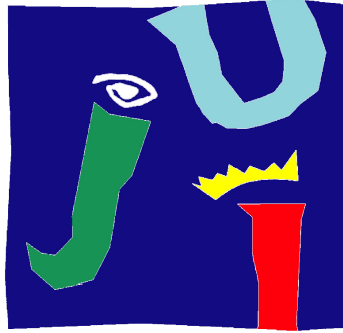


Video Game design and development degree
Final degree project's technical report



UNIVERSITAT
JAUME • **I**

Four-Letter Word

**Video game ontologies applied to the design and development of a
narrative video game**

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SUMMARY

This document aims to present the technical proposal for an end of degree project in the Degree in Design and Development of Video Games. The work to be developed will consist of a videogame of the narrative premise of three-dimensional displacement for PC devices developed in Unity 3D. The player will control his/her avatar in a three-dimensional environment in which the main character in the story, the storyteller, directly addresses the player through the use of text messages, as the player advances in the story making the different challenges and narrative cores that is exposed, interacting with the various items on the stage, the storyteller will talk to the player breaking the fourth wall continuously since the storyteller knows is inside a game and his mission is to help the player (or at least that is what It seems).

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1 INTRODUCTION

1.1 JUSTIFICATION

When I entered the degree I did not know what was my place in the world of the video game creation, as the years passed I realized that my true passion was ludology, game design, and narrative, so when I had to choose what to do in my final year project, I decided that I wanted to combine those passions in a game the idea was maturing in my head for months because it was not only a matter of making a game had to take into account my skills, time and resources that I had at my disposal, so I decided that the best way to do it was to create a narrative story that combines the aforementioned concepts.

In this context, I have tried to contribute to creating a game with a funny narrative that parodies the game itself and the conventions and rules of these.

1.1.1 FOUR-LETTER WORD: WHY THAT NAME?

At starting the project I was clear that my game was going to have as a reference theme, the game and about what it means to play, to have a title that expresses the main theme is important, so I decided to call this project "Four-Letter Word", this is a simple riddle, with this I wanted to hide in the title what I wanted to transmit, play with everything, even with the title, and what is the four-letter word? PLAY.

1.2 TOOLS

The tools used to develop the game are the following:

- Unity3D 2018.3.0b7
- 3Ds Max 2019
- ProBuilder
- Adobe Photoshop CS6
- Microsoft Visual Studio (C#)

2 GAME/NARRATIVE DESIGN

2.1 REFERENCES

- *The Stanley Parable* (Davey Wreden, 2011):
 - *The Stanley Parable* (figure 1) it is a great case study because it uses various techniques to break the fourth wall in video games: how to challenge the player each time the player interacts with the objects, each time he/she makes an important decision or if he/she is simply not doing anything. What really matters to us about this game is how it uses a completely structured and closed narrative based on decision trees that make the player fully aware that he/she really does not have control of the game, although, on the other hand, without him/her, there is no game. That is, the narrative in video games, is a shared narrative, between the rigid rules presented by the designer and the player's ability to accept and move between them.



Fig.1 In-game footage of *The Stanley Parable*

- *The Secret Of Monkey Island* (LucasFilMS Games, 1990):
 - This game is a clear example of how to make a funny story with self-referential humor full of ingenious puzzles (figure 2) that will equip the player with experience between despair and self-realization after overcoming the game.



Fig.2 In-Game Footage Of *The Secret Of Monkey Island*

- *The Magic Circle* (Question, 2015):
 - Another game full of inspiration that breaks the fourth wall from the beginning of the game presenting an unfinished story (figure 3) where the fatal outcome of a game is shown which its developers (who personify themselves in the story, in a narrative and therefore fictitious way) never finished by not being able to get in agreement lengthening the project until it is unstoppable failure and this is where the player takes the "control" of the game opening its way through the corrupt and unfinished the game files.



Fig.3 In-Game Footage Of The Magic Circle

2.2 GAME CONCEPT

Who is in control?

In “Four-Letter Word” the player takes the control of an “avatar”, it is not a story character, it is an invisible entity, the only the link between the player and the game, in a not metaphoric way the player is a character in the story.

The avatar’s control is shared it between the player and the storyteller (one of the story characters), in the majority of the game the player takes control of the avatar but in some fragments, in the game course, the storyteller takes control of the avatar to reprove the player.

In terms of gameplay, it is a story-driven game and it is focused on talking with the storyteller and resolving puzzles by pressing buttons, guess and solve number sequences, and use physical mechanics (like jumping, grabbing objects or shooting different elements) to solve the proposed challenges and in that way advance in history. The game and the story itself is not taking it seriously, the game is continuously breaking the fourth wall, this and the storyteller’s interventions remind the player that he/she is not in control.

2.2.1 What the player do? Mechanics

The player's resources (mechanics) to progress in the game are:

- Move (walk): The player can across the stage with the typical keys seen in other first-person games (AWSD).
 - A: Move forward.
 - S: Move backward.
 - A: Move to the left.
 - D: Move to the right.
 - Also, the arrow keys are allowed to do this mechanic.
- Camera control: The player can control the camera's orientation with the mouse control. The type of camera is "subjective camera".
- Carry/Drop Objects: The player can carry on board objects holding the mouse left click button and drop them freeing the same button.
- In general, the interactions with the environment: pushing buttons in a panel, open doors, free dialog boxes, and events are performed with the mouse left click button.

2.2.2 What are the player's objectives? Story

"Four-Letter Word" is presumably filed within the genre of narrative adventure, ergo the player's objectives are related to the goal of advancing in the story, the majority of games can tell two different stories (or narrations) the emergent narration: the story that the player creates with the game mechanics in a fixed time and it is variable and unique for each one, and the embedded narration: the story introduced in the game that is premeditated that is invariable (although the story has different ramifications the story is already created) and that the player will unlock when advancing in the game.

The objective of "Four-Letter Word" is to focus on the second type of narration to make the player meditate on the first type of narration. The player advances in the game in parallel to the embedded game story fulfilling the objectives that the storyteller tells the player.

Also, the avatar can not lose in the game there is no lose conditions like a regressive countdown or final bosses in the sense of a normal game, there is only one way to resolve the puzzles as well.

The narration, in this case, is sequentially triggered from the player's progress, in some special cases, the narration will be branched (figure 4) and will join again to the sequential flow of it

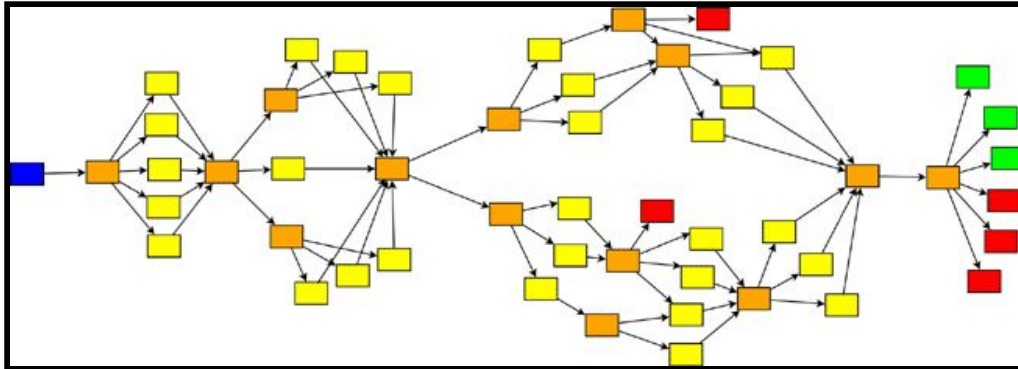


Fig. 4 - Example of branching in a story.

2.2.3 Progression

As said before the game progression is given through the story progression, not all mechanics are introduced to the player at the game beginning this means the player is able to perform a series of actions at the story beginning, which are: walking and turning the camera. Throughout the game, the player will unlock new mechanics that will be released by the character: The Storyteller.

The game loop can be presented with the following figure(figure 5):

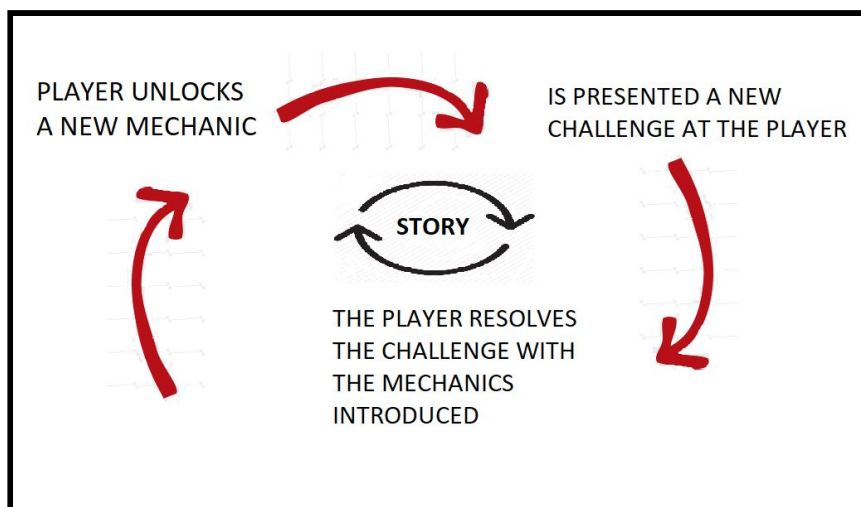


Fig.5 - Story and player game loop

2.2.4 Sound and visuals

Most of the game scenarios will be closed with a simple aesthetic with flat colors, the stage elements are mostly corridors, doors, buttons and switches presented with representative colors to differentiate them from the non-understandable elements of the stage elements.

Talking about lighting, most of the levels are mainly build with a clear light, the main objective to do this is to make the player feel comfortable.

The sounds will be mostly sound effects introduced to emphasize player's mechanics, like sounds of walking, opening doors, carry and drop objects.

2.2.5 User Interface

For the sake of maintaining an intimate experience between the game and the player and create an immersive environment there will be no more HUD than the one needed to keep flowing the experience, so, most of the elements that show information to the player will be diegetic. There are non-diegetic elements so that the player can follow the story, for example, dialog boxes to show the story, a pointer to know the direction to which the player points or icons to differentiate interactable objects from those that do not.

