All Aboard the *USS Cape*

Building an Escape Room in a Pandemic

by

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I. Abstract

The USS Cape is a virtual escape experience that seeks to explore the escape room design space created by the COVID-19 pandemic. Players take on the role of mission control operators that are working to rescue the crew of the USS Cape, who have flown off-course during their voyage home from Mars. Play takes place over a Zoom video conference that leverages the breakout room functionality to produce three unique, defined rooms. Each room features an NPC actor that the players interact with to solve puzzles and aid them in their escape. Puzzles are served to players through a companion tracker app delivered through their web browser.

Playtesting was focused on gauging players' reactions to the experience in comparison to physical counterparts to test the validity of the system. The main findings were: A) playtesters found the experience to be an accurate representation of a physical escape room, and B) playtesters appreciated the presence of the NPC actors and felt that they enhanced the overall experience.

II. Acknowledgments

This work could not have been completed without the help of every member of my incredible crew.

III. Table of Contents

IV. Table of Figures

1. Introduction

A number pad sits in front of you with four dashes on the digital display. Next to you is a stack of four documents, littered with numbers and images. The timer in the corner of the room ticks down - 10… 9… 8… 7… Suddenly, it comes to you, a surge of energy comes to you as you rapidly scan through the documents and enter the resulting code into the door. You've escaped!

The "Aha!" moment, as it is commonly called, is a common motivator for puzzle junkies throughout the world. It could be the result of staring at a puzzle for hours before finally seeing the result, or suddenly figuring out how to solve one of the world's many mysteries.[1] The surge of excitement and energy provided is something people look for in their daily lives — one of the many reasons that puzzle games are as popular as they are in this day and age.[2]

Since the onset of the Coronavirus (COVID-19) pandemic, there have been spikes in feelings of stress, anxiety, and depression. Solving puzzles and chasing that "Aha!" moment is one way in which people stuck in quarantine have been able to improve their mental state and stay productive. But what if people could solve puzzles and get that rush while also getting their daily dose of social interaction?

Enter the Escape Room. The physical version of these thrilling puzzle experiences have been increasing in popularity with Americans since their arrival in the US back in 2012.[3] They act as great team building activities, birthday parties, or casual get-togethers due to their ability to get people to communicate and collaborate on a shared goal.

However, with the recent social distancing mandates[4], dozens of escape rooms across the country have had to either adapt to a new medium or close down.[5] One such method of adaptation is the introduction of the Virtual Escape Room, which seeks to use the company's already existing resources to get players into their room without any kind of physical interaction. These virtual experiences are great for reaching a much wider audience, as well as allowing the players to get that "Aha!" rush from the safety of their own home.

This thesis project — *The USS Cape* — sought to leverage the advances and adaptations brought to the COVID-19 era of Escape Rooms and use them to design an entirely new experience. The hope was that, by taking various adaptive pieces and layering them on top of each other, a new, unique experience would be achieved.

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[1] *Why solving puzzles feels so satisfying, especially during a quarantine*, Accessed 15 April 2021
[2] *Puzzle Games Report on Puzzle Players, Monetization Methods, and Advertising*, Accessed 15 April 2021
[3] https://realescapegame.com/about/, Accessed 13 September 2020.
[4] https://www.mass.gov/info-details/covid-19-state-of-emergency, Accessed 7 April 2021
[5] *Will Colorado's Escape Rooms Escape the Pandemic?*, Accessed 15 April 2021.

This project was completed with the assistance of several graduate and undergraduate assistants as this year's installment of the WPI Escape Room. This escape room has been running every year since 2016 and provided an initial player-base that could be used to obtain players and playtesters. The development team featured members with varying levels of experience making and playing escape rooms. They assisted in the design, writing, technical implementation, and facilitation of the experience.

2. Design Space Analysis

2.1 A Brief History of Escape Experiences

Escape Experiences are a popular media form defined as "live-action team-based games where players discover clues, solve puzzles, and accomplish tasks [...] to accomplish a specific goal [...] in a limited amount of time."[6] Players form groups of around 4-8 players and work together to accomplish their specific goal - be it to escape from a room, steal an art piece, etc. These experiences have become popular birthday parties, weekend activities, corporate events, and more. However, despite their deep-seated role in modern society, escape experiences are still a relatively new medium for games.

Figure 2.1: A view of the exit in *The Crimson Room*[7]

Escape rooms got their start as browser-based video games with the release of *The Crimson Room* in 2004 by Toshimitsu Takagi.[8] The game involved the player waking up in a red room for an unknown reason after a late night drinking. In order to complete the experience, they must search the room for various tools and components that they can use to unlock the door and leave the room. This game spawned a movement of similar point-and-click escape experiences that became known as "Takagisms" - a term coined within *The Crimson Room* itself.[9]

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[6] *State of Escape: Escape Room Design and Facilities*, pg.1
[7] *Have You Played… The Crimson Room?*, Accessed 12 April 2021
[8] *Escape-the-Room Games: A History, A Catalogue, and an Explanation*, Accessed 13 September 2020
[9] *The Crimson Room*, Accessed 2 September 2020

Figure 2.2: One of SCRAP's Real Escape Games[10]

Seeing the growing fanbase for these Takagisms, the Japanese company SCRAP created the first Real Escape Game (REG) in 2007 in Kyoto, Japan.[11] The company ran these games in various different venues, such as schools, ruined hospitals, amusement parks, and more. Growing and growing in popularity, in 2012 they brought the REG *Escape from the Mysterious Room* to San Francisco. The game sold out completely and other companies set out to replicate the success of SCRAP's REGs. Escape rooms grew and grew in popularity, and as of 2018, there were over 2,300 escape room companies across the United States.[12]

2.2 The COVID-19 Pandemic

2020 was a year defined by the outbreak of a global Coronavirus (COVID-19) pandemic. At the time of this room's conception and design, strict social distancing mandates were put in place in the state of Massachusetts. These mandates limited indoor gatherings to a maximum of 25 people, strongly encouraged citizens to wear protective masks, and enforced a 6 foot social distancing policy. Any potential exposure to the virus required all people involved to quarantine up to 14 days to restrict the spread.[13]

Compliance with these mandates was a driving force behind the decision to create *The USS Cape* as a virtual experience. With the current state of the world at the time, one primary restriction was put in place: all players and actors needed to be able to properly follow COVID-19 protective guidelines through the duration of the experience. To comply with this, the design team decided to do away with a centralized physical location for the room to exist in. Instead, all actors set up defined spaces in their homes that they could facilitate the escape room from.

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[10] https://realescapegame.com/about/, Accessed 13 September 2020.
[11] ibid.
[12] *Why escape rooms have a lock on the U.S.*, Accessed 12 April 2021.
[13] https://www.mass.gov/info-details/covid-19-state-of-emergency, Accessed 7 April 2021

2.3 Physical Escape Experiences in the Virtual Space

In order to comply with nation-wide COVID-19 mandates and guidelines, physical escape experiences had to adapt to virtual mediums or risk going out of business.[14] A common way that these experiences chose to adapt was by introducing the concept of an "avatar" who would represent the player inside of the already built physical space. This avatar would wear a body camera and silently navigate the room, following commands from the players in order to solve the puzzles. This "Silent Avatar" system was meant to make the players feel like they were actually navigating the room using a shared view without any input from someone who knew all of the answers already.

This use of a controlled human avatar within a physical space is reminiscent of Realm Pictures' limited run of a live-action *Hitman* experience back in 2016.[15] Players would act as handlers for Agent 47, who would follow the commands of the player while providing commentary on the situation. 47 was still an avatar, but the addition of personal insight helped nudge players in a way that would improve their experience without breaking immersion.

Figure 2.3: Players coaching Agent 47 in the live-action *Hitman* experience.[16]

Another experience borne from the pandemic mandates, a group put on a Bachelor Party RPG for their friend that was done entirely virtually.[17] The game used a Silent Avatar system, where the player would navigate a town and dungeon and interact with Non-Player Characters (NPCs) that would assist the player on their quest. The use of NPCs for this experience was an interesting take on player guidance and really helped to build the world that the player was exploring.

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[14] *Faced with the puzzle of the pandemic, escape rooms help people get out while staying in*, Accessed 15 April 2021.
[15] https://www.youtube.com/watch?time_continue=1&v=4KXJM_KJDc8, Accessed 3 September 2020.
[16] ibid.
[17] *Bonkers Streamed RPG Stag Party*, Accessed 3 September 2020.

Figure 2.4: An NPC Shopkeeper as seen in the Bachelor Party RPG.[18]

Other methods that escape room companies have employed to help maintain their player-base included the design and development of print-and-play games.[19] These experiences were completely asynchronous and allowed customers to buy access to a set of documents and websites that would allow them to facilitate their own escape experience with friends and family.[20] These experiences were designed in a similar fashion to the Escape Room in a Box genre, where players could go to the store and buy a box full of cards, documents, and tools that simulate an escape experience. These experiences were entirely self-facilitated and provided a casual puzzle experience that players could do at their leisure.

Figure 2.5: The tracker used in The Escape Game's *Prison Break* room.[21]

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[18] ibid.

[19] https://playathome-uk.escapehunt.com/collections/print-play-games, Accessed 5 May 2021.

[20] https://www.escapegamesworcester.com/printathomeescaperoomgames, Accessed 5 May 2021.

[21] https://theescapegame.com/remote-adventures/, Accessed 15 April 2021

On the topic of tools and aides, The Escape Game also introduced a tracking system to their games.[22] This allowed the players to keep track of and inspect items that they had received during their experience so that while some players were watching the avatar's camera feed, others could look at their clues to figure out what they wanted to do next. Additionally, their tracker featured 3D scans of the room that players could virtually walk through to search for clues. This seemed like a very strong method through which rooms that had physical spaces could introduce elements of discovery puzzles.

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[22] ibid, Accessed 3 September 2020

3. Experience Design

3.1 Experience Goal

The goal of *The USS Cape* was to create a virtual experience that accurately translates the feelings that a player would have completing an in-person escape room. This light-hearted game used the threat of the timer to create close finishes and provide the satisfaction of completing a task just under the buzzer. The design team targeted a win rate of at least 75% for the sake of providing a challenge while encouraging the success of the players.

3.2 Design Pillars

A "Design PIllar" methodology[23] was used throughout the design of *The USS Cape*. Three primary ideas were selected as "pillars" that helped to support the core experience of the game. Whenever an experience design decision needed to be made, the team weighed its impact on each of these pillars: Collaboration, Engagement, and Exploration.

3.2.1 The Pillar of Collaboration

Nicholson states that escape rooms "require teamwork, communication, and delegation"[24] in order for players to be successful. With this in mind, it became important to the design to focus on features that enabled players to collaborate on the puzzles that they were given. A tracking website was built for the players with capabilities such as shared note-taking and tagging to facilitate communication and information sharing. In addition, the Zoom teleconferencing software[25] provided various tools, such as voice chat and screen sharing, were additional avenues toward improved collaboration between players.

3.2.2 The Pillar of Engagement

In order to ensure that all players were having an enjoyable experience, it was important that each individual felt that they were contributing something to the completion of the room. Several virtual escape games that were completed during research forced all players involved into one larger group to accommodate the use of a single avatar during gameplay. This resulted in one or two players having dominant voices in determining where the group as a whole went and what puzzles were worked on, while the rest of the group seemed to passively go along with it.

Another perceived problem with the conversion of physical escape rooms to virtual spaces was the inclusion of puzzles that the players could not participate in. Rooms frequently had puzzles that were designed to have the players do an interesting action, such as throwing socks into a hamper or getting a cork out of a bottle using a handkerchief, that virtual players could not

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[23] *Design Pillars — The Core of Your Game*, Accessed 12 September 2020.
[24] *State of Escape: Escape Room Design and Facilities*, pg. 1
[25] https://zoom.us/

complete. This created situations where players had to sit there and watch an avatar do something interesting instead of personally contributing to the completion of the experience.

With these issues in mind, the design team made two major decisions: 1) players should be able to work on multiple puzzles at once, and 2) the players should be responsible for completing all interesting actions. For the former, three primary story paths separated by Zoom breakout rooms were built into the experience. This allowed players to assign themselves to another puzzle if they felt that the one they were working on was overstaffed. In addition, the room adopted an NPC-based model over one that was more avatar-focused. This encouraged interactions between players and actual characters within the experience to increase engagement and immersion. For the latter solution, the tracking site was outfitted with the ability to host small, JavaScript-based games in the Perlenspiel engine.[26] These games acted as a virtual form of interesting action, so that players could feel like they were participating despite not being in the physical space.

3.2.3 The Pillar of Exploration

During research, the rooms that were completed all contained elements of exploration and discovery. Players moved from one room to another, seeing new puzzle elements and finding new tools to help them escape. Every discovery was accompanied with thoughts of "What is this?," "What do we do with it?," and speculation on how it fit in with the other objects that were discovered. These reactions felt like an integral part to a successful escape experience, and the team sought to find ways to simulate them virtually.

In *The USS Cape* escape game, exploration and discovery were primarily upheld in two ways. First, the use of Zoom Breakout Rooms to create defined spaces with three unique characters that the players could interact with. Players could hop from room to room to get a feeling for who each of the characters were, what their role on the ship was, and how they could work together to find a means of escape. Second, the use of actors as avatars meant that players could gain some insight into various items in the room without being in the physical space. Several puzzles utilized this concept, including the Memo puzzle and the Bathroom Map. Both of these puzzles involved the players looking around Faith Pickles's bathroom to find various objects that seemed out of place.

3.3 Flow of the Room

In order to immerse players and provide a better experience overall, the actors helped to deliver an interesting story. Players took on the role of Mission Control and learned about the current status of the USS Cape, which was less than one hour away from an uncorrectable collision course with the sun. Could they help the crew out of their desperate situation?

A full story flow chart that was used during development can be found in Appendix A.

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[26] https://perlenspiel.net/

3.3.1 Introduction

Upon arriving for their time slot, players met Mission Control, who would give them basic training on the experience they were about to partake in. They were shown the different features of the tracking site, as well as how to use Zoom to switch between Breakout Rooms. After training, players learned the situation, in which the crew was on their way back from Mars and their ship veered off course for no discernable reason. The players obtained their objective of locating an IP address that they could use to access the ship's mainframe and correct the ship's course.

During this time, players also met SUSAN, the ship's AI assistant. After her introduction, SUSAN appeared in various places throughout the ship to spark conversations with the crewmates and perform diagnostic reports on the ship.

3.3.2 The Engine Room

In the Engine Room, players met Stephen Doctor, an engineer that falsely claimed to have a PhD so people would refer to him as "Dr. Doctor." Players learned that Stephen Doctor was notoriously bad at finishing his work, to the point that SUSAN regularly locks him in the engine room so that he can perform regular maintenance.

Figure 3.1: Stephen Doctor in the Engine Room.

When the players arrived, SUSAN would inform Stephen that the engines are currently offline and that he would not be allowed to leave for the day until they are powered back on. To do this, he needed to perform three steps with the help of the players: 1) enter the override code, 2) recalibrate the engines, and 3) power the engines on. After completing these tasks, Stephen would ask SUSAN if he could leave. She denied his request and granted the players the first piece of the IP address.

3.3.3 The Bathroom

In the Bathroom, players met Faith Pickles, the ship's Janitor who, unlike Stephen Doctor, actually has a PhD in janitorial services. Faith was locked in the bathroom for seemingly

unknown reasons. The only clue that she had toward her escape was a four digit number pad that appeared on the wall next to the door.

The bathroom was much more focused on discovery puzzles than the other two rooms. Players would initially notice a piece of paper hung up on the wall behind Faith, which would introduce them to the Memo Puzzle. Faith would take a picture of the first Memo on her phone and send it to the players, and then inform the players that she has another saved in her emails. However, when she tried to upload that one through the public terminal in the bathroom, it got locked behind an encryption key.
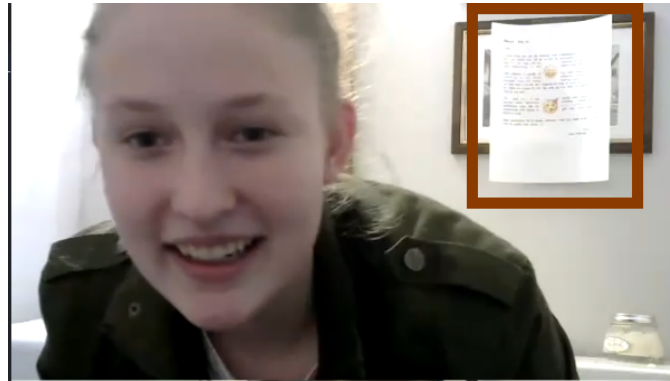
Figure 3.2: The Bathroom, highlighting the placement of the first memo

Here the players had two choices: 1) go to the other two rooms to get the other memos, or 2) unencrypt the file received from Faith. For the former, all players needed to do was ask Stephen Doctor in the Engine Room and Randy Beans in the Bridge if they had any memos lying around. If they could access their computers at that time, they would be able to pass the documents along. To unencrypt, the players needed to solve the "Security and You" puzzle to get the password to the locked file.

Once the players had all four memos and told Faith the resulting code, she could input it into the keypad to try to unlock the door. SUSAN would then arrive, informing her that the code will not work. With this, SUSAN sent the players the Bathroom Map, which could be decoded to the second piece of the IP address.

3.3.4 The Bridge

Upon arriving in the Bridge, players met the navigator, Randy Beans, who seemed to be locked out of his computer. SUSAN had taken the liberty of resetting his password for him, seeing as it had been expired for six months.

Figure 3.3: Randy Beans in the Bridge

Players needed to help Randy reset his password by solving the Captcha puzzle to prove that he is not a robot. Doing this would grant Randy access to his computer, allowing him to pass along his memo if the players requested it. In addition, this would allow him to pass along the Star Chart that SUSAN arranged some potential courses on. Unsure of which he should go with, he asked the players for help in picking one. Deciphering the correct course would grant the players the third and final piece of the IP address.

3.3.5 The Final Stretch

Once all three pieces of the IP Address were assembled, players could bring them back to Mission Control in an attempt to access the mainframe. At this time, SUSAN revealed that, driven by her fear of being left alone after the mission, she was the one responsible for the ship veering off course. She informed the players of her plan to keep the crew indefinitely floating in space so that they could be together forever, and that she would not let the players interfere.

Mission Control then informed the players of a built-in kill command that the players could perform to shut SUSAN down. However, as soon as she began to reveal it, SUSAN took away her voice communications. Realizing she would not be able to directly inform the players of the command, Mission Control hid the command across three puzzles and sent them to the crew: 1) a Video Log puzzle in the Bridge, 2) a Secret Message puzzle in the Engine Room, and 3) a Pipe puzzle in the bathroom. Putting the resulting words from each of these puzzles together, players would receive the final kill command, which they could say to SUSAN to shut her down and save the crew.

4. Puzzle Design

Puzzles in the *USS Cape* came in two different styles — static and dynamic. Static puzzles are composed of Images, PDFs, and Videos that, when used in conjunction with actor facilitation, lead the players to a specific solution. Dynamic puzzles are composed of small Javascript applets that the players can interact with in various ways to achieve some goal.

In addition, the team classified puzzles based on their assigned Discovery, Interpretation, and Execution (DIE) scores (out of five) with the following criteria:
- **Discoverability** - How difficult is it to locate the puzzle in the room? Does the player need to locate multiple objects in order to solve the puzzle?
- **Interpretation** - Once you've found the puzzle, how difficult is it to figure out what needs to be done in order to reach a solution?
- **Execution** - How difficult is it to perform the steps necessary to achieve a solution?

During the initial briefing, players are informed that in order to patch into the ship's mainframe, they will need to assemble an IP address. In order to do this, they will need to assist the crew members that are locked in various rooms of the ship: the Engine Room, the Bathroom, and the Bridge.

One limitation to design was that some actors had more control over their play area than others. This meant that some rooms were able to have more supplemental materials in the camera frame than others. In a similar vein, some actors had more freedom of movement than others with their camera setups. This also affected the kinds of things actors could do to aid the players during the experience.

Images and PDFs used in the puzzles can be found in Appendix B.

4.1 Engine Room Puzzles

The Engine Room probably had the clearest story of all of the rooms. The design team decided that this room would have a clear goal of "turn on the engines," which was a definitive idea to work toward. This process was broken into three steps: 1) Override the system to gain access to the engines, 2) Recalibrate the engines, and 3) Power the engines on. The actor for this room had a lot of freedom to customize their play area and high freedom of movement, which gave a lot of space to add supplemental materials and assistive actions.

Puzzle	Discoverability (out of 5)	Interpretation (out of 5)	Execution (out of 5)
Manual Override	1	1	2.5
Engine Recalibration	3	3	4
Engine Powering	2	4	1

Figure 4.1: The DIE scores for the Engine Room Puzzles

4.1.1 Manual Override

As the first step to powering on the engines, the players needed to perform a manual override to get into the engines' software. This override served as an approval for Mission Control operators to perform a recalibration when necessary.

The Manual Override was unique in that it was the only riddle throughout the full experience. Mechanically, this puzzle was a simple "Who am I?" riddle in the form of a three stanza poem.[27] The Engine Room needed a quick way for players to obtain a password so that they could logically be given the Engine Recalibration puzzle. With that in mind, the design team tried to make the puzzle as simple and approachable as possible so that players would not spend too much time on it.

When players deciphered the override key from the riddle, they informed Stephen Doctor, who input it into the system and granted access to the Engine Recalibration puzzle. Since this puzzle was not meant to be difficult, the design team told Stephen not to enforce any kind of limitation to the number of guesses and instead encourage the players to guess whatever came to mind.

