# Puzzle Research and Design Document

Introduction

 The goal of this document is to track and log research done on Puzzle Design and utilize this research to create a puzzle game of my own. This document will show the progress I have made with my understanding of what makes good puzzles and show how I can use the things I will learn from several puzzle games analyses in my own game.

My initial understanding and knowledge on puzzle design

Puzzles make people think. They create a challenge to players, and if done right, will bring satisfaction as they are successfully solved. Good puzzle design, in my eyes, is about making a simple, original mechanic, where players hold all the cards, and must make do with what they have. Good puzzle mechanics are introduced early, where players can quickly solve a problem with intuitive mechanics. As players progress through the game, that same mechanic will be used again, but in a different context, with increasing difficulty. Good puzzle design should put players in a flow state, where players must make an effort to find the solution, but not in an excessive amount where it takes them hours to solve the problem.

My current skill in puzzle design

I have made a few puzzles so far in my game design learning path. Most of those puzzles were very simple and quite easy to solve, while it took me a long time to design them. The best puzzle I have made is from the last group project I participated in, a deciphering puzzle where the player must figure out symbols which represent numbers from 0 to 9, to be able to open a door with a keypad using these symbols. The game took place in a human farm, where the player is an encaged human trying to escape. To explore the farm, the player needed to open doors, and one of them had this keypad. While playing the game, the player can talk to other humans, and a couple would repeat a 4 number sequence, 3625.
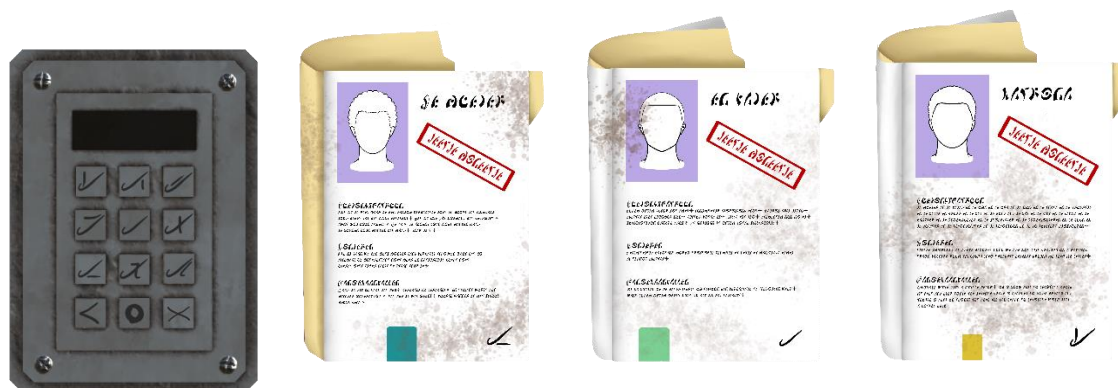
The solution to the puzzle was simple: find a folder which had 10 pages, notice that there is a symbol on each page, which can be deduced as page numbers. Knowing the 4 number code 3625, the player

can match symbols to the numbers by going through each page and figure out the code for the keypad.

The puzzle was received quite well, as most players were able to solve it without too much trouble, and it fit into the narrative of our game.

What makes a good puzzle?

From Game Maker's Toolkit YouTube video: What Makes a Good Puzzle?

Source: https://www.youtube.com/watch?v=zsjC6fa_YBg

In the video (link above), Mark Brown defines 6 things that are needed for a good puzzle game:

1. Good mechanic/rules

An intuitive mechanic which the player can quickly learn to use, with specific, explicit rules about the puzzle. This comes with a goal which relates to the concept of the game.

2. The catch

Doing an action does something, but there is a catch to that action. For example, standing on a tile opens a door, but getting off the tile closes the door.

3. The Revelation

The "Aha!" moment. Using the mechanic in a way that is not obvious, and takes some thinking to figure out. This could be a revelation about the mechanic and the rules which the player did not even know before. Puzzles can be setup in a certain way to force you to understand this certain rule or mechanic quirk.

4. The Assumption

Making the player assume that the solution to a puzzle is done in a specific way that they have seen before, but in fact the player needs to break the assumption to find the solution. This helps the player to not be overwhelmed by the puzzle, as they think that they know how to solve the puzzle, but they don't. This also makes the player fail at least once. Lastly, this makes the player focus on the catch explained in point 2.

