

Game Design Document

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Game Title: Paddleball

1 EXECUTIVE SUMMARY

Paddleball is a puzzle “platforming” game set in a huge abandoned cold-war era spy safehouse. You take on the role of a young teen, who was looking around the forest until he stumbled upon a run-down cabin. Breaking into it, he opens a door inside that surprisingly leads to an elevator which brings him down before abandoning him for being unauthorized. Now he must use a paddleball looking device to climb upwards and escape.

This facility has many hazards within that the player must avoid if he is to be able to get through. Thankfully the paddleball device will allow him to knock down objects using a bouncing ball. A sticky ball feature will allow the ball to stick to objects and the environment. Using that sticky ball, he can tether himself along the ground, walls, and ceiling.

This game will target those looking for a killer VR movement option as well as those who love puzzle games. The VR movement via the paddleball device makes for intuitive movement that is immersive while not feeling as cheap as simple teleportation in other VR games.

The puzzles that derive from these fun and novel mechanics will be sure to keep users engaged and coming back for more. For example: There is a high ledge on which the exit sits, the player can't throw the ball directly to the ledge because of a ball-blocking barrier but he can throw the ball under the barrier to the ledge. The player can then tether themselves to the ledge and exit the floor.

This game is designed exclusively for VR. It should take a team of 3 about 5 weeks of development time using the Unity game engine.

2 GAME DESIGN - CREATIVE

2.1 High Concept

The player is exploring and attempting to escape an abandoned secret spy facility equipped with a paddle-ball-like device that you can swat a ball away from. The ball exists on an intangible magnetic tether to the paddle which can be used to bring objects to you, or you to other objects.

2.2 Design Goals

2.2.1 Main Design Features

2.2.1.1 Player goals and objectives.

Main goal: The main goal is to escape the spy facility by making your way to an exit above ground.

Secondary goals: Subgoals include climbing up levels of the facility that you are on. The player must also solve puzzles.

Challenges: Each floor has many challenging puzzles which must be overcome to progress. Rooms may be filled with hazards that must be avoided or the player will die.

Conflicts: Hazards such as spikes line the floors and walls, making traversal harder.

Winning condition: The player wins the whole game by escaping the facility. The player wins each level by ascending a floor.

2.2.1.2 Main rules and procedures

Operational rules

- The player comes into the facility with nothing.
- The player can't move around far on his own, he must use the environment or the paddleball.
- The ball of the paddleball can be launched upon releasing the trigger button and swinging the controller.
- The paddleball's ball can bounce around behind corners and knock back free objects.
- The ball can be tethered back to the player upon the press of the trigger button.
- The player can obtain an upgrade to make the ball stick to surfaces when a side button is pressed.
- Once the ball is stuck to a loose object, it can tether the loose object back to the player.
- Once the ball is stuck to a wall or other stationary object, the player can be tethered to where the ball is stuck.

Main game mechanic

The main game mechanic is the use of a paddleball-like device which can launch a bouncy ball from a paddle. The ball is tethered to the paddle magnetically, meaning the tether always goes straight to the ball even through walls. The tether can be used to recall the ball to the player. The sticky ball upgrade expands the gameplay even more so that the player can stick the ball onto objects and bring them to the player. Furthermore, the player can stick it to walls and move themselves towards where the ball is. This is fun because it offers a physics-based tool to interact with the world. It also offers a novel way of locomotion that doesn't involve just teleporting.

2.2.1.3 Player Resources

The player can find objects which they can interact with via the paddleball device. These objects can be pulled to the player and then picked up to be used, such as a key or a block.

The paddleball device itself will be picked up by the player. An upgrade to add the sticky ball part of the device will be picked up later as well.

2.2.1.4 Boundaries and Constraints

The walls of the spy facility restrict the player from bypassing puzzles and reaching the end easily. Various hazards also restrict the player as they will damage or kill them.

2.2.2 Appeal

Genre: Puzzle “platforming” game without any jumping

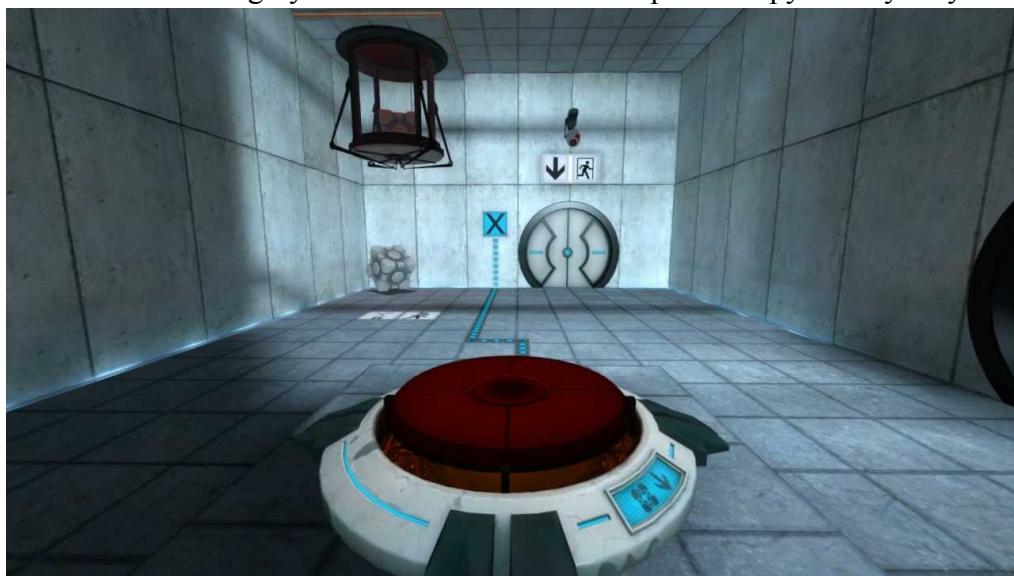
Target audience: Those looking for a killer VR movement option as well as those who love puzzle games.

