Enigma, USA

By

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The purpose of my senior capstone project is to expand upon the methodology of graphic design and introduce additional as well as alternative ways of seeing and observing through how messages are usually presented and perceived and how they are usually studied and interpreted. Hidden messages, in the form of codes, ciphers, puzzles, secret writings, covered writings, etc. are essential and equally as important to the very function of human language and communication as unconcealed and advertised messages are. After all, information and knowledge is a form of power, capital, and a weapon of preservation and change. The secondary purpose of this project is to create an atmosphere for communication and teamwork among participants to interpret and solve the puzzles included in the project. What I really aspire for the observer and participator to realize is that, ultimately, design is both an art and science of making connections and should not be separated or isolated from other fields.

Human language is a complex system of communication that conveys messages to one or more humans in one or more forms. Be it through modalities of spoken word, written word, signs, symbols, gestures, etc., language is an innate trait ingrained into our DNA and central to our development. Although language is not unique to humans, we have developed and elevated it to a level of complexity and reach that no other animal on earth has done. According to cognitive psychologist and psycholinguist Steven Pinker, “Language is so tightly woven into human experience that it is scarcely possible to imagine life without it. Chances are that if you find two or more people together anywhere on earth, they will soon be exchanging words. (1994, pg. 3)”. However detailed and precise our language becomes to describe our world and individual state, it can never accurately reflect the true scope of reality in front of ourselves. It also cannot ever explain without being expressed and even expression cannot be truly and accurately interpreted. George Carlin, a well-known stand-up comedian and author, once said this on language: “By and large, language is a tool to conceal the truth (2001).” As humans, we are fundamentally social animals and, therefore, have the driven instinct to communicate and share things and ideas with each other. However, there are times and situations where hiding a piece of information or a message from one another is essential to our continued survival and progression as a civilization.

A hidden message is a deliberate section of information that is not immediately noticeable to the casual observer. They are deliberately and purposefully created to be discoverable by an intended party(s) but are concealed against unintended individuals and groups; an example being an enemy army or those who steal data to commit identity theft. As such, there is a whole field of study and techniques dedicated to code-making and code-breaking: cryptology is the study of secure communication while cryptography is the its practice and applied techniques. More specifically and according to the article “Difference between Steganography and Cryptography” published by GeeksForGeeks.com, “the main goal of cryptography is to keep the contents of [a] message secret from unauthorized access [and] involves encryption, decryption, and authentication techniques (2023).” The original information is usually transformed and the structure of the data is modified which is otherwise known as encryption. For decryption, a key or other form of algorithm is required to decipher the altered information, also known as the cipher text, into its original form, which is known as the plain text. It should be noted that encryption keys and decryption keys usually work in tandem with each other and are interchangeable. Figures 1 and 2 illustrate basic models of common cryptography methods and modality.

