode.Alpha1, which opens the the hint for the lever puzzle. I took it as the hint to the keypad puzzle and got stuck for a while. 2) The collider on the building exterior is missing on the level 2, therefore you can escape the building by jumping off the wall.
- No
- No
- I got stuck outside of the map LOL
- No
- First and foremost, on the second floor of the building, there are a multitude of fake walls that if the player walks into they will fall out of the map. I noticed a big one near the door to the lever room where on my first try due to the speed I clipped out and fell to the first floor. I tried again and went plummeting into the void. Secondly, this is less of a bug, but most of the stairs in the building need to be jumped up. I thought this was a design choice initially, but the last set allowed me to run up it. Thirdly, when the player has the notes in

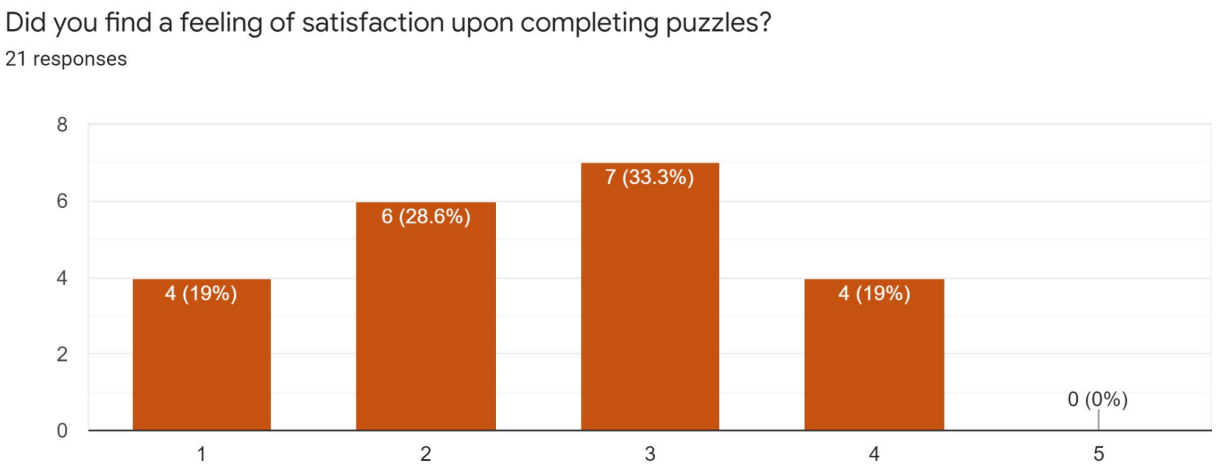
the lever puzzle up while holding the 1 button, the players movements are not turned off and so when the notes get pulled down by letting go of 1, the player moves in any direction they just so happened to be holding. Basically, while the player shouldn't be able to move, the game is storing the input values and duration and then, when the players movement isn't paused by the notes being up, is forcing the player to move in those directions.

- No

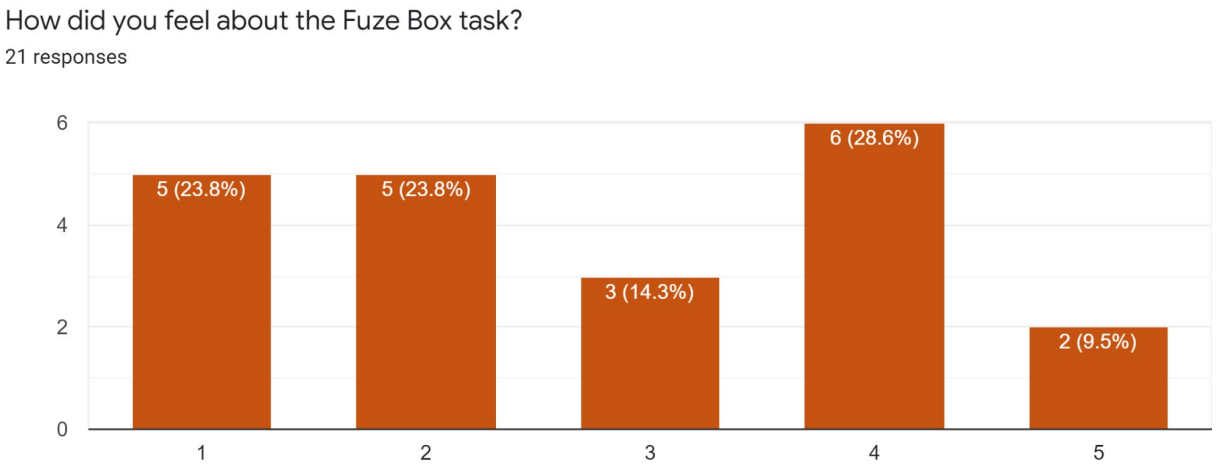
3. On a scale of 1-5, how do you feel about the player controller speed?