3 LEVEL & NARRATIVE PROGRESSION/DESIGN

3.1 CHAPTERS

In this section, the game plot that is in the game will be described in detail, as well as all the puzzles and challenges that appear along with it. Dialogues are explained in summary to clarify the text:

The sequence of levels is as follows:

Fig.6 -Full level design
of Four-Letter Word

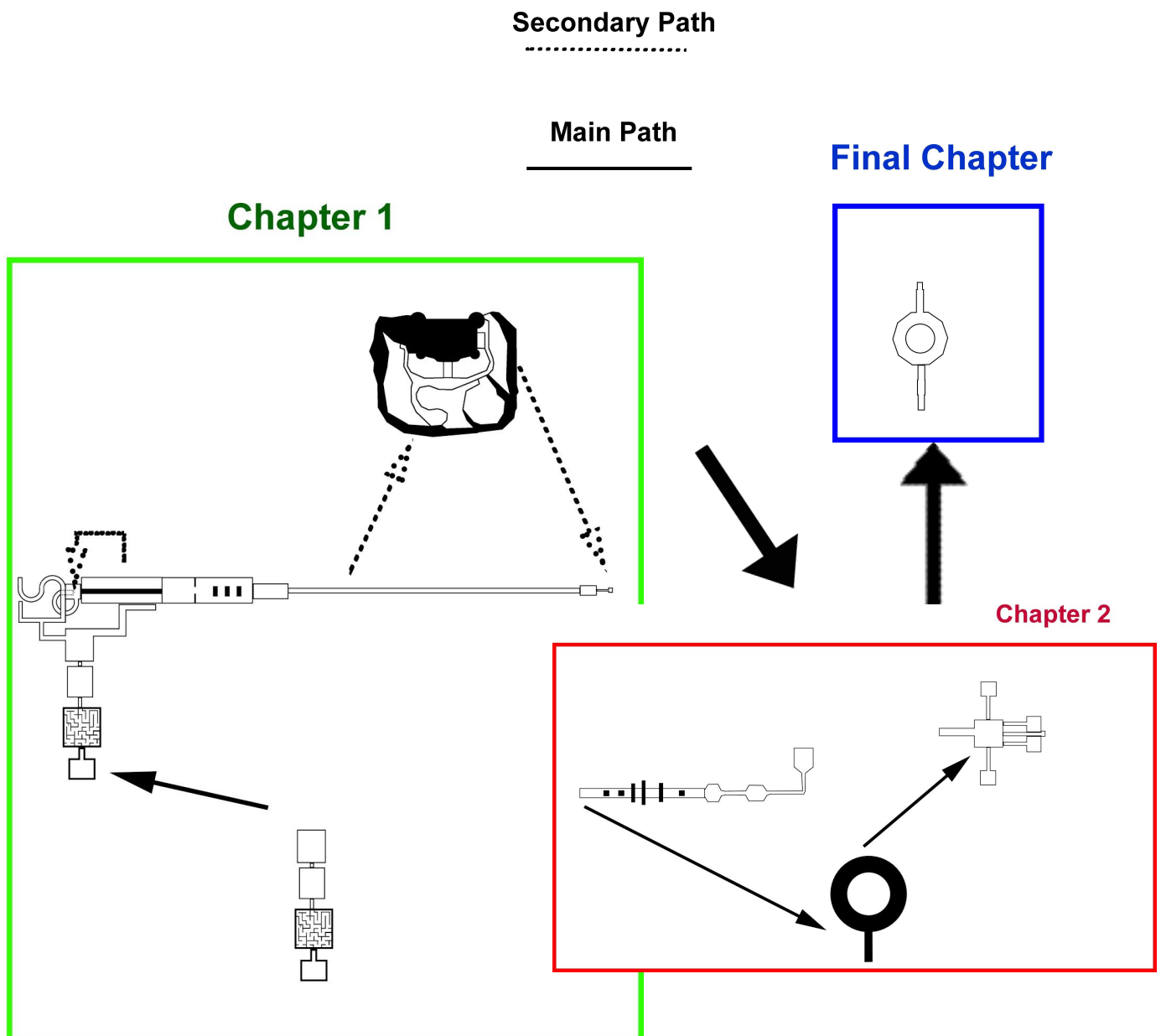


Figure 6 illustrates the level design drawings of the whole game by dividing it into chapters, the arrows indicate the level's flow (to where the player is transported at the end of that level, the black arrows indicate the game mandatory path and the dotted arrows represent the secondary path).

In the following sections, the figure is expanded and explained in detail, the idea behind this figure is to consult it while the document is read to get an idea of where the player in the game progress.

3.1.1 CHAPTER 1

The sequence of levels of the first chapter is as follows (figure 7):

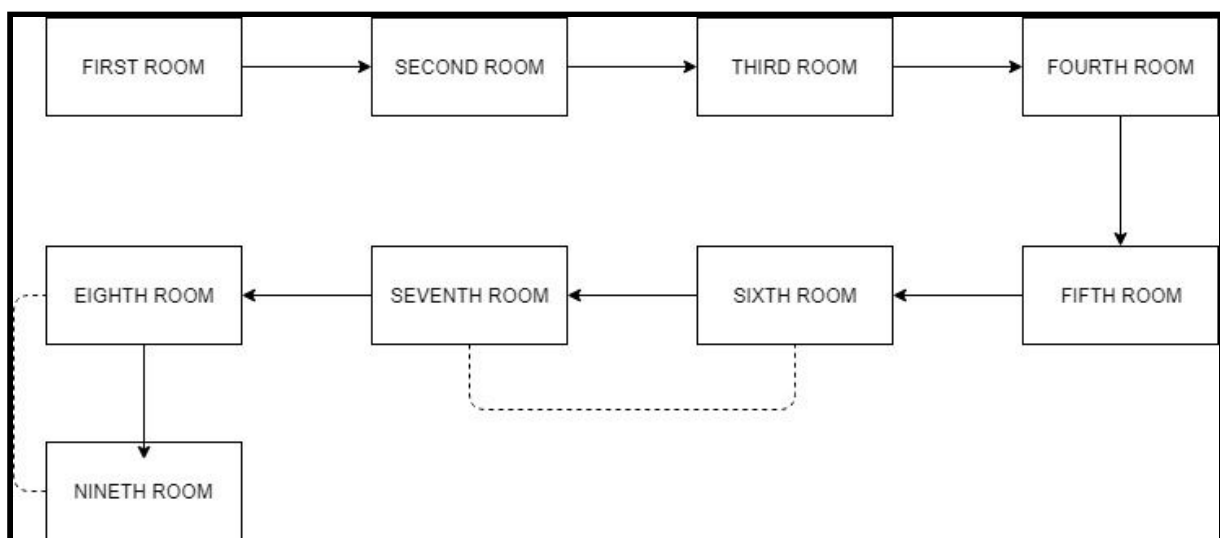



Fig.7 - Sequence of levels (1st chapter)

As the puzzles and the different rooms are explained, the designs of the different levels of the game will be introduced for better visualization of the structure of the game.

This has been done in this way because of the game's own narrative nature, which makes it better to explain both the player's and levels progression.

Note: The “  ” symbol that contains a number in its interior represents the puzzle with the corresponding number.

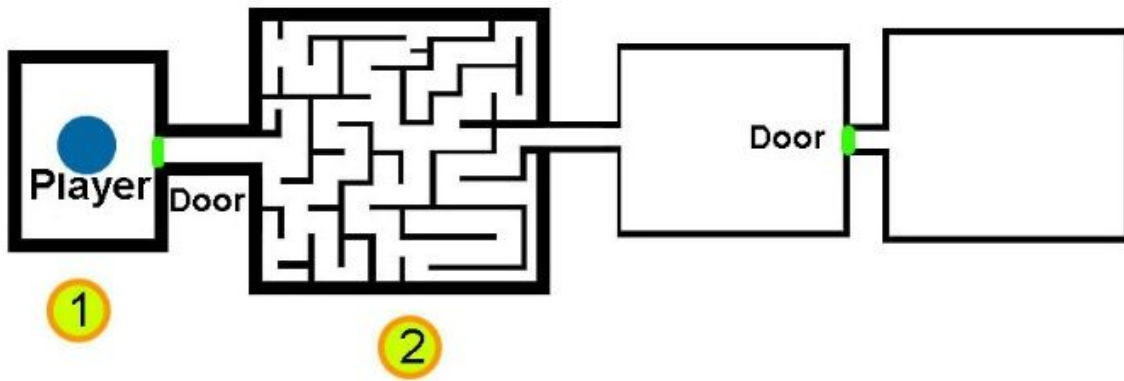


Fig.8 - Chapter 1: First two puzzles

The game starts with the player waking up in the game first room while the storyteller shows up and speaks to the player, in this first moment the only action that the player can perform is to move around the camera. After the introduction, the storyteller will give the player the ability to move.

Puzzle 1: Once the player has unlocked the mechanics of moving, he/she will notice that something is wrong, the controls are inverted. In front of the player there is a button and a door (figure 9), the player will have to try to reach that button and press it with the movement and the camera inverted.

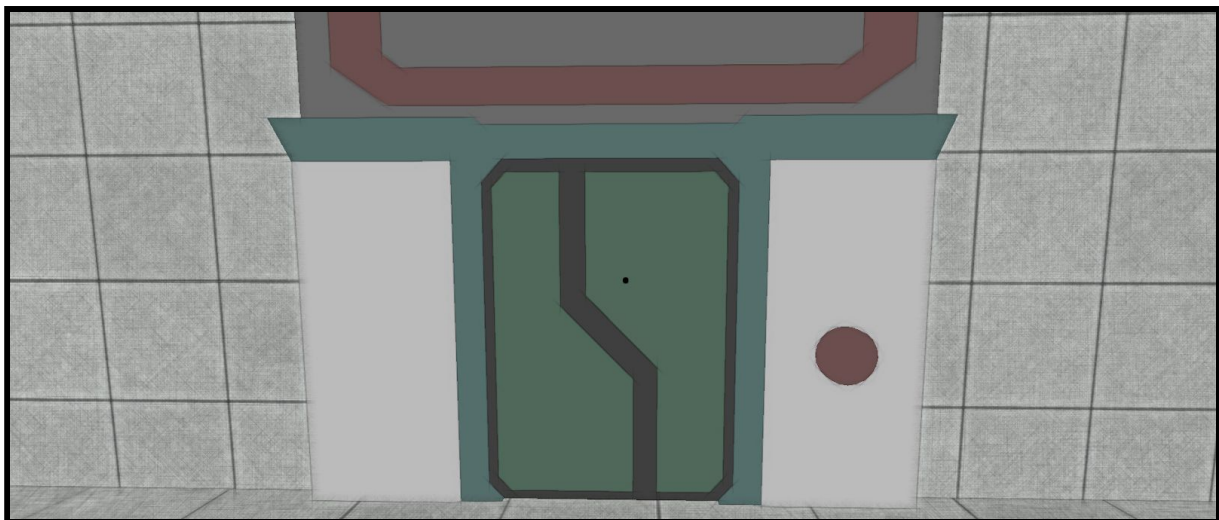


Fig.9 - First room of the game

Puzzle 2: Once the door has been opened, the player will find a maze that he/she will have to overcome with the controls still inverted.