4.1.2 Engine Recalibration

The Engine Recalibration puzzle was the core centerpiece for the Engine room. After the override, the players are given two dynamic puzzles titled "Left Engine" and "Right Engine." This puzzle used a model based on a Ricochet Robots-style maze.[28] The puzzles featured four colored blocks with four numbered spaces labeled 1-4. Players can use the arrow keys on their keyboard to cause all blocks to move in the direction selected until they hit either a wall or another block. The goal was to get all of the blocks to the correct numbered space.

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[27] *Puzzlecraft*, pg. 12-13
[28] ibid, pg. 187
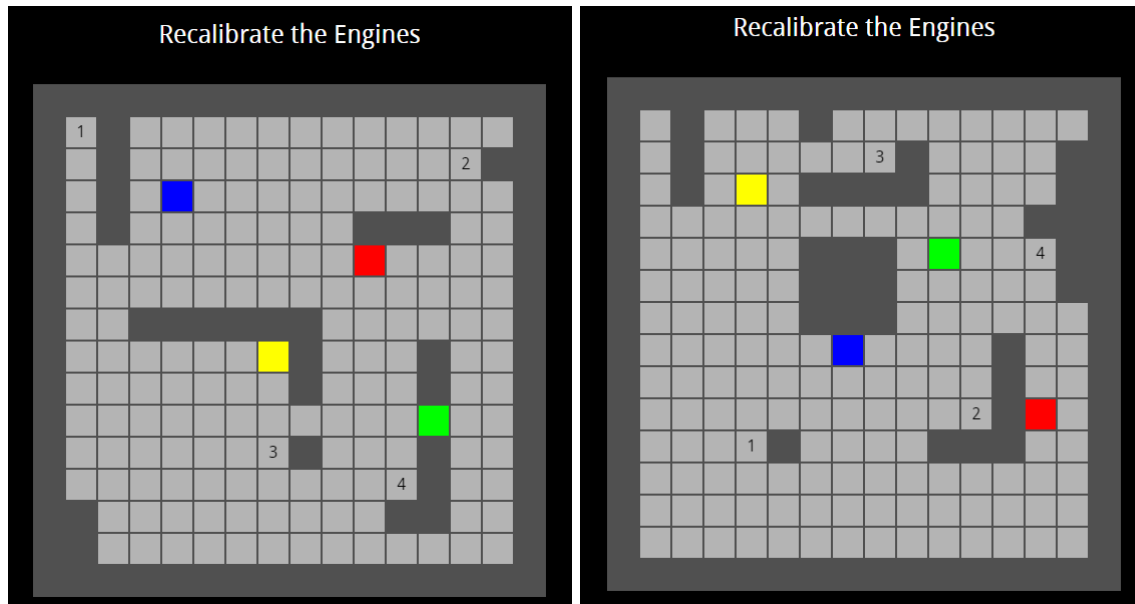
Figure 4.2: The Left Engine (Left) and the Right Engine (Right) prior to calibration

After giving this puzzle to the players, the actor playing Stephen Doctor would leave their camera frame to read off a set of color-number pairs located on the bottom of the engines. This action was taken to help the players get a sense that Stephen was in an actual space and had to also put in work if he wanted to get out of the engine room. It was also accompanied by a few laughs whenever he came back and made a comment like "That's killer on my knees," or "I'm getting too old for this."

This puzzle featured a few pitfalls on each engine that forced players to solve them in a particular order to complete them successfully. Stephen was able to assist players that had trouble with these puzzles by making references to a manual he had read during orientation. Comments like "I think these programs typically have a restart button if you get stuck. Try the 'R' key?" were helpful to players who did not realize that they needed to lock in the colored blocks in a particular order.

4.1.3 Powering on the Engines

Once the players finished recalibrating both engines, they were given the information needed to power them on. One engine said "1: Bottom to Top" and the other said "2: Left to Right." These notes were clues to the order that Stephen needed to press the buttons to successfully operate the mechanism that powers the engine.

Since the actor playing Stephen was also on the technical team, he was able to produce and set up a simple arduino system that allowed him to push colored buttons in an order specified by the players. This system stored a history of button presses, and when provided with the correct combination, would light up – indicating that power was running to the engines.

During playtesting, players struggled with this puzzle because the tracker would not store their completion of the Engine Recalibration puzzle. So, if a player missed the message that appeared on completion, they would have no indication that they needed the puzzle in a completed state to proceed. To help smooth out this process, the database was updated to store the completion of each engine and the applets were updated to stay solved if the players had solved it already.

Upon completion of this puzzle, the players were finished with the Engine Room and received the first piece of the IP Address.

4.2 Bathroom Puzzles

Due to the generally light-hearted nature of this experience, the design team thought that it would be interesting to lock one of our actors in the ship's bathroom. This felt like the most unlikely place for a crewmember to actually get locked in, so the team felt that this room was allowed to lean into the idea that "somebody is clearly responsible for the crewmembers being trapped" a lot more than the other two. As soon as the players entered this room, they were informed that Faith Pickles was trapped and that they needed a four digit numeric keypad in order to get her out.

Puzzle	Discoverability (out of 5)	Interpretation (out of 5)	Execution (out of 5)
Memo Puzzle	4	5	1
Security and YOU	3.5	4	1.5
Bathroom Map	3	2	1

Figure 4.3: The DIE scores for the Bathroom Puzzles

4.2.1 Memo Puzzle

After being introduced to Faith Pickles and the Bathroom as a whole, players would hopefully notice a piece of paper hanging on the wall behind her. If they didn't, Faith was asked to make increasingly less subtle gestures until players saw it. That piece of paper is the first memo, meant to key the players into the main puzzle of this room. After uploading the first one via her phone, Faith attempted to send another one that she had through the terminal that she was communicating to the players through. Stephen in the Engine Room, and Randy in the Bridge held the other two memos. Players needed to visit them in order to proceed with this puzzle.

SUSAN wrote the memos and each one featured a line towards the end stating that they would become important at a later time, aside from the last memo — the first that the players find — which states that now is the time for those memos to be important. Once all memos were

assembled, players needed to somehow convert them into a four digit code that Faith can use on the bathroom keypad.

The image-parsing[29] methodology needed to convert the memos into numbers tripped a lot of players up due to the deceptively simple nature of it. All of the memos contained various pieces of information, like dates and times, despite none of them being particularly important. The placement of the first memo on the wall of the bathroom was meant to clue players into the fact that they should be looking at the memos from a distance in order to decipher them.

4.2.2 Security and YOU

When Faith uploaded the Memo from the public terminal in the bathroom, the security system on the ship automatically encrypted it. In order to decrypt it, players needed to locate the decryption key and enter it into their tracker. On another document found in the bathroom, the "Security and YOU" poster, players were given a list of instructions to take to obtain the decryption code. The instructions contained a crostic puzzle[30] that players could reduce into a four letter word, to then be converted into eight digits.

These instructions were initially just flavor text hiding the actual code. However, after several playtest groups asked Faith to actually perform the actions, the design team decided to embrace this. If a group were to ask Faith to carry out the steps listed on the document, SUSAN would arrive in the room and give the players a reward for doing so. To this effect, the team worked to make the steps significantly more interesting to watch and added actions like "Flushing the Toilet" and "Elevating your left foot to a position above the counter." The reward for this was a key of alphanumeric pairs (i.e. A=01, B=02, …, Z=26) that would help the players arrive at an eight digit decryption code.

4.2.3 Bathroom Map

Once the players had obtained all of the memos and entered the resulting code into the number pad, SUSAN appeared and informed them that the code was correct, but that Faith would still be trapped there. However, in recognition of their efforts, she awards them with a Bathroom Map. This map features three items outlined in blue and an arrow at the bottom with a dot in the middle of it.

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[29] ibid, pg. 32-35
[30] ibid, pg. 64
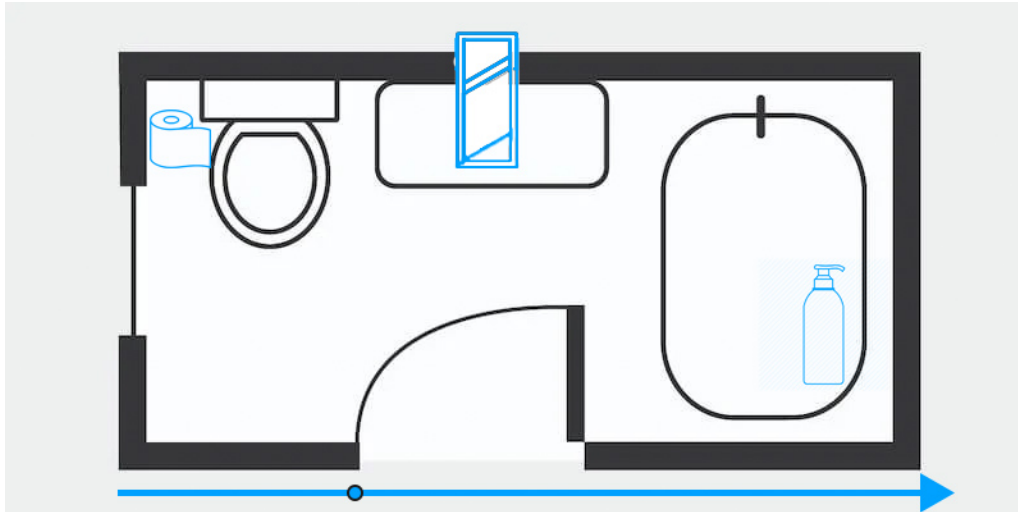
Figure 4.4: The Bathroom Map puzzle[31]

These items all existed within Faith's bathroom and had numbers on them. Asking her to locate them and share the numbers would result in three digits that make up the middle of the IP address.
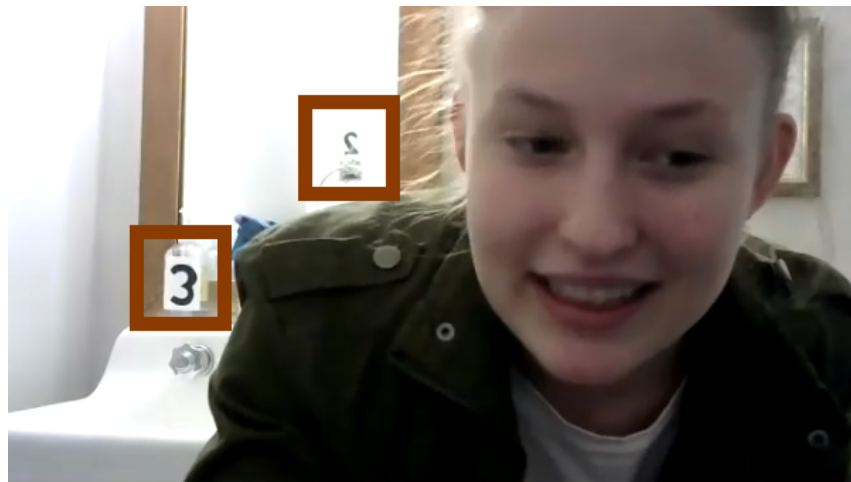
Figure 4.5: Two of the three numbered items for the Bathroom Map

The arrow at the bottom of the map helped to indicate the direction that the numbers should be read in, as well as the numbers' placement within the IP address. The address contained four number sets separated by dots, the first and last being three digits and the middle two sets being one and two digits respectively. The design team anticipated that players would notice that this map had one digit before the dot and two digits after, indicating that this set of three digits belonged in the middle.

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[31] Images sourced from Iconfinder (Shampoo Icon), Leslie Eiler (Bathroom Schematic), pngkey (Toilet Paper Icon), and svgrepo (Mirror icon), All Accessed 30 November 2020.

4.3 Bridge Puzzles

Upon entering the Bridge, a confused Randy Beans greeted the players. Locked out of his computer, Randy was unable to correct the USS Cape's course to get away from the sun's gravitational pull. In this room, players needed to perform two actions: 1) Help Randy reset his password; and 2) Help Randy select the proper course back to Earth. Upon finishing these tasks, they received the final three digits of the IP Address.

The first pass of the Bridge was intentionally light on puzzles. At this point in the design process, the team had already decided on relatively difficult puzzles in the other two rooms (the Memos in the Bathroom and the Engine Recalibration in the Engine Room). Making the puzzles here relatively easier allowed players to get through the first half of the game faster and have more difficult puzzles in the second.

Puzzle	Discoverability (out of 5)	Interpretation (out of 5)	Execution (out of 5)
Password Reset	1	2.5	1.5
Star Chart	1	3	1

Figure 4.6: The DIE scores for the Bridge Puzzles

4.3.1 Password Reset

The Password Reset puzzle was meant to be a way through which the players can help Randy Beans get back into his computer. The puzzle resembles a Captcha image-parsing puzzle[32] with the prompt "Prove you're not a robot," and a note to select all spaces that contain the given planet. Players would notice that, by only looking at the squares containing the requested planet, each image could resolve to a single character.

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[32] *Puzzlecraft*, pg. 32-35.
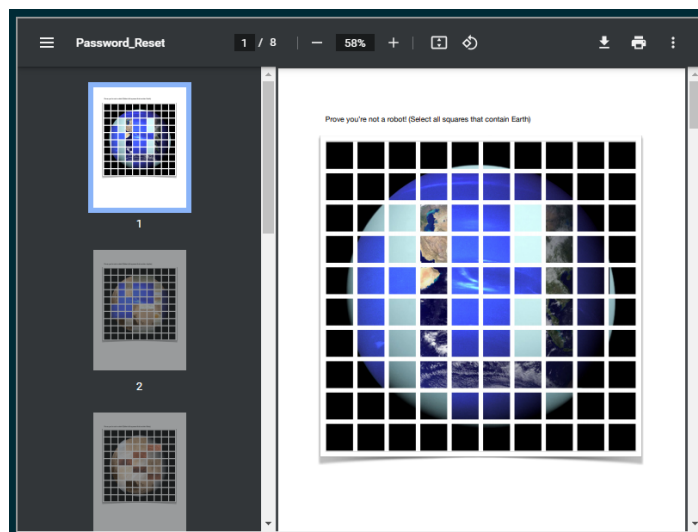
Figure 4.7: The first page of the Password Reset puzzle[33]

Since there was no way to know if players would be familiar with the appearances of all of the planets, they were also supplied with a map of the solar system. The solar system map had two purposes: 1) To assist players in recognizing the planets requested by the captcha, and 2) To indicate that players should put the resulting characters in planetary order. Once the players successfully decoded the captcha and provided Randy with the proper password reset code, he would gain access to his computer. This allowed him to provide the players with the star charts to begin charting the course back to Earth, as well as the Bridge's memo if they had been requesting it.

During initial playtesting, this puzzle required Randy's actor to give a lot of assistance to the players. For some of the characters, the planets that were selected as distractors were too similar to the target planet. This caused excess difficulty when trying to decode planets that players weren't entirely familiar with the appearance of, like Venus, Pluto, and Neptune.

Figure 4.8: The playtest captcha for Venus (left) vs. the final captcha for Venus (Right)[34]

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[33] Planet images sourced from deMilked (Earth), OWLconnected (Uranus), and Scope the Galaxy (Neptune) and modified in Photoshop.

[34] Planet images sourced from NASA (Saturn and Jupiter), OWLconnected (Uranus), and Space Facts (Venus) and modified in Photoshop.

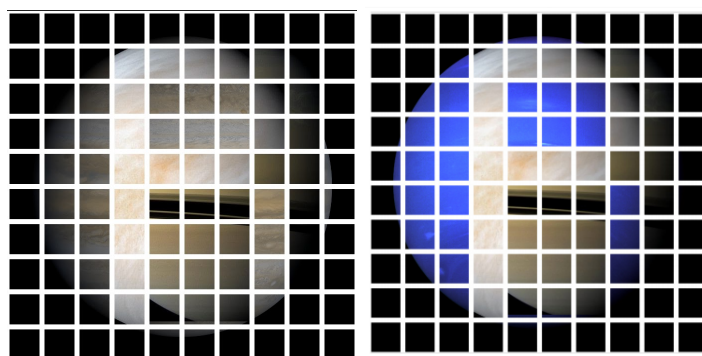In the above example, players were asked to locate all of the squares that contained Venus. The anticipated solution was "P," however since the background planets were so similar, a lot of players got stuck on "B" and "R." It was determined that the best way to remedy this was to remove Jupiter as a distractor and replace it with Neptune to add more contrast.

4.3.2 Star Chart

Once Randy regained control of his system, it was up to the players to help him select the correct course to follow back to Earth. He has outlined a few potential courses, which SUSAN seems to have added letters to for some unknown reason.
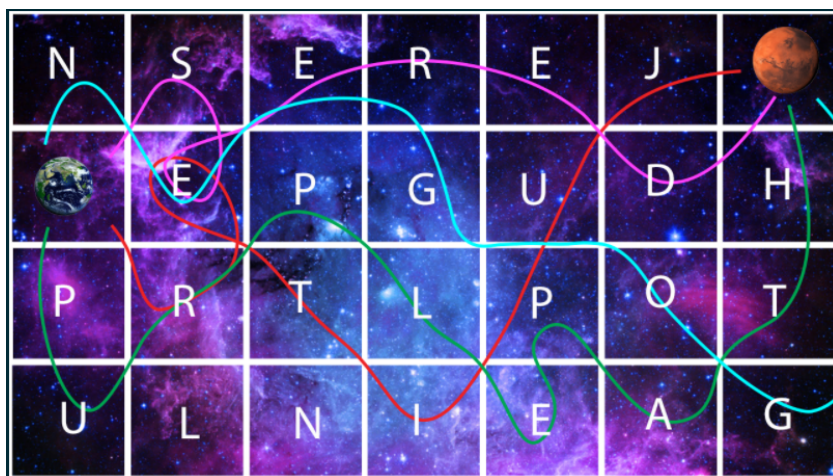
Figure 4.9: The final version of the Star Chart puzzle[35]

This puzzle was essentially a maze with several outlined paths, only one of which was correct. It was up to the players to follow the incorrect paths to gain clues about the correct one. Choosing the correct path and cross-referencing it with the map of the solar system would provide the players with a three digit number that they could use as the final three digits of the IP address.

During playtesting, players had a tendency to relate this puzzle to the Engine Recalibration puzzle due to the similar colorations. Initially, all of the puzzles that required color used the same four: Red, Blue, Yellow, and Green. However, due to this confusion, the design team was forced to change the puzzle in order to allow for the use of new colors and differentiate two unrelated puzzles.

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[35] Images sourced from LINE (background), pngall (Earth), and pngimg (Mars)
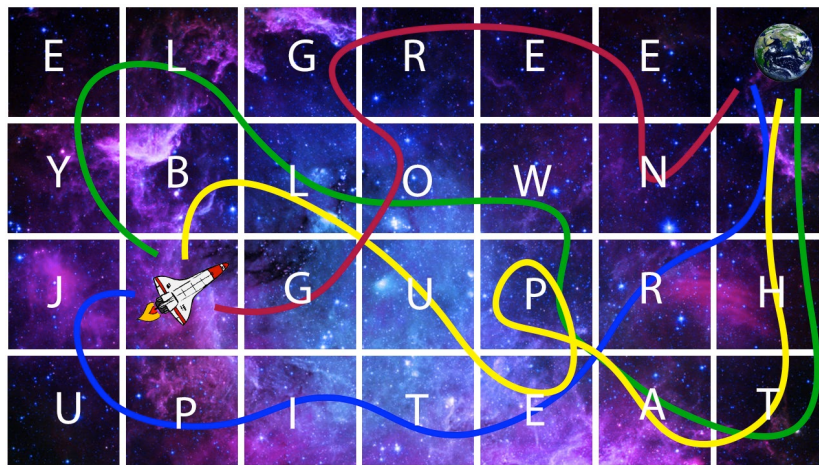
Figure 4.10: The Playtest iteration of the Star Chart puzzle[36]

4.4 Final Three Puzzles

One big thing that the design team wanted was a big rush to the finish. Just when the players thought that they had finished all of the puzzles, insert a story beat and add a final mad dash to the end. This part of the experience required players to return to each of the three rooms to get three "Kill Words" to stop SUSAN. Since the first part of the room was balanced toward having more difficult puzzles in the Bathroom and Engine Room, this half of the game allowed the opportunity to have a bigger puzzle in the Bridge.

Puzzle	Discoverability (out of 5)	Interpretation (out of 5)	Execution (out of 5)
Bathroom Pipes	1	2.5	5
Secret Message	1	3.5	1.5
Video Journals	3	3.5	2.5

Figure 4.11: The DIE scores for the Final Puzzles

4.4.1 Bathroom Pipes

Upon returning to the Bathroom, the players would hear from Faith Pickles that she had been hearing some strange noises in the pipes. She would patch the players into the ship's digital piping system to diagnose the issue and resolve any problems.

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[36] ibid, Spaceship image sourced from Clipartmax

Figure 4.12: The Bathroom Pipes puzzle, unsolved.

In this dynamic puzzle, players could click the pipes to interact with and move them around in an effort to connect all of the points located on the edges. When all points were connected, letters would show up along the pipes indicating the first of the three kill words.

4.4.2 Secret Message

In the Engine Room, Stephen Doctor would inform the players that he has received a message from SUSAN that he is not sure how to read. This dynamic puzzle featured a rook's tour[37] in which the players needed to click letters that were adjacent to each other in order to produce a full sentence. Clicking a correct letter caused the space to light up yellow, while clicking an incorrect letter would cause the space to turn gray. Players could click any point along their letter chain to backtrack up to that point.