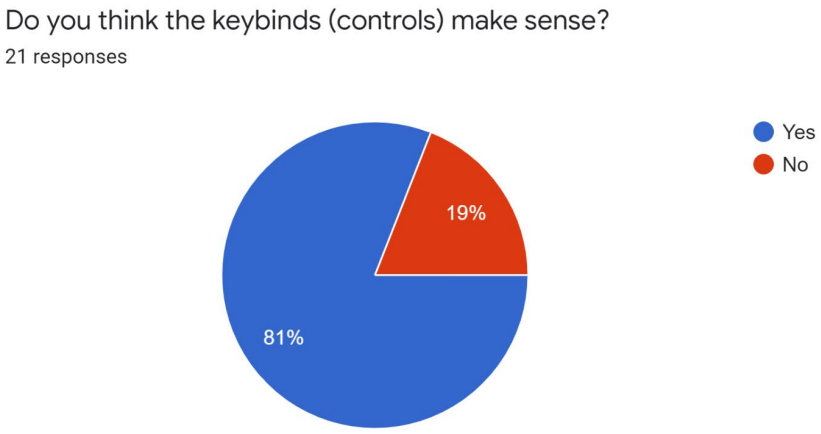
4. Did you find a feeling of satisfaction upon completing puzzles?



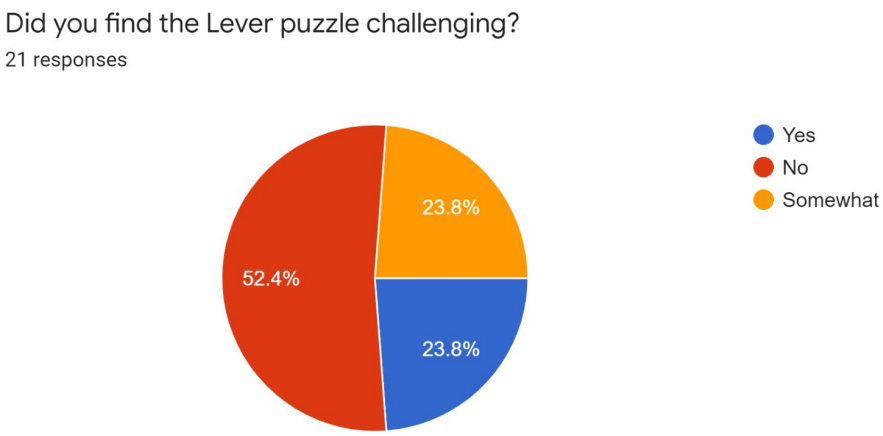
5. How did you feel about the fusebox task?



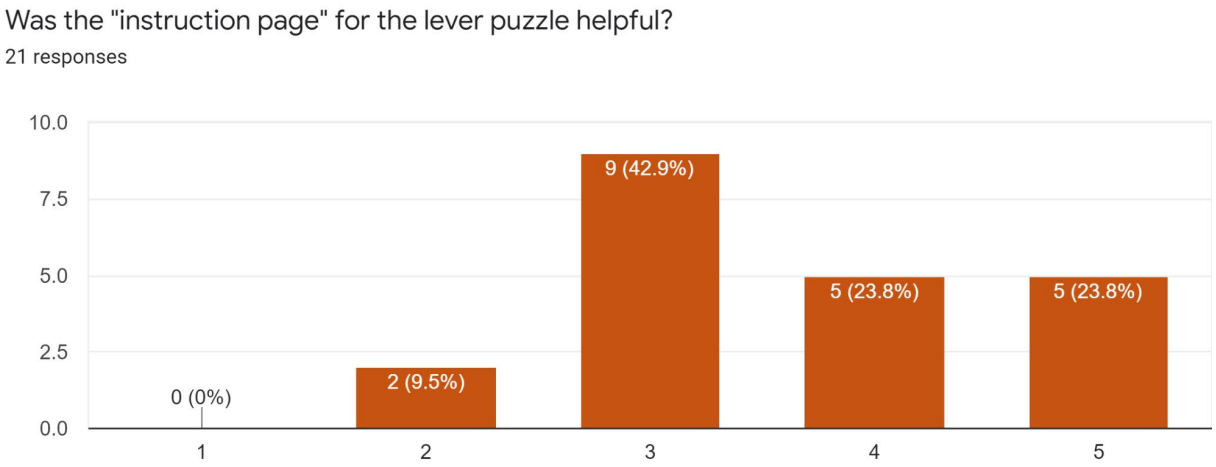
6. Do you think the keybinds (controls) make sense?