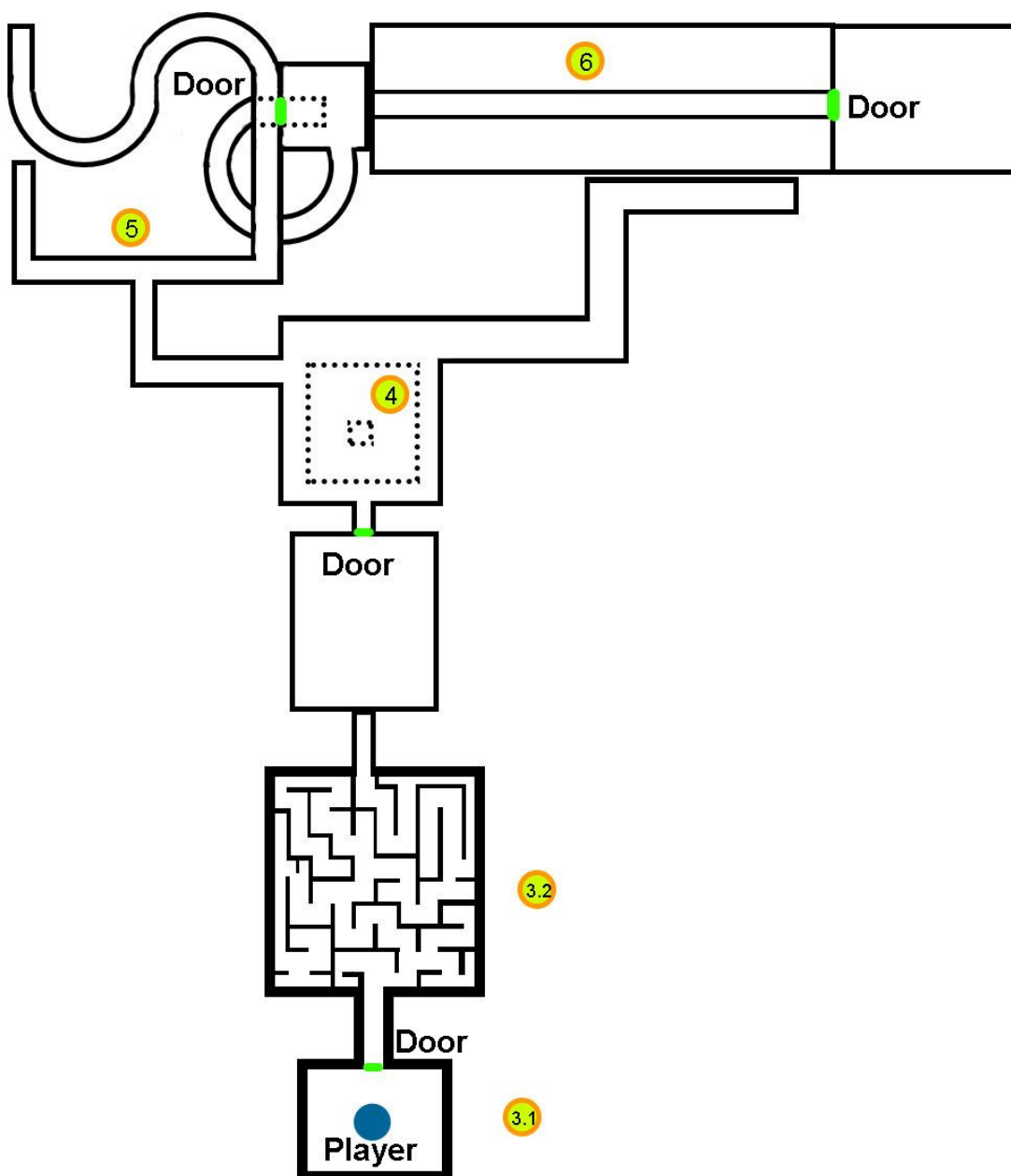


Fig. 11 - Chapter 1: Puzzles, from 3.1 to 6

Puzzle 4: In this puzzle, the player is in a room with a door with a button to open it is not located next (as in the game first door) to the door but above the player (figure 12). However, this button after being pressed does not open the front door but opens a hatch under the player sending it to a new room.

Puzzle 5: The player is sent to a poorly lit room (figure 13) in which he/she will have to be guided by the sound ([ref\[S.3\]](#)) to find the exit from the room.

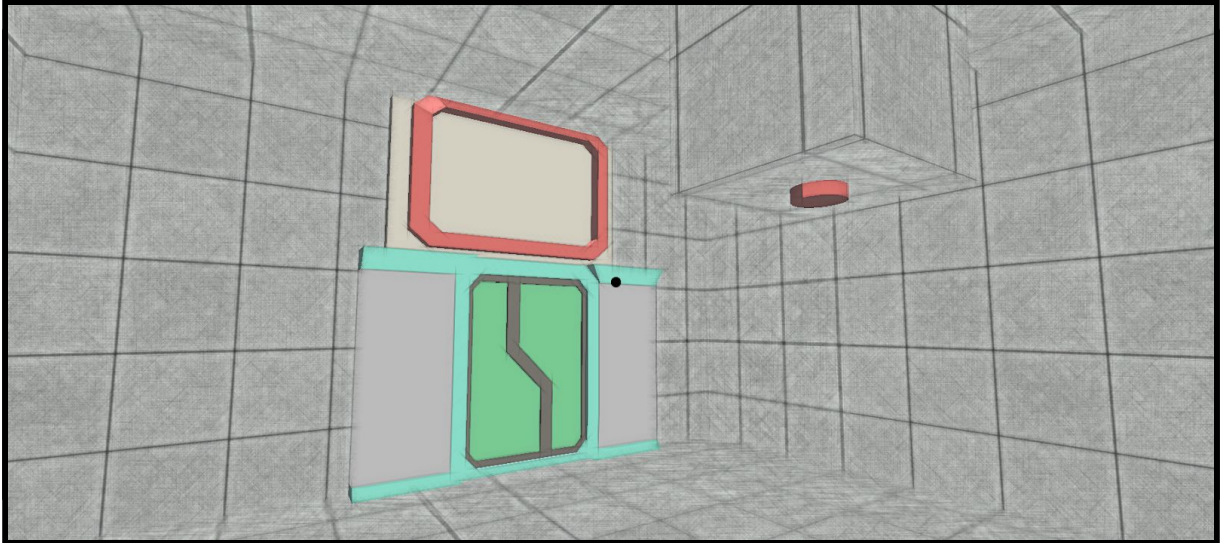


Fig.12 - The Trap Room

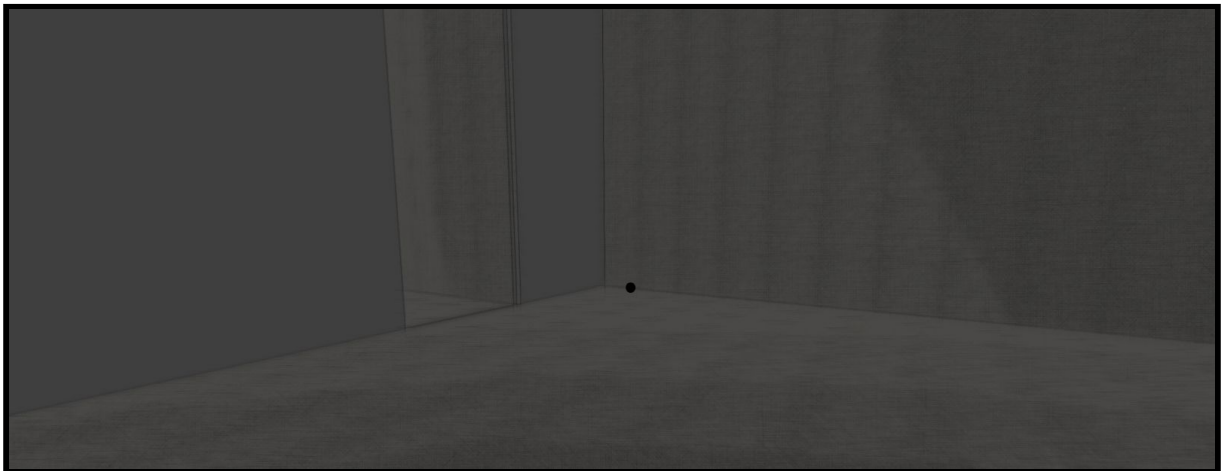


Fig.13 - The Dark Room

Puzzle 6: Once the player has overcome the previous challenge he/she will find himself/herself in a room with a door that must be reached through a corridor. If the player tries to throw himself/herself or fails to overcome the corridor (figure 14), the storyteller will save him/her by removing the control and returning him/her again, if the player tries to throw himself/herself a second time the storyteller will not save him/her, killing the player in the process and reappearing in the same room, however, the storyteller will have placed an invisible floor so that the player can not start killing himself/herself again.