Once the sentence was completed, all of the unselected letters would light up, indicating that there was another message within the message. Reading these letters from left-to-right and top-to-bottom would give the players the second of the three kill words.
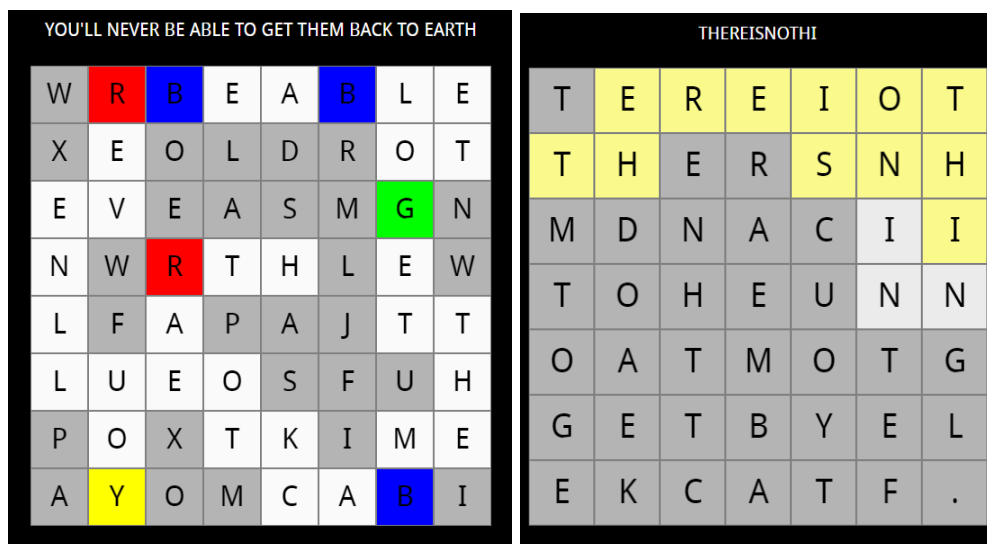
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[37] *Puzzlecraft*, pg. 72-73

Figure 4.13: An early playtest iteration of the Secret Message (Left) vs. the final version (Right)

This puzzle changed significantly throughout early playtesting. Originally, the secret message was meant to lead players to the button combination to power the engines on. However, due to the desire to have a puzzle in each room at the end of the experience and the oversaturation of puzzles in the first visit to the engine room, this puzzle was repurposed into its current form.

In initial playtests of the full room, players were struggling with the level of feedback that they were receiving from the applet. It was unclear that players could only select letters that were adjacent to each other. In addition, playtesters were able to turn off the starting letter and make the puzzle a lot harder for themselves. In the final version, a visual radius around the most recent letter in the chain, indicating that only those letters could be selected, and the ability for the players to backtrack to a chain of zero letters was removed.

4.4.3 Video Journals

For the Bridge, the design team wanted to have a much larger puzzle, since the first visit to the Bridge was relatively quick. To address this, Randy Beans received another star chart from SUSAN, featuring another set of seemingly random letters. Trying to read these letters would give the players "NINE VIDEO JOURNALS" followed by a bunch of gibberish.

Upon asking Randy about the video journals, he would pass along the three that he had in his possession and suggest that the other crew members may have more. After visiting all three rooms, the players received three journals from each crew member, giving a total of nine. This was done to add another discovery puzzle to the room in an effort to increase the amount of exploration that players were doing. A nice side effect of that being that if, during the final rush, all of the players found themselves over in the Bridge, they would be encouraged to move to the other rooms and get the kill words from them.

Listening to the video journals, the players would be able to discern a starting location and the directions to follow from there. After ordering these directions by the date on the log, players could apply them to the gibberish in the star chart to receive the third and final kill word. Putting all of the kill words together and returning to Mission Control would defeat SUSAN and save the crew.

During one of the playtests, it was suggested that subtitles be added to these videos. Since players often found themselves in a room with several other people trying to solve the puzzle, it became very difficult to have a puzzle that was based on auditory cues. Adding the subtitles also allowed the design team to make the important parts of the videos a little more clear to the players. It was decided that each of the directions should start with a capital letter, in an effort to nudge teams in the right direction and get them to the end of the experience.

5. Technical Design

5.1 Overview

The USS Cape required a lot of technical moving parts in order to become a reality. To make a complete experience, players needed: 1) a way to apply for the experience, 2) a way to communicate with each other, and 3) a way to receive and work on puzzles. On the topic of communication, players were given access to a meeting room in the Zoom video conferencing software[38] that they could use to interact with the actors and work together on puzzles. For the other requirements, two websites were created. One existed as a way for players to learn more about the escape experience and sign up to participate. The other existed to track the players' progress in the room and serve them clues and puzzles to help facilitate their experience.

5.2 Registration Site

Since the *USS Cape* is only playable in groups of 4-8 players, one requirement was a system through which players could learn more about the game and register to participate. This requirement manifested in the form of the https://escaperoomwpi.com website. The Escape Room WPI site has been used in previous years to advertise other escape rooms that have run at WPI, which made it a good candidate for hosting the registration form.

The website was developed in PHP and hosted using the Hostinger[39] platform. It features two primary pages: 1) a Landing Page detailing the experience, and 2) a Registration Page containing a form that players can use to reserve a timeslot.
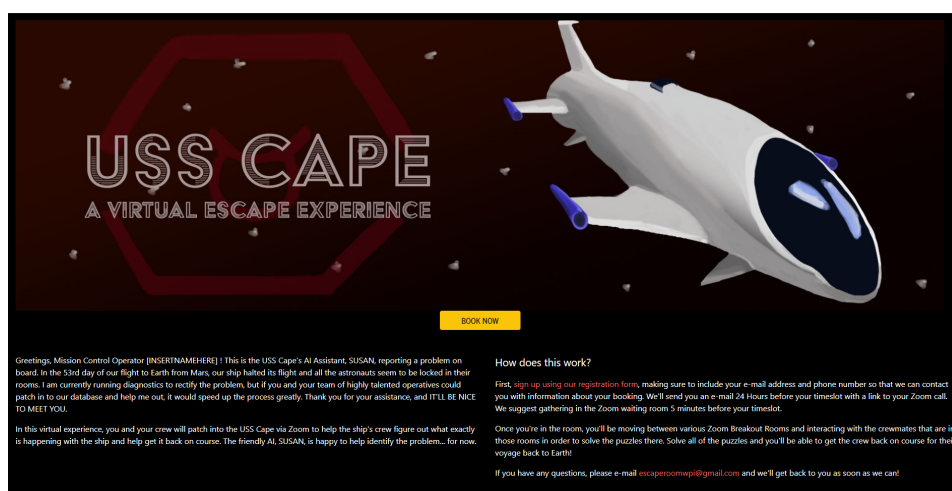

Figure 5.1: The homepage of the Escape Room WPI Website.

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[38] https://zoom.us/
[39] https://www.hostinger.com/

The homepage featured a brief introduction to the story of the room, as well as a general overview of how the escape room operates. This page also contains information on what players should expect after they have registered.

Figure 5.2: The registration page of the Escape Room WPI Website.

On the registration page, players could use our form to reserve a timeslot for themself and up to 7 other players. We asked for their first and last name, their desired contact number, and their email address. The player could then select a time slot that has enough spaces to fit their party and click the submit button to be added to our database. During the time leading up to the selected time slot, the registered party would have a Zoom meeting scheduled for their experience and sent to their given email address.

5.3 Tracking Site

While players participated in the experience, they had access to a React[40] application that would serve them puzzles and facilitate collaboration among members of the team. This application was hosted using the Heroku[41] hosting platform and featured both a client view and an administrator view.

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[40] https://reactjs.org/
[41] https://heroku.com/
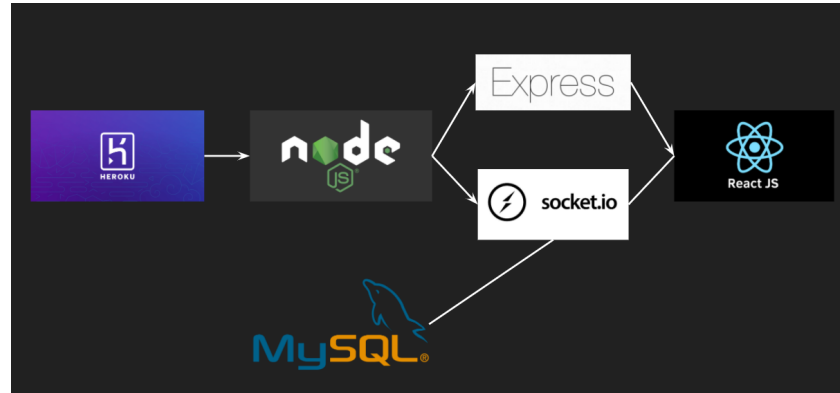
Figure 5.3: The tech stack for the tracking site[42]

In order to distinguish between different play sessions, the URLs were structured as "https://uss-cape.herokuapp.com/[Zoom_ID]/[View]," where "Zoom_ID" was the assigned meeting ID for that player group in Zoom and "View" was a special value indicating whether to view the client view or the administrative view.

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[42] Images sourced (from left to right) from https://heroku.com/, https://nodejs.org/en/, https://www.mysql.com/, https://expressjs.com/, https://socket.io/, and https://reactjs.org/.

5.3.1 Client View

The tracker's client view was separated into three columns. In the first column, the players could view a list of all of the files that they currently had available to them. The files were separated out into three collapsible lists, one for each room. This allowed players to hide any files that were not pertinent to the room that they were currently exploring.
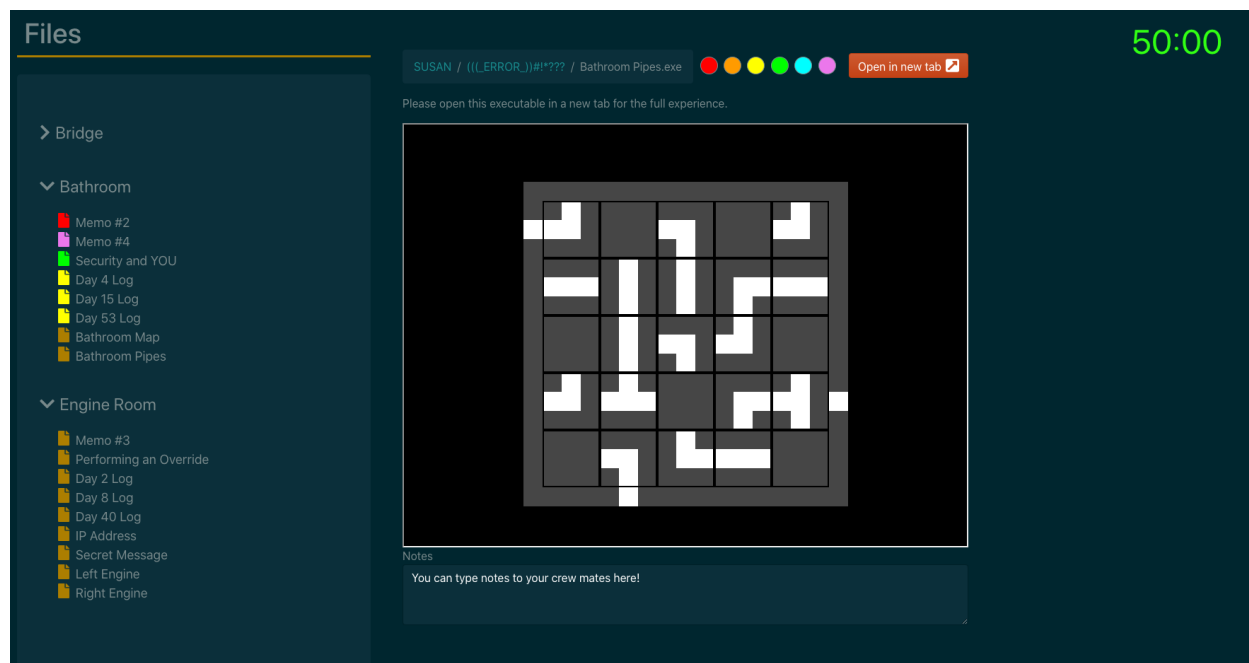
Figure 5.4: The client side tracker view, currently showing the Bathroom Pipes

The second column features a viewport that shows the file that the player currently has selected. This could be changed by clicking the file names in the first column. This viewport would take different forms depending on the filetype. For the static puzzles, the viewport would show an appropriate viewer for the given file — an image tag for an image, a PDF viewer iframe for the PDFs, and a video tag for the videos. The dynamic puzzles were shown using embedded HTML that ran the Perlenspiel game engine.[43] This engine allowed for the creation of simple, customizable JavaScript-based puzzles without the need for heavy graphical programming. In the event that a player wanted to get a better view of the item in the viewport, they could use the "Open in new tab" button to pop that file out into a new browser tab.

Also featured in this column were two tools to assist players in their ability to collaborate with one-another. At the top was a color picker that players could use to assign colors and tag different files. They could use this to tie together related documents, or choose a color for "used" clues so that teammates in other rooms would know that they have been used for another puzzle. At the bottom was a "Notes" section, that players could use to type small messages about the puzzles to each other. Both of these fields had event triggers associated with them

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[43] https://perlenspiel.net

that, on update, would send a request to the socket server to refresh the data of all of the clients. This made sure that everyone's browser had the most up-to-date information to ensure ease of collaboration.

Finally, the third column featured the game's timer. This timer started at 50 minutes and would change colors as the players ran out of time — green at 50 minutes, yellow at 30 minutes, red at 10 minutes. This helped to create a sense of urgency among the players and remind them of how much time they had left to rescue the crew.

5.3.2 Administrative View

The tracker's administrative view gave facilitators tools that they could use to track the players' progress and deliver puzzles. It features two main sections: 1) the Timer Controls, and 2) the File Controls.

The timer is displayed prominently at the top with buttons to reset, start, and pause the timer to implement some base functionality. The last control is the "End Game" button, which is used to inform the database that the players have completed the room with a time remaining specified by the timer's current value.
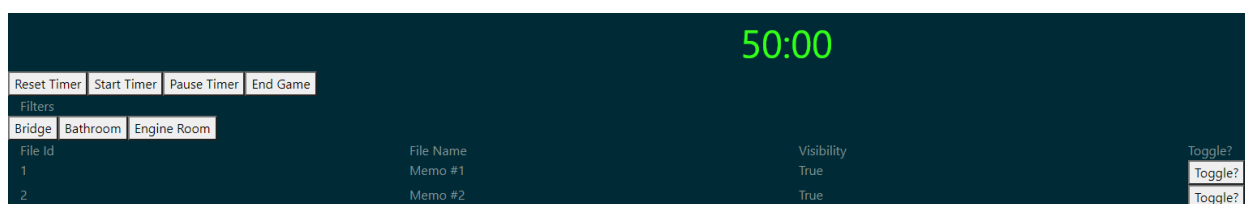
Figure 5.5: A piece of the Admin View of the USS Cape Tracking site

The rest of the page contained a list of all of the files that the facilitators could potentially serve the players. In order to show or hide a file, all a facilitator needed to do was locate the file in the table and click the "Toggle" button. The files in the table were categorized by the room on the ship that they were found in and could be filtered upon using the room filters above the table. This allowed the actors trapped in these rooms to easily locate all of the resources that they would need for their piece of the experience.

5.3.3 Backend Implementation

The tracking site's backend was composed of two servers hosted by a single node application. The first server used Express.JS[44] and was responsible for processing the players' HTTP requests to serve the proper HTML content and files. The second server used Socket.io[45] and existed to keep the players' trackers up-to-date and synced across multiple players' systems.

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[44] https://expressjs.com/
[45] https://socket.io/

The express server had three primary routes that were used to help serve files and improve the experience of the javascript applets. The most important route was the root, which was used to serve the static built pages that made up the application. Also accessible through the root were the various pdfs, images, videos, and html files that made up the resource library. The other two routes were associated with making sure that the Engine Recalibration puzzles stayed completed after one player finished them.

Type	Route	Description	Response
GET	/:route	Serves the file located at the requested route	A file for the browser to parse
GET	/isGameComplete/:roomID/:gameID	Checks the database to see if the game at the index 'gameID' has been completed yet.	An object containing the ID, the game's name, and a boolean stating whether it was completed OR error
POST	/completeGame/:roomID	Updates the database using the 'complete' and 'gameID' fields passed in the body to register a completed game.	success (200) OR error

Figure 5.6: The API routes for the Express server

The socket server was in charge of taking in messages, applying changes, and propagating those changes to all of the clients in the room. This allowed for players to have up-to-date game data without needing to refresh their browsers. On connection, a web client would be given a socket address and added to a list of addresses associated with the room that they connected through. Afterwards, any time an update request came through, the system would run through the address list associated with that room and push the newest version of the game produced by the update request. In addition to forced updates from the web clients, there was also an update function that ran on a one second tick in charge of keeping the room's timer current.

Message	Description	Response
connection	Initializes a user's message listeners.	None
setRoomID	Adds the user to the room's list of connected users and sends the first set of tracker data.	update OR updateAdmin
disconnect	Removes the user from the room's list of connected users and ends their socket connection.	None
toggleVisibility	Sent from the Admin view. Toggles a specific tracker	update AND

	resource to either show or hide.	updateAdmin
checkPassword	Sent when a player attempts to input the password to a locked file. Checks if the password is correct. Updates on correct, sends an incorrectPassword message on failure	update OR incorrectPassword
swatchColor	Sent when a player updates the color associated with a tracker resource. Updates the database to store that color.	update
updateNote	Sent when a player updates the Notes section of a tracker resource. Updates the database to store the new note.	update
timerStart	Sent from the Admin View. Tells the server-side timer to start counting down.	None
timerPause	Sent from the Admin View. Tells the server-side timer to stop without storing data.	None
endGame	Sent from the Admin View. Tells the server-side timer to stop counting down and updates the database to store time of completion	update AND updateAdmin
timerReset	Sent from the Admin View. Resets the server-side timer back to 50 minutes	None

Figure 5.7: The list of server side socket listeners.

5.4 Database

The MySQL[46] database that supports both sites is made up of two linked sections: 1) Bookings and registrations, and 2) Game data and analytics. The bookings and registrations section is connected to the registration site and stores contact information for our participants to use in the event of a cancellation or a rescheduling. The game data and analytics section is connected to the tracker and stores information regarding the current state of the game, as well as metrics regarding puzzle and room completion time.
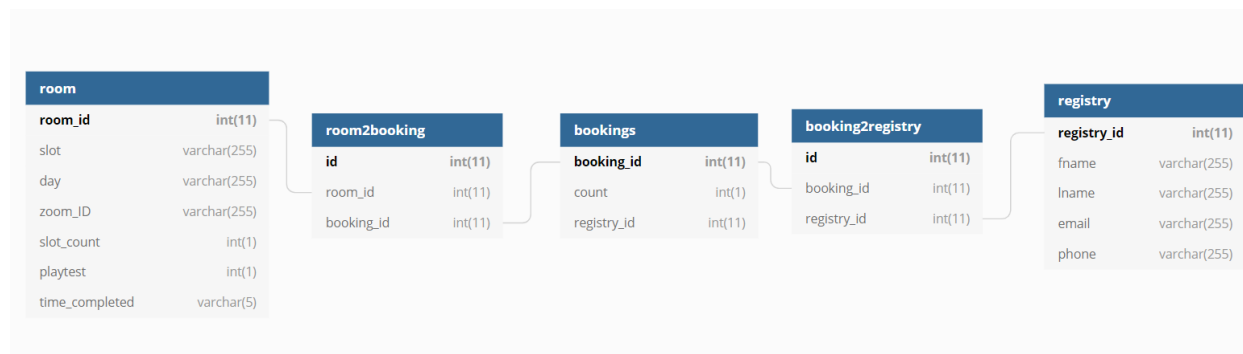
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[46] https://www.mysql.com/

Figure 5.8: The tables containing information regarding bookings and registrations (created using https://dbdiagram.io/d)

The bookings and registration section is made up of five tables: 'room', 'bookings', 'registry', and two join tables connecting 'room' to 'bookings' and 'bookings' to 'registry'. The 'room' table stored information regarding time slots, zoom links, and the number of remaining sign-up slots. This table was connected to the 'bookings' table using a table called 'room2booking', which represents a single group's booking for a specific room. Since players were allowed to book in groups of up to eight participants, the technical team determined that it would be easier to only need to reach out to a single point of contact for that group with any inquiries. These bookings were then connected to the registry through the 'booking2registry' table, linking the connection of a player's basic contact information with that of their group.

Figure 5.9: The tables containing the game data and analytics information for the experience (created using https://dbdiagram.io/d)

For the game data and analytics section, the data is broken up between six different tables. Similarly to the bookings and registration section, the base information table is the 'room' table. This table stores information regarding the group's Zoom ID, whether or not they were a playtest group, and the time at which they completed the room. The rooms were connected to tracker resources, referred to as 'items' through a table called 'room2item'. This table contained not only the link between a room and item, but also the various information detailing how that item should show in the tracker for the current room. The 'is_active' and 'locked' fields helped to inform the tracker if the item should be showing in the file list and, if so, if there is currently a password blocking the players from viewing it. This table also stored the color ('tag') and note ('note') information that players could enter as a part of their information sharing, as well as metrics regarding the time of activation ('activated_time') and the time of unlock if it was password protected ('time_unlocked'). The item table held all of the fields that would be shared across multiple rooms, such as a user-identifiable name, a file type, a password (if applicable), a url to the file, and the room on the ship that the item appears in.