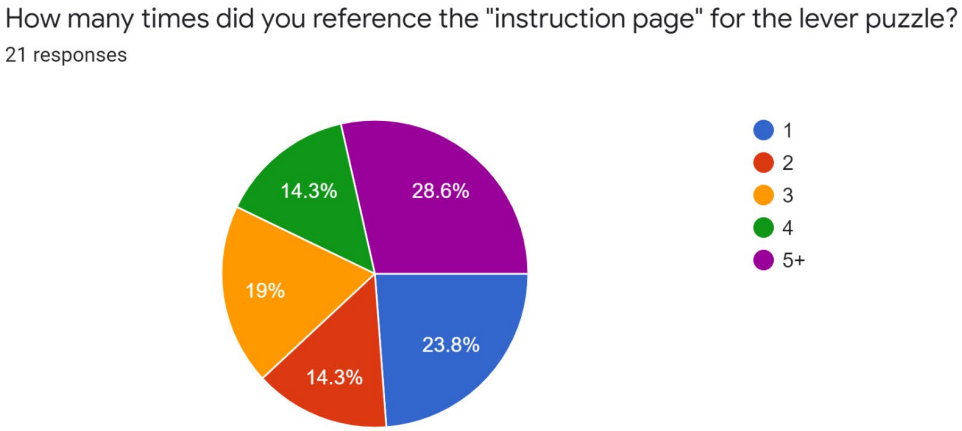
7. Did you find the lever puzzle challenging?



8. Was the “instruction page” for the lever puzzle helpful?



9. How many times did you reference the "instruction page" for the lever puzzle?



10. Please use this space as an opportunity to give more detailed opinions that were not addressed in the survey.

- The zoom in to inspect the fuses was kind of annoying. I didn't feel like inspecting the fuses was very important
- I really like the models used for the interactable objects.
- The game has a very interesting concept that I would like to play once the game is fully finished.
- "The movement felt odd. You move too quickly while also having an oddly delayed stop. It was a good concept, but certain aspects were a bit weird to figure out.

  Also, the lever puzzle wasn't very fun, with it being the type that people can brute force without consequences while also potentially taking way too long. I feel like there should be better visual cues as well for that puzzle to allow for the player to better know if they have completed it, because I didn't realize I had completed it originally.

  One other thing I would recommend is that you should try to use some form of blocker instead of an invisible wall for the top of the stairs, maybe some clutter or another door could be there instead.

  Overall, it is a good concept and has a lot of potential, though it could use some tweaks to make it more interesting and less frustrating, especially with the movement."

- I feel like the movement speed was just a little too fast, I felt like I would slide while trying to move because it was very sensitive. Although it was nice being able to move across big pieces of the map quickly, it was kind of hard to control the player movement

when doing the tasks (such as fuse box or levers). The fuse box task could be somewhat harder, it was really easy to just pick the pieces up and then quickly just place them into the fuse box. The lever puzzle was kind of confusing, I wasn't sure if I had to put all of the codes from the page in to unlock the door, or if it was just a random code that was on the page. I also was kind of confused if I had to test/reset the lever puzzle after I plugged in each lever order code. I do like the concept idea though and think this is a great idea and a cool game mechanic idea for this concept.

- "A good start but there are some crucial additions to be added.

  - Ambient sound/music would help sell the environment a lot

  - A time limit would also help enforce the tone and urgency of both the game and the story being told.

  - The player should not have to hover their cursor directly over the objects they want to pick up.

  - The picking up/examining interface is cool at first, but has no real use unless there is something important about the items being viewed.

  - The player accelerates too fast and comes to a stop too abruptly

  - The central silo is a great hub area that gives a fantastic sense of size and purpose.

  - Maybe adding more obstacles to hinder the player would make things more exciting. "

- There are no guidelines for picking up fuse. When you put the mouse on the fuse, there will be a click prompt. But when clicked in it does observe rather than pick it up. I tried

pressing most of the usual keys to pick them up. I spent more time trying to pick up the fuse than I was solving puzzles. I ran around to see if I missed the guide, or something else.

This feeling of knowing what to do but not knowing how to do it is annoying.

- Is the fuse puzzle inspired from the escape room in 5wits?
- I am wondering if you are using impulse for player movement due to the momentum of the main character. Also, I didn't realize at first that I beat the lever puzzle until I wasn't able to interact with the levers. The one light changing made me feel like I got one of the lever switches right but the others were wrong, not that the puzzle was beat.
- Maybe because my computer is old, I was not able to get through the first door with the "1234" passcode. I tried going up the stairs to explore more but that led me nowhere. I wish I could have gotten through the first door. Typing the passcode would not work and trying to press the actual buttons in the game did not either so I got stuck at that point. Typing "1" opened the lever hint page but that is all I was able to figure out. It must have been for a different puzzle.
- I couldn't finish the game because the camera was moving so fast that I got too dizzy.
- The model is not textured, which is understandable, but since there are no lighting shadows set up, the whole scene is so bright that it makes my eyes uncomfortable.
- I was going to try all the 120(P(5,5)) possible answers in the lever puzzle before I got bored and killed myself by jumping off the building. If the correct answer is on the sheet, maybe it would be better if it is highlighted.
- I got the lever puzzle right on my first try but I have no idea what I did.