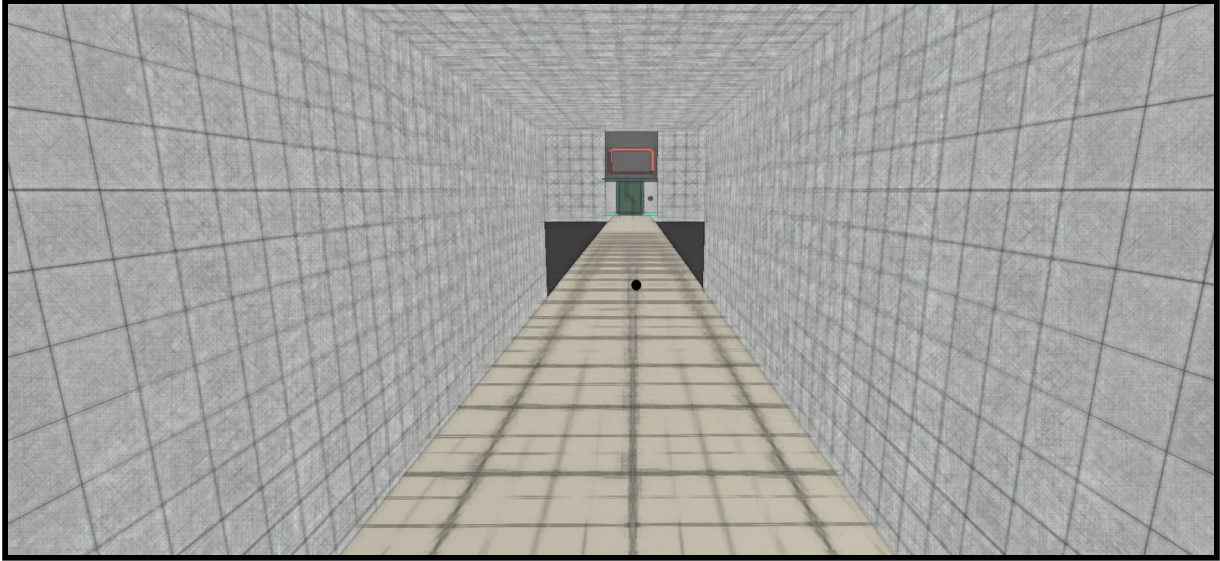


Fig.14 - The Corridor Room

Puzzle 7: Once the player passed the corridor room and she/he have opened the door, the player will enter a room where the challenge will be to jump a series of obstacles (figure 15) to reach a door, however the player will realize that no matter how much she/he press the jump key (space), her/his avatar will not jump, this will be known by the storyteller and he will be in charge of making it easier for the player to jump (after the storyteller will apologize for the player for the small inconvenience) so the player can overcome the challenge.

Once the player has unlocked the jump mechanic, he/she can jump the platforms, reach the door and press the button that will reach the next room.

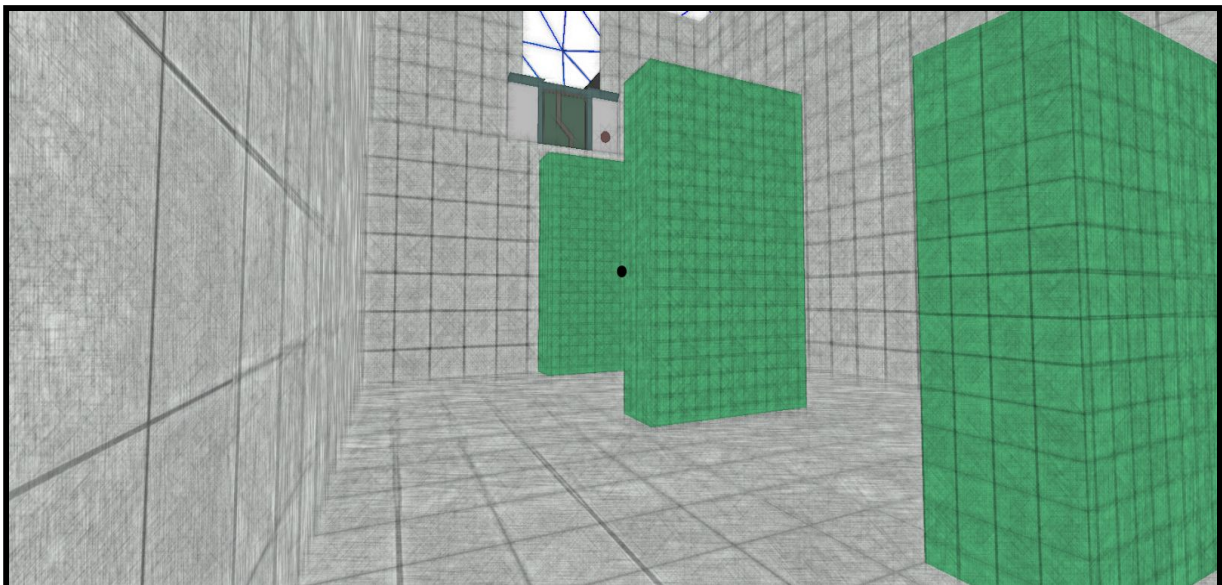


Fig.15 - The Jump Room

After this, the player is in an ascending corridor full of buttons ready to be pressed (figure 16), the storyteller will tell the player not to press them, two possible narrative paths open (Puzzle 8.1 or Puzzle 8.2):

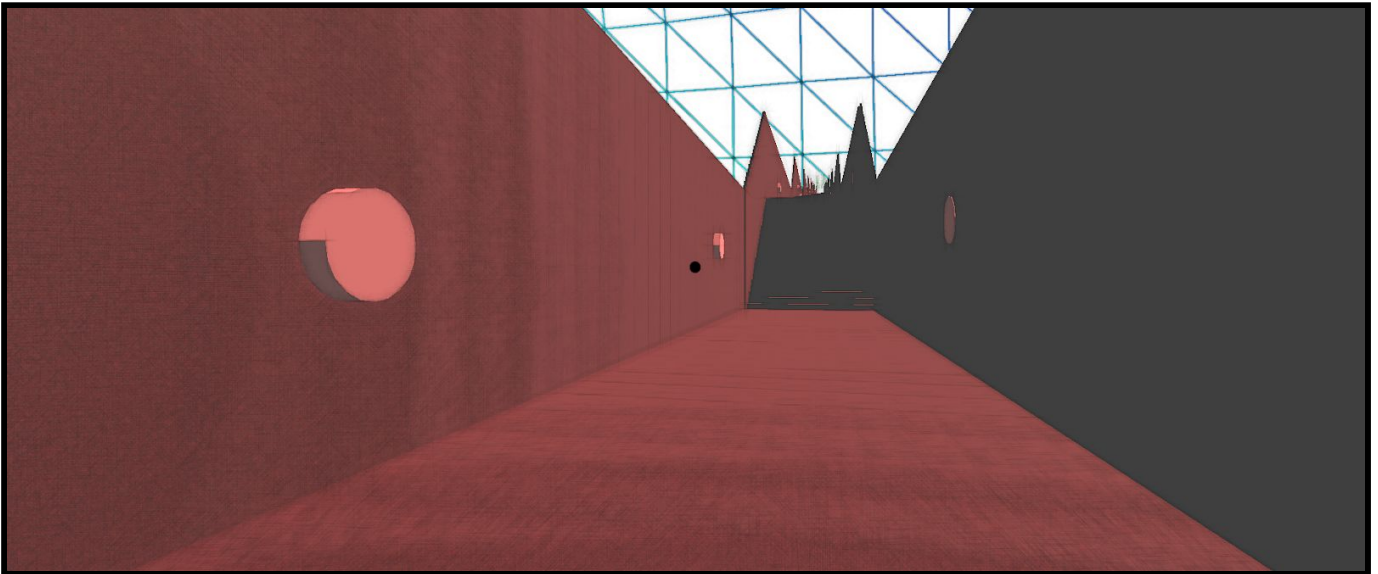


Fig.16 - The Temptation Room

Puzzle 8.1: The first player option is to listen to the storyteller and overcome the hallway without pressing any buttons, after that the player will move to puzzle 9.

To create an overwhelming feeling to the player, while ascending this corridor a song will sound that will accelerate over time ([ref\[S.1\]](#)).

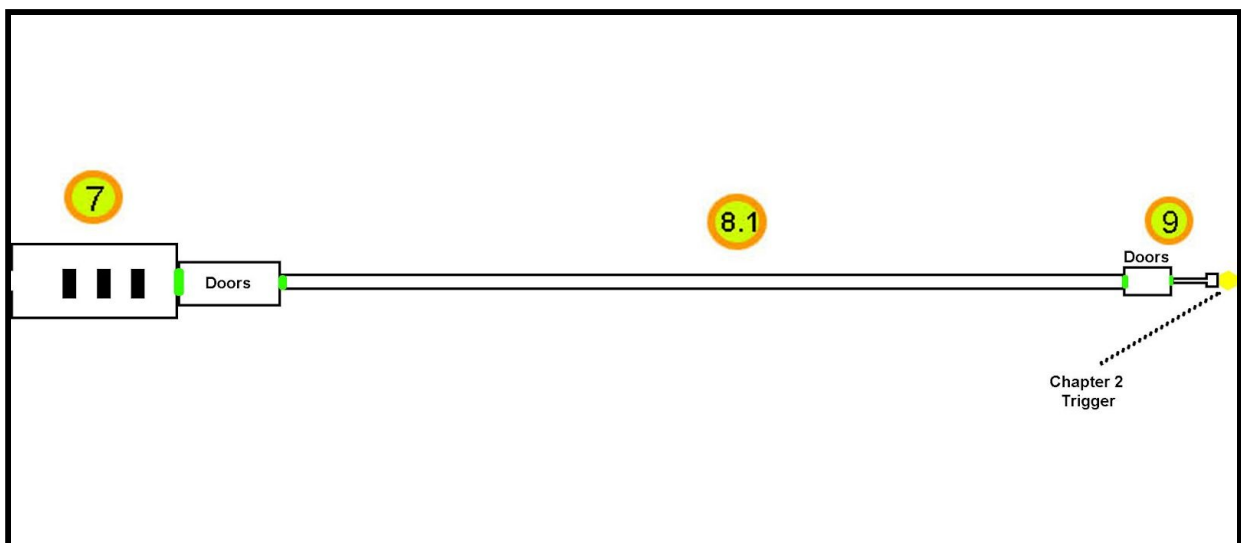


Fig. 17 - Chapter 1: Puzzles, from 7 to 9

Puzzle 8.2: The second option is to ignore the storyteller and push any of the many buttons that are in the hallway. If the player does this, he/she will be transposed to a new world/game: Peach's Castle (figure 18), the player will be reproached by the storyteller, refusing to help her/him. The player must find the exit of this world and thus be able to return to the normal game flow: puzzle 9.

The trigger that releases the player from this zone and transports him to puzzle nine is marked in yellow in figure 17.

The idea behind this puzzle (besides being a joke and an excuse to break the fourth wall) is to play with the player's expectations and curiosity, not in the fact of disobeying the storyteller, the player has been given an order, or rather advice, and due to the fact that the narrator's order implicitly allows the player to disobey him, so what we have to ask ourselves is: Will the player be a good player and will follow the rules? or on the contrary: Will the player succumb to temptation and press the button? and if so: What happens when the button is pressed?

To satisfy the player curiosity in case he/she presses the button, there enters the Peach's Castle, the intention is to transport the player to another game to test his/her expectations, and on the other hand to surprise him/her and instead of scolding the player as the storyteller does for pressing the button, rewarding his/her curiosity with a scenario recognizable to the player.