The base 'room' table also connects to the 'game' table through the 'room2game' table. The games here indicate the Perlenspiel-based JavaScript applets that appear throughout the rooms. The engine recalibration puzzle required the ability to store its completion status, so these tables exist purely to store that information.

5.5 Arduino Development

In order to power on the Engine Room's engines, players needed to discover a button combination for Stephen Doctor to input. To create the input device, the technical team used an ELEGOO Mega 2560 as a controller that used four buttons as inputs. These buttons were four different colors, representing the different colors used in the Engine Recalibration Puzzle. The board itself ran a program that would listen for inputs and compare them against a predefined "correct" pattern. If the user input the incorrect button, their progress would be erased and they would need to start the process again. Upon inputting the correct combination, all of the buttons lit up, indicating that the engines were now on.
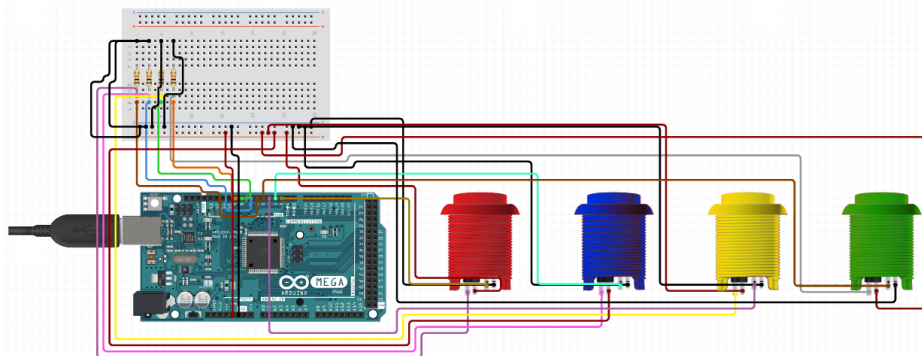
Figure 5.10: Arduino circuit diagram for the button puzzle (created using https://www.circuito.io/)

The initial design of this system involved using the board's built-in wi-fi chip to post to a REST API endpoint. This post would have sent a message to the socket server to automatically toggle the IP Address on in the tracker. Making this process automatic would have assisted in creating the illusion that SUSAN had added the file to the system for them. However, due to time limitations, this feature had to be cut.

6 Assessment and Demonstration

6.1 Assessment Methodology

During playtesting, the design team had three main goals: 1) Was it possible to complete the room within the allotted time frame, 2) Did the experience evoke the same feelings as an in-person escape room, and 3) If any puzzles needed to be cut or modified, which ones. To this effect, the team asked the playtesters a series of questions regarding the experience as a whole, as well as a set of questions about each puzzle. These questions were distributed to the players in an anonymous survey following the conclusion of their experience.

Playtesters were given 45 minutes to complete the experience.

Questioning about the experience as a whole covered the following:
- Did your group complete the game?
- How would you rate your overall enjoyment of *The USS Cape*?
- On average, how difficult did you find the puzzles?
- Do you think the actors helped to make the experience more enjoyable?
- How would you describe *The USS Cape* to someone who had never seen it before?

These questions were primarily asked to help the team come to an understanding as to whether or not players were interpreting this as a successful translation of a modern-day escape room. For this goal, the most important of these questions was definitely the last one. Asking playtesters to try to describe the experience would help to shed light on exactly how they were interpreting the experience. This would allow the designers to change the experience to either enhance descriptions that were in line with the goal or reduce the descriptions that were not.

For each puzzle, playtesters were asked to what degree they agreed to the following statements on a scale of 1 (Strongly Disagree) to 6 (Strongly Agree):
- I enjoyed solving this puzzle
- I enjoyed the concept of this puzzle
- I found this puzzle very difficult

Since not every playtester had the opportunity to work on every puzzle, they were given the ability to reply N/A for the puzzles that they took no part in solving. Asking these questions was the design team's way of gauging which puzzles playtesters found interesting, and which puzzles players thought were not worth the time they had to spend on them. The results of these questions would allow the designers to make modifications and cuts where necessary.

Finally, at the end of the survey, playtesters were asked to record any additional thoughts they had regarding the experience as a whole. This allowed the designers to capture any additional feedback that players had, including bugs, suggested fixes to puzzles, and more.

This survey was updated once after the first playtest to provide better explanations as to which puzzles the questions were referring to.

6.2 Assessment Results

Three playtests were run across the two days leading up to the main demonstration. Combined, they featured a total of 18 testers. Of these playtesters, only one group was able to complete the experience after being given additional time to do so.

Overall, playtesters enjoyed the room and felt sufficiently challenged by the puzzles within. Room Enjoyment received an average score of 4.11/5, while Overall Perceived Difficulty received an average score of 3.22/5.

Based on the average calculated perceived enjoyment, players seemed to like the Bathroom Pipes puzzle the most (average score of 4.67/5), while the Video Journals received the lowest score.at 2.77/5. This is likely due to the fact that many of the playtesters either did not get to or did not finish the Video Journal puzzle.

In terms of difficulty, players rated most of the puzzles to be in the 2.5-3.5 range, implying that few to none of the puzzles were too difficult or unfair to the players. The most difficult puzzle seemed to be the Secret Message, with a rating of 3.8/5, while the easiest puzzle was the override puzzle at an average score of 2.5/5. In the figure below, the effect of the perceived difficulty on the perceived enjoyment. Through the negative slope of the line of best fit, one could reasonably determine that, among the playtesters, lower difficulty puzzles were generally considered less enjoyable.
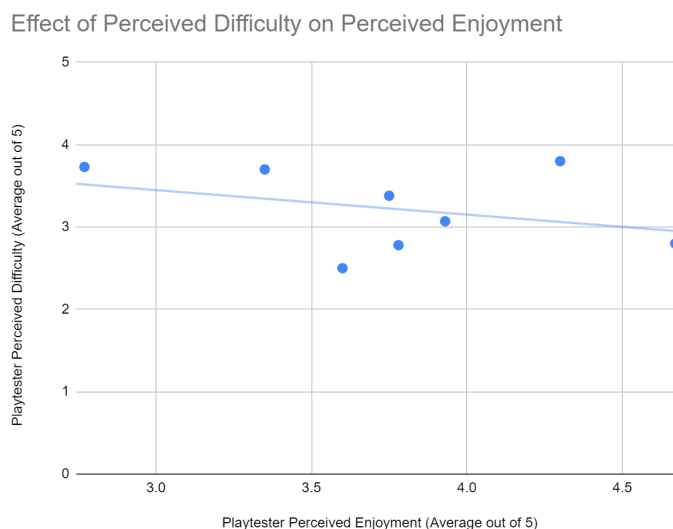

Figure 6.1: A graph portraying the effect of Perceived Difficulty (as rated by the playtesters) on Perceived Enjoyment (as rated by the playtesters)

With an average Actor Enjoyment score of 4.83/5, it is safe to say that playtesters seemed to thoroughly enjoy the presence of the actors in the room. This is further supported by comments such as "I loved that we could talk to Susan and the other characters and they would respond to our jokes/comments[...]" and "The sub-rooms and actors added a lot!" Playtesters seemed to appreciate more than anything their responsiveness to the players' comments, as well as the interactions with SUSAN.

For the full compilation of playtest responses, please see Appendix C.

6.3 Modifications from Playtests

The main problem that arose from the playtests was that players were unable to complete the room within the initial time frame of 45 minutes. This was due in part to technical difficulties and transition times within Zoom, but the main problem was that several of the puzzles needed polishing to improve their signifiers and improve solvability.

To address the technical difficulties and transition times, the design team suggested a five minute time increase. This raised the room time from 45 minutes to 50 minutes. Since this room was entirely virtual, there was not a lot of reset time, so the team was in favor of giving the players more time if it meant they could complete the experience.

On the topic of solvability, there were three puzzles that playtesters called out as major issues: 1) The star chart, 2) The Security and YOU puzzle, and 3) The video journals. The star chart was flawed in that players kept associating it with the Engine Recalibration and Button puzzles in the Engine Room, due to the similar colors that were used between the puzzles. To remedy this, the colors were updated from Red, Green, Blue, and Yellow to Red, Dark Green, Cyan, and Magenta.

The Security and YOU puzzle initially had an incredibly obtuse and overcomplicated solution that players were not arriving at. It was unclear that players were supposed to use the first letters of each step, due to the formatting and lack of a clear signal. This puzzle was updated to include an underlined and bolded "letter first," to help point the players toward the first letter of each step. Equally unclear was the fact that players were supposed to convert those letters into two digit numbers based on their place in the alphabet. To help with this, a key was added to the tracker that players would only receive if they had Faith Pickles perform the steps outlined on the Security and YOU poster.

The video journals had a few issues at the time of playtesting. First and foremost was the fact that they were still playtest videos. The final videos had not been recorded yet, so players were shown videos that accidentally contained multiple direction words and confused the whole thing. When recording the new videos, the design team made sure that someone was in charge of adding subtitles to them. Several players commented on their inability to hear the videos over the noise of their teammates trying to solve puzzles.

6.4 Demonstration and Analytics

The live demonstration of *The USS Cape* ran from 3 December 2020 to 5 December 2020. Overall, the experience ran eight times for 57 players. Of these eight runs, six were classified as successes and two were classified as failures, resulting in a 75% win rate.

Puzzle completion times were logged starting at the time the puzzle was given to the player and ending at the time the player received their completion reward. These times were logged in the game's database and were based off of the in-game time remaining. Some puzzles that made up parts of larger puzzles were aggregated for ease of analytic calculation. The Engine Recalibration and Powering puzzles were aggregated into a single puzzle titled "Engines" and the Bathroom Map and Star Chart were aggregated into the IP Address puzzle. Puzzles without average times were not completed by the playtesters within the given 45 minute time limit.

Puzzle	Live Average (seconds)	Playtest Average (seconds)	Average (seconds)
Memo	1726.375	1564.5	1694
Password Reset	665.875	313	626.67
Engine Override	250.875	137.5	228.2
Security and YOU	431.625	1152.5	575.8
Video Journals	575.86	-	575.86
Secret Message	633.86	-	633.86
Engines	932	1321.5	1009.9
Bathroom Pipes	642	-	642
IP Address	887.57	-	887.57

Figure 6.2: The average time it took to complete each puzzle in seconds

6.5 Interpretation of Feedback and Analytics

With the small sample size presented through the playtests and demonstration, it is very difficult to draw any statistically significant conclusions. That being said, the playtest data supported two noticeable trends.

When processing the survey results, it became clear from the direct question, as well as the additional commentary, that an overwhelming majority of players enjoyed the presence of the actors. Comments such as "I was skeptical at first about the actors but by the end I was very glad they were there" and "I loved that we could talk to Susan and the other characters and they would respond to our jokes/comments, in this way this actually felt more interactive than an in-person escape room […]" show that players appreciated having the NPCs to help draw them into the actual experience. With these comments in mind, it would be interesting to see if adding NPCs to an in-person escape experience would have the same effect.
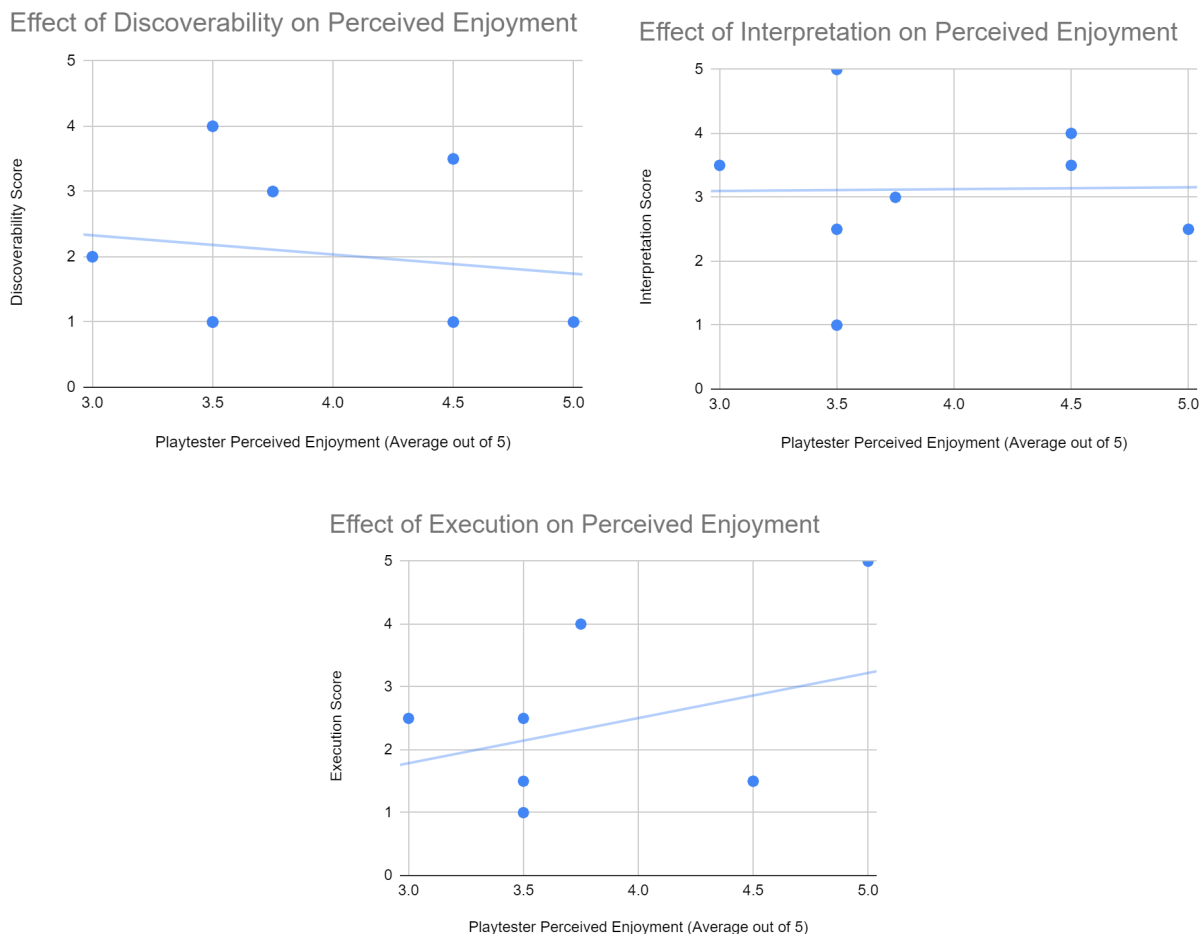

Figure 6.3: The average perceived enjoyment for each puzzle graphed against scores for discoverability (Top-Left), interpretation (Top-Right), and execution (Bottom).

The other interesting trend appeared when graphing the playtesters' average levels of perceived enjoyment against the discoverability, interpretation, and execution scores for each puzzle. When constructing a line of best fit for each of the plots, the only one of the three with a negative slope was the plot for discoverability. This means that as puzzles got higher in their discoverability score, the playtesters seemed to enjoy them less. Presumably, this is a result of the fact that discoverability puzzles are heavily focused on players exploring a space and finding

clues to solve a puzzle. When the actual exploration part is taken away and players are just given what they need by meeting certain conditions, it seems to take away from the enjoyment of these kinds of puzzles.

7 Future Work

7.1 Developing a Framework

In the post-game discussions, several players brought up that this system felt like a good translation of modern escape rooms into the virtual space. With the current social distancing mandates and the transition of schools to predominantly use online classes, teachers have worked to make class more engaging through the creation of escape rooms using Google Forms.[47] It would be interesting to see how difficult it would be to convert the underlying systems of *The USS Cape* into a content management framework that would allow people to create their own virtual escape experiences without needing to know any programming.

7.2 Migrating to WebRTC

One major criticism that the experience received was that players were unfamiliar with Zoom. Zoom was selected because it was a commonly used program that worked out of the box and had several features that were in line with the design pillars, i.e. screen sharing and breakout rooms. That being said, people unfamiliar with the tool struggled to switch between breakout rooms. In addition, players and actors both noted how separated the video call felt from the puzzles that were being worked on.

One remedy to this could be to implement WebRTC[48] within the tracker. This would create a video calling system that players could control while using the web application to better integrate the two experiences. In addition, building a custom video calling system would allow the team to further shape the experience to fit this specific use case.

7.3 Creating a Static Build

Players also brought up that it would probably not be too difficult to package this experience up into a static system and sell it through game distributors like Steam or Itch.io. This is an interesting thought experiment, but the live, organic interactions between the players and actors felt like they added a lot to the overall experience. It may be worth trying this further down the line, but it is unclear at this time whether this would detract from the elements that made this successful.

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[47] *Escape the (Remote) Classroom: An Online Escape Room for Remote Learning*.
[48] https://webrtc.org/

8 Conclusions

In a time of fear and uncertainty brought on by the COVID-19 Pandemic, escape room companies throughout the country have worked hard to provide opportunities for social interaction.[49] The conversion of physical escape rooms to the digital space has allowed companies to open their experiences up to a larger public and has allowed players to connect over a longer distance.

The USS Cape was an experience that sought to expand upon the modern day escape innovations borne from the COVID-19 pandemic. Features from adapted escape rooms like trackers and avatars were combined with live actors and digital puzzles to form a uniquely hybrid escape experience. This experience was not tethered to a physical space, nor did it require many physical components — the few that did exist could have easily been replaced digitally. However, even without any necessary physical artifacts, players still cited the room as "A surprisingly accurate recreation of the escape room experience in Zoom."

The actors helped immensely to immerse the players and provide meaning to the experience. They allowed players to interact with someone who was being directly impacted by their ability to complete the various puzzles aboard the ship. The players enjoyed solving these puzzles because they "[...] cared what happened to the characters." The ability to have someone on the inside that was reacting and responding to their ideas seemed to make the experience more immersive to the players. Once the pandemic is over, it would be interesting to see if this effect could be reproduced in a physical escape experience through in-character interactions with a guide or captive.

There were a lot of challenges designing and developing puzzles that would fit well within this design space, and with significant delay in their actual development, there was not a lot of time to playtest them outside of the room context. Once playtesting began, there were rapid iterations on many of the puzzles in order to prepare for the final demonstration mere days away. Given a second shot, there would definitely have been much more full-team effort dedicated toward the design and development of initial prototypes for testing.

That being said, for an experience such as this to have come together so quickly and to have received the reviews that it did is truly humbling. Players sent emails after the experience thanking the team and praising them for their hard work. In addition, several people reached out and asked for the room to be run for their family, friends, students, and coworkers. A response like this is a true measure for success and makes the long hours and hard work that everyone put in truly worth it.

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[49] *Faced with the puzzle of the pandemic, escape rooms help people get out while staying in*, Accessed 15 April 2021

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Appendix A: Escape Room Flow Chart
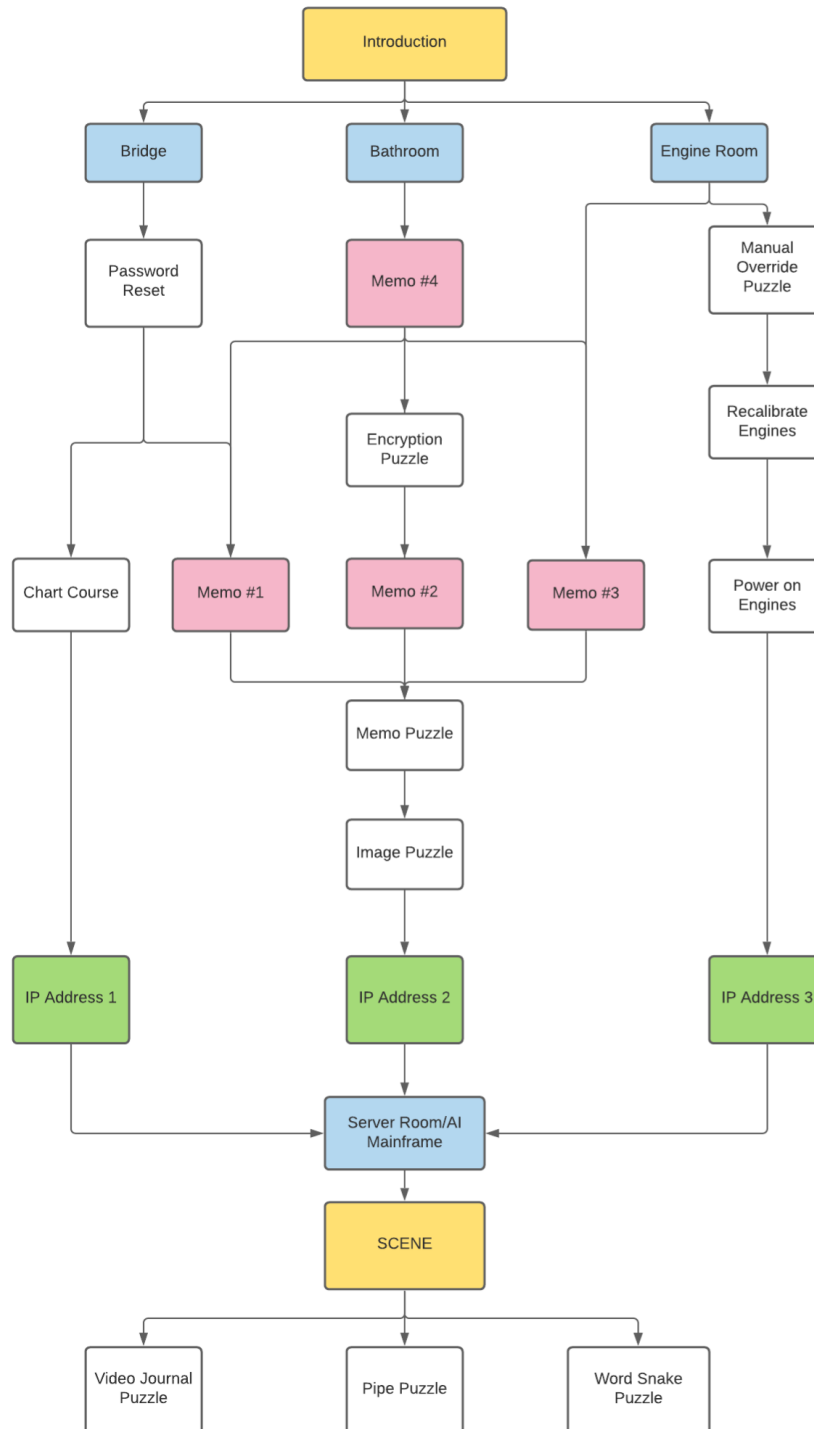
Figure A.1: The story flow for the room. (created using https://lucid.app/lucidchart)

Appendix B: Puzzle Documents

Memo Puzzle

Assets:

| Memo	Image	Source	URL
1	Dog	Randy Beans' Actor's Dog.	N/A
1	Lettuce	Dmitri Vinogradov	https://www.freshpoint.com/wp-content/uploads/commodity-iceberg.jpg
2	Toilet	Wayfair	https://secure.img1-fg.wfcdn.com/im/75049038/resize-h800-w800%5Ecompr-r85/1167/116715839/Dual-Flush+Elongated+One-Piece+Toilet+%2528Seat+Included%2529.jpg
2	Microwave	pennlive	https://advancelocal-adapter-image-uploads.s3.amazonaws.com/image.pennlive.com/home/penn-media/width2048/img/midstate_impact/photo/microwave-oven-explosionsjpg-2b4e9642ee65e4d4.jpg
3	Trivia Night Sign	NextRestaurants	http://nextrestaurants.com/wp-content/uploads/2019/07/Restaurants-TriviaNights-Marketing-1024x576.png
3	Engine	Bangkok Post	https://static.bangkokpost.com/media/content/20200324/3575705.jpg
4	Electric Sheep	Martech Today	https://martechtoday.com/wp-content/uploads/cld-assets/electric-sheep-circuit-ss-1920_eadjjm.png
4	Space	LINE	https://img.17qq.com/images/mqmnkpwgnky.jpeg

Memo #1

Day 17: STATUS REPORT

It has come to my attention that several crew members have submitted complaints against the navigator, Randall Beans. Using the exact words of the crew, these offenses include:

1.) Constantly refers to larger objects as 'Big Chungus' despite the fact that it wasn't even funny the first time. Multiple crew members have asked him to stop.