Age: All ages (who can play VR)

Why is game fun: The VR movement via the paddleball device makes for intuitive movement that is immersive while not feeling as cheap as simple teleportation.

2.2.3 Look and Feel

The style of this game will be a lot like Portal with a simple mostly clean white and gray aesthetic that a fictional top secret spy facility may have.



2.3 Worlds, Characters and Story

2.3.1 Back Story

You're a teen in the 90s with nothing to do. It's summer in your small town, and all your friends are away at camp. A dense forest sits at the town's edge. What better way to spend your afternoon than exploring it?

Deep in the brush, you stumble upon a decrepit cabin and break in, figuring nobody's lived here in years. As you walk further into the space, you discover an elevator and take it underground, leading you to a secret Cold War-era spy facility. Amazed, you hurry back to the elevator to tell everyone – only for it to lock you out due to having “improper clearance”.

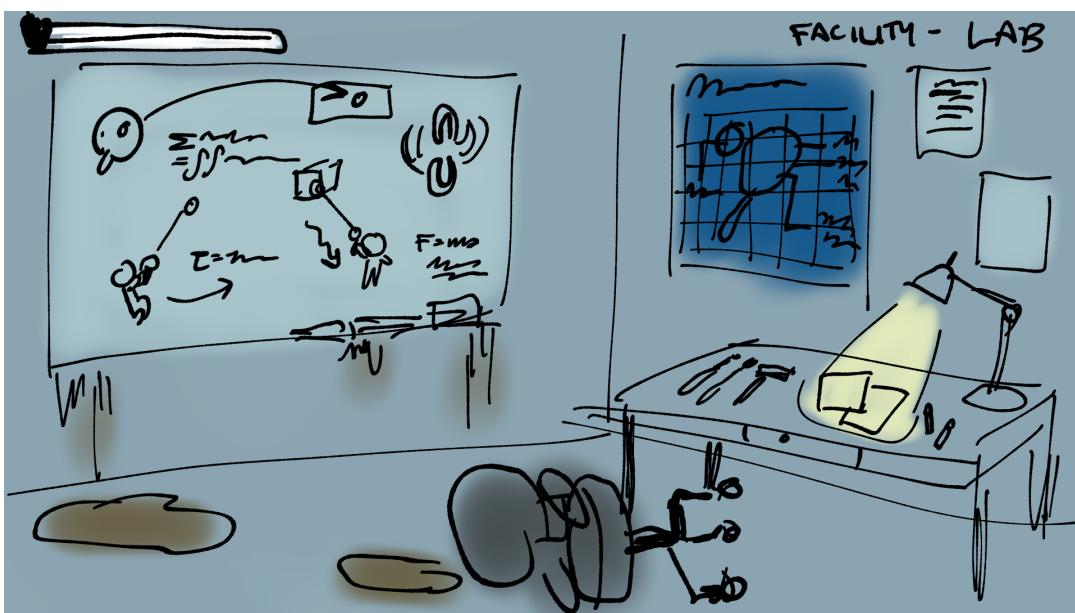
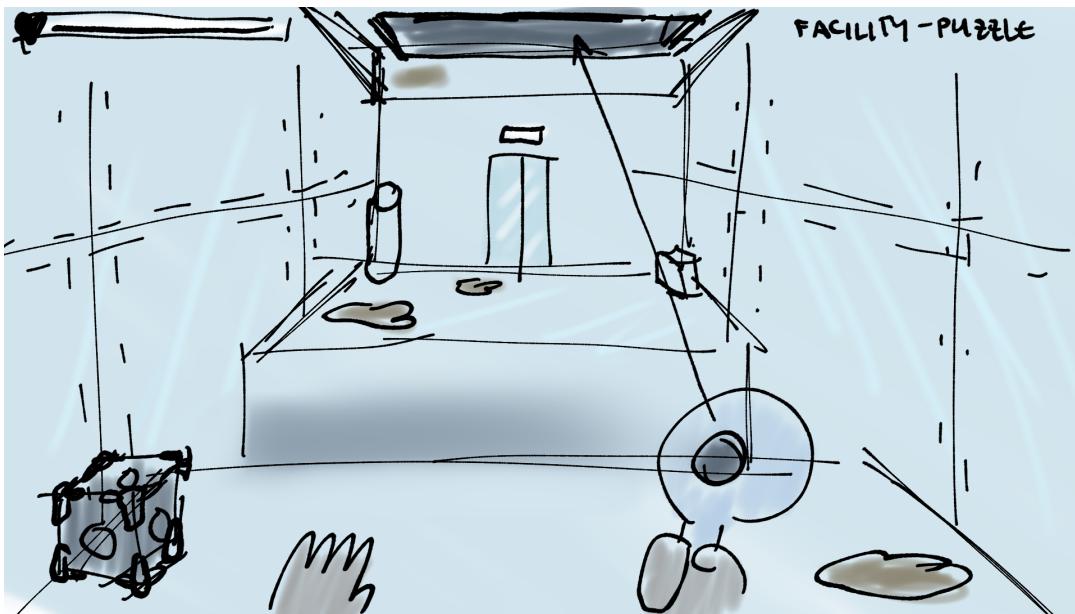
Now, it's your mission to escape the facility. It's cold, dangerous, and somehow devoid of usable weapons... except for a suspiciously futuristic-looking paddleball unearthed from one of the laboratory rooms. With practice, you must learn to use this paddleball to grab essential objects, propel yourself to great heights and across great chasms, and eventually reach the surface world, so you can finally go home.

