

# Game Design Document

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## **1 1. Game Overview**

### **1.1 Game Title: Cryptotron**

### **1.2 Genre: Puzzle**

### **1.3 Target Audience**

The target audience of Cryptotron is any person who enjoys puzzle games like Wordle and also finds interest in the subject of cryptography.

### **1.4 Platform**

Cryptotron will be available on the PC platform as it will be designed and optimized for the use of a keyboard and mouse.

### **1.5 Game Summary**

The main objective of Cryptotron will be to decipher a given piece of cipher text to reveal an interesting quote. The text can be enciphered using a number of predefined ciphers which will be either chosen by the player or decided based on the player's selected difficulty level. To assist the player in deciphering the text, a number of tools will be provided which are frequently used to analyze the cipher, such as a frequency table analysis.

## **2 2. Educational Goals**

### **2.1 Primary Learning Objectives**

The particular knowledge and skills that the player will acquire in playing Cryptotron will be ability to recognize patterns in language which appear in constructed ciphertexts in the case of simpler ciphers which don't do as much to obscure them. In the case of deciphering cipher texts which employ more capable strategies, the player will learn which tools are available to use and how those tools can help in deciphering texts which are encrypted with a certain cipher. The game will also provide knowledge on how the ciphers used work.

## **2.2 Subject Matter**

The subject matter of Cryptotron is cryptography, specifically simple substitution and permutation ciphers.

## **2.3 Cognitive Skills Targeted**

The cognitive skills that Cryptotron will target are problem solving, pattern recognition, logical reasoning, and memory recall. Pattern recognition will be targeted with the patterns that appear in natural human language which often propagate in the cipher text. Logical reasoning will be another skill that is targeted because the player will have to make logical decisions about which letters may possibly correspond to their cipher text counterparts based on the use of the tools provided. Finally, memory recall will be targeted because deciphering the text will likely include trying multiple combinations of letters and remembering what the text as a whole looks like with each particular combination.

## **2.4 Assessment Methods**

Learning outcomes will be measured by keeping track of the time it takes the player to decipher a text of a reasonable length. The user will be able to compare their times against each other and see improvement over time and after gaining more knowledge of the subject. Players will also be able to measure their skill and knowledge by increasing the difficulty of the game which will change which ciphers are used or which tools are allowed while solving the cipher.

# **3 3. Narrative and Storytelling**

## **3.1 Story Premise**

This is a puzzle game so there will not be a overarching plot as I believe adding one would feel forced. If deemed necessary, a plot could be added in which deciphering a text would give the player a certain amount of points depending on their performance which contributes to a fictional player career in which they level up as cipher breakers or forensic analysts of some sort.

## **3.2 Player Role**

As mentioned above, a player role could be added in which the player plays as an amateur codebreaker and improves his skill and knowledge as he completes more games which "promotes" him. Amateur to Junior to Senior to Expert, for example.

## **3.3 Key Characters**

Key characters that could be added would be malicious actors which are the explanation for the source of the cipher texts.

### **3.4 Story Progression**

If a story were added, it might progress by having the player "catch" higher and higher level criminals who use the cipher texts in their crimes.

### **3.5 Integration**

The narrative might give more drive for a player to continue playing and learning so that they can achieve a higher status within the game as a code breaker.

## **4 4. Gameplay Mechanics**

### **4.1 Core Gameplay Loop**

The main actions that the player will take are the substitution of letters in place of their cipher text counterparts. This action will replace every occurrence of the letter in the text so that the plain text as a whole can be better visualized. Should the user decide the letter that they replaced no longer feels right, the player can also remove the letter or replace it with another. The player might also have the option to use a number of provided tools which they can use to analyze the cipher text so they can make better informed decisions.

### **4.2 Game Modes**

Cryptotron will be divided into multiple modes that will be defined by difficulty. The difficulty level will be influenced by the difficulty of the cipher used or the number of tools available to the user. Should the player wish to play with others, that could be accomplished in person by having multiple people examine the cipher text and suggest plain text letters to substitute.

### **4.3 Challenge and Puzzles**

Cryptotron will engage players with educational tasks by providing supplemental information on the ciphers included in the gameplay and the tools that can be used. Help will be provided to the player on how to approach deciphering the texts and this will hopefully encourage them to want to solve more puzzles as they get better at it.