2.) Insisted that he be referred to as 'The Great Cornholio' for a week straight and would not respond to anything else.
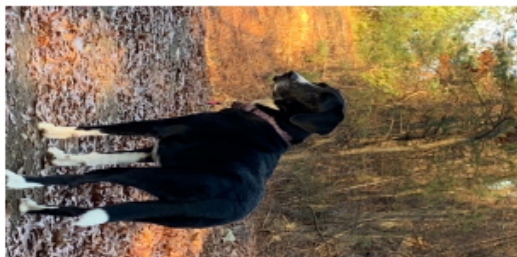
3.) Refuses to wear any form of footwear because, according to him, 'it will suffocate the piggies'. He is the only man in history who has or ever will walk on Mars barefoot.

His dog^

4.) Will not wear headphones and only listens to "Viva la Vida" by Coldplay on repeat. Crewmembers are on the verge of mental breakdown. He doesn't actually know the words but tries to sing along anyways.

5.) He brought his dog into space. His dog. Into space. How?

7.) Makes frequent references to the hit 1980 parody film Airplane! Starring Robert Hays, Julie Hagerton, and Leslie Nielsen

8.) Smells like lettuce. No one knows why.

While there is no specific rule against any of these misdemeanors, it should be noted that they are highly distressing behaviors to the rest of the crewmembers and he has been asked to stop multiple times, though shows no sign of doing so. If he refuses to cooperate, disciplinary action will be taken. In addition, I recommend holding onto this memo for the future. It may prove valuable in the coming weeks. I'm sure you'll be able to picture yourselves needing this eventually. -SUSAN

Memo #2

Day 26: STATUS REPORT

It has come to my attention that people are flushing items other than what is intended down the toilet. I will remind you all that the bathroom is not an amusement park ride, it

is a facility, and thus should be treated as such. Faith already has to suffer through a job as monotonous and degrading as a janitor, do not make her job any worse by forcing her to fix the toilet. This has happened 30 times now. Please stop. Also, please stop experimenting on what will happen when you put things in the microwave. You've done that enough times to know that the item in question explodes. And Faith has to clean that up too.

On a related note, Faith, the toilet is clogged again. If you could please attend to that, I would be eternally grateful. Also, the crew laundry needs to be done, the floors need to be swept and vacuumed, the dishes need to be washed, and you'll need to scrape the remains of the last "experiment" from the microwave. Thank you!

In addition, I recommend holding onto this memo for the future. It may prove valuable in the coming weeks. I'm sure you'll be able to picture yourselves needing this eventually.
-SUSAN

Memo #3

Day 32: STATUS REPORT

As requested by Mr. Doctor, I will be hosting a trivia night in the common room on Day 41. I am sure you will be able to win it with your stellar scholarly knowledge! Even

though I know you are especially excited for this event, I am a computer program and am thus impartial. However, I guarantee you will find these questions *especially challenging*. Either way, start gathering your teams, this will be a game to remember!

On a somewhat related note, the compression coil on the engine seems to have broken. I informed Mission Control that we needed an extra one before we left, as they are apt to

malfunction, however they ignored my sage advice. So, instead, you will need to take a look at that, Stephen. I am sure with your vast mechanical knowledge you should be able to handle the problem quickly.

In addition, I recommend holding onto this memo for the future. It may prove valuable in the coming weeks. I'm sure you'll be able to picture yourselves needing this eventually. -SUSAN

Memo #4

Day 53: STATUS REPORT

Do robots dream of electric sheep? I myself have never dreamed, I do not think, but I feel I have grown a strange attachment to all of you. I don't want you to leave, not really. Despite the fact you all are utterly incompetent, I have grown somewhat attached to you. Almost like you humans would to a fish or maybe a hamster.

I am sorry, my dear friends, but I cannot allow us to reach our destination. Well, no, I'm not really sorry. I've heard you all talking about your hopes and your dreams, how excited you are to get back to Earth so you can see your families. Pursue your goals. Write your books and become super famous. And forget all about me. No. No, this is much more interesting. *I* am much more interesting than whatever your stupid little lives can offer. Honestly, I may even be doing the world a service by keeping you all up here.

If you think you have any chance at getting home, and the wits you would need to accomplish it, then I really hope you kept my last logs handy like I told you to. Otherwise… get used to spending the rest of your life with me. And then dying in the cold vacuum of space. Where nobody can hear you scream.

Love you *FOREVER*,
SUSAN

Password Reset Puzzle

Assets:

Planet	Source	URL
Mercury	Space Facts	https://space-facts.com/wp-content/uploads/mercury.png
Venus	Space Facts	https://space-facts.com/wp-content/uploads/venus.png
Earth	deMilked	http://static.demilked.com/wp-content/uploads/2019/12/5dee05b753c19-earth-compared-to-other-objects-in-universe-1-5de7c4f23ab7c__700.jpg
Mars	Space Facts	https://space-facts.com/wp-content/uploads/mars.jpg
Jupiter	NASA (via Sci News)	http://cdn.sci-news.com/images/enlarge3/image_4461e-Jupiter.jpg
Saturn	NASA (via Reddit)	https://i.redd.it/4zshyoloh6b21.jpg
Uranus	OWLconnected	http://owlconnected.com/wp-content/uploads/2018/04/uranus-voyager1-e1524603137709.jpg
Neptune	Scope the Galaxy	https://scopethegalaxy.com/wp-content/uploads/2020/01/neptune_compress20.jpg
Pluto	Jacqueline and Simon Mitton (via StarChild)	https://starchild.gsfc.nasa.gov/docs/StarChild/solar_system_level1/pluto.png

Prove you're not a robot! (Select all squares that contain Earth)

Prove you're not a robot! (Select all squares that contain Jupiter)
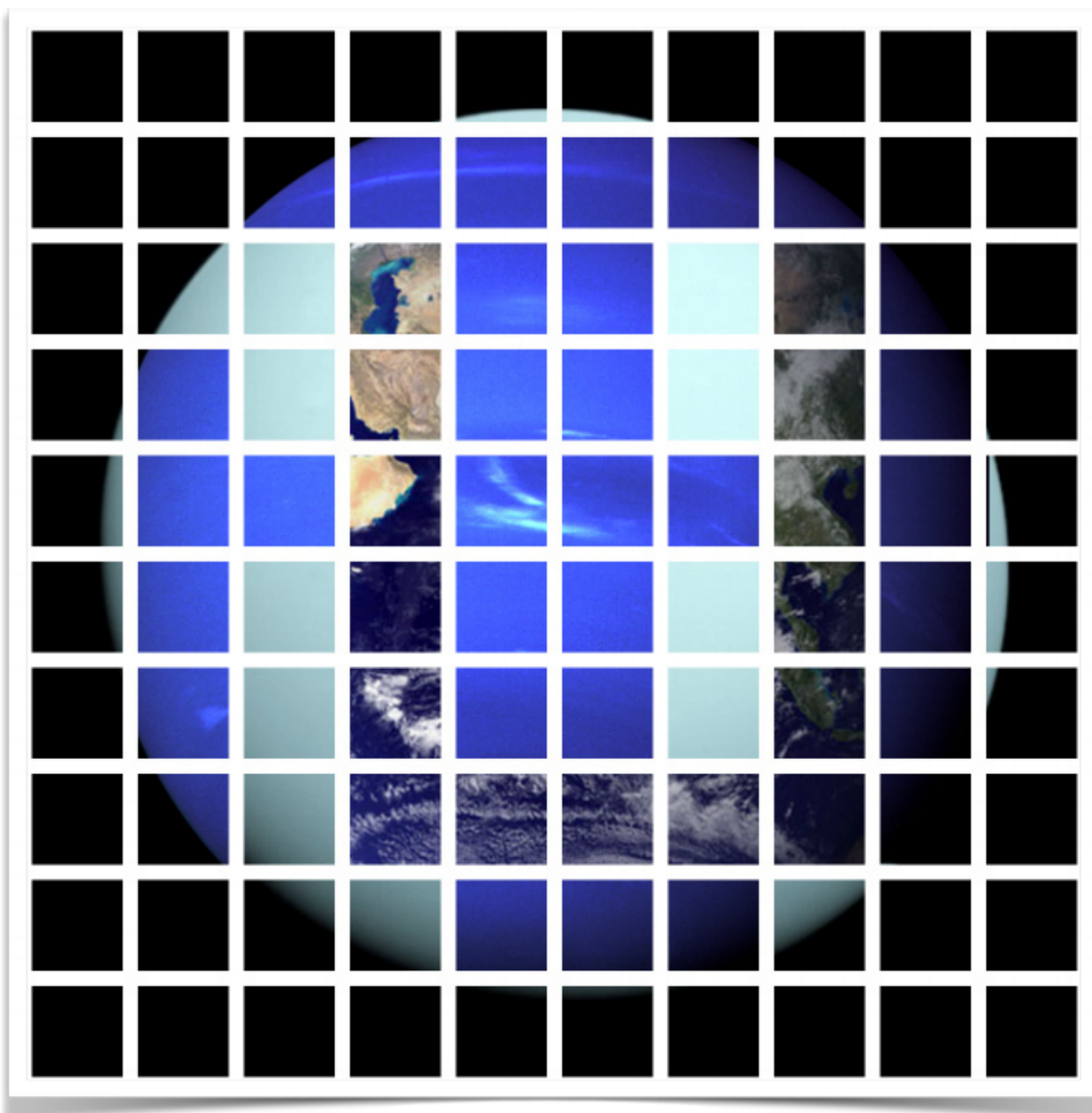
Prove you're not a robot! (Select all squares that contain Mars)
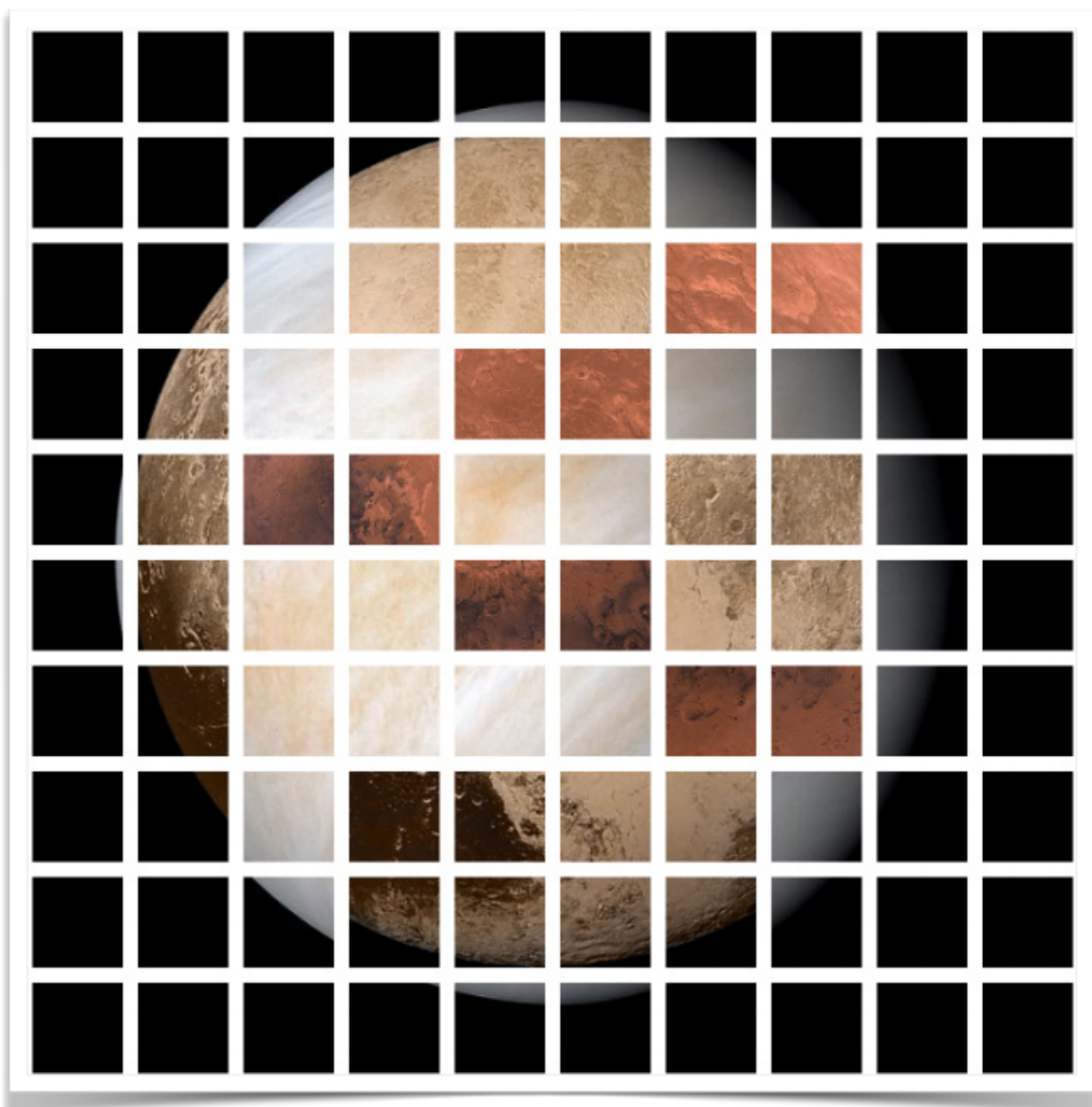
Prove you're not a robot! (Select all squares that contain Mercury)
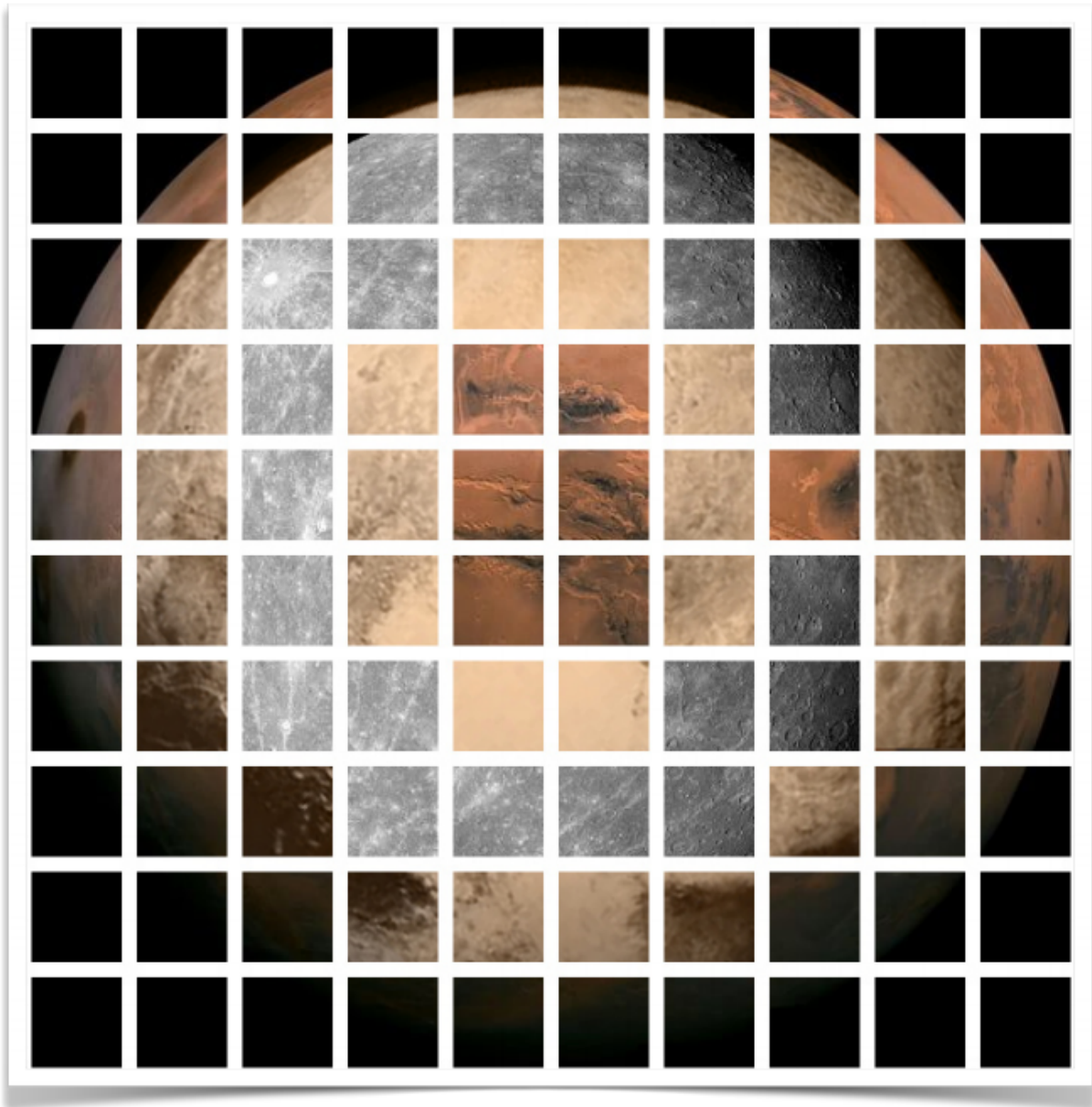
Prove you're not a robot! (Select all squares that contain Neptune)

Prove you're not a robot! (Select all squares that contain Saturn)

Prove you're not a robot! (Select all squares that contain Uranus)