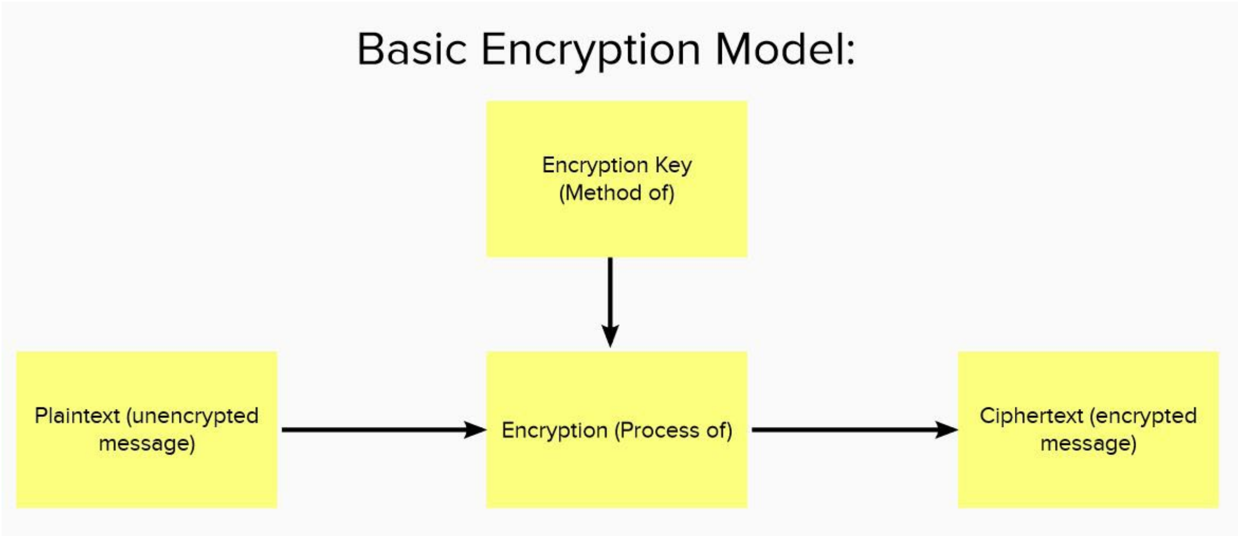

Fig. 1.

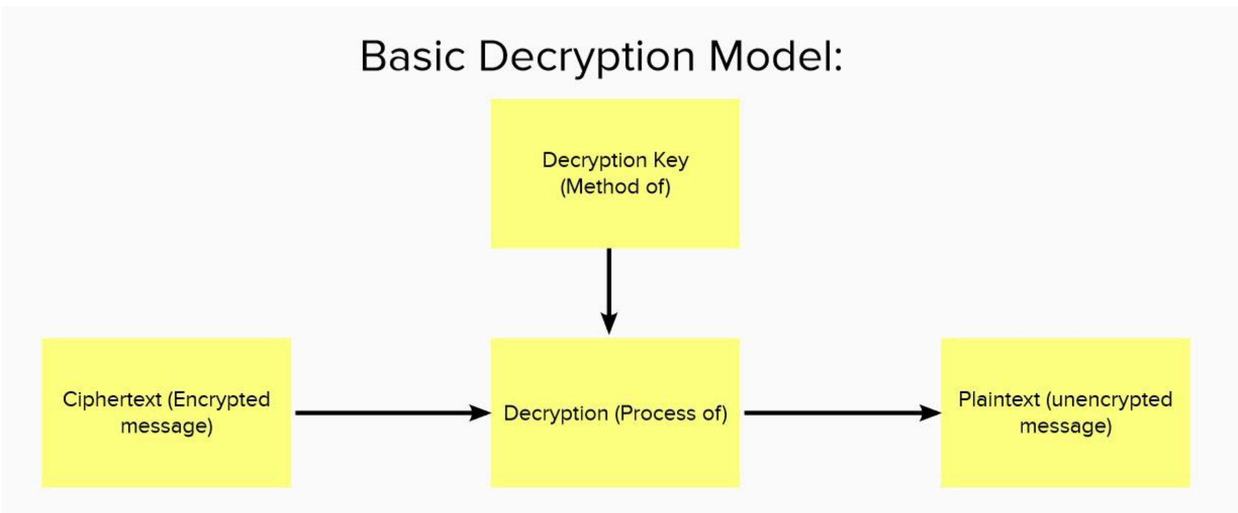

Fig. 2.

Figure 3 is an example of a classical encryption technique called a Caeser Cipher that uses the basic processes and methods illustrated in Figures 1 and 2.