### **4.4 Exploration and Progression**

Players will progress either by solving more and more cipher texts or by increasing the difficulty of the ciphers used using the built-in difficulty settings.

## **4.5 Player Feedback and Rewards**

The game will reinforce learning by providing a hint functionality so that the player can progress even when they feel they have reached a point where they are stuck. The player will also be rewarded, by solving the cipher, with an intriguing quote.

# **5. User Interface and Experience**

## **5.1 Control Scheme**

The method of performing actions within the game will be using the mouse and keyboard. The keyboard will be used to select which letter is to be replaced and which letter to replace it with, or alternatively, the mouse would select which letter to replace and the keyboard would choose which letter to replace it with.

## **5.2 HUD and On-Screen Information**

Information will be displayed to the user by displaying the cipher text entirely on the screen with blank spaces left above each letter that will correspond to the plain text letters. Additionally, there will be a letter bank displayed below the text which shows which letters have been used and which letters have yet to be used. In the event of a letter being used twice on two different cipher text letters, the previously selected cipher text letter will be erased since such a thing is not possible in the ciphers used. Finally, tools will be present to the side with the option of being opened should the player wish to examine the analysis of one of the tools.

## **5.3 Accessibility Features**

Cryptotron will be incredibly accessible as it has the same level of accessibility as a normal looking web page with heavily contrasting background and text colors so that it is easy to read, such as black and white. As long as the player can see and read, they will be able to play the game easily.

## **5.4 User Engagement Features**

Cryptotron will maintain motivation and immersion by presenting a relatively simple problem and a timer. These two elements will naturally encourage the player to decipher the text since it is hard for humans to leave a problem unsolved due to curiosity and the timer will make the game slightly competitive so that players are encouraged to complete the problem quicker each time.

## **6 6. Visual and Audio Design**

### **6.1 Art Style and Graphics**

Cryptotron will have a simple art design with most fonts used being easily legible. Colors of the menu and toolbar will be simple so as to not be too distracting which will give the game a clean and sleek look.

### **6.2 Character and Environment Design**

As mentioned above, since there are not many elements to the "setting" of the game, the main screen will include the two texts, a toolbar and letter bank.

### **6.3 Music and Sound Effects**

Audio cues may be included such as a success sound for deciphering the text or simple audio cues for actions performed such as selecting a letter or replacing a letter. Music is an audio element I remain unsure of since quiet, focused music may be nice for a short time but could possibly contribute to frustration if it becomes repetitive.

### **6.4 Voice Acting and Narration**

One possible element of voice acting or narration may be, similar to a sound cue for success, a voice which congratulates the player on a solved cipher. Other than that possibility, I don't see many other applications for voice acting or narration.

## **7 7. Technology and Development Tools**

### **7.1 Game Engine**

I do not expect to need to employ the use of a dedicated game engine since my game will be relatively simple.

### **7.2 Programming Language**

I will be using the programming language Python to design the game.

### **7.3 Third-Party Tools and Libraries**

The main libraries used will be pygame for its graphics and sound design capabilities, as well as some functions from the crypto library which will support the logic for enciphering the quotes used. I expect to also use some libraries such as pandas or numpy to handle the supplementary data such as the list of quotes which will be enciphered.

## **7.4 Platform Requirements**

Since the game will not have any graphics or computation intensive features, the minimum system specifications will be on the minimal side. If I had to estimate, a machine with even a single-core CPU and less than a GB of RAM would likely be sufficient. Obviously a monitor, keyboard, and mouse would also be necessary hardware requirements.

# **8 8. Testing and Iteration**

## **8.1 Playtesting Plan**

User testing will be conducted predominantly by myself but others might be recruited to playtest the game as those unfamiliar with the way the game works are likely to find ways to break it or things to improve upon.

## **8.2 Bug Tracking and Quality Assurance**

Simple debugging tools provided in most IDEs are likely sufficient to track bugs which are discovered in the game and quality will be assured by performing analysis of the main game logic to ensure it is sound.

## **8.3 Feedback Implementation**

Player feedback could be implemented by added functionality to submit a bug report which will allow the player to describe the problem they are encountering and why which will be communicated to me.