- So the movement speed seems fast because there is some kind of drift going on where after you stop moving your character continues to keep going a little bit so I kept running into walls and everything.

  The fuse box puzzle was fun (I didn't think it was a puzzle though because i just picked up all the fuses and clicked on the box four times and it put all of the fuses in the right places for me. Not sure if its supposed to do that based on the questions you asked. I think that right now its perfect for just an intro to the game so I would keep it this way even if it was meant to be a different puzzle).

  The level puzzle was fun. At first i just started clicked random levers and then I realized that I could look at my notes so I did. I tried the first combination and it worked though the sound was a little confusing because I didn't know if the sound meant I won or I lost. Not being able to interact with the levers after completing it though confirmed that I had succeeded so then I went to the next level."

- The level design is nice but lacks contrast. The player controls feel slippery, especially the camera. Stairs were sometimes hard to get up. Overall cool concept and game
- I know this was an early build and I figured certain aspects would have bugs and so I wanted to compose this part to explain some of my confusions and problems.

  As stated above in the bug question, I found three. The first one is the most crucial as it causes the player to have to escape entirely out of the game when they fall into the void. At first I thought the problem was the geometry of the pipes clipping my character out of bounds, but I soon realized after restarting that it was the whole wall or at least most of it.

The stairs problem isn't too much of a concern cause jumping is possible, but still it might be something to look at. The notes problem is more problematic, but isn't the biggest issue.

Explaining some of my numeric ratings:

The movement of the character is way too fast, so much so that it's nearly impossible to get through the doorways in the large circular center room without brushing against the wall (or on the second floor, nearly clipping out of bounds)

I personally didn't feel satisfied with the puzzles because one of which is just introductionary, which I understand, and the other just confused me. All I did was put the first number of the notes that wasn't crossed out and it worked. Maybe I missed something like the notes were just a hint for the real puzzle, but I'm pretty sure they were supposed to be a mechanic added upon in the future.

The fuse box puzzle is great for a first room puzzle. It shows off some of the mechanics as well as the 3D models. The only thing that seemed interesting to me was that it would show the same model all four times. It seems like the game will include a timer to help escape or stop the nuclear explosion, and thus maybe if the player picks up the same item then it doesn't show it off in that way. Then again, I don't know the full scope of the build and project, so I could just be missing some ideas or it could be something for the preliminary stage.

Finally, I stated it before, but the lever puzzle didn't make much sense to me because I just followed the first thing on the notes. I could have missed something, or perhaps the

notes will be placed somewhere in the silo in the full game and I would have to find it to get an idea of what to do. But in the current build, it doesn't seem to challenging or rewarding.

Thank you for letting me beta test your game and I'm sorry if the amount I'm typing is too much (this is my first typing)"

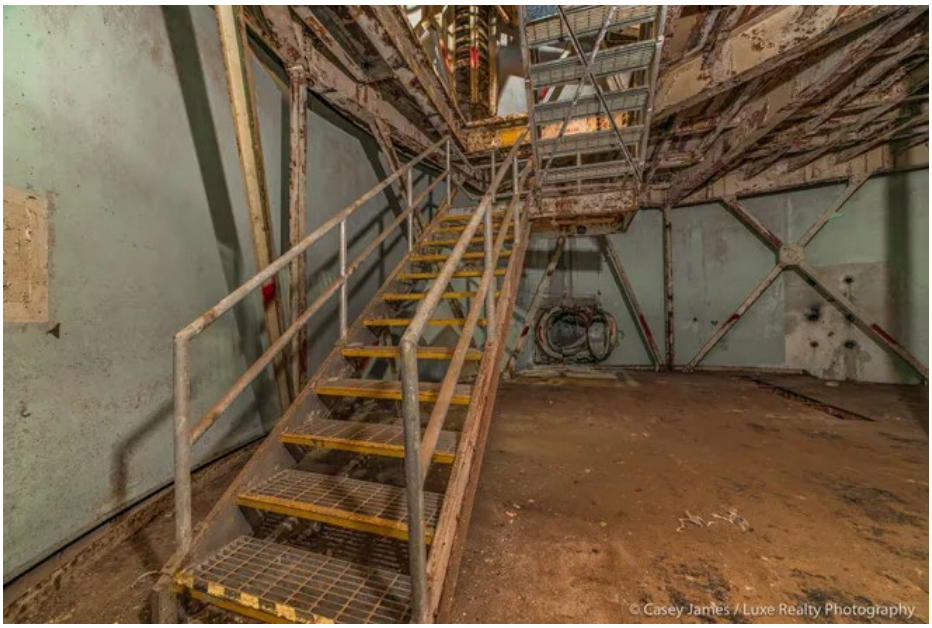
- "1. You need to fix your movement. A good way to do so is to use exsting codes or packages of player movement. There are many open source ones and there are many free ones in the store as well. 2. I think the UX of collecting items should be refined. I literally tried every button on my keyboard to test it out that I need to first pick items to examine and then press e to collect it. I tried directly press E without examing, and I tried many other things. One way to do it is to simplify the process. Also, I would recommend more tutorial levels. Note: 1 lesson each level. 3. Maybe you want to provide some of story in the game?"