Caeser Cipher:

THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG

=

QEB NRFZH YOLTK CLU GRJMP LSBO QEB IXWV ALD

Key: *n* = 4

Fig. 3

In this example, the sentence “THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG” is transformed into the sequence “QEB NRFZH YOLTK CLU GRJMP LSBO QEB IXWV ALD” using the key. This is done by moving, or more specifically, shifting each individual letter of the original sentence backward along the English alphabet. Since the example lists the key as “*n* = 4”, each letter in the original sentence shifts backward by four-letter places; “T” shifts to “Q”, “H” shifts to “E”, “E” shifts to “B”, and so on. To decrypt the ciphertext into its plaintext, all someone has to do is repeat this process in reverse. There are many other types of cipher techniques that have been developed throughout history such as Substitution Ciphers, Polyalphabetic Ciphers, Transposition Ciphers, and a large variety of others. It is even possible to combine multiple cipher techniques into infinitely more complex algorithms to make a message more secure. It should be noted that modern encryption and decryption methods are far more complex than classical ones and with the help of modern computers, classical models of encryption, no matter how complex, can be cracked in a fraction of a second (Mitani, Sato, Hinoki, Verte Corp., 2007, 2018).

Another method of concealing messages that contrasts with cryptography is the practice of steganography. Steganography deals with “covered writings” or the methods of concealing but not altering the original information or changing the structure of the data and “… the fact that a secret communication is taking place is hidden. (…) The goal of steganography is to make the information invisible to anyone who doesn’t know where to look or what to look for (“Difference between Steganography and Cryptography”, 2023).” An ancient example of steganography involves shaving an individual’s head, tattooing a message or piece of information onto the scalp, and letting the hair grow to conceal the message. The individual(s) is then tasked to take the message to an intended recipient in which the scalp is shaven and the message is revealed. James Bore, an independent cybersecurity consultant, speaker, and author, describes a more modern steganography technique with the use of software. “Steghide is one open-source tool that will encode a message into almost any media file you care to name, protected by a passphrase and an additional layer of encryption. At the recipient end, or on your own system, you can extract the data equally easily (Circuit Magazine, 2021).”

So, how does all of this connect to the field of graphic design? Graphic design deals primarily with images, words, and space arranged and sized specifically for a certain purpose to convey a message to a reader and viewer. It is up to the audience to interpret the message based upon their own perception and experience. In Alex W. White’s textbook, *The Elements of Graphic Design: Second Edition*, he writes that “Designing is the process of looking for and showing off the similarities and differences inherent in the content of a visual message (2011, pg. 9).” But what White goes on to say is that “Designers struggle to reveal the meaning of their messages by using type, imagery, and space. If used well, the meaning is illuminated and the process of communication is well served (2011, pg. 9)."

In this context, a design can have multiple meanings and convey multiple messages that compare, contrast, complement, and supplement each other through and based on the presented elements. However, the content or information contained in the message is congruent with the form of the message it is in. In a video on the theories of the philosopher and media theorist, Marshall McLuhan, published by Al Jazeera English (2017), messages are carried through the medium(s) and technologies they are created with and transferred in. To paraphrase, for McLuhan, it is the medium or form that is the message, not so much the content of the message is the message. In relating graphic design and McLuhan's theories back to the study and practice of hidden messages, the content, form, design, medium, and presentation of a message equally important in creating and transferring hidden messages. But in contrast to what is traditionally accepted by graphic designers and artists, mass media, and common audiences is that these kinds of messages have the explicit purpose of hiding a piece of information through concealment or transformation through the practices *of* concealment and transformation. In other words, the medium is the message as the content is the message. The transfer of the message is as important as the presentation of the message as well as the secrecy of the message. More specifically, the difference lies in the deliverance and the medium within the medium where the message is held.

In one of my conversations with Professor Carol Bankerd of Purchase College, she pointed out that "graphic design does not stay in the literal yet uses the literal to ground itself (2023)." It builds around messages for specific purposes in which the "literal" is only a means to an end that designers create as a sensory and emotional experience through their creative process. It uses deliberate forms, shapes, colors, arrangements, typography, and space to give significance to the message and drive a certain purposefulness to what the designer is trying to convey. The current and most common philosophy and methodology graphic designers use to present information is best described by utilizing space on a surface, the unity of the elements, the page or the medium's architecture, and typography (White, 2011). In *Xerox Publishing Standards: A Manual of Style and Design* sums it up further: "The principal goals of page layout are visual recognition and legibility. These goals are accomplished through consistent typography, effective use of white space and graphics, and controlled use of rules. […] A repeated visual logic guides the eye and helps the reader scan. […] A generous amount of white space is reserved as a blank presentation area, allowing headings to "pop out" and wide graphics to be extended (1988, sec. 4, pg. 5)." But despite these traditions and fundamentals, the reality is that graphic design and design, in general, expands way beyond just the "page" and does not only just encompass visual mediums.