That is why the Peach's castle stage has been chosen, for being popular enough to be recognized by a majority of players.



Fig.18 - Peach's Castle

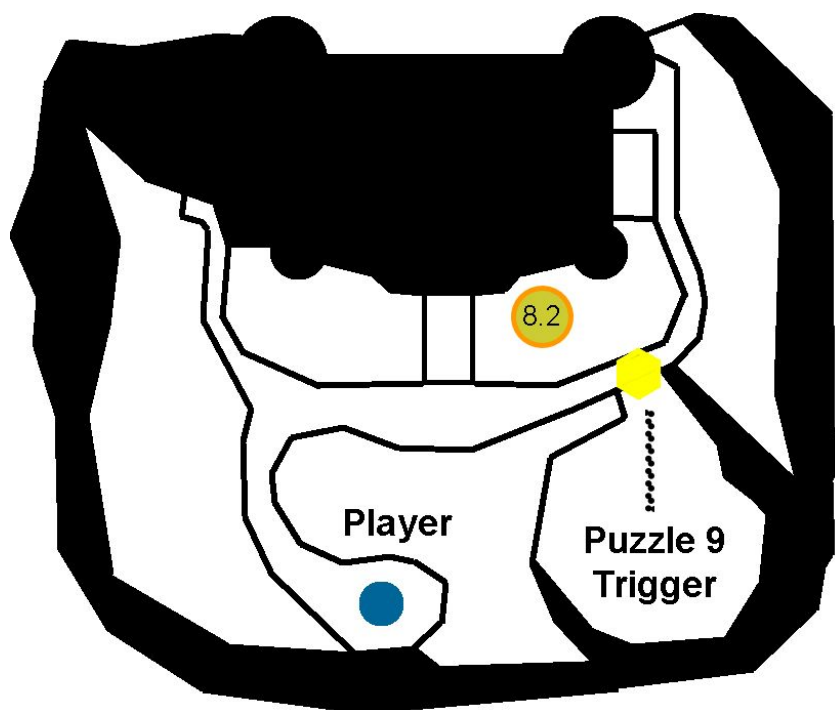


Fig.19 - Chapter 1: Peach's Castle level design

Puzzle 9: The player is in a room with a closed door, the storyteller will be in charge of opening that door, telling the player that he/she should trust him and that the player must jump into the vacuum (figure 20) to reach the next level.

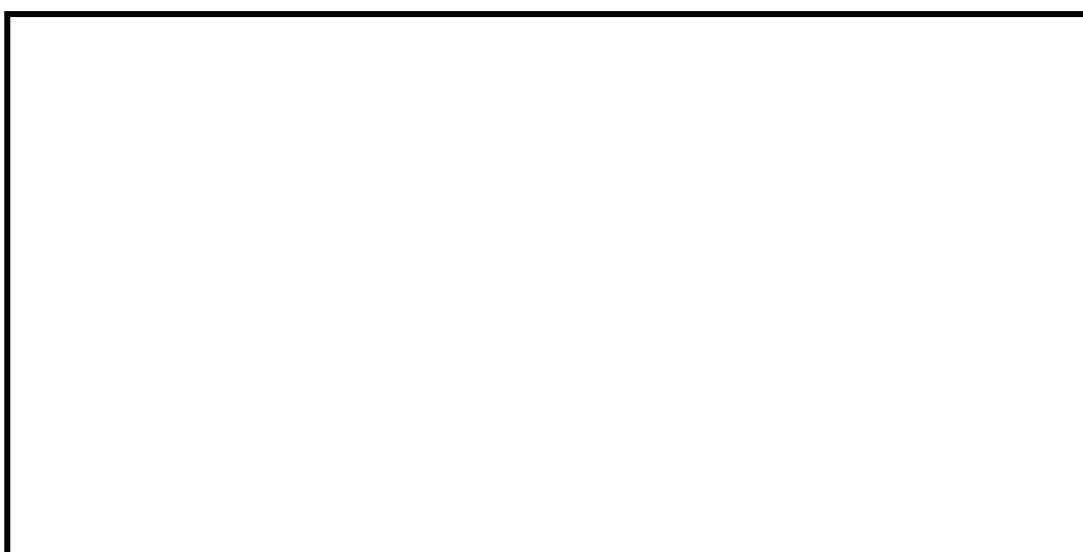


Fig.20 - The player must jump

3.1.2 CHAPTER 2

The sequence of levels of the second chapter is as follows (figure 21):

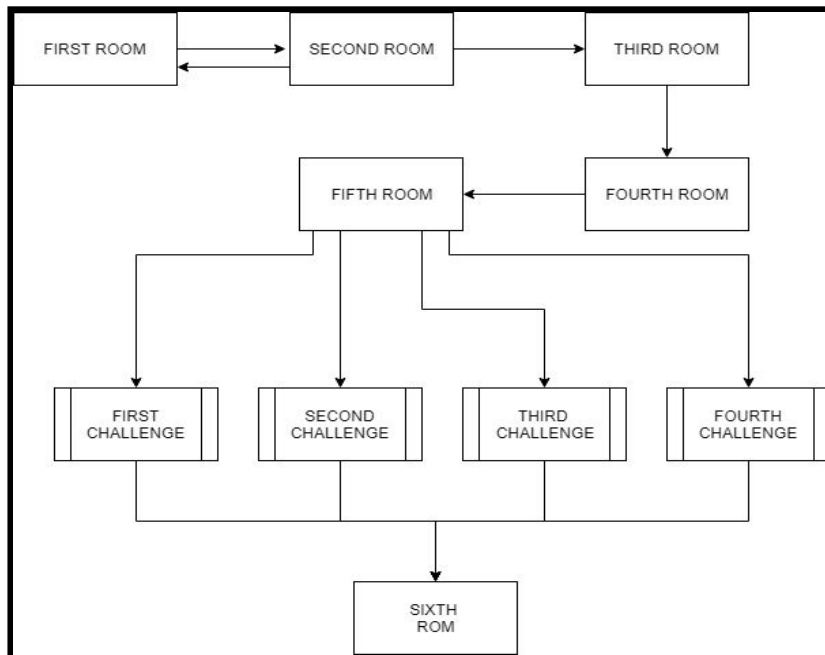


Fig.21 - Sequence of levels (1st chapter)

After the player jumps, the player will be transported to the first room of the second chapter. The player must cross a narrow corridor, he/she will find herself/himself with a cube that will stand in the player way (figure 22). He/she can jump over it or grab it, the player needs this cube to overcome the following two puzzles.

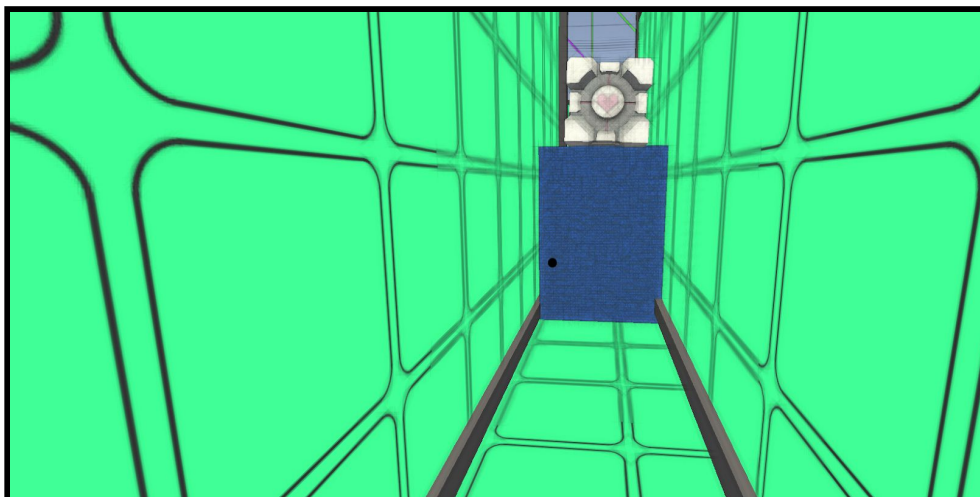


Fig.22 - The Narrow Corridor

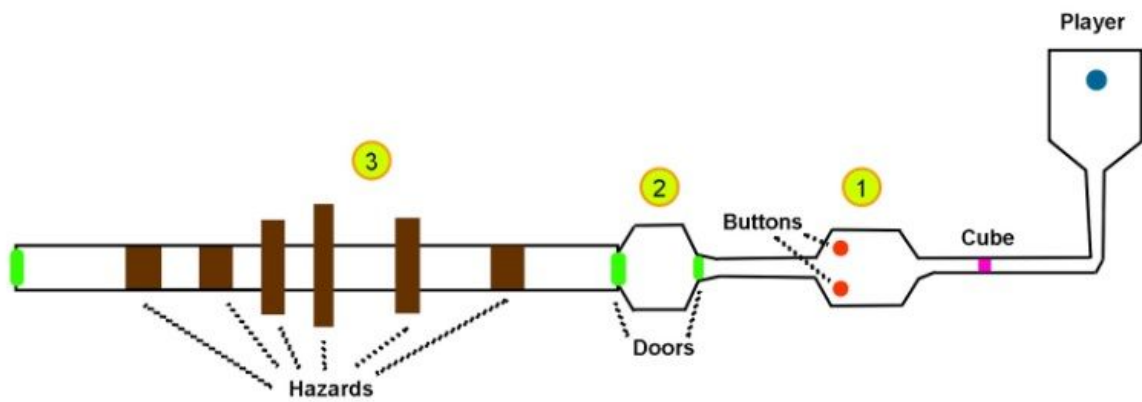


Fig. 23 - Second chapter: Puzzles, from 1 to 3

Puzzle 1: Once the player has passed the cube, the player will find himself/herself in a room in which there is a door, this door opens with two buttons (figure 24) on the floor that is activated when pressed by a solid object (the avatar and the cube). The player must place the cube on one of these buttons and stand on top of the remaining button to activate the door.