Throughout the game, we will reveal background lore about how the mysterious paddleball came to be, who created it, and what connection the town has to this run-down facility. There will be documents the player can read and (potentially) audio recordings they can listen to.

2.3.2 Spaces/Worlds

The player will briefly spend time in the cabin that houses the elevator at the beginning of the game, but most gameplay will occur within the facility, exploring its many puzzle rooms and laboratories.





2.3.3 Characters

The only character in the game is the player character, who will always remain in first-person and cannot be seen in full. Other mentioned characters may include the player's family and friends, as well as the scientists and spies who once worked at the facility.

2.3.4 Levels of Difficulty

As the game progresses, the levels will increase in difficulty, both through the nature of the puzzles and the mechanics that the player will have access to. The first level will simply be an introduction to the environment and will only require walking around and moving objects by hand. The next level will introduce the paddleball and require the player to use it to knock over items to get to the next stage. The player will finally gain the ability to let their paddleball “stick” to objects, and the last two puzzles will involve sticking/grappling/gathering actions using this new ability. Each level will feature new resources and obstacles and become more complex in structure.

2.4 Interaction Models

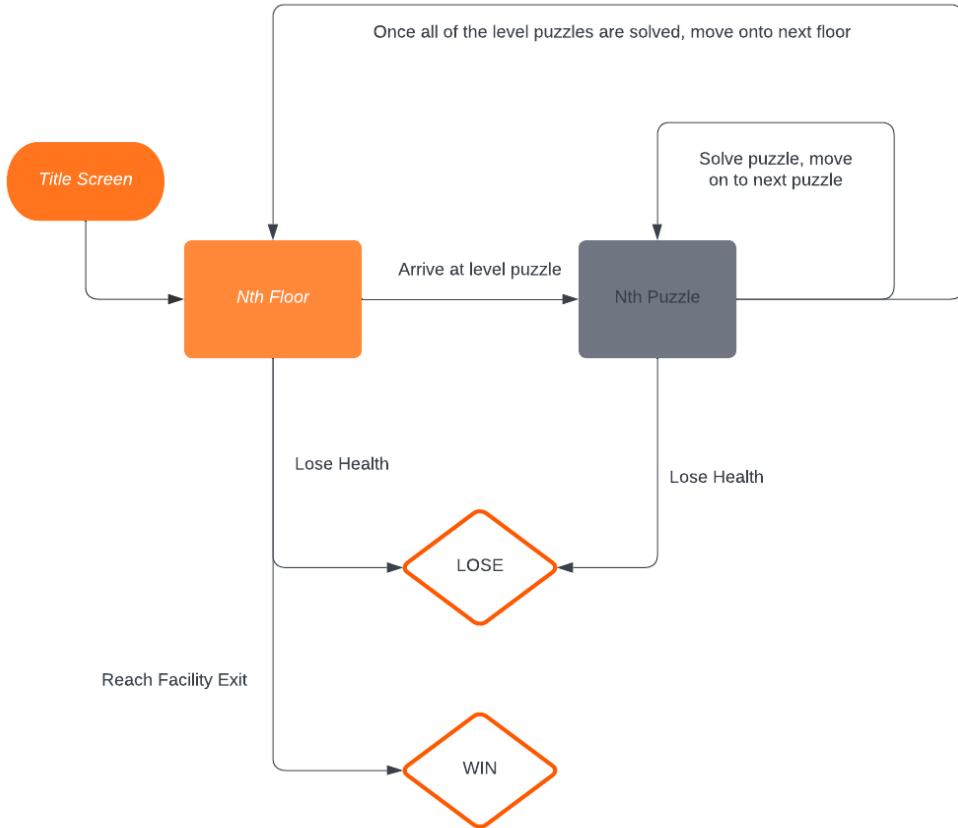
2.4.1 User Interface - Navigation and Movement

The player will control the game using one VIVE Controller. The player can throw the ball by pressing the controller trigger and using a throwing motion with the controller. Once the ball is thrown, the player can tether to the ball’s location by pressing the controller trigger again. The player can only move around the world using the paddle mechanism.