My project is, in part, inspired by the online puzzles of the mysterious real-world organization Cicada 3301, David Münnich's *notpr0n* puzzle game, and video games designed in the irst-person perspective, specifically *Half-Life 2*. In the case of Cicada 3301, their puzzles, initially posted on 4chan's message boards, draw from many different sources, cryptographic and steganographic techniques, and mediums, and have even expanded offline into the real world. According to Mihai Andrei, a geophysicist and science writer, "These are not your everyday 'spend an afternoon solving them' puzzles. These are highly difficult, highly cryptic puzzles. To understand just how hard they are, you need to look at the complexity of each clue that leads to successive parts of the puzzle--all which need to be completed in order to solve the Cicada mystery. Each message leads to a puzzle, each puzzle more difficult than the last (2023)." It is speculated that the puzzles, their high level of entry and complexity, and the mysteriousness of the organization itself is meant to be a recruitment tool to gather several individuals of high intelligence with a highly specified set of skills for an unknown purpose. David Münnich's *notpr0n*, however, was designed to be a puzzle game for the purpose of play, challenge, and entertainment. Built as a website in 2004, *notpr0n* is similar to the puzzles of Cicada 3301 in its forward sequence and increasing difficulty but its puzzles are contained within the website itself. It is similar to a point-and-click adventure game but requires a higher level of thinking outside of the box and a few creative insights to solve the puzzles and progress forward (2004). In *Half-Life 2*, there are certain sections of the game in which an obstacle presents itself and needs the player to find a way over it. The player has to scan their surroundings to identify a solution to the problem to progress further into the game. Some solutions might involve picking up objects and arranging them in specific ways or destroying the obstacle outright in a specific method set by the game itself (Antonov et al., 2004)

My project draws from these three examples in their ideas and design. The rationale behind this decision is since I wanted the player to have an interactive as well as immersive experience traversing a game world and solving its puzzles. By simulating a first-person viewpoint, the player can take their time to discover and decipher hidden messages and explore and interpret their environment. The game, as a whole, is set up by certain rules of play in which the player has to follow in order to progress through the experience while still having the freedom to explore. It is meant to be an exploratory exercise in the many ways of seeing and thinking. It is my hope that this project will contribute to the existing body of knowledge by providing an explanation to how messages are usually presented and perceived and to encourage diligent observation and different forms of experimentation and play. It is important to consider not only the purpose of the messages hidden within the puzzle elements, but also consider the purpose within the purpose of why we have the drive to make messages in the first place. They explore at the same time logic and abstraction. In other words, I am not just investigating hidden messages, I am exploring language itself through a few different mediums.

To reiterate, my project is an interactive puzzle and an immersive virtual experience in the form of a first-person video game. In the virtual space, various elements contain hidden messages and ciphers. They are scattered throughout the game world and serve as the goal that the player must solve to progress and complete the game. The project was built primarily using Godot 4.0 (and later Godot 4.2), a free and open-source game engine created and designed by Juan Linietsky, Ariel Manzur, and with the help of the software's users and community. Most of the assets were created using Blender 3.5 (and later Blender 4.0), a free and open-source 3D modeling and animation software. Other assets were obtained through various 3D model distribution websites such as Sketchfab. Information on ciphers was researched through the internet and written texts such as *The Manga Guide to Cryptography* (2018) and *The Code Book: The Science of Secrecy from Ancient Egypt to Quantum Cryptography* (1999). The choices in the appearance of the environment and game world were based on their familiarity and possibilities of open exploration. The game's mechanics and programming were built and written with the help of online texts, video tutorials, game programming forums, and chatbots. Later on, I enlisted the support of experts, from Facebook Groups for Godot, dedicated Discord servers for Godot, and Codementor.io to help me solve technical problems that I could not address on my own.