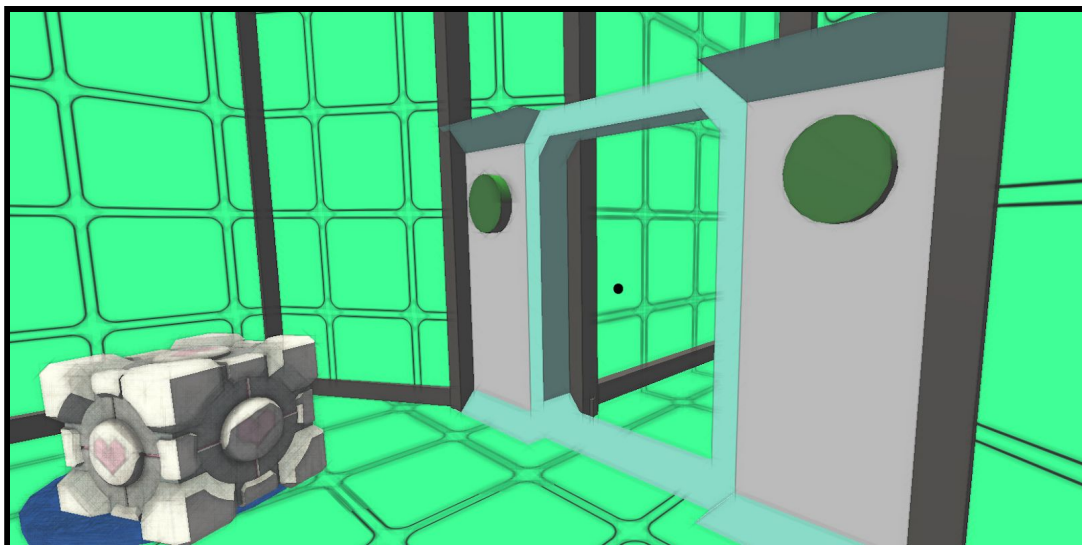


Fig.24 - The Two Buttons Room

Puzzle 2: The player is in a room with a door that can not reach even jumping, to reach the door the player must use the cube to jump on it (figure 25).

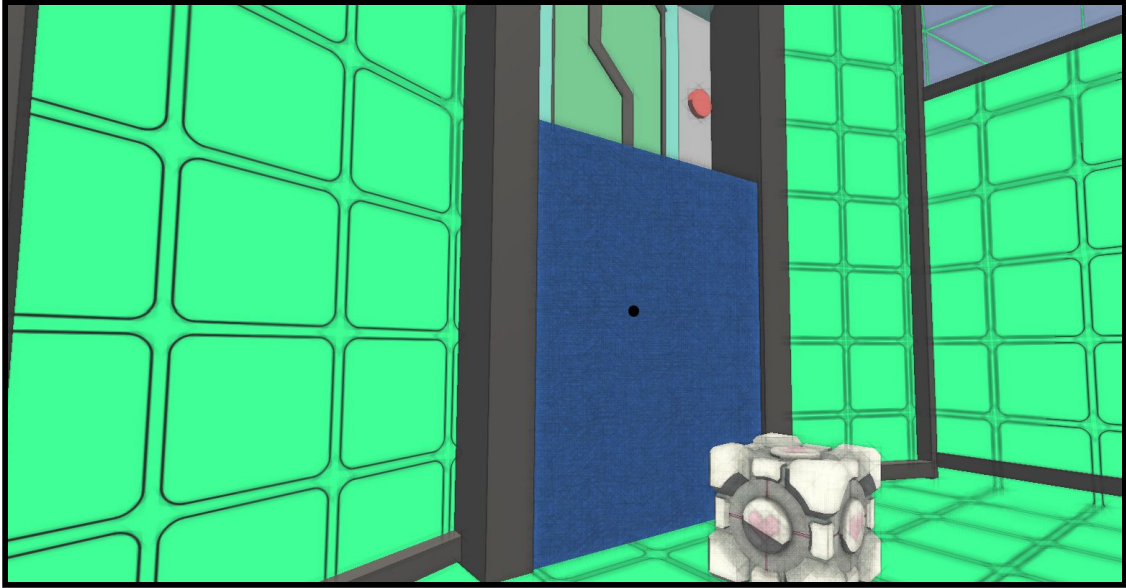


Fig.25 - Puzzle solution

Puzzle 3: This challenge consists of an obstacle race (figure 26), this challenge is designed to make it impossible to overcome by the player, once the player has failed a certain number of times the storyteller will release some dialogue phrases and will transport him/her to another room.

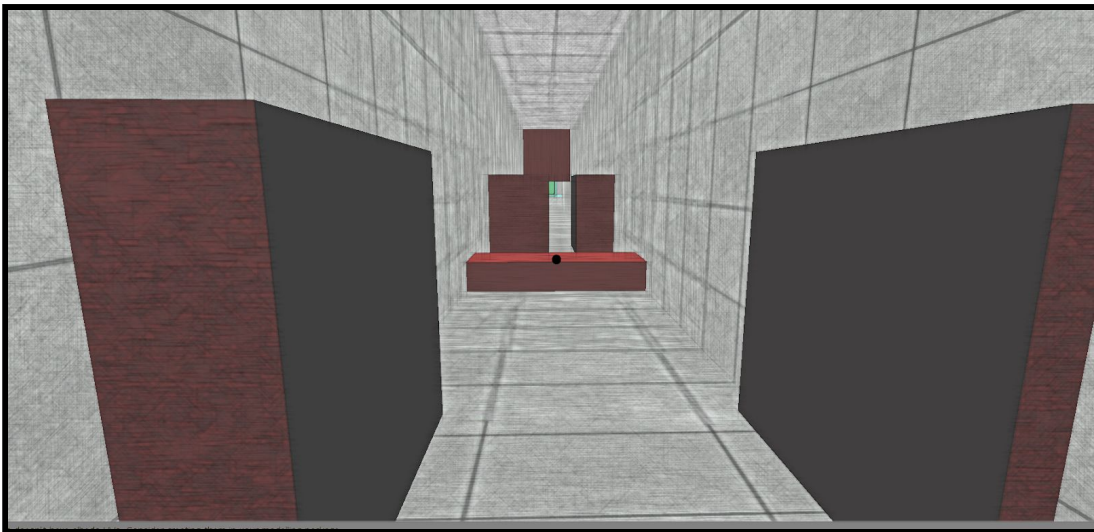


Fig.26 - The Impossible Challenge

Puzzle 4: This room consists of a coliseum in whose center there is a new character, the difficulty curve (figure 27), the storyteller will tell the player must destroy to advance to the next level, giving him/her a weapon to be able to perform that task.

Note: the zone painted in black in figure 28 represents the scenario's area the player cannot pass over it.

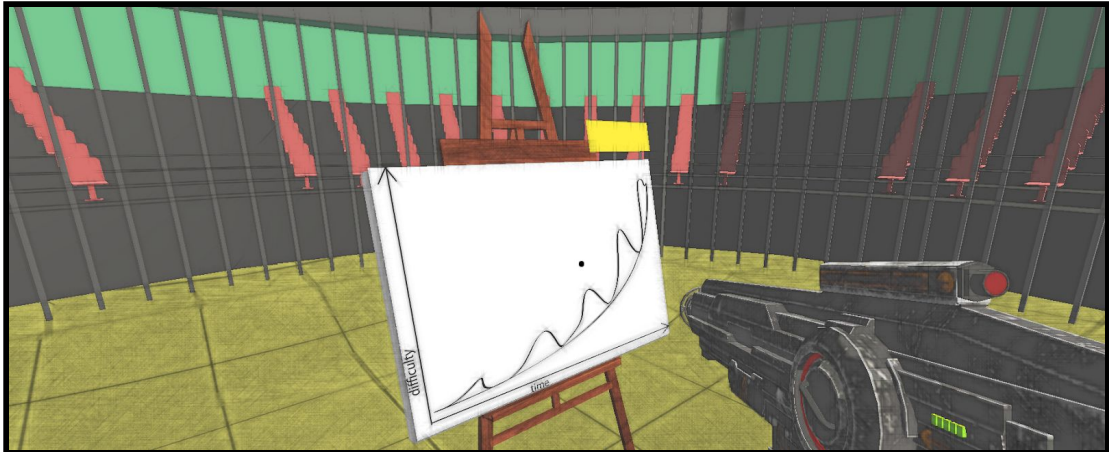


Fig.27 - The Difficulty Curve

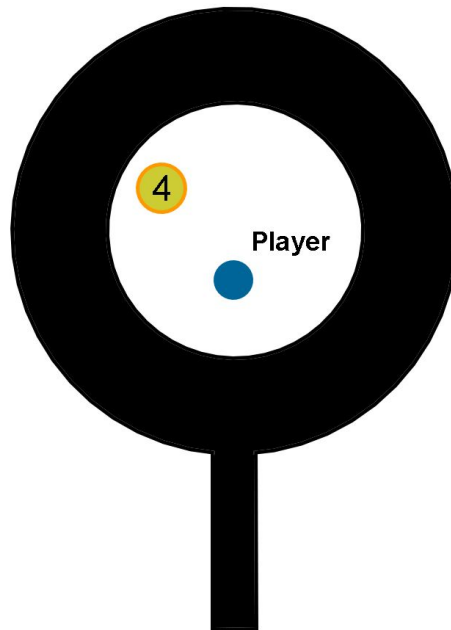


Fig. 28 Chapter 2: Difficulty Curve puzzle

Once the player has destroyed his/her "mortal" enemy the storyteller congratulates him/her and will teleport the player to the next game level.

This level will consist of four challenges (figure 29) that the player can perform in the order that he/she needs. Each challenge is separated from the others by closed rooms to make the player focus on one challenge at a time.