Example of game user interface

2.4.2 Game Play Sequence and Levels



2.4.3 User/Environment – Obstacles and Props

The user interacts with the environment using the paddle. Collision detection will be implemented using Unity's built-in Rigidbody colliders and physics engine. There will be free objects that the player can knock over and move around using the ball (e.g. a box). This will be done by adding physics-enabled collider components to both the box and free objects. All other objects will be fixed in space such as the environment (wall, floor, ceiling). The tethering will

2.4.4 User/Character

The player will control the main character from a first-person perspective. They will be able to move around the world using the paddleball tether mechanic.

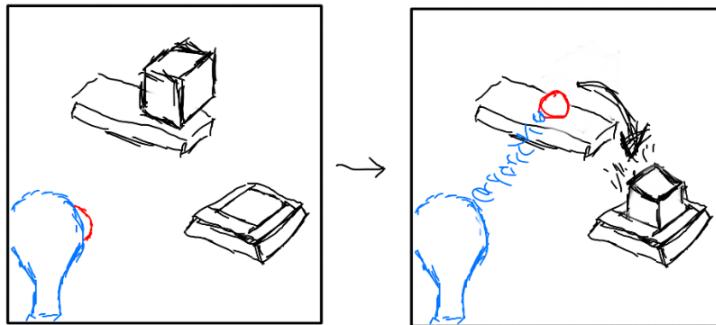
2.4.5 Character/Character

There are no other characters present in the game apart from the main character.

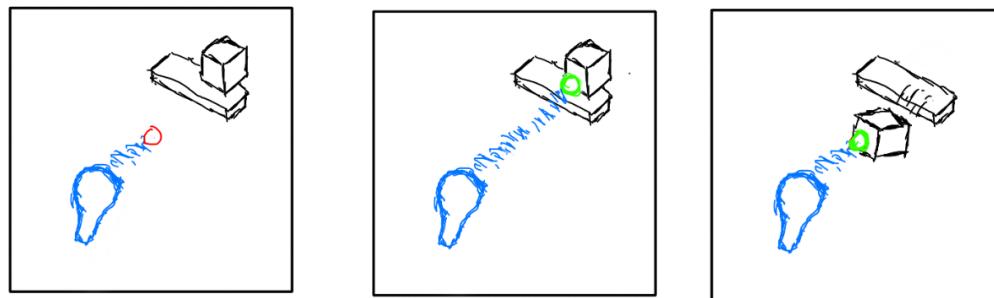
2.4.6 Puzzle Design

In our game, we plan to implement one level (floor) with the following types of puzzle elements:

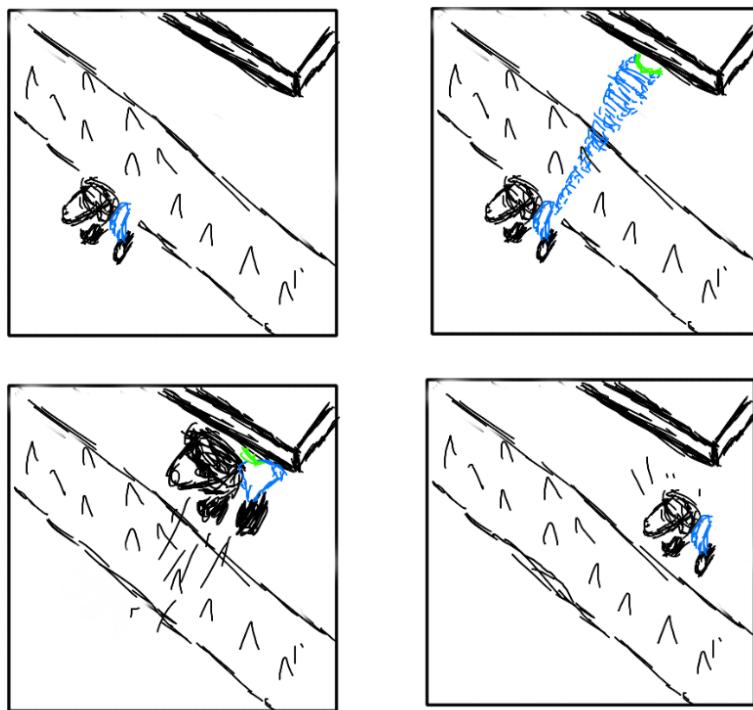
Knock down objects to activate switches.



Pull down objects to bring them to switches.