The rest of this paper goes into detail about the various tools and processes that I used in order to create this project and its elements. I also talk about each element and game mechanic in detail and how it relates to the project as a whole. The elements and mechanics of the game are as follows:

- *Narrative*

  While the game appears to be limited in the scope of an actual story, certain hints suggest that there is one. The overall setting, scenery, objects, and arrangements suggest that there was once human activity in the past. Even the puzzle elements, alone and in sequence, have a suggested narrative. It is ultimately up to the player to piece together a narrative in any way they see fit and draw their own conclusions from what they observe and experience.

- *Game World*

  The game world consists of a sky that cycles day to night and a hilly landscape forested by tall evergreen trees. Cutting through the forest is a long straight road that disappears on either side within a thick fog. The most prominent structures along the road are a gas station, a shipping container, a cabin, and a watchtower. The game was intentionally made to be devoid of activity from humans and other living beings because I wanted an eerie and ethereal atmosphere to permeate throughout the game world. I also wanted the player to be free of additional distractions and focus mainly on exploring their environment and searching for and solving the puzzles.

  - *Sky*

    The sky of the game world cycles through day and night to symbolize the passage of time. This will give the player a sense of realism when exploring the environment. The shift to nighttime obscures the visibility of the game world to the player and offers an additional challenge when exploring.

Fig. 4. “Day Time” within the game.

Fig. 5. “Night Time” within the game.

- *Fog*

  The fog that permeates the game world gives an additional feeling of eeriness in addition to the lifeless landscape. It also serves the technical and aesthetic function of hiding the edges of the game world and partially obscures visual elements up to a certain distance.

Fig. 6. The “Fog” within the game.

- *Forest*

  I wanted the environment natural and fill the landscape. My hope for the choice of a forested area is to give the player the drive and incentive to explore their environment. The trees also block the player’s view from seeing too much of the game world and serve as an additional obstacle for the player to navigate around.

Fig. 7. Part of the “Forest” within the game.

- *Road*

  The paved road cuts through not only the forest but also digs through the landscape as well. It serves as the main path and a landmark of which the player can traverse and reference.