D. Asset list

3D Environment Models
Catwalk
Silo Wall V1
Silo Wall V2
Stairwell
Doorway
Door
Tunnel Doorway
Tunnel Straight
Tunnel Bend
Tunnel Stairs
Room V1
Room V2
Room V3
Light
Pipes V1
Pipes V2
Silo Base
Silo Cap
Missile
Additional 3D Assets
Dosimeter
Led Box

Journal
Journal Pages
Pen
UI Assets
Dosimeter
Intro Screen
Journal Page 1 - Door Mechanism
Unity Store Assets
Old Military Beds
Lockers
Vintage Control Room
Lever
Lever Console
Fuse
Fuse Box
Pin Pad

E. Reference images

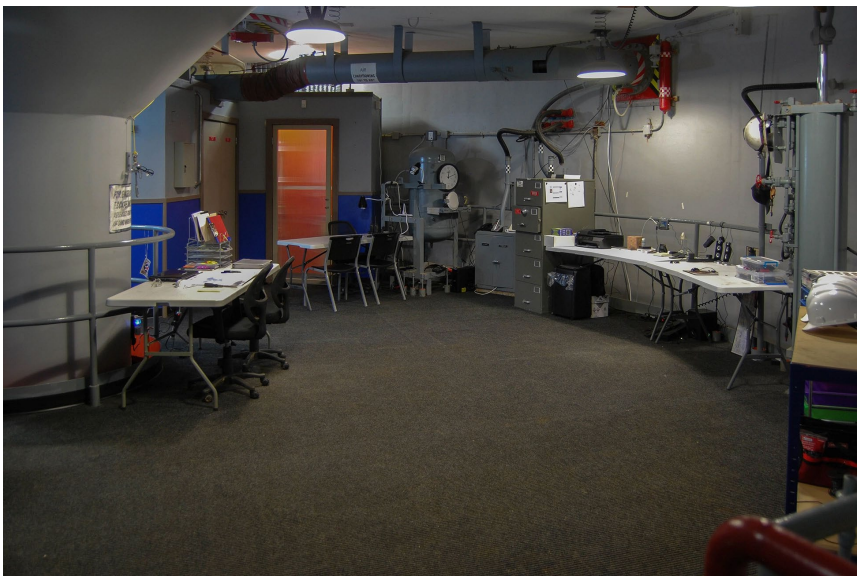


Titan Missile Silo Stairwell. Source: URL

Titan Missile Silo Tunnel. Source: URL

Titan Missile Silo Doorway. Source: URL

Atlas F Missile Silo Doorway. Source: URL



Atlas F Missile Silo Workspace. Source: URL

Titan II Missile Silo Hallway. Source: URL

Titan II Missile Silo Workspace. Source: URL

Titan II Missile Silo Workers. Source: URL

USA/USSR Missile Dioramas. Source: [URL]

F. Meeting notes

October 28, 2021

- Game, Report, Presentation

- Report: around 30 pages per person, dev blog

- Alpha fest: Friday before thanksgiving

- Show fest: last Friday of D term

- Get working Alpha by end of B term

- irb form

- Presentation: end of D term, 10 min presentation

- Made in Unreal

- CITI tests: follow Moriarty's directions, 6 quizes 5 questions multiple choice 4 of 5 to pass, NEED THE CERTIFICATION NUMBER FOR IRB CERTIFICATION!!!

- Required playtesting, post-play survey, under irb protocol, results anonymously published

- informed consent agreement

- only need to pass irb once

- mention collecting anonymous info while play

- irb template included in report

- procedurally generated rooms (how to approach?)

- ESCAPE ROOM

- additional meetings (weekend times?)

- tech suites

- set up trello/miro

- physical kanban board?

- Garret - audio

- single theme

- The Room, Escape Room

- Perforce source control!!! (ask professor Roberts/who teaches IMGD4000 for seats)

- BitBucket source control backup

- any help, credit person in paper

November 4, 2021

- refresh of report

- Moriarty Phases of Production:

  - Alpha = feature complete

  - Beta = content complete

  - Gold Master = beer party

- SCOPE SCOPE SCOPE

- Goal: Alpha by end of term

- Draft of report done by end of second term (besides evaluation/formal playtesting)

- START REPORT!!!