Pull yourself around the game world to avoid obstacles and get to the goal.



2.4.7 Motion Tracking

We will use the built-in VR Unity interface with the VIVE headset and controllers.

2.4.8 Multi-Player

Not featured in this game.

2.4.9 Mobile

Not featured in this game.

2.4.10 Networked Play

Not featured in this game.

2.5 Performance and Scoring

2.5.1 State Variables

Variables to save:

- Player Health
- Paddle State: used for tethering; ball is either on paddle or off paddle (thrown)
 - Ball location
- Current level

For Pausing/Resuming: No further state info needed

2.5.2 Feedback

- **Positive Feedback:** As the player progresses through the level, the player can gain resources and power-ups (e.g. sticky ball upgrade), which will help the player reach the next level.
- **Negative Feedback:** Hazards are dispersed throughout the environment, hindering the player from progressing through the level.

2.5.3 Performance and Progress Metrics

Progress is measured by how close the player is to reaching the facility exit. Each time the player passes through a level (floor), they are closer to winning the game. Once the player reaches the facility exit, they win the game. A player loses the game by losing all of their health due to hazards, which drain the player's health.

3 GAME DESIGN - IMPLEMENTATION DETAILS

3.1 Design Assumptions

3.1.1 Hardware

The minimum hardware configuration is as follows (as stated in the Unity VR specifications):

- Operating System

- Windows 10 64-bit version
- Processor
 - Quad-core Intel or AMD, 2.5 GHz or faster
- Memory
 - 16 GB RAM
- Graphics Card
 - DirectX 11 or 12 compatible graphics card
- VR Headset
 - VIVE Pro 2 Full Kit

3.1.2 Software

We will develop the game using Unity with the DirectX 11 or 12 backend. It will be available for Windows 10.

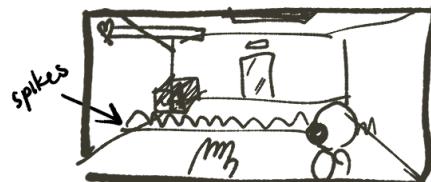
3.1.3 Algorithms and Techniques

There are two main algorithms we will need to employ within the game: one for launching the ball from the paddle, and another for tethering the player/attached objects. To implement either of these algorithms at a base level, we anticipate that all it will require is an application of force in the launch direction specified by the player, or along the shortest path toward wherever the ball is stuck (respectively), accounting for in-path collisions (like bouncing off the wall) and weights of tethered objects (e.g., how quickly/easily would the player tether to a high-up place, versus tethering a tissue box to the player?). After that, we would simply need to adjust the parameters until realistic motion is achieved, and fix any sudden player motion that might cause motion sickness in the player. There must also be a system for determining what the ball can stick to, what it can knock over, and what is movable/immovable; this will likely be achieved by just tagging the prefabs and checking the tags in our algorithms as necessary.

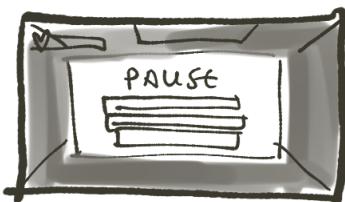
3.2 Storyboards



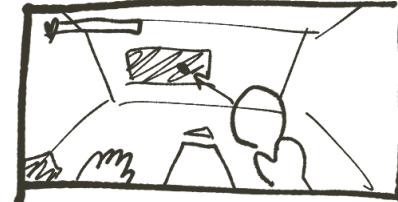
START MENU



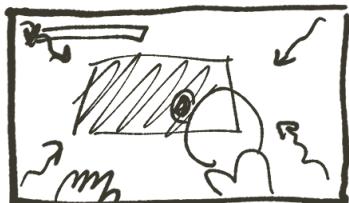
LEVEL



IN-GAME PAUSE MENU



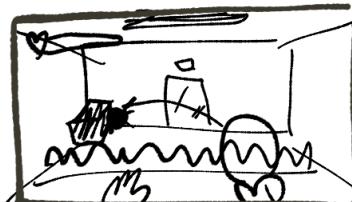
LOOK UP — STICK PADDLEBALL
TO IMMOVABLE SURFACE



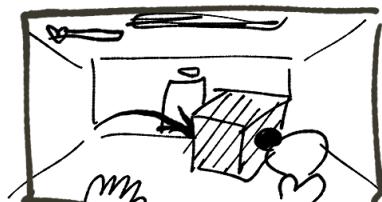
GRAPPLE YOURSELF IN
DIRECTION OF STUCK BALL



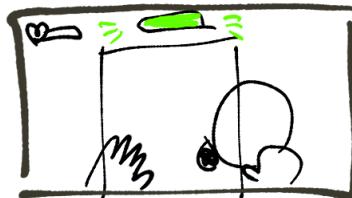
(spikes)
GET HURT AND DIE —
LOSS STATE



STICK PADDLEBALL TO
MOVABLE OBJECT



PULL OBJECT TO SELF
WITH BALL



REACH DOOR (UNLOCKED)