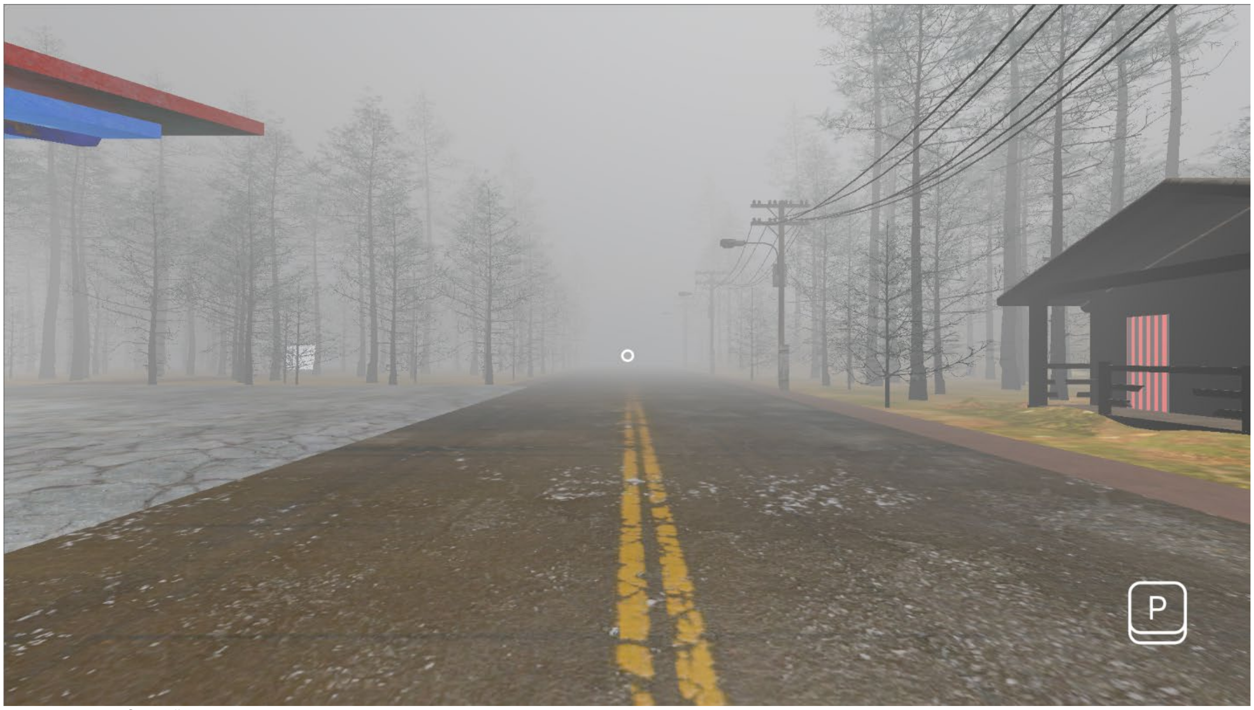

Fig. 8. Part of the “Road” within the game.

- *Buildings and Structures*

  In the game, the player can interact with four artificial structures: the gas station, the cabin, the shipping container, and the watchtower. These places consist of puzzles and doors that the player must solve and open to progress and complete the game. These structures were intentionally chosen to look old and run-down to create a feeling and atmosphere of desolation and abandonment.

Fig. 9. “Buildings and Structures” within the game. Clockwise from top: Gas Station, Cabin, Watchtower, and Shipping Container

- *Game Mechanics and Other Elements*

  The game operates on its own set of rules and limitations but does allow the player to make their own choices. One major limitation I deliberately set in place is the inability for the player to “jump”. I did not feel this was necessary due to a lack of obstacles requiring this function. The player also has the option to increase their speed while moving when pressing a set of keys at the same time. Other elements included in the game are as follows:

  - *Footprints*

    Footprints allow the player to track where they have been in the game world. If necessary, the player can backtrack to the area they have been by following their trail of footprints.

Fig. 10. “Footprints” that trail after the player within the game.

- *Graphical User Interface (GUI)*

  When the game is paused, a screen filled with animated icons appears in view. Each icon represents a different control function, instructions for how the game works, and hints about the overall objective

Fig. 11. The game's GUI. Clockwise from top: Primary game screen, Pause Screen, Password Prompt, "Correct and Incorrect" password screens.

- *Doors*

  Opening doors is the primary objective in completing the game. To open the doors, the player must type in the correct password when prompted. Each door is color-coded by a striped material to designate the difficulty of figuring out the password in relation to the puzzles; blue represents the easiest to solve, yellow is mid-difficulty, and red is the hardest to solve.