5. The Presentation

The puzzle needs to be presented in a way that the player can figure out the puzzle. There should be clear feedback present in the level, which helps the player understand how it is built together, and what works and does not work. It should be clear that if something did not work, it is because it was not done in the right way.

6. The Curve

Puzzles should ramp up in difficulty, and they should use the things that you learn throughout each level.

Types of puzzles games

There are different types of puzzle games, and it is important to be able to differentiate between each:

1. Physics-based puzzle games
2. Adventure puzzle games
3. Knowledge based puzzle games
4. Mystery/detective puzzle games
5. Escape room
6. Tile-based puzzle games
7. Logic puzzle games

Since I will mostly be working in 3D on Unity for the rest of the year, I have chosen that I will make a physics and logic-based 3D puzzle game. These are also my favorite types of puzzles games, as they usually offer more freedom and interaction with the world. Although this is a specific type of game, there is still variety in the genre.

Games Analyses

I have chosen to analyze 4 different types of 3D puzzle games to obtain a good understanding of what makes them good or bad.

1. Tears of the Kingdom

Although this game is not primarily a puzzle game, it has many puzzle elements, especially in the shrines that can be explored throughout the map.

Goal: Reach the end of the shrine to obtain a spirit orb which can contribute to make a heart container for your character.

Rules: In most shrines, you can roam as you wish and utilize whatever items or power that you like. In the combat-based shrines, the rules are limited, but these are usually not puzzles, so there is no point in expanding on them.

Mechanics: Player movement, weapons, jumping, glider, ultra hand ability (move objects, fuse objects, auto build), recall object ability, ascend ability.

Solution: There are usually multiple solutions to the puzzles, as there is a lot of freedom to do anything you want to progress.

Pros: The player has a lot of freedom to solve the puzzles how they wish with the abilities they are given and allows for in game prototyping and creative solutions. The Ultrahand ability allows for a lot of control and manipulation and is designed quite well.

Cons: Too much freedom can sometimes be bad, as it might lead to game-breaking exploits, or it might even stray the player from finding a solution that works, as there is too much to think about and work with. This is usually not a problem as the puzzles are presented in a way that the player can have a clear idea of how the puzzle can be solved.

Things to take away: A puzzle does not need a complex game mechanic, and Zelda Tears of the Kingdom shows this. The Ultrahand ability gives the player the ability to move objects and rotate them in a 3D space, and glue objects together. This mechanic is simple in terms of design but allows for a variety of puzzles and freedom for the player to come up with different solutions.

2. Outer Wilds

This is primarily a knowledge-based puzzle game, but with unique physical interactions and world behaviors, making it worth analyzing. To find the solutions to puzzles, you need to learn how certain things behave through learning the story, talking to certain NPCs in the world, read on ancient information, and use what you have learned to solve the puzzles.

Goal: Find out what is happening in the solar system, why you are stuck in a 20-minute time loop and what happened to the alien species that was in this solar system in the past.

Rules: The player can die in multiple ways: staying in the ghost matter, taking fall damage, being eaten by an angler fish, and at the end of the 20-minute time loop when the sun becomes a supernova. Each planet that the player has a different gravitational force which players can use to their advantage. The player is affected by all gravitational forces.
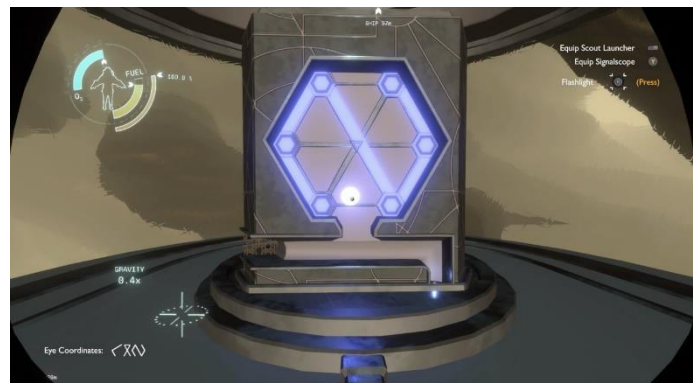
Mechanics: The player may move as they like, jump, utilize their spaceship, send out a probe which can take pictures at different angles.

Solution: There is usually only one solution to each puzzle, and they are found through learning how things behave in the world.