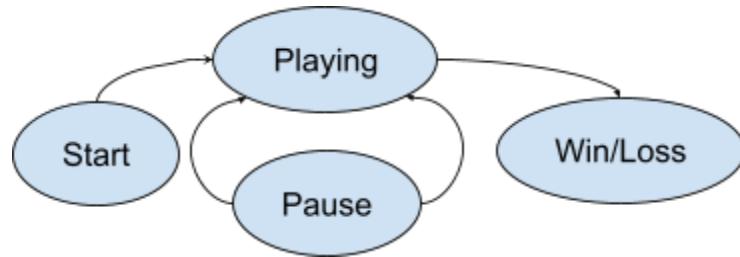
GO THROUGH DOOR —
WIN STATE

3.3 Design Logic

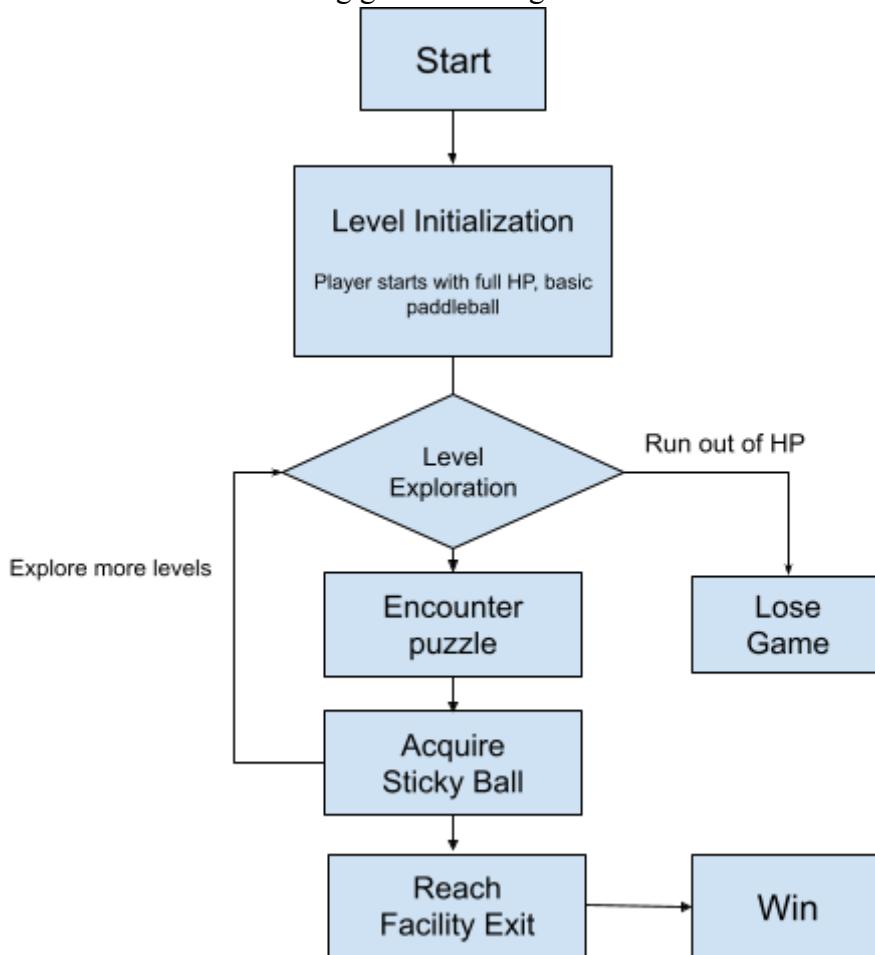
3.3.1 Finite State Machines – Events/States/Effects

The player starts the game at the Title Screen. Once the player starts the game, the player enters the Playing mode and begins at the initial level. The player can pause at any point. At any point, if the player runs out of health, the player loses the game. Otherwise, successfully completing all of the puzzles and reaching the facility exit results in a win. Later levels can only be reached after earlier levels are beaten.