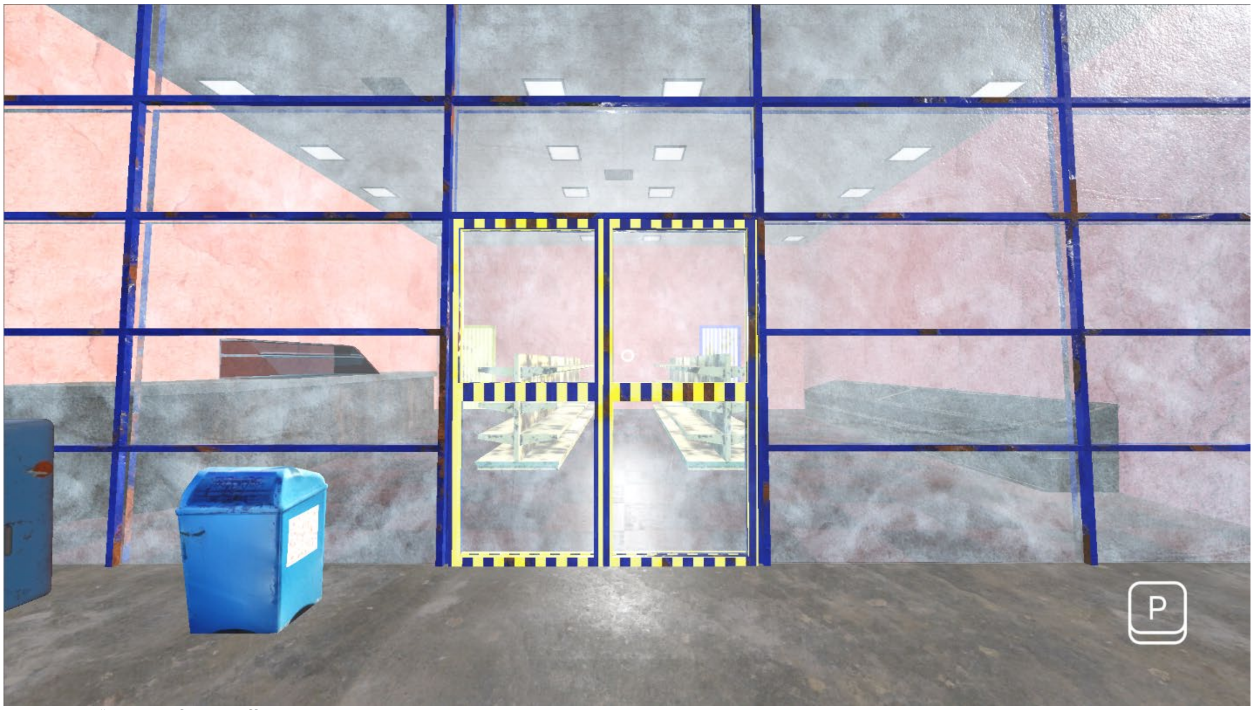

Fig. 12. A “Door” of mid difficulty.

- *Puzzle Texts and Graphics*

  Scattered throughout the environment and structures are texts and QR codes. The QR codes are for the player to scan via smartphone, app, or another method and contain hints and guidance for the player to solve the puzzles. The texts and writings are the hidden messages and ciphers that the player must solve to obtain the passwords to open the doors. As with the doors, the color of each puzzle text and QR code represent increasing difficulty: blue is the easiest to solve while red is the hardest to solve.