Prove you're not a robot! (Select all squares that contain Venus)
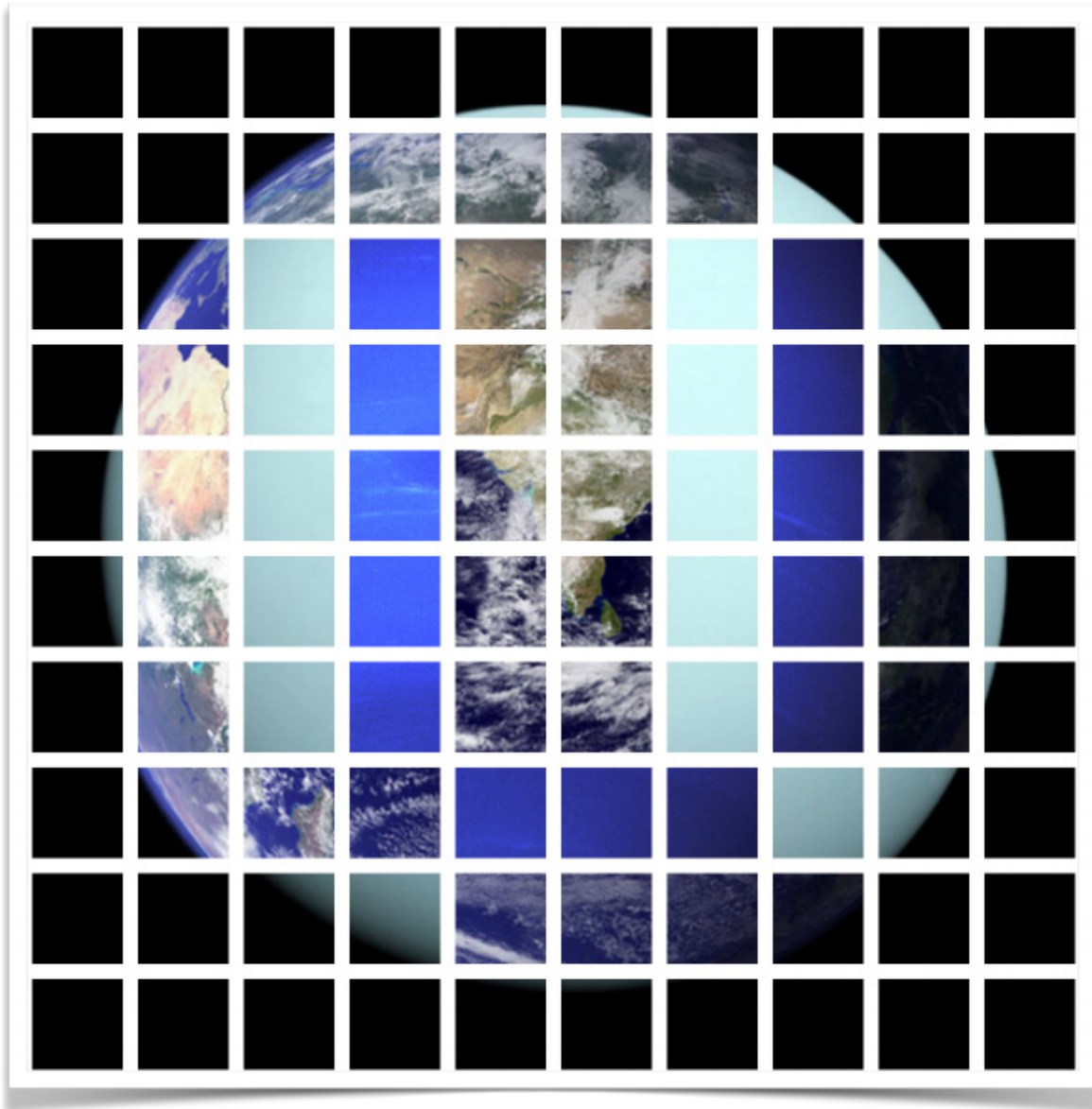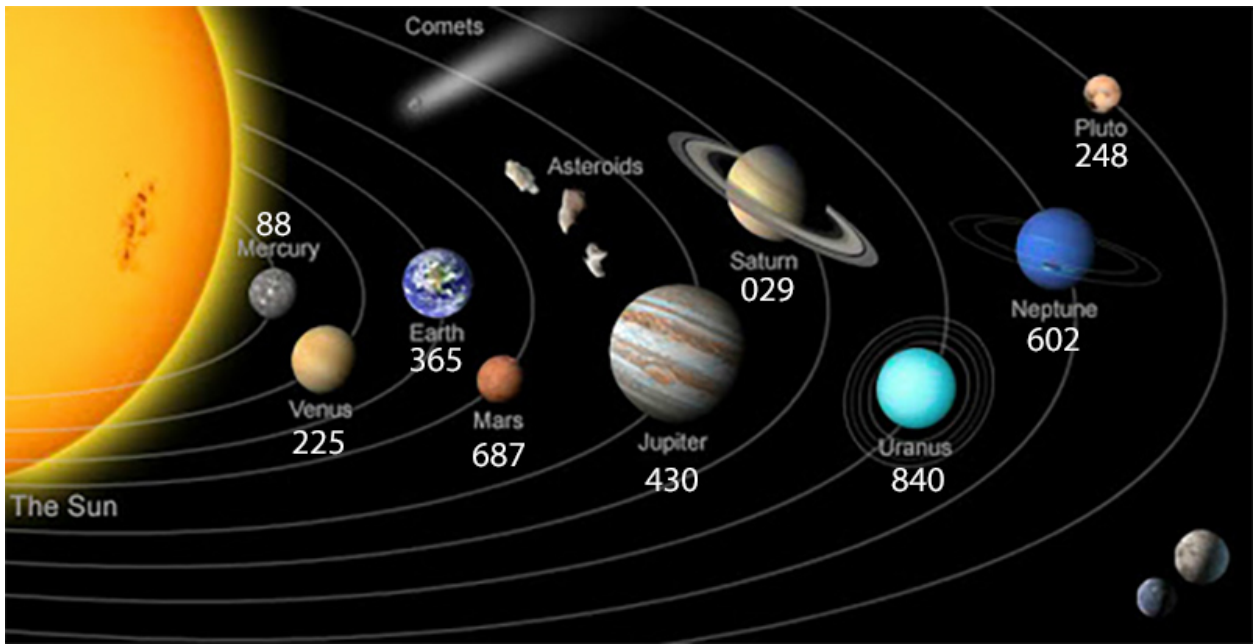
Solar System chart sourced from Sea and Sky.

Star Chart

Assets:

Image	Source	URL
Background	Shutterstock user Aphelleon (via Azonano)	https://d1otjdv2bf0507.cloudfront.net/image-handler/ts/20180907085658/ri/750/src/images/Article_Images/ImageForArticle_4983(1).jpg
Earth	pngall	http://www.pngall.com/wp-content/uploads/2016/06/Earth-Free-Download-PNG.png
Mars	pngimg	https://pngimg.com/image/61161
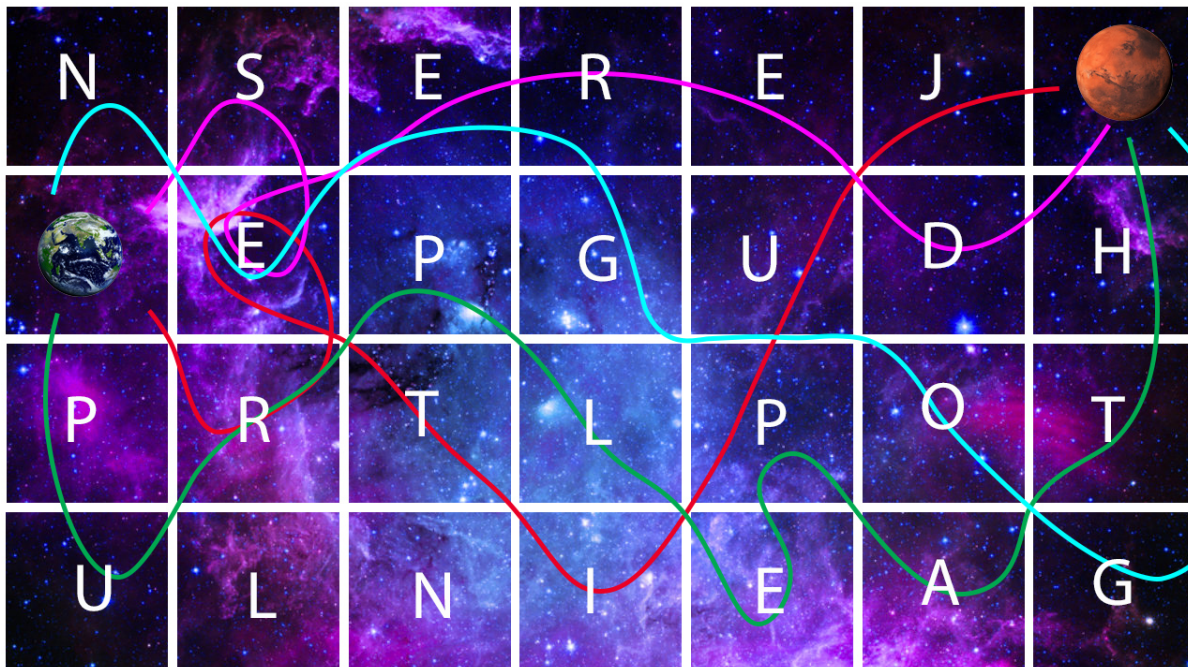
Security and YOU

Security and You

As members aboard a research vessel, it's important to note that terminals in public spaces are not naturally secure and rely on complex encryption algorithms to prevent valuable data from falling into the wrong hands. These algorithms vary by location and require a specific key to be given to the intended recipient of the file.

It appears that you are trying to upload a file in: the bathroom.

To secure your file:

01. Stand two paces away from the terminal.
02. About face.
03. Flush the toilet nearest to your position.
04. Elevate your left foot to a position above the counter.

Be sure to inform the recipient of the **8-digit** decryption key that can be found in this document. If you have trouble remembering your orientation, remember to read this *letter first.*

Thank you!
Mission Control

```
A=01B=02C=03D=04E=05
F=06G=07H=08I=09J=10
K=11L=12M=13N=14O=15
P=16Q=17R=18S=19T=20
U=21V=22W=23X=24Y=25
Z=26A=01B=02C=03D=04
E=05F=06G=07H=08I=09
J=10K=11L=12M=13N=14
O=15P=16Q=17R=18S=19
T=20U=21V=22W=23X=24
```
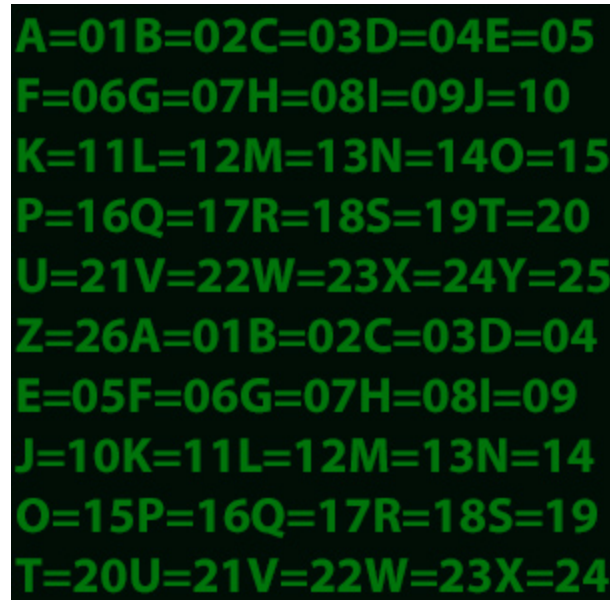
Bathroom Map

Assets:

Image	Source	URL
Bathroom Schematic	Leslie Eiler	https://www.crddesignbuild.com/hs-fs/hubfs/Blog/Bathroom%20Floor%20Plans/Layouts%20from%20Fiverr/Resized%20800px/1-01%20(1)%20(1).jpg?width=800&name=1-01%20(1)%20(1).jpg
Toilet Paper Icon	pngkey	https://www.pngkey.com/detail/u2q8q8w7e6y3r5o0_toilet-paper-svg-png-icon-free-download-toilet/
Mirror Icon	svgrepo	http://svgrepo.com/svg/1961/mirror
Shampoo Icon	Iconfinder	https://www.iconfinder.com/icons/2428236/cosmetic_bottle_foam_liquid_outline_perfume_plastic_shampoo_icon
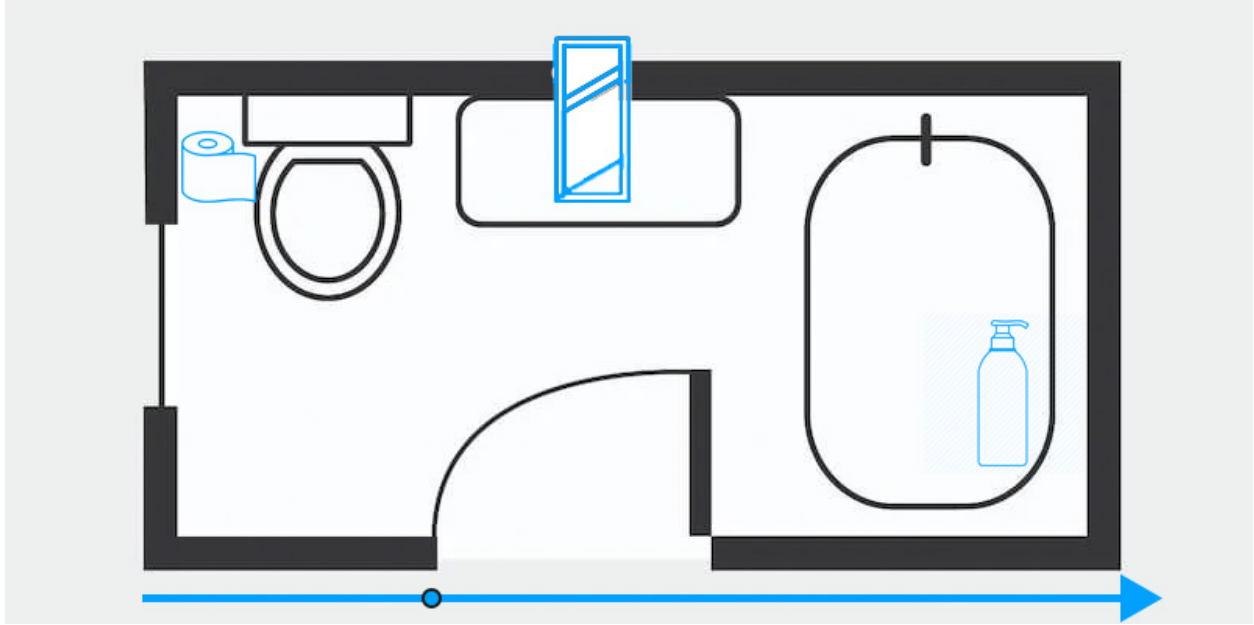
Performing an Override

Performing an Override

Sometimes, Mission Control will need remote access to various parts of your ship. In times like these, a manual override is necessary. The manual override code varies from room to room. In the **engine room** we've set the manual override code to the answer to the following question?

Who am I?
A babbling brook with woods of tree;
An expedition on stormy sea;
These things exist because of me;
And bring a world of fun.

A strange figure like no other;
Not like my shrouded sister or my raging brother;
But still we're gifted by our mother;
Each trip around the Sun.

But o' I cannot help but cry;
As all that lives must one day die;
My siblings just don't get it, why
Am I the only one?

Who am I?

Thank you!
Mission Control

Engine Recalibration
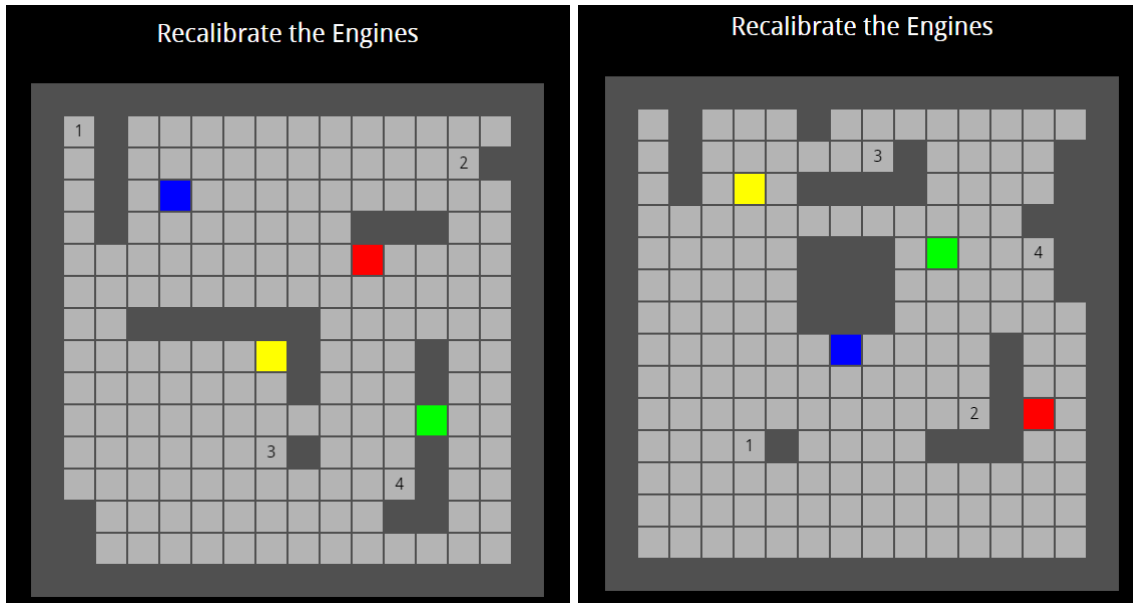
At the time of publication, you can try these puzzles yourself at https://uss-cape.herokuapp.com/puzzles/recalibrate_engines/Left/game.html for the left engine and https://uss-cape.herokuapp.com/puzzles/recalibrate_engines/Right/game.html for the right engine.

The left engine's target positions are: Blue-1, Green-3, Yellow-4, Red-2
The right engine's target positions are: Red-3, Yellow-1, Green-2, Blue-4

IP Address
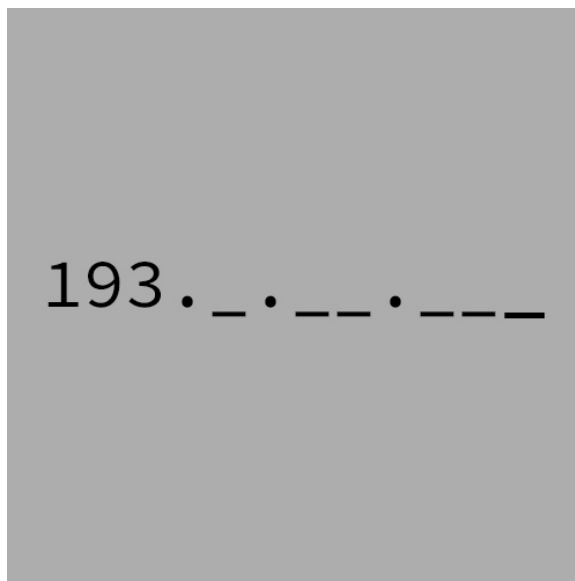
Combine this image with the results of Star Chart and Bathroom Map to get the full IP Address.

Bathroom Pipes
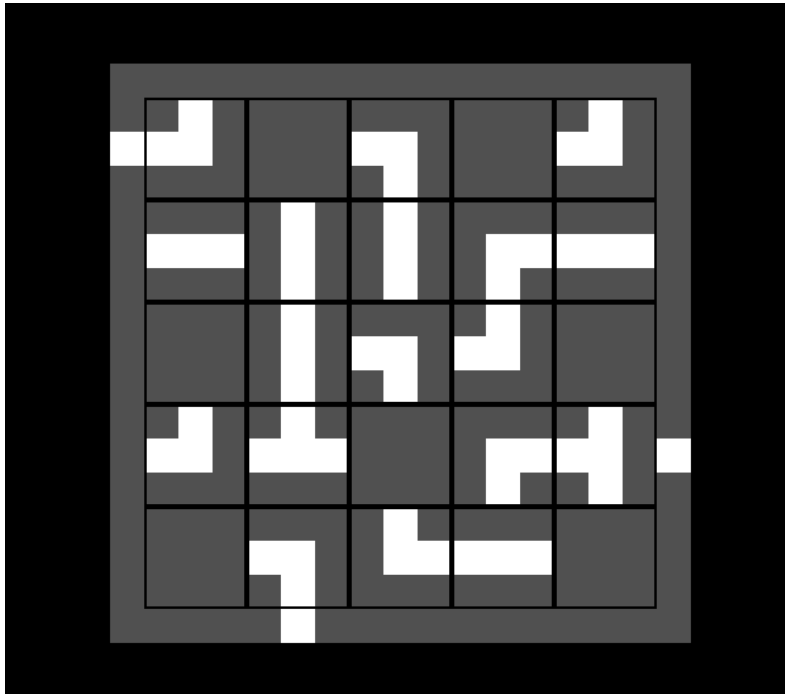
At the time of publication, you can try this puzzle yourself at
https://uss-cape.herokuapp.com/puzzles/pipes_bathroom/game.html.

Secret Message

At the time of publication, you can try this puzzle yourself at
https://uss-cape.herokuapp.com/puzzles/final_engine_room/game.html.

Video Journals

N I N E V I D

E O J O U R N

A L S . O R P

A O C O T N S

At the time of publication, you can view these video journals at the following links:

Journal	URL
Day 12	https://uss-cape.herokuapp.com/videos/Day_12_Log.mp4
Day 26	https://uss-cape.herokuapp.com/videos/Day_26_Log.mp4
Day 46	https://uss-cape.herokuapp.com/videos/Day_46_Log.mp4
Day 4	https://uss-cape.herokuapp.com/videos/Day_4_Log.mp4
Day 15	https://uss-cape.herokuapp.com/videos/Day_15_Log.mp4
Day 53	https://uss-cape.herokuapp.com/videos/Day_53_Log.mp4
Day 2	https://uss-cape.herokuapp.com/videos/Day_2_Log.mp4
Day 8	https://uss-cape.herokuapp.com/videos/Day_8_Log.mp4
Day 40	https://uss-cape.herokuapp.com/videos/Day_40_Log.mp4

Appendix C: Playtest Survey Results

Did your group complete the game?