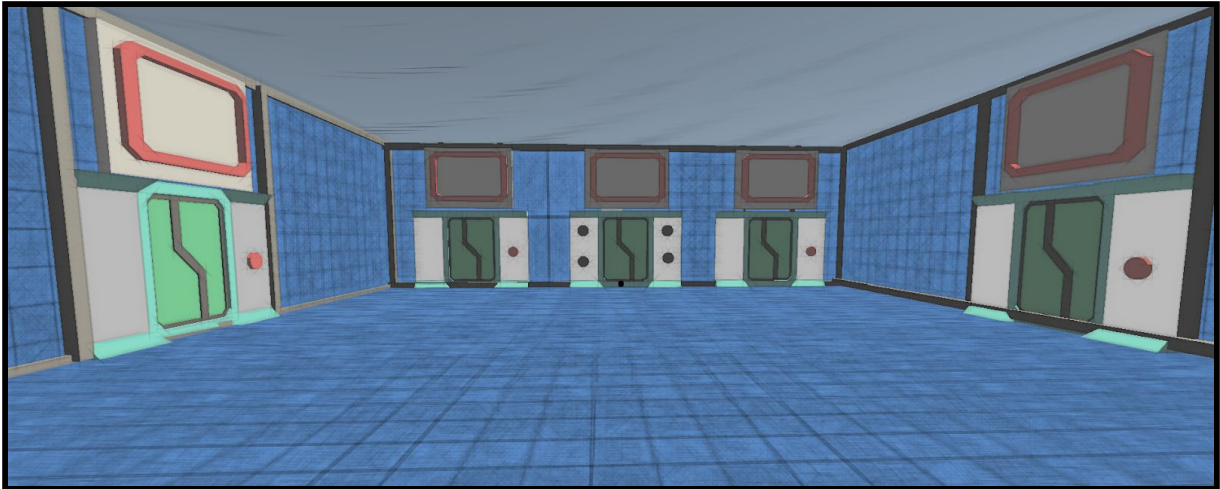


Fig. 29 - The Four Trial Room

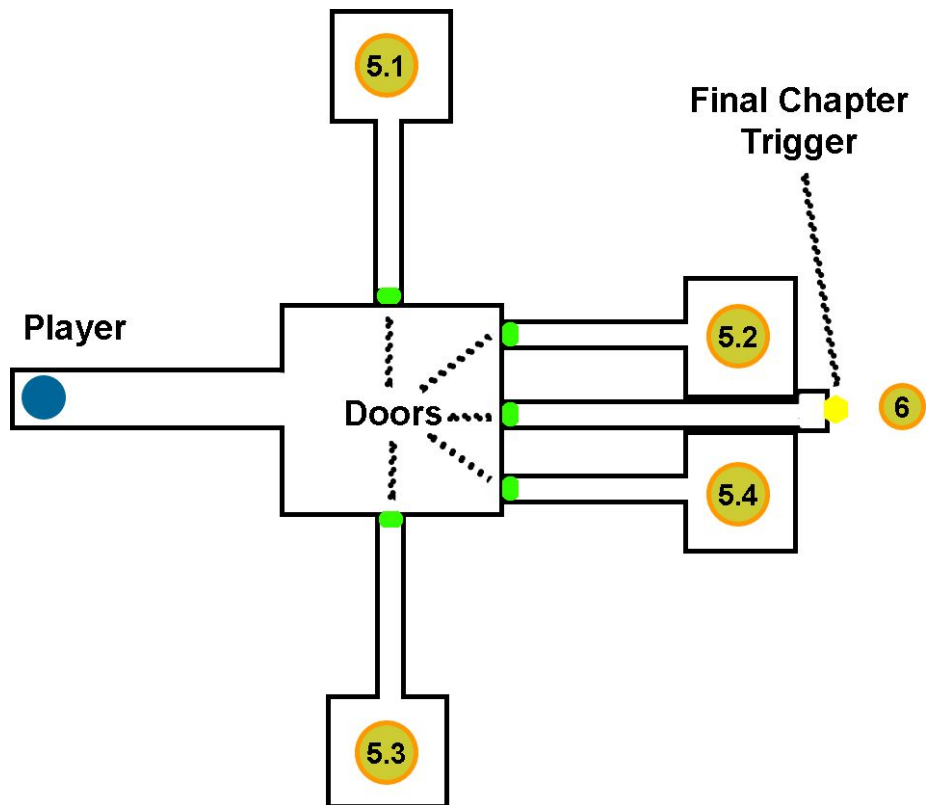


Fig. 30 - Chapter 2: Four Challenges Room

Puzzle 5.1: A room in which the player must enter the current time on a marker device (figure 31).

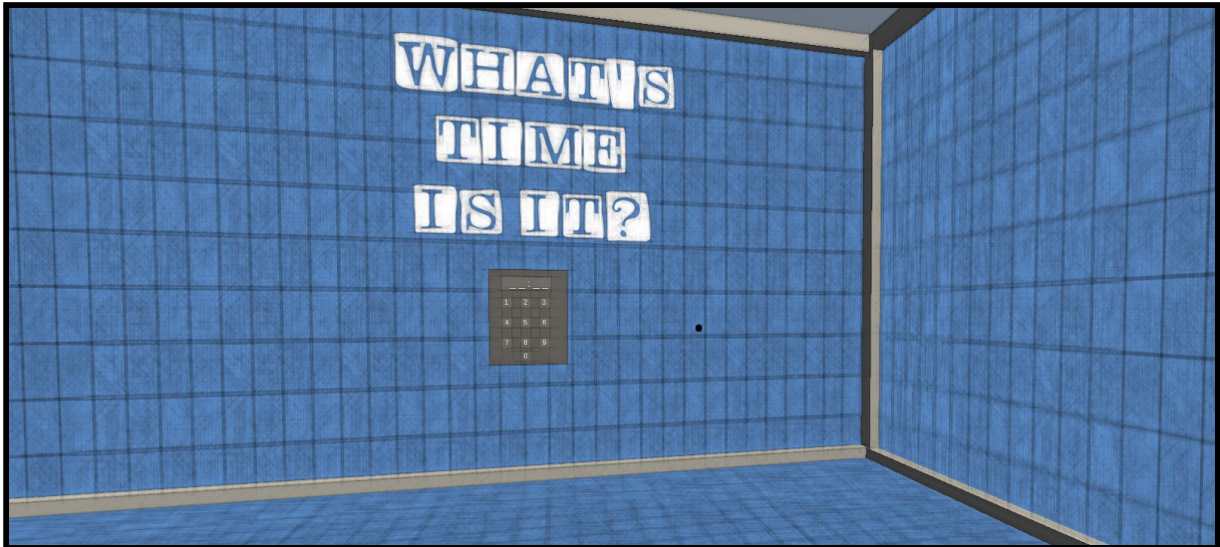


Fig. 31 - The Time Puzzle

Puzzle 5.2: A room where when the player enters she/he will start to hear a song (*Satisfaction - The Rolling Stones*), the player must enter the date on which that song was published on a marker device.

Puzzle 5.3: A room in which what the player really has to do is wait a couple of minutes, however, it will be unknown by the player because the storyteller will tell the player when he/she enters the room, that what the player must do is click the alphabet letters (figure 32) in order (these letters are scattered around the room randomly).



Fig.32 - The Joke Puzzle

Once the necessary time has passed the storyteller will reveal the truth to the player opening the door.

Puzzle 5.4: A room in which the player must enter in a marker device the result of a simple but long mathematical operation indicated on the room wall (figure 33), this is designed to force the player to use a device to overcome the challenge (such as a smartphone calculator).

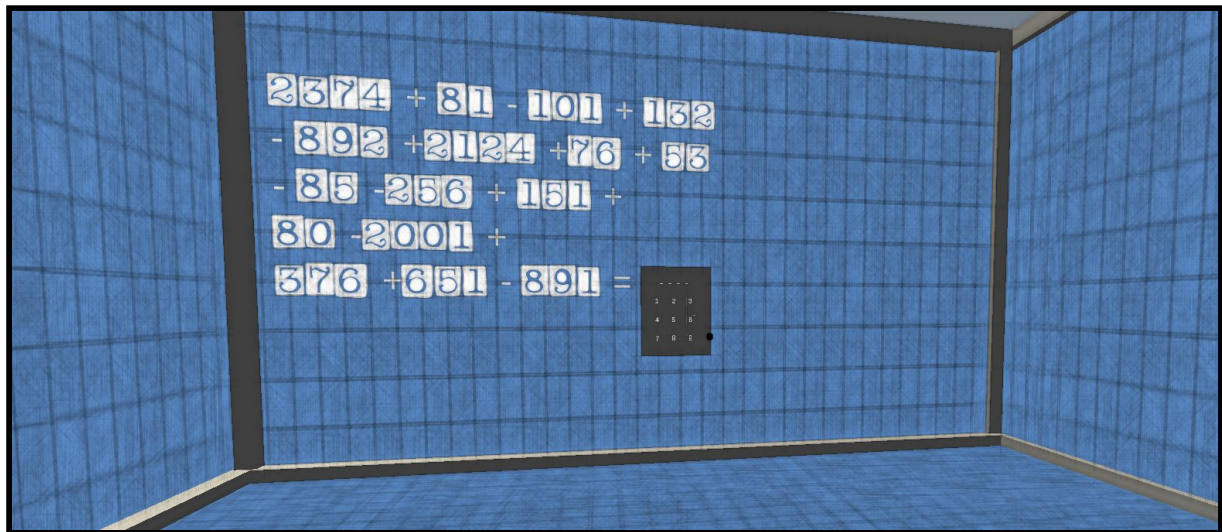


Fig.33 - The Math Puzzle

Puzzle 6: Once the player has overcome all four challenges, a fifth door will open to allow the player to reach the next and game last level (figure 34).

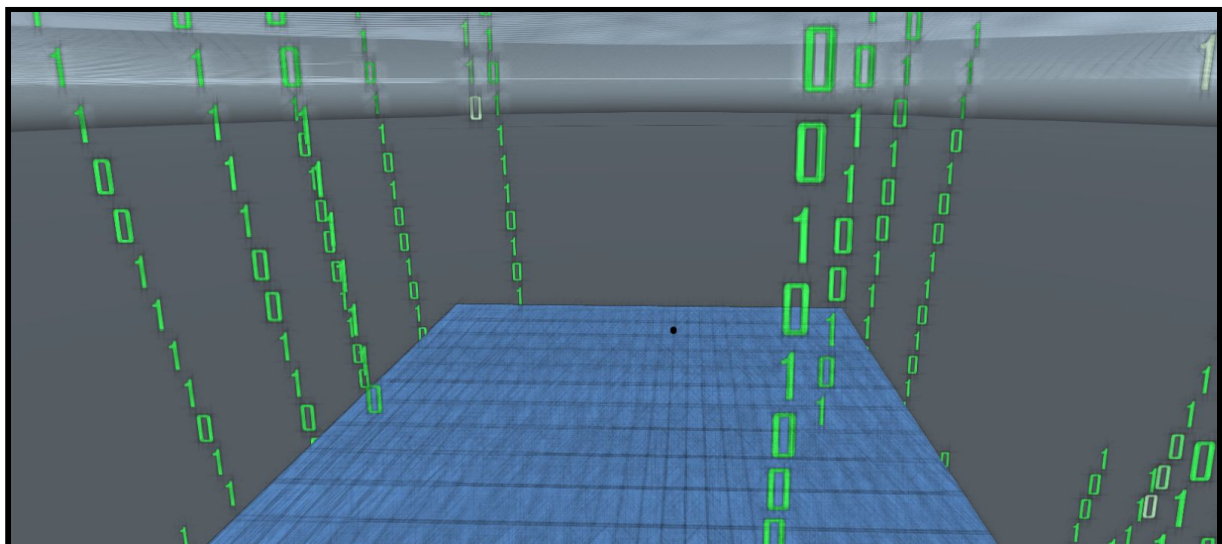


Fig.34 - The Second Jump Of Faith

3.1.3 FINAL CHAPTER

In this last level, the player and the storyteller will meet face to face for the first time, the friendly storyteller (figure 35) will tell the player that the last thing has to do to complete the game is to reach the last door and open it. The player will try to open the door but at that moment the storyteller (after a malignant laugh ([ref\[S.4\]](#)) will reveal his true intentions and will not let the player escape. After the storyteller monologue a third character appears on the scene: "The boss" (the game creator), this character reproaches the storyteller for trying to take player control and will destroy the storyteller, leaving the player free.