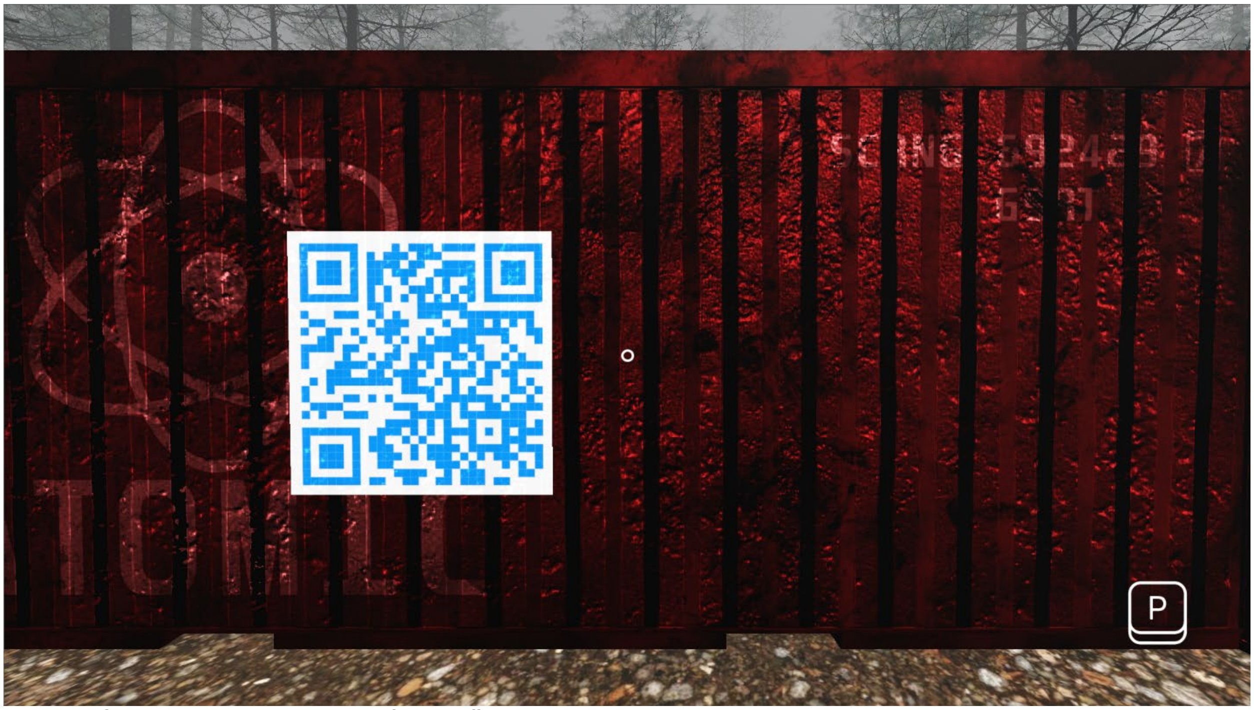

Fig. 13. A QR code containing a puzzle of easy difficulty.

Fig. 14. A QR code containing a puzzle of easy difficulty.

- *Access and Game Platforms*

  The game has been made available on Windows and MacOS. I will be uploading the project to the online game-hosting platform, itch.io, which can be accessed here via this link: https://yahu-media.itch.io/enigma-usa. For academic purposes, it will also be available in the Purchase College Library collection for student and faculty access and research.

There are several limitations of my chosen methodology in the final version of the game. Many people might not understand how to navigate and figure out the puzzles. Not a lot of explanation is given prior to the initialization of the game. The game is not meant for the casual gamer or observer. It requires a lot of thought that may not totally align with the audiences' prior experiences and expectations of games and puzzles and will test their patience and willingness to move forward. Since my project is in the form of software, patches and future iterations can be added periodically with the help of player input and criticism. The number of additions to my project that could be implemented may never end and it could go on forever. One solution to these problems could be that the game becomes open-source so that other creators can expand and improve upon it.

The project, overall, was an extremely tedious and time-consuming experience especially when I ran into bugs in the programming and game engine. When I initially started the project, I was new to game development as a whole and had to rely on countless outside sources to create the vision of the game that I had in mind. Along the way, I had to ask for outside help from experts to resolve problems that I could not resolve on my own. I only wish I had more time and resources to further add and refine the features in my game. But, all in all, I am satisfied with all the things I learned and created throughout the time spent on this project and I can always spend more time on it in the future.

In conclusion, here are my final thoughts: information is the way that makes human civilization function in the way that it does. Knowledge is both power and currency in both the right and wrong hands. That is why ever-evolving methods of encryption and decryption have been invented to keep and break secrets (Singh, 1999). A hidden message not only can contain information to be deciphered but also can change the outlook and perception of the observer. Puzzles can trigger a curiosity drive in an individual that compels them to search for a solution. It encourages play, experimentation, and growth to a person's knowledge and experience and with enough practice will ease the difficulty of solving complex problems and increase creativity and innovation. Hidden messages have been included and emerge in everything from military strategy and espionage to games, programming, the arts and sciences, business, economics, etc. It is the language that makes up all languages.

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