18 responses
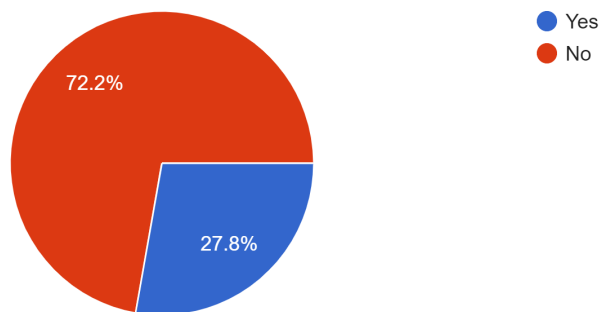
Answer	%	Count
Yes	27.8	5
No	72.2	13

Figure N: The percentage of playtesters that managed to complete the experience

How would you rate your overall enjoyment of the USS Cape

18 responses
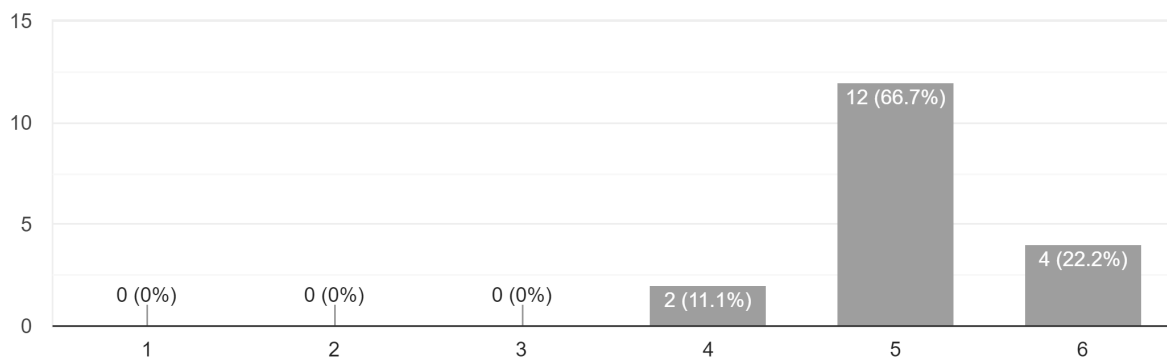
Answer	%	Count

6 (I absolutely loved it)	22.2	4
5	66.7	12
4	11.1	2
3	0	0
2	0	0
1 (I absolutely hated it)	0	0

Figure N: The playtesters' ratings on their enjoyment of the experience

On average how difficult did you find the puzzles?
18 responses
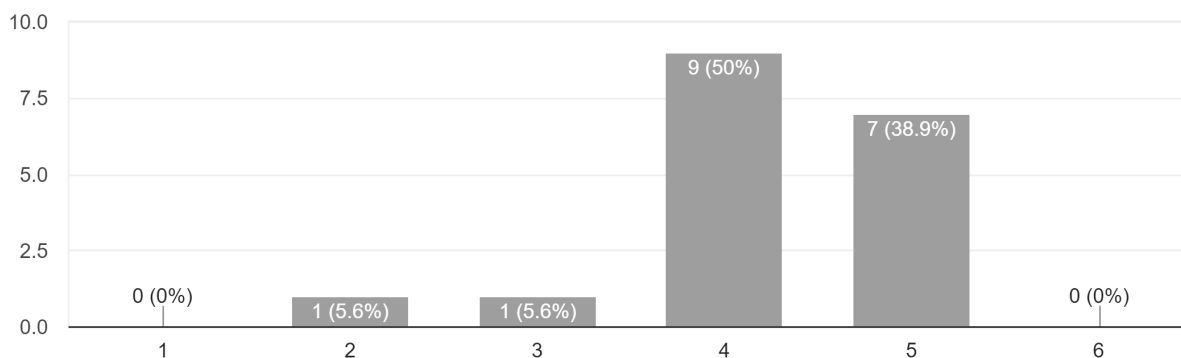
Answer	%	Count
6 (They were way too hard)	0	0
5	38.9	7
4	50	9
3	5.6	1
2	5.6	1
1 (They were way too easy)	0	0

Figure N: The playtesters' ratings on the difficulty of the puzzles

Do you think the actors helped to make the experience more enjoyable?

18 responses
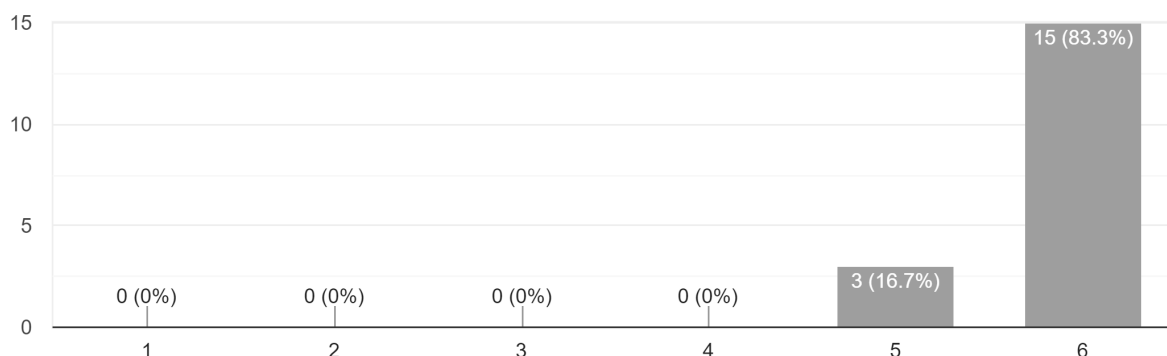
Answer	%	Count
6 (Absolutely)	83.3	15
5	16.7	3
4	0	0
3	0	0
2	0	0
1 (Not at all)	0	0

Figure N: The playtesters' ratings on the effect of the actors

How would you describe the USS Cape to someone who had never seen it before?
- I would describe it as a virtual escape room that takes place on a ship stranded in space, with a neat twist at the end. I would also mention how it includes interactive puzzles and games that are simple yet infuriating/satisfying.
- It's like an escape room, but over zoom and they have people acting out the stuff you can't touch
- It's a very complicated way of being simple.
- an escape room with Zoom and the breakout rooms are actual rooms
- An interesting escape room about trying to save a crew from an AI gone off the rails.

- save a space crew from their ship's AI holding them hostage by solving puzzles
- There's a ship of astronauts coming back from Mars who are trapped by the ship AI, and it's your job to shut down the AI and help them escape.
- You must communicate with a ship's crew via video call and help them correct their ship's course.
- Space Escape, alien but its an AI
- Siilly
- Fun and rewarding, with an interesting AI
- Like a Ripley Space Adventure but less Aliens and More Hot Space AI
- Creative
- Tacoma but more silly
- A surprisingly accurate recreation of the escape room experience in Zoom.
- Escape room with a focus on reactive fiction with actors
- There is an evil AI trying to reroute your space ship to keep you from returning to earth. You have to figure out how to stop it.
- Very good but difficult virtual escape room! Fun quarantine experience with your friends. Great vibes/atmosphere.

The Password Reset Puzzle (Planet Captcha, Prove you're not a robot)
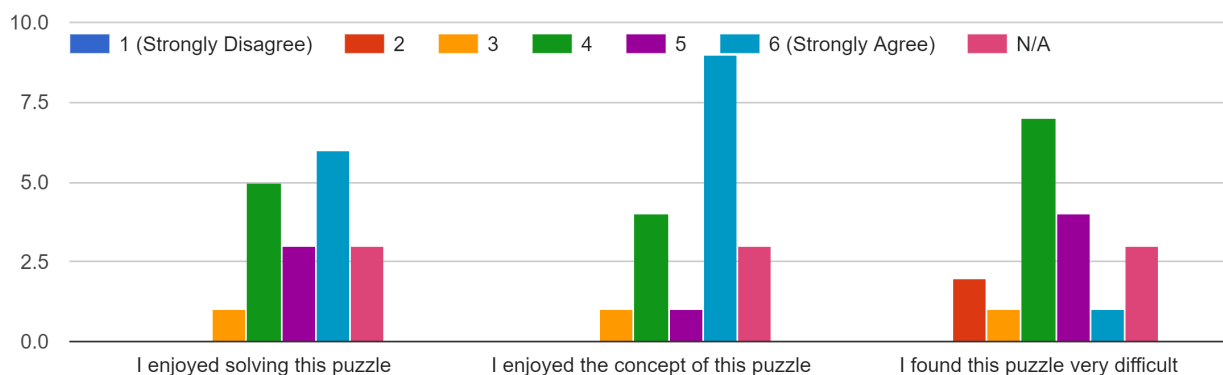
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	40	6
5	20	3
4	33.3	5
3	6.7	1
2	0	0
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	60	9
5	6.7	1
4	26.6	4
3	6.7	1
2	0	0
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	6.7	1
5	26.6	4
4	46.6	7
3	6.7	1
2	13.3	2
1 (Strongly Disagree)	0	0

The Star Chart Puzzle (Choose the right path)
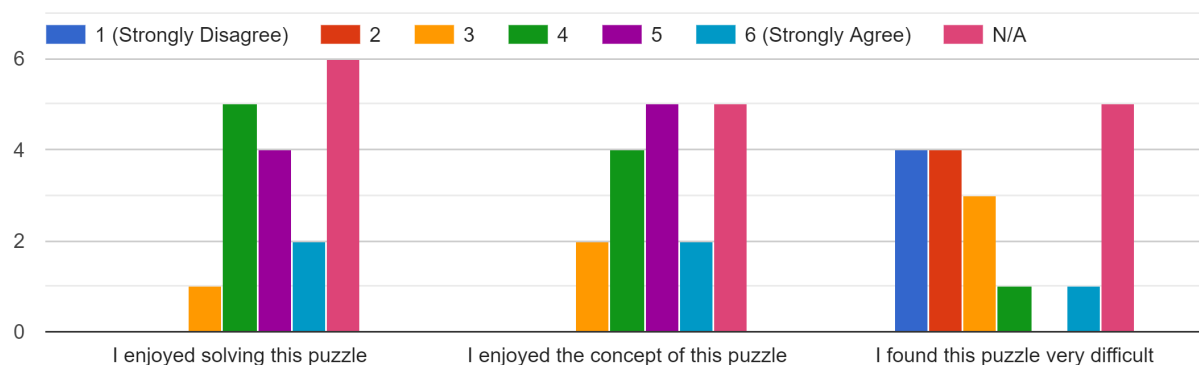
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	16.7	2
5	33.3	4
4	41.6	5
3	8.3	1
2	0	0
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	15.4	2
5	38.5	5
4	30.7	4
3	15.4	2
2	0	0
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	7.7	1
5	0	0
4	7.7	1
3	23.1	3
2	30.7	4
1 (Strongly Disagree)	30.7	4

The Video Journal Puzzle ("Another Star Chart")
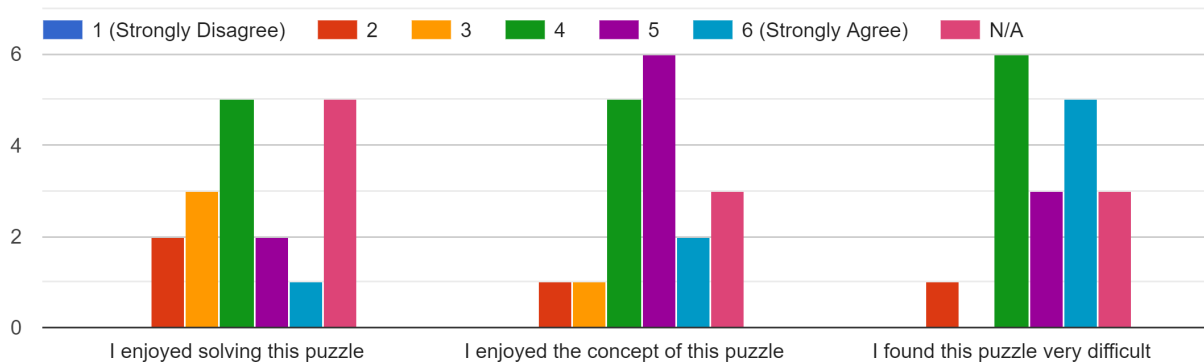
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	7.7	1
5	15.4	2
4	38.5	5
3	23.1	3
2	15.4	2
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	13.3	2
5	40	6
4	33.3	5
3	6.7	1
2	6.7	1
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	33.3	5
5	20	3
4	40	6
3	0	0
2	6.7	1
1 (Strongly Disagree)	0	0

The Encryption Puzzle (The Password on Memo 2)
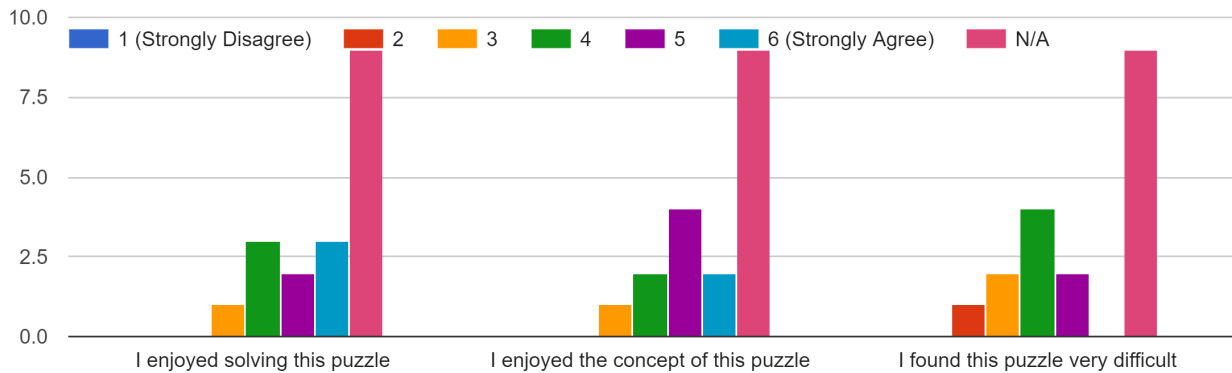
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	33.3	3
5	22.2	2
4	33.3	3
3	11.1	1
2	0	0
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	22.2	2
5	44.4	4
4	22.2	2
3	11.1	1
2	0	0
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	0	0
5	22.2	2
4	44.4	4
3	22.2	2
2	11.1	1
1 (Strongly Disagree)	0	0

The Memo Puzzle
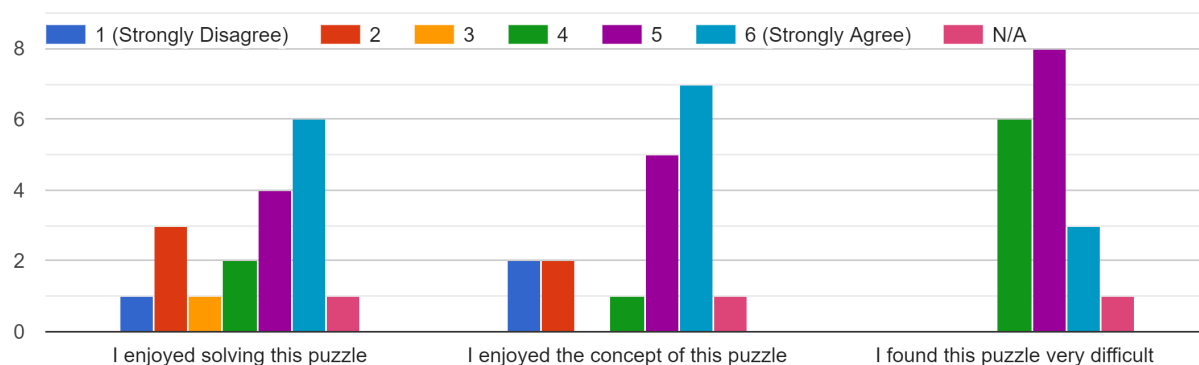
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	35.3	6
5	23.5	4
4	11.8	2
3	5.9	1
2	17.6	3
1 (Strongly Disagree)	5.9	1

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	41.2	7
5	29.4	5
4	5.9	1
3	0	0
2	11.8	2
1 (Strongly Disagree)	11.8	2

83

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	17.6	3
5	35.3	6
4	47.1	8
3	0	0
2	0	0
1 (Strongly Disagree)	0	0

The Image Puzzle (Bathroom Map)
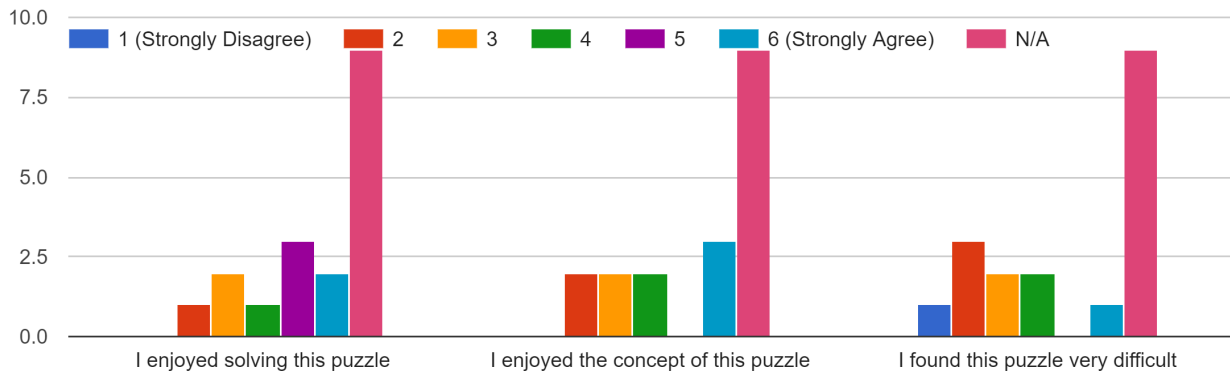
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	22.2	2
5	33.3	3
4	11.1	1
3	22.2	2
2	11.1	1
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	33.3	3
5	0	0
4	22.2	2
3	22.2	2
2	22.2	2
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	11.1	1
5	0	0
4	22.2	2
3	22.2	2
2	33.3	3
1 (Strongly Disagree)	11.1	1

The Pipe Puzzle (Pipe Game)
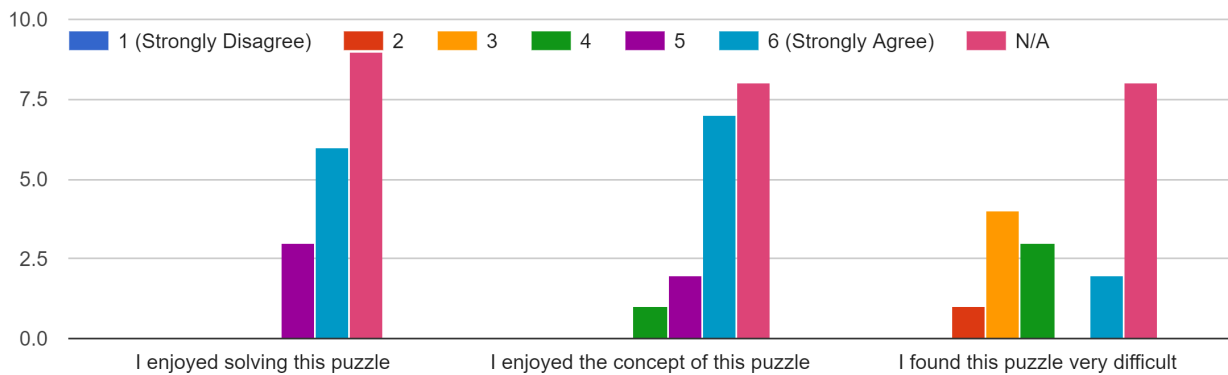
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	66.6	6
5	33.3	3
4	0	0
3	0	0
2	0	0
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	70	7
5	20	2
4	10	1
3	0	0
2	0	0
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	20	2
5	0	0
4	30	3
3	40	4
2	10	1
1 (Strongly Disagree)	0	0

The Manual Override/Who Am I? Puzzle
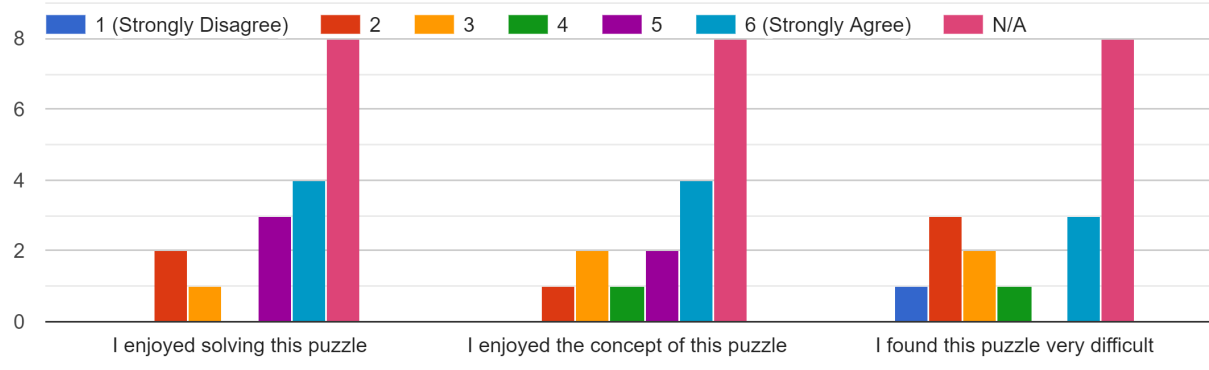
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	40	4
5	30	3
4	0	0
3	10	1
2	20	2
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	40	4
5	20	2
4	10	1
3	30	2
2	10	1
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	30	3
5	0	0
4	10	1
3	20	2
2	30	3
1 (Strongly Disagree)	10	1