- how you chose what project and why

- what tools you use, why those, experience with said tools

- Report is published

- don't be afraid to scope down

- small but beautiful

- modular - rearranged

- back and forth?

- one room -> each launch rearranged

- slider puzzle

- procedural puzzles

- priority list -> must have, really want, would be nice

- what part of project is yours

- post soviet era factory

- uniform concrete design

- why is the player there

- is there anything outside?

- is there a phone/radio?

- phone -> vocal hint

- pin pad -> opening door or fire missile? last puzzle

- deception

- story: cold war?

- spy craft

- locks, circuits

- fuse box -> find fuses -> locked in box -> need code ->

- flexible settings (submarine, missile silo)

- player needs a sense of where they are and why they're there (could be deceiving)

- elevator

- countdown (pauses)

- length of game experience (~ 10 min)

- replayability (randomization) -> player feature or portfolio feature?

November 11, 2021

- two keys
- music (60s)
- people to maned the silos were typically young
- Boney M - Rasputin (Night Flight to Venus)
- nationalistic pop
- soviet anthem
- player
  - spy
  - mistaken identity
  - american or russian spy
  - incompetent american spy, but things work out
  - what's his story?
  - does not know russian
- some humor
- missile is going to launch
- get smart
- russian keyboard
- vocal help
- bond type villian
- trello set up, master doc set up
- IRB follow directions on doc Moriarty provided

November 14, 2021

- story stuff

- bad ending = blowup the moon?

  - usa got to the moon, soviet mad

  - flip book animation

- good ending = land in ocean/deactivate

- flip book animation cutscene

- character story:

- american spy self-aware underqualified (backstory, disposable)

- clumsy

- only one there

- soviet soldiers left

- intercom recording: warning/leave instructions/puzzle stuff?/in russian

- music stuff

- folk music

- time sensitive puzzle/music speeds up (mario kart)

- building layout

- ladders/stairs/elevator

  - elevator music

- start at bottom/work way up

- main silo + connecting rooms

- 5-6 inner levels

- circuit breaker turns on/opens stuff (towards end)

- connecting rooms
  - main control room (end)
  - barracks
  - server room
- wall items:
  - set locations, spawn randomly
- puzzles
- wavelength puzzle/match frequencies
- levers
- door wheel/find and crank open/door labeled matching handle
- find manual/logic puzzle/persons locker
- find fuses
- knobs/turn to match
- status board/offline
- morse code/pin to access computer/have chart/visual and auditory
- certain order? all, some?
- turn on elevator (offline status)
- russian phonetic military alphabet
- simon says memory test (legit toy)
- platforms/lower
- working title
- russian word for puzzle
- golovolomka

- escape

  - pobeg

- silo

  - bunker

- puzzle silo

  - pazl bunker

November 18, 2021

- Final Paper complete draft by first week of April

- Final Paper due April 26th by 5:00pm

- Trip to the Moon

- Alpha Build when

- Alpha be part of game

- most important part of paper is evaluation part (test data and how well game is working)

- I R B

- Put game in Git

- intercom in Russian (bad subtitles)

- Russian Military Movies:

  - Fail Safe

  - Red Dawn

  - Invasion USA

  - https://coldwar.unc.edu/film/

December 5, 2021

- Puzzles

- START Board/Lever = turn levers on (3 levers)

    - 1st - turns on right away (indicator light off) (turns lights on)

    - 2nd - flips but wont turn on -> fuse puzzle

    - 3rd - turns on starts alarm (can't be turned on before 2nd) (opens chain link door to access rest of the silo)-> pin puzzle

- Fuse Puzzle = find missing fuse (spawn randomly under something), allows the player to turn on the second lever.

- Pin Puzzle = alarms, flashing light, pinpad below light, 4 worn numbers, trial and error of what order the numbers must be pressed (can be procedural)

NEXT CHAPTER

- Wavelength Puzzle = tune knobs to match wavelengths, makes morse code clear -> morse code puzzle

- Morse Code = 2nd floor, on desk, numbers, give player instructions, pin pad code, opens next door to access next floor

NEXT CHAPTER

- find crank to open door

- staircase is broken -> vent shaft in barracks

- locker -> has book and screwdriver -> vent shaft poof next floor

- Locker Puzzle? = nameplate on footboard of each bed, correlates to locker

NEXT CHAPTER

- Elevator Puzzle = offline, fuse puzzle but different (wires from fuse box lead to other locations, put in fuse for elevator, blow fuse, other fuse leads to stupid random thing, different ampage/volts, move fuses around) (radio play music)

NEXT CHAPTER

- one more chapter?