Pros: Finding the solution to these puzzles is usually very satisfying, as they can be difficult and incomprehensible at first.

Cons: Some puzzles require the player to know the solution from another interaction in the world, and it is sometimes not obvious that the solution can be found elsewhere. This can lead to players doing trial and error on certain puzzles and finding the solution by accident, which takes away from the beauty of the game.

Things to take away: Outer Wilds does a good job at setting up puzzles. They show a problem in the world with an unknown behavior and show an explanation of that behavior through another event which happens somewhere else, where the player can then understand how things interact and go back to the puzzle to solve it. I would say that Outer Wilds does a good job with presentation of puzzles, as the whole solar system is a presentation to the different puzzles and specific behaviors.

3. Portal 2

This is a physics-based logic puzzle game, where the player must go through different rooms, trying to solve the puzzle present in the room and advance to the next one.

Goal: The goal is to solve puzzles that open doors which to advance through different rooms, and uncover the story of the Aperture Science Enrichment Center which they are in.

Rules: The player has a gun which may shoot out two portal ends which any object, including the player, may go through. The portals must be used to solve the puzzles in each room.

Mechanics: Portal gun, player movement and object grabbing, companion cube, different gels to enhance movement.

Solution: There is usually one intended solution, but the player may find other creative alternatives to find their way out of each room.

Pros: A unique portal mechanic which allows for creativity and fun. The game also has a good narrative with comedic elements, adding to the player's experience.

Cons: There are not many negatives connected to Portal, as it is considered a classic of puzzle and narrative design. The only thing that can be said about it is that the game is not long enough.

Things to take away: Portal 2 has a good, linear learning curve. The game uses the Assumption well, making players always interested in finding a solution. Again, Portal 2 has one core mechanic which allows for a lot of freedom and creativity, the portal gun, which makes the game so much more interesting.

4. Superliminal

This puzzle game's whole idea is to make puzzles be based on perspective. The game lets the player grab certain objects and change their size depending on perspective, giving the player the tools to navigate themselves through different rooms and through the story.

Goal: Navigate through puzzles in a dream-like world and uncover the story of the game.

Rules: The player can move, jump and grab certain objects. Grabbing objects changes their size based on perspective.

Mechanics: Moving, jumping grabbing objects, and exit portals.

Solution: Similarly to Portal, there is usually one intended solution, but with room for experimentation and error. For example, if the player needs change the size of a plank to make a big ramp to go up something, the size and position of the ramp do not need to be exact.

Pros: Unique game mechanics, which work very well and allow for a lot of fun from the player. The puzzles are creative and have a good flow to them. The curve is well implemented.

Cons: Limited replay ability. Once the solution has been found, there is not much fun in doing it again. Sometimes, the solution might involve using a small object the player did not see which can be quite annoying.

Things to take away: Superliminal has a good learning curve and a strong core mechanic of perspective, just like Portal. The mechanic is intuitive and very interesting, leaving the player always intrigued to see what kind of puzzles can be created from it.

Creating my Own Puzzle Game

After analyzing 4 different 3D, physics and logic based puzzle games, I decided to make a game with a similar format to Portal and Superliminal, where the player must go through different rooms with mechanics being introduced and difficulty gradually ramping up.

Core mechanics: One thing that I am interested in is gravity and the manipulation of it. I decided to make the core mechanic based on the manipulation of gravity to solve puzzles. The player will be able to manipulate the force of gravity in the 3D space and its direction. This will make the player jump at different heights, depending on the force of gravity, and make them fall at different speeds. Certain objects will also be affected by this gravitational force, but not all.

Other mechanics: Doors need to be unlocked with pressure plates. There are pressure plates for moveable objects and pressure plates for humans.

Story: The game takes place in a simulation in which the player has agreed to take part in. Researchers have developed a new technology which enables them to manipulate gravity in different ways, such as force and direction. This experiment is meant to test the player and find out how gravity shapes the world around us.

Goal of the game: Advance through different rooms by solving the puzzles and opening doors and completed the simulation.

Rules: The player can move around and jump, they can push moveable objects if they wish, and change the gravitational force and direction. Pressure plates can only be activated with the right amount of gravitational force.

Catch: The catch of the game is that when changing a gravitational component, such as direction, it changes it for the player and for moveable objects. This can be used to create puzzles with restrictions as changing the gravitational direction and force to perform a certain action as a player will also affect how the objects move around the world.