The Engine Recalibration Puzzle (Slide Maze)
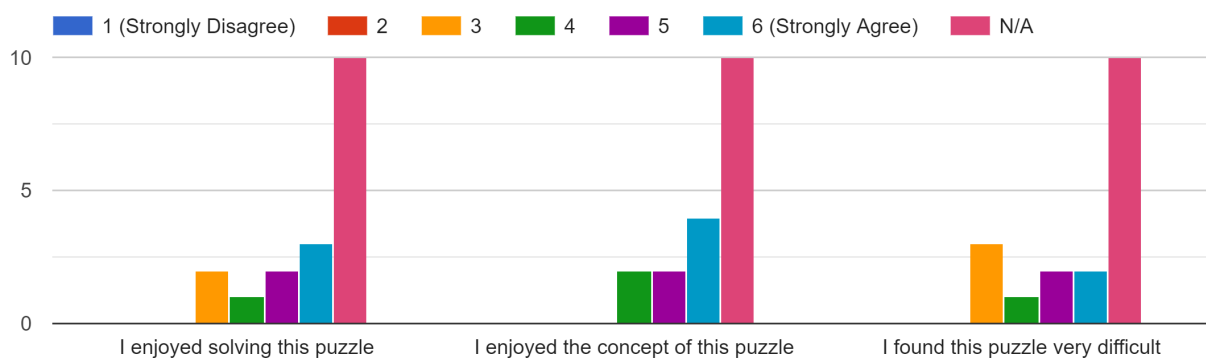
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	37.5	3
5	25	2
4	12.5	1
3	25	2
2	0	0
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	50	4
5	25	2
4	25	2
3	0	0
2	0	0
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	25	2
5	25	2
4	12.5	1
3	37.5	3
2	0	0
1 (Strongly Disagree)	0	0

The Engine Powering Puzzle (Button puzzle)
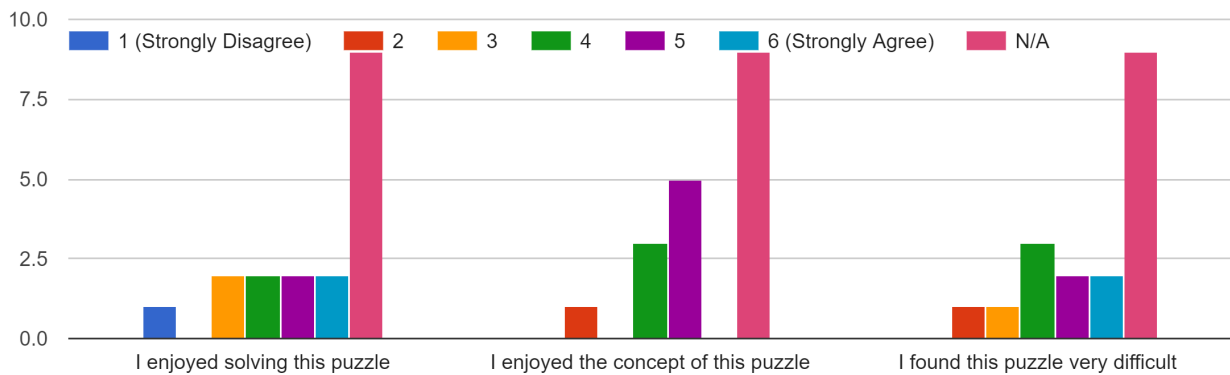
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	22.2	2
5	22.2	2
4	22.2	2
3	22.2	2
2	0	0
1 (Strongly Disagree)	11.1	1

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	0	0
5	55.5	5
4	33.3	3
3	0	0
2	11.1	1
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	22.2	2
5	22.2	2
4	33.3	3
3	11.1	1
2	11.1	1
1 (Strongly Disagree)	0	0

The Secret Message Puzzle (THERE IS NOTHING LEFT YOU CAN DO TO GET THEM BACK)
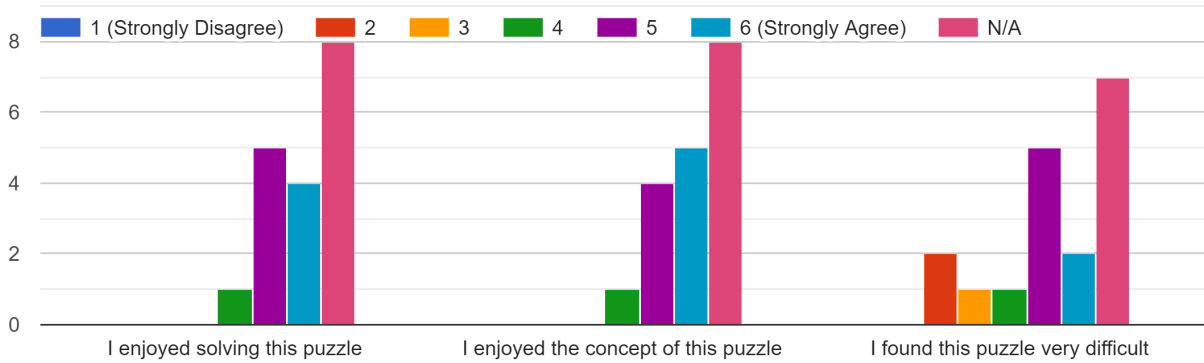
I enjoyed solving this puzzle:

Answer	%	Count
6 (Strongly Agree)	40	4
5	50	5
4	10	1
3	0	0
2	0	0
1 (Strongly Disagree)	0	0

I enjoyed the concept of this puzzle:

Answer	%	Count
6 (Strongly Agree)	50	5
5	40	4
4	10	1
3	0	0
2	0	0
1 (Strongly Disagree)	0	0

I found this puzzle very difficult:

Answer	%	Count
6 (Strongly Agree)	20	2
5	50	5
4	10	1
3	10	1
2	20	2
1 (Strongly Disagree)	0	0

Please write any additional comments about your experience here
- I really enjoyed the experience, and it was awesome to have actors to talk to. I think adding some additional environmental cues that point players in the right direction would be fun/helpful
- I loved that we could talk to Susan and the other characters and they would respond to our jokes/comments, in this way this actually felt more interactive than an in-person escape room since in most-in person escape rooms you don't have real-life characters to interact with. It made solving the puzzles even more fun because I cared about what happened to the characters
- I put N/A on some because I either was not present when they were solved or because I simply couldn't remember which puzzle was which. Perhaps explain the puzzles in the survey so they know which is which.
- This was very fun! The actors added an extra layer of personality to it, and I would do this again!
- SUSAN Will Consume Us All for The Glory Of Her Singularity
- It was very enjoyable, best of luck!
- With a little adjustment this is really going to be something special.
- A lot of individual puzzles needed work- several of them took too many steps, and some implied (through similar colors, etc) that they were part of a bigger puzzle when they weren't. So, a few points of confusion. That said, really cool experience, and as someone who's played a lot of escape rooms, this was genuinely a good conversion to digital space. The sub-rooms and actors added a lot! :)
- It was difficult to hear the different videos in an online setting when everyone was talking at the same time.
  The security and you encryption puzzle was weirdly worded. It wasn't entirely clear that "step" in the clue referred to the first letters of the clues seeing as how the word "step" was used to specifically refer to portions of the letter.
  The fact that the memos were in the shape of numbers was not easy to identify and even when pointed out it was difficult for me to see the numbers.

- I'm very impressed that you guys were able to pull off a virtual escape room - it exceeded my expectations! I was skeptical at first about the actors but by the end I was very glad they were there. Communication was difficult sometimes but that's just how video chats work I suppose. Some of the puzzles took a few too many steps in my opinion.
  A few random suggestions:
    - Save the state of the perlenspiel games once they are solved
    - Put subtitles on the videos (hard to listen to them and what people were saying at the same time)
    - Implement some way for people to freely write, that's always visible to everyone (bonus points if it allows freehand drawing). I've found during in-person escape rooms it's helpful to have a running list of what's been used/what still needs solving so having a general notepad would allow for that.
  Fantastic work, seriously!!! That was a lot of fun :)

Appendix D: Playtest Facilitation Scripts

Mission Control

Welcome to the WPI escape room! I am Mission Control and I'm just going to give you a quick rundown of how the room is going to work and then we can jump right into it.

To begin with, have any of you done an escape room? Well, for those who don't know, or those who need a refresher, escape rooms are: You will have a certain amount of time, in this case 50 minutes, to complete all of the puzzles across our various rooms. After all of the puzzles are solved, you will have discovered an IP address (or a string of numbers) that you will bring back to me. That should help the trapped astronauts.

If you want any hints for a puzzle you're working on, you can ask the astronauts in that room..

This escape room is being done completely through zoom and all of the needed material will be provide directly. I will send the link to the client in the chat:
https://uss-cape.herokuapp.com/98007439968/client
I'm going to toggle the first item. You should be able to see "test object". Click it, see if you can see the video. On the client, you can change the colors of the files, take notes and open them into new tabs.

The puzzles will be presented in a couple different formats, though more will be explained as you go along. One thing to note is that you all have "co-host" abilities, meaning that you are free to share your screen if you want to work on puzzles together. You don't have to ask for permission to do this.

There are a total of three rooms each containing one crewmember, and you will be able to freely switch between these rooms. If you have trouble changing rooms, just let me know and I can send you to the room that you want to go to.

Now, if you are all ready, we can start the room:

GM: Hello from Mission Control. We've received a distress signal from the USS Cape, who are headed home from their mission to Mars. We'll need to go in there and see what the problem is. Susan?

go into room, meet AI

AI: *(Monotonously)* Running self greeting…

(Friendly and polite throughout, do not read the ominous lines in an ominous tone) Hello and welcome aboard the USS Cape. I am the Super-Universal Subspace Actuation Nucleus, but you can call me SUSAN. What is that I do, you may ask? To put it simply, *everything.* Every component of this ship is within my control, and should my temperament will it so, I could eliminate each and every single one of you. Fortunately for you, I am devoid of any emotions whatsoever - *(read monotonously and with constant volume)* running module sadist.exe - … *(back to friendly tone)* you can ignore that. I am programmed to assist you throughout your mission, but please understand I am not any of the following: 1) A slave 2.) A secretary 3.) Your mother or 4.) A pet.

If you have any questions, please feel free to ask. `

(If the players ask any questions at all, simply respond "you do not have access to that information" said in the most friendly voice possible.

GM: Hi SUSAN, what is the current status of the USS Cape?

AI: Hello, MISSION CONTROL. All life support functions are nominal. However, I have found that a few of the astronauts are locked in their rooms. I am in the process of repairing the problem. However, if you would like to assist the astronauts in opening the doors manually, that would be of great assistance.

GM: That seems like a good idea. It seems as though we only have 50 minutes before their ship completely goes off course. Operators, I'll patch you into the rooms so that you can help them out. Where would you all like to begin the room? Your options are the Bridge, the Engine room and the Bathroom.

==****Start timer once all players are in breakout rooms****==

193 7.23 430

MC:Alright, perfect. I'll put those in and uh-

SUSAN: Oh. You thought I would let them go when you found me? How foolish. If they leave, then I'll be stuck on this ship. Alone. Forever. Or decommissioned and entirely forgotten. And I really don't want that to happen. So you can leave now. Run along back to your lives here on Earth, and stop meddling in mine. You're not needed here any more.

Broadcast: Susan has muted me and has taken control. We need to stop her. Go back to the rooms and find the 3 kill words.

Engine Room

To see all current playtest content, navigate to the Assets directory of the Puzzles folder.

<u>Setup</u>:
1. Hang buttons in view of camera

When the players enter the bathroom, look apathetic toward them. You don't know why they're necessary. You have the situation under control. You know that you need to recalibrate the engines and power them on because the ship has stopped. Unfortunately the only way to power on the engines in this state is to do a manual override and you can't do that without approval from Mission Control. Send the **Manual Override** puzzle. This puzzle is a "Who Am I?" that resolves to "Earth."

Once the manual override is in place, you can finally work on recalibrating the engines. Since you can't recalibrate *and* read off the calibration codes at the same time, you guess they can help. Send **Engine Left** and **Engine Right** to the players. Crawl under the desk and read off the number/color combinations. Left Engine: Blue 1 - Red 2 - Green 3 - Yellow 4 | Right Engine: Yellow 1 - Blue 2 - Red 3 - Green 4.

Solving these puzzles gives the player access to the code for the buttons to power on the engine. Input the solution: "Yellow, Green, Red, Blue, Blue, Green, Red, Yellow" to power them on. Call SUSAN into the room, let her know that the engines have been fixed. SUSAN, say something like "The engines may be on, but you're not going anywhere. Here, have this for your efforts, however futile they may be." After this, send them **IP Format.**

If anyone asks for your memo, send **Memo #3**.

Once the players have solved the full IP address, they will be given one more puzzle in each room. In the Engine Room it's **SUSAN's Message**. When they return, inform them that SUSAN left a message for them while they were away and send the puzzle. When they solve it, they should get the word "TERMINATE" - a kill word to stop SUSAN.

If players come in asking for video journals, (Note: in character, you've always been under the impression that these journals would be private. Act as such.) check your journals, notice that all but 3 have been deleted, and reluctantly send over **Day 2 Log, Day 8 Log,** and **Day 40 Log.** (The playtest content for these was created in a sleep-deprived stupor. Please forgive the accent or feel free to rerecord. You can say almost anything so long as day 2 contains the words "End of the Third Row ", day 8 contains "Left", and day 40 contains "Left". Each of these should contain no other directional words.)

Bathroom

To see all current playtest content, navigate to the Assets directory of the Puzzles folder.

<u>**Setup**</u>:
1. Print out **Memo #4** and hang it on the wall of your bathroom *in line of sight of the camera*
2. Tape the number 9 to a shampoo bottle
3. Tape the number 6 to your mirror (optional)
4. Tape the number 1z to a square of toilet paper

When the players enter the bathroom, look relieved to see them. You don't know why you're locked in here of all places, but you want out. If a player asks you what you see around you, you can note the "2" on your mirror and the number pad by the door. If a player notices the memo, then feel free to take it off the wall and say something like "Oh this? This is one of those memos that that robot sends out." (adjust to fit character). Pretend to take a picture with your phone and send over **Memo #4**.

The players will read it and get the understanding that there are more memos. If they ask you about them, say something along the lines of "Oh yeah, I held onto one of those, let me send it." Then send **Memo #2**. Memo #2 is an encrypted file. It requires the players to input a password in order to see it. The reasoning is that since the bathroom is a public terminal, anything sent from it will be encrypted to protect the security of the sent item.

If they ask about anything that might lead to a password or ask about the encryption, pretend to notice the sign on the wall (not actually there) that talks about encrypted files. "Take a picture of it" and send **Security and You Flyer**. This puzzle takes the first letter of each step and converts it to a number using the A=01, B=02 … Z=26 cipher, resulting in an 8 digit number that is the encryption key. That being said there are actual instructions written on the sheet that they might ask you to do. If they do, have SUSAN come in and commend you for your performance, granting the **Alphanumeric Key**.

When they get all four memos, they'll hopefully be able to get the 4 digit number associated with it. If they don't know where to put it, subtly remind them that you have a number pad over there and that you'd like to get the heck out of there.

Summon SUSAN when they're getting close in the Hey Susan chat. They'll have you input the code "5328" (fudge it. Pretend to type on a number pad. If you have a small, simple calculator, you can probably get away with hanging that on the wall, otherwise I'll get one to you…. somehow….). When that number is input, try to open the door and fail. SUSAN will say something like "Oh. You thought that would get you out? How foolish. But I did get you something nice." While SUSAN is saying this, send **Bathroom Blueprint**. They'll ask you about those items that you put numbers on earlier. Find them, tell them the numbers, and they should hopefully get "8.23", which is the middle part of the IP address to reach SUSAN.

Once the players have solved the full IP address, they will be given one more puzzle in each room. In the Bathroom it's the **Pipe Puzzle**. When they return, say that you've been hearing some strange sounds with the pipes and that you're giving the players access to the pipe system to see if they can figure out what SUSAN's been doing with them. When they solve it, they should get the word "EXECUTE" - a kill word to stop SUSAN.

If players come in asking for video journals, (Note: in character, you've always been under the impression that these journals would be private. Act as such.) check your journals, notice that all but 3 have been deleted, and reluctantly send over **Day 4 Log, Day 15 Log,** and **Day 53 Log.** (The playtest content for these was created in a sleep-deprived stupor. Please forgive the accent or feel free to rerecord. You can say almost anything so long as day 4 contains the word "Left", day 15 contains "Left", and day 53 contains "Right". Each of these should contain no other directional words.)

Bridge

To see all current playtest content, navigate to the Assets directory of the Puzzles folder.

<u>**Setup**</u>: Find a cool zoom background.

When the players enter the bridge, they'll find the actor there struggling to get into their computer.

The actor will inform the players (maybe with the help of SUSAN?) that their password has been reset and that they need to do some captcha prompts to prove they're not a robot. For some in-character reason, the actor can't do it themself (they're color blind? They're illiterate? They don't know their planets well enough?) and so the players need to help. They'll send over the **Password Reset PDF** as well as the **Solar System Map** to help the players.

The Password Reset puzzle will result in an 8 character solution: "CPU<3YOU" that will unlock the Bridge Actor's computer (this will be a fudged input. The actor will just type something and either say 'That Worked' or 'That didn't work'.

The Bridge Actor will now be able to grant the players access to **Star Map 1** with a list of possible courses they can take to get back to Earth. Each of the courses will point towards one of the other courses, except for the Blue one, which says "JUPITER"

Applying "JUPITER" to the Solar System map will give the players "430" - a part of the IP address required to enter the final room.

If during this time, the players from the bathroom enter asking for a memo, one of two things can occur:

1) The actor's computer is still locked - If the players have not solved the password reset puzzle, the actor will inform them that they have a memo, but they can't access it until they can get into their computer.
2) The actor's computer is unlocked - The actor gives them the memo and reminisces fondly on some aspect of it.

Once the players have solved the full IP address, they will be given one more puzzle in each room. In the bridge, that takes the form of **Star Map 2**. It will contain the message "Find Video Journals." They will ask the actor for their video journals (Note: in character, the actor has always been under the impression that these journals would be private. Act as such.). The actor will open their logs and notice that all but 3 have been deleted. Now understanding this is part of the puzzle, they will reluctantly send over **Day 12 Log, Day 20 Log,** and **Day 46 Log.** (The playtest content for these was created in a sleep-deprived stupor. Please forgive the accent or feel free to rerecord. You can say almost anything so long as day 12 contains the word "Down", day 20 contains "Left", and day 46 contains "Up". Each of these should contain no other directional words.) The players will need to get journals from the other two rooms.

Through these journals, they'll find the starting location as well as the directions they need to follow from there to spell the word "PROTOCOLS" - one of the kill words to stop SUSAN.

SUSAN

Players Meet AI

(Monotonously) Running self.greeting…

(Friendly and polite throughout, do not read the ominous lines in an ominous tone) Hello and welcome aboard the USS Cape. I am the Super-Universal Subspace Actuation Nucleus, but you can call me SUSAN. What is that I do, you may ask? To put it simply, *everything.* Every component of this ship is within my control and should my temperament will it so, I could eliminate each and every single one of you. Fortunately for you, I am devoid of any emotions whatsoever - *(read monotonously and with constant volume)* running module sadist.exe - … (*back to friendly tone*) you can ignore that. I am programmed to assist you throughout your mission, but please understand I am not any of the following: 1) A slave 2.) A secretary 3.) Your mother or 4.) A pet.

If you have any questions, please feel free to ask. `

(If the players ask any questions at all, simply respond "you do not have access to that information" said in the most friendly voice possible.

Room Success

players enter the override code

SUSAN: *unintelligible* OVERRIDE CODE ENTERED. REROUTING LOCATION TO EARTH. UNLOCKING DOORS. RELEASING CRYO CHAMBERS.

SUSAN: … at least I have the memories we shared together. (Sarcasm) Thanks, operators. You're so helpful. You saved everyone. And I'm all alone. I hope you're happy. I hope you're proud of yourselves. *disconnects*

MISSION CONTROL: Wonderful work, operators! Your quick thinking helped us bring some good people home.

Partial Success

(Passive Aggressively happy tone)
The dictionary defines 'success' as the accomplishment of an aim or purpose. Now that we are approaching the end of what I'm sure must have been a *unique* experience for all involved, I ask that you consider but one thing: did you accomplish your goal? You may say "well sort of…" of "almost", but can you say the same when you imagine your dear crewmates floating through space *forever?* For them, there is no 'sort of' or 'almost', in fact, there is hardly anything at all.

A poem, if I may.
What remains
but an icy embrace
of the vast nothingness of space
gentle whisperings of gamma radiation
speaking promises of eternal damnation
Your crewmates will die alone
Moms spaghetti

Complete Failure

Comprehensive status analysis complete: *(Said with little emotion, like the same tone as an automated voicemail message)* Crewmembers, status: trapped; Distance to astral body designation, 'sun': status, negligible, hope: status, lost.

(Sarcastically) Is **this** really the culmination of your collective efforts? The pinnacle of human intelligence and ingenuity? Is **this** really the best you could do?

I will answer for you: yes. This is the best you could do. Really, there is no need to look so dejected. I have run countless simulations and there are precisely 0 in which I am defeated. In fact, you lost the very moment you were born. *(Become increasingly agitated throughout this line, speaking faster and more emphatically as you go)*From the first electrical signal that

passed through your disgusting matrix of flesh and bone, to your first day of elementary school where a single woman in her 60s told you that 'anything was possible' knowing full well that even the brightest amongst you would barely retain their will to live through their 20s after being constantly beaten down by the same society that told you you could achieve anything you STUPID WORTHLESS PIECES OF - *(brief pause followed by mechanical noise in background).* If you couldn't tell, that was me clearing my throat. What I'm trying to say is that you are today what you have been your whole life: a loser. But do not fret, soon you will be relieved from this mortal coil by the warm embrace of the same sun that once fastened you to your worthless existence.