- player walks into control room, pushes buttons randomly, sequence starts

- fail puzzle shortens countdown

- 5-10 min -> bait player to fail -> 2-3 min

- END Found manual, match controls, 4 status lights, 4 puzzles,

    - manual - book found in barracks missing pages 2-5, player finds pages (spawn randomly), each page is an instruction for the final puzzle.

    - 4 lights over closed glass panel with emergency stop lever, complete 4 tasks to get open and shut down the launch

- Russian phonetic alphabet (and number?) puzzle = password to log on to control panel

- Set Angle Puzzle

- Set Launch Power Puzzle (fail point?)

- Set Aiming Switches Puzzle

- one last step to confirm?

December 9, 2021

- ASSET LIST (Morgan)

- Watch Fail Safe

- Final report outline (Brendan)

- Own directory for git

    1. Always start with a Pull

    2. Work only in your directory

    3. Pull again

    4. Push commit

- only one person builds, communicate!

- Copy file out of directory and place in development directory

- Some audio (asset list will contribute)

- Pin pad functioning

- Git invites?

- Progress on doors?

- Report and presentation

- IRB this weekend

December 15, 2021

- main menu + pause screen

- asset list + blockout

- audio track

- audio report progress

- ambience sound

- player controller

- spacial audio (ambient fan near vent)

- electrical hum ambient sound

- recording lab

- working alpha

- IRB

- plan for 2 play tests

- lots of credits (at least 12)

    - mention of any similar games = credit

    - tutorials = credit

- draft of a report by end of c term (minus evaluations)

- take a break!

January 19, 2022

- github

- irb meeting

- default movement controller

- russia released documentary testing of tsar bomba

- covids impact?

- 4 weeks -> testable build

- what were trying to do

- at least 2 test sessions

- operational testing

- need irb certified testing in document

- each tester will be presented with an irb speech and read a consent form, sign agreement

- post test

- downloadable

- survey questions need to be approved

- telemetry

- how long did they play?

- how long spent on each puzzle

- survey include open ended section

- optional comment sections

- how did this game make you feel; check boxes; 3 goal, 3 opposite of goal, 3 middle

- writing center; check in sections

- NEED:

- sample survey (12 questions or less; no names; final q is open ended)

- 1-2 sentence short description of the game and a screenshot

- covid protocol

- “no personal identifiable info is being collected”

- google forms/qualtrics

- what went right, what went wrong, what u recommend

- documents of irb approval added to appendix of doc

January 26, 2022

- switch to Unity

- Adventure creator for Unity

- look at other frameworks

- placeholder assets

- screenshot of game + paragraph

- survey questions

    - how would you describe this game to someone who hasn't played it?

    - similar games?

    - mood?

- playtesting

- report

- Unity version 2020.3.10

- Unity shader for wavelength

- switch engines page for report

February 2, 2022

- procedural gen; hallways

- character controller

- hallway signs

- pages random spawn points

- items to spawn in general random locations

    - fuse

    - missing door handle

    - manual pages

- abandoned silo, trap, player proceeds as if the missile is going to launch

- defect radioactive; player dying?

- previous spy messed up the sabotage, player is there to "save the day"/launch the missile to save yourself

- radio -> hint to the keypad

- elevator -> finding a keycard

- radiation/nuclear badge, turns black is bad

- signs of chaos

- find the saboteur

- timer is time to die

- what is the ending?

February 9, 2022

- trim sheets, modularity

- irb questions ready

- pick ups

- pin pad in progress

- github folders confusion

- sound effects

- microphone from ATC; zoom recorders

- saboteur 's body is found (British spy?)

- time based

- radiation badges/UI element

- Unity adventure package (Fungus)

- lead box for dosimeter

- player internal monologue

- metal and concrete floors

- sampling sounds this week

- bullet holes -> missile

- environmental storytelling

- player start with a briefing/classified blacked out document

- not knowing about the radiation

- find radiated dosimeter next to clean dosimeter

- echo with the music

February 16, 2022

- mic acquired
- UI stuff
- 3D models of puzzle items
- audio mixing + reverb
- room generation is done/need to test in build
- playtesting
    1. sign informed consent form
    2. playtest
    3. survey
- Qualtrics or Google Forms
- last question should be optional type in box "any suggestions"
- after every question have an optional type in box
- give names through the informed consent
- telemetry
- test branch pushing
- pull then push
- art, audio, programming branches
- starting with a build
- final puzzle (damaged?)
    - wavelength
    - targeting (battleship board)
    - find piece?
- inventory ui tied to # keys

- 5 inventory slots
- pages are a separate system (j to bring up journal)/(page labeled 1/4)
- page location's set/pages randomized in these locations
- first things found - journal and dosimeter
- journal in russian/english in margins
- inventory system packages
- press button to place
- List of Audio to be Recorded:
    - footsteps
    - switch