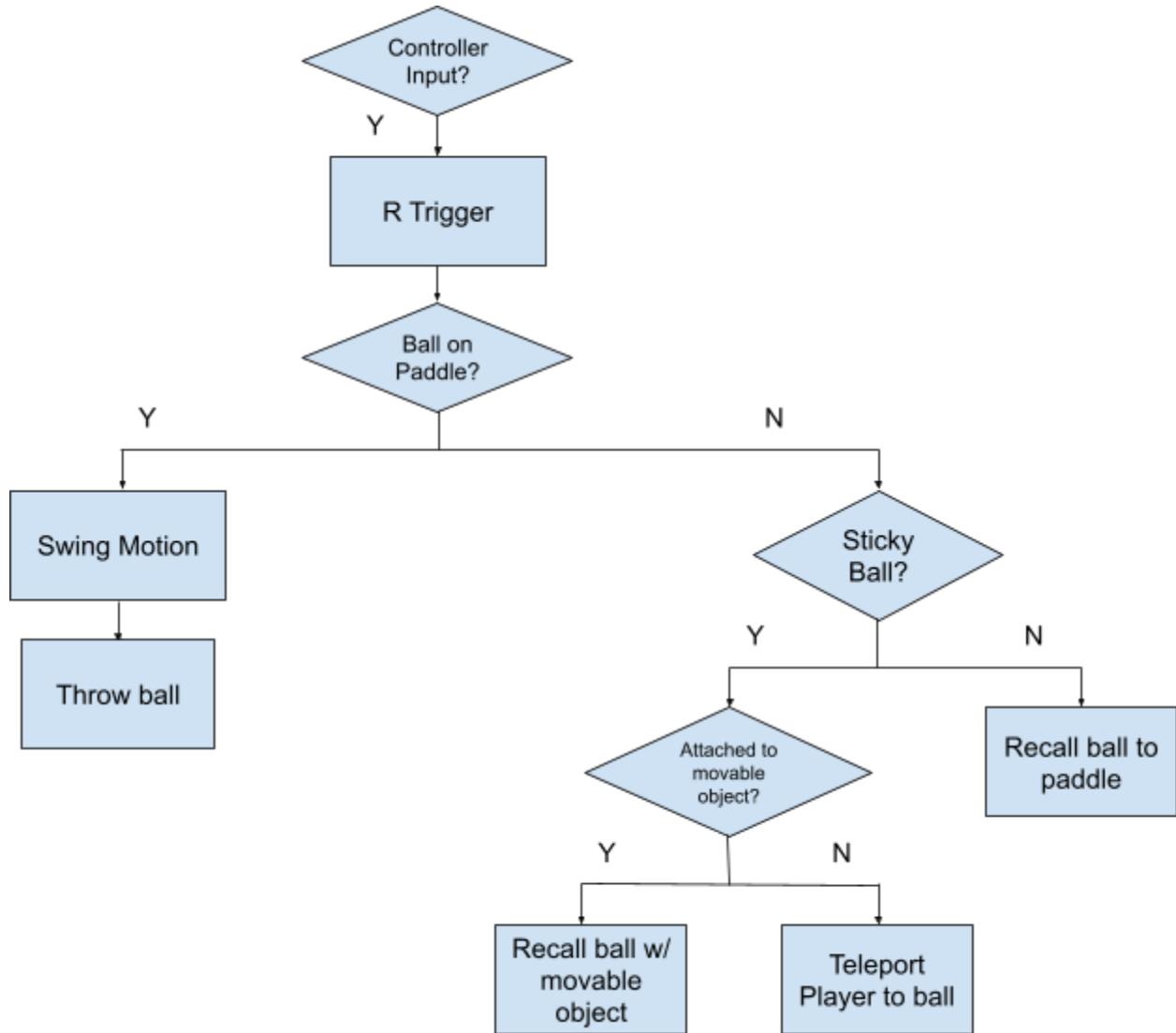
Each level has the following game flow logic:



Each level has the following game flow logic:



The player can throw the ball by pressing the controller trigger and using a throwing motion with the controller. Once the ball is thrown, the player can tether to the ball's location by pressing the controller trigger again. The player can only move around the world using the paddle mechanism.



3.3.2 User Solution/Actions

The player will win once they reach the facility exit and will beat a level when they have reached the next floor.

3.4 Software Versions

3.4.1 Alpha Version Features (vertical slice through total experience)

The following features will be implemented for the alpha version:

- The player should be able to move around the environment using the paddleball mechanics (throwing the ball and tethering to it)
- The thrown ball should bounce around in a physically acceptable manner.
- The player should be able to pick up the sticky ball upgrade.
- The player should be able to pick up movable objects by using the sticky ball upgrade (the thrown sticky ball should stick to the object and can be recalled back to the player).
- Running into hazards should drain the player's HP.
- Basic level design should be completed, with all obstacles, free objects, and hazards in place.

3.4.2 Beta Version Features

The following features will be implemented for the beta version:

- Any bugs from the alpha version will be resolved.
- Level design will be polished and finalized according to the playtest feedback.
- Graphics should additionally be finalized.

3.4.3 Descriptions of any tutorial levels and/or self-running Demos

Not featured in this game.

4 WORK PLAN

4.1 Tasks

Task 1 – Picking Up Objects in VR

Duration: 2 Days ()

Implement basic picking up objects in the VR space and letting go of them/throwing them.

- **Subtask 1.1. Pick up Objects**
Be able to pick up certain objects.
- **Subtask 1.2. Place/Throw Objects**
Be able to place/throw objects in hand.

Task 2 – Basic Paddleball Mechanics

Duration: 2 Days ()

Implement the ability to throw the ball out from the paddleball device. The ball should bounce around. The ball should also be able to be recalled via the magnetic tether to the device.

- **Subtask 2.1. Throwaway Ball**

Have the ball be throwable outward from the device.

- **Subtask 2.2. Ball Bounce**

Have the ball bounce around in an acceptable way.

- **Subtask 2.3. Tether Back**

Have the ball be retractable via the magnetic tether back to the player.

Task 3 – Sticky Ball	Duration: 1 Day ()
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Implement the system that allows the paddleball to stick to objects and the environment. The

- **Subtask 3.1. Ball Sticks to Immovable Objects**

Have the ball be able to stick to immovable objects.

- **Subtask 3.2. Ball Sticks to Movable Objects**

Have the ball be able to stick to movable objects.

Task 4 – Tether to Stuck Ball	Duration: 2 Days ()
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Create the ability to tether the player towards a stuck ball on an immovable object. The player shouldn't tether to a ball on a movable object.

- **Subtask 4.1. Tether to the Stuck Ball**

Have the player move towards the stuck ball when tethering.

- **Subtask 4.2. Tether only to Immovable Objects**

Only tether when the object the ball is stuck to is immovable.

Task 5 – Tether Movable Objects to Player	Duration: 2 Days ()
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Create the ability to tether movable objects the ball is stuck on towards the player. The player shouldn't tether an immovable object.

- **Subtask 5.1. Tether Object the Ball is Stuck to**

Have an object the ball is stuck to tether towards the player.

- **Subtask 5.2. Tether only Movable Objects**

Only tether when the object the ball is stuck to is movable.

Task 6 – Hazards and Obstacles	Duration: 1 Day ()
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Create hazards for the player to run into. The player will lose health and/or die from the hazards. Create obstacles that block the player's ability to maneuver themselves or other objects.

- **Subtask 6.1. Create Spikes**

Create hazardous spikes that harm and kill the player.

- **Subtask 6.2. Create Ball-Blocking Barriers**

Create barriers that block the ball from going through them but will allow anything else to go through.

Task 7 – Level Design	Duration: 8 Days ()
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Design the environment and the puzzles in a way that is fun to explore and fun to solve. Make sure the environment can not be exploited in unintended ways.

- **Subtask 7.1. A Puzzle Without the Paddleball**

Design and implement a puzzle that does not use the paddleball device, it will instead use the basic ability to pick up and throw objects.

- **Subtask 7.2. A Puzzle with the Paddleball**

Design and implement a puzzle that uses the basic paddleball device. It will use the ability to knock down objects with the ball.

- **Subtask 7.3. Two Puzzles with the Sticky Paddleball**

We will design and implement two puzzles that use the sticky ball as the means of solving. This includes one puzzle centering around pulling objects to the player and another puzzle around pulling the player to the exit.

Task 8 – Graphics	Duration: 4 Days ()
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Create custom graphics and shaders that will help clearly outline the gameplay. Models fall under this category.

- **Subtask 8.1. Basic Shader**

Render in a crisp slight toon shader that still retains a lot of detail.

- **Subtask 8.2. Models**

Objects now have models past simple shapes. i.e. a box now looks like a styled box rather than just a default cube.

4.2 Milestones

4.2.1 Minor

Week 1: Basic paddleball mechanics done, picking up objects in VR done

Week 2: Sticky ball mechanics done, hazards done

Week 3 (Alpha): Obstacles done

Week 4: Level design almost done

Week 5 (Beta/Final): Level design done/graphics done/everything done

4.2.2 Major

Alpha Version

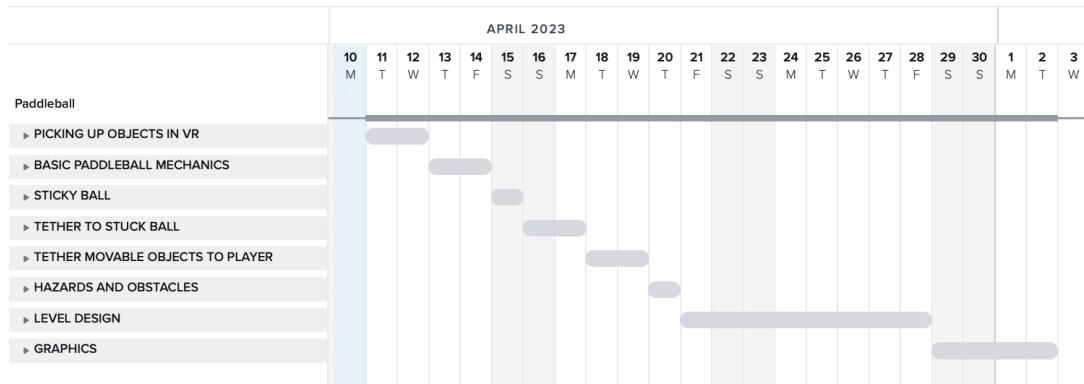
The alpha version will have all the core game mechanics in place. The paddleball device should be implemented with the bouncy ball. The sticky ball mechanic should also be done. The player should be able to move and collide with the via the sticky ball tether movement. Hazards and obstacles should also be implemented by now.

Beta Versions

The beta version will have the complete set of game features as well as a bunch of level design finished. The graphics should additionally be finalized.

4.3 Development Schedule

4.3.1 Overview



4.3.2 Expanded