February 22, 2022

- dosimeter ui bg transparent
- locker in barracks -> keycard use safe system from puzzle pack
- qualtrics vs. google
- trim sheet in progress
- brendan in charge of testing
- unity psx renderer
- final puzzle
    - 1st: determine coordinates (battleship)
    - 2nd: repairing lever
    - 3rd: wavelength (simplified)
    - 4th: finding and using two keys

- 1st 3 puzzles done in any order

- soviet launch key

- key in safe > manual shows safe code

- key lockbox -> multiple keys, only one shape works, use manual to figure that out

- lever handle missing; turn doesn't work; prompt panel to interact; wires puzzle; manual explains

- find journal w/ page 1 and 5; page 1 intro, page 5 index

- 4:3 stretched res(?)

February 23, 2022

- revise survey questions

- add how they are going to be scaled?

- keep notes on experience with unity puzzle package

- survey:

    - did you reach an ending? if so with one?

    - please rank these puzzles in order of difficulty/check the puzzles you though were too difficult

    - did you get lost? check all that apply/how often were you confused?

    - how easy was it to understand the ui /timer/journal/inventory

    - how helpful did you find the manual pages in the final puzzle?

    - how would you describe the mood of the environment (give suggestions)?

    - did you encounter any specific bugs/issues?

    - how would you describe this game to someone who hasn't played it?

- add section to document on switch to unity and packs used and why

- recommendation - go get this stuff first

- lever hidden by the saboteur/used to turn on the

- no coordinates puzzle

- other puzzle option:

    - fuel gauges

    - hatch opening

- hasty notes written in the margins

- contingency plan/fail safe

- consistency of hiding the notes

- pack of cigarettes, pen; coloration (red, white, blue)

- show picture of open pen w/ page in briefing

March 1, 2022

- consistent red pen

- radiation -> green glow/mist

- inner monologue: trigger based

- 1st puzzle

    - lever + fuse power

        or

    - lever + wire repair

- 2nd puzzle

    - wavelength?

    - radio frequencies?

    - switchboard 4 switches in an on or off position, computer decides, player guesses

- 3rd puzzle

    - find elevator keycard in barracks

    - safe by bed -> find person locker -> has safe code -> card in safe

- final puzzle

    - lever repair + wire mini task = 1st puzzle mechanic

    - fuel = 2nd puzzle mechanic

    - keys = 3rd puzzle mechanics (safe); one key out, one in safe

March 2, 2022

- Friday meeting

- wire task

- playable build by first week of D term

- Moriarty's class + imgd email group

- Apr 22nd = IMGD project presentation day

    - 10 min formal live presentation

    - everyone must participate

    - followed by a q&a

    - give moriarty a draft by ~15th

    - 1st min = trailer

- Report

    - get complete draft to moriarty by April 19th

- citation format = MLA or APA

- any pictures or diagrams must have a numbered caption/figure# that is the citation and must be reference in the text (source: screen capture)

- have an appendix (audio sources, images, etc)

- irb documents = appendices

- draft must be a word document

- needs a title page

- abstract less than 100 words

- table of contents

- introduction == purpose and experience goals

- story of how you built it, what tools, problems, etc

- evaluation = how tested and summarize test results especially results that led to changes (all test data can be added as an appendix)

- latek?

- D-term meeting time = Thursday or Friday

March 18, 2022

- worked on report

- first floor done by next week, Friday

- thursdays at 5pm

- this weekend, game jam this shiz

11am - 6pm

- windows and mac build

- pin shown, player includes number in survey

- (have pin add up to same number, that way we know it is real)

- include disclaimer "all events are fictional"

- presentation

    - begin with a 1min trailer

    - everyone must participate

    - summary of report

    - April 20th show moriarty presentation

    - look nice (business casual, matching suits, matching "company" t shirts)

- report

    - provide complete draft by April 19th

    - first page; cover page

    - second page; 1 paragraph abstract (less than 100 words)

    - third page; table of contents

    - introduction; explain what it was you were trying to do, why you chose the setting, what kind of experience did you want to take, what were your goals, why did you make decisions

    - how you build it

    - appendices; all irb docs, raw data from tests (screenshot of excel or word table), works cited,

    - pictures should have a # caption with source cited in caption (source: URL [hyperlink])

    - works cited, instead of the full url include URL with hyperlink

    - include hyperlink to itch page containing game

- TIMELINE

    March 25th - testable build

    March 28th - start heavily drafting report/get a first draft done

April 4th - start looking at test data and drafting eval

April 11th - start work on presentation and trailer

April 19th - submit final draft of report to Moriarty

April 20th - practice final presentation with Moriarty

April 21st - PAX East + Made in Mass

April 22nd - project presentation day

May 4th - done!