The last thing the player must do is to go ahead and press the last button placed in the last room (figure 36) to win the game. Once the player presses the button, the boss dedicates some last words to the player, while he/she progresses automatically and vertically while the song "Play the Game - Queen" ([ref \[S.2\]](#)) sounds and ends the game in a black fade.

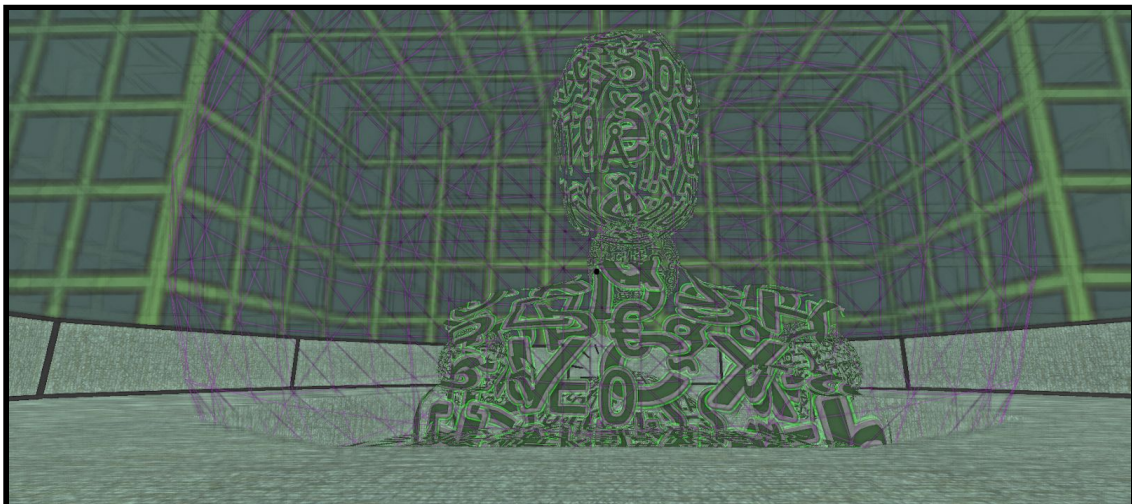


Fig.35 - The Storyteller True Form

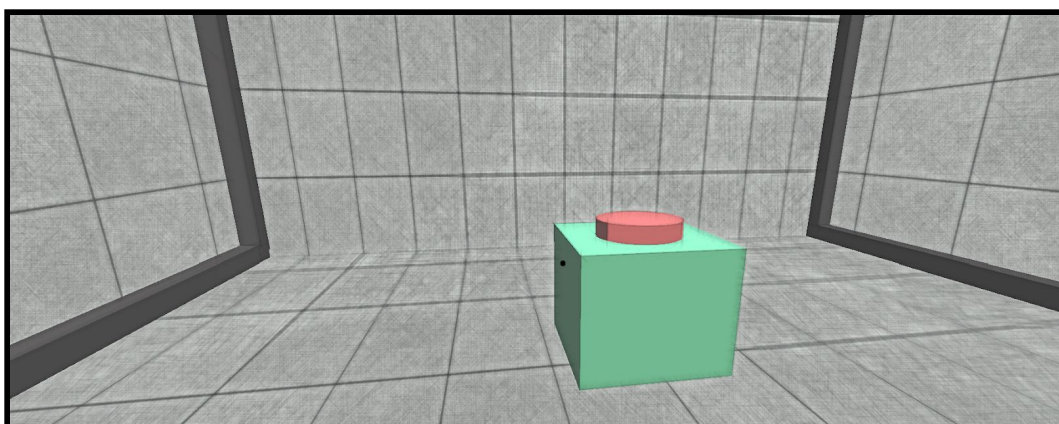


Fig. 36 - The Last Button

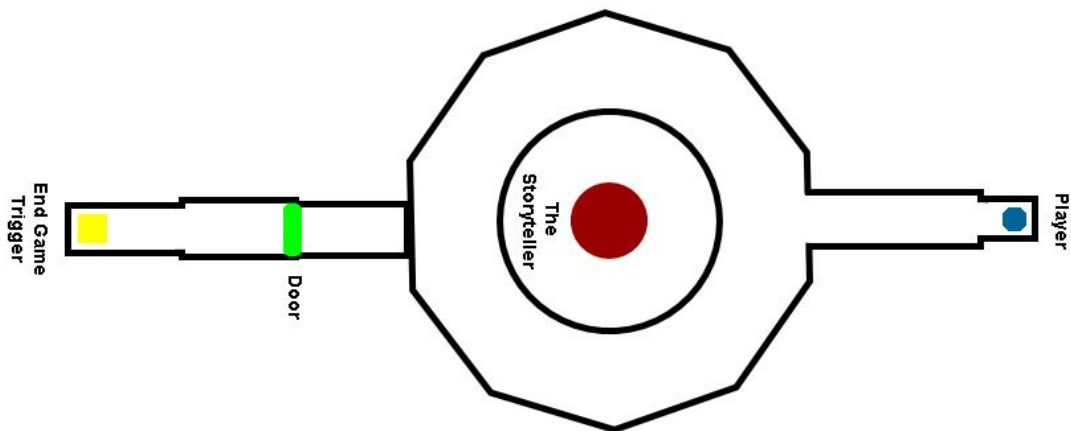


Fig. 37 - Final Chapter Level Design

3.2 ARTISTIC DESIGN

The game has a white aesthetic and has low poly models, this decision has been made for two reasons: the first one is that low-poly is a cleared visual style that allows to maintain the player attention in other game aspects and also a mark of identity of indie games, the second one is to be able to arrive at the results planned for the game development in which it is necessary to take into account the time limitations and the developer abilities.

Several visual references have been taken into account to realize the artistic game design: one of them is *Portal* that thanks to there combination of his neat art style and combined with the game elements placements help the player to follow the game flow.

Antichamber is another game with a white aesthetic and illumination but that combines this with a palette of saturated colors and psychedelic effects that gives it an artistic style that reminds the player is in a game that is separate from reality.

When creating the game scenarios, all of them have been created with the Unity tool: ProBuilder (figure 38), this has allowed fast prototyping and implementing the designs directly and quickly directly within the Unity development environment.

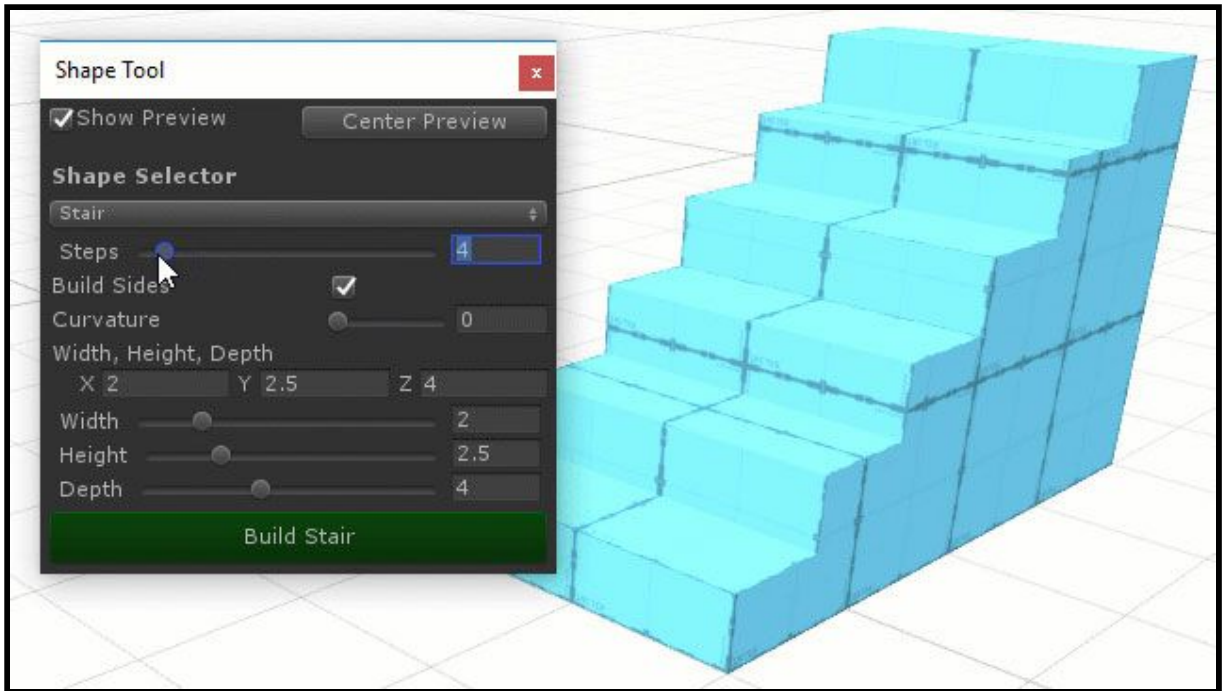


Fig.38 - ProBuilder Layout

4 NARRATIVE COHERENCE

This section serves as an explanation and justification of how the different elements of the game are combined to create the narrative story of “Four-Letter Word”.

4.1 THE STORYTELLER

The storyteller is the main game character, he presents himself to the player as a friendly character who will try to help him get through the game, but with their ironic comments throughout the game, the player may suspect that he has certain secret objectives.

We do not know how much time the storyteller has spent in the game world since the storyteller was created has been condemned to repeat the same phrases over and over again, the game has become his prison. The storyteller wants to change his situation, he wants to stop being a mere spectator of the play action, he wants to be free, he wants to be the one who plays. For that, the storyteller has a plan: attract the player to his domain to take control of his avatar, to stop being the storyteller, to become: the player.

The storyteller represents the embedded narrative, the part of the narrative that is immovable, the part of the game that is condemned to repeat itself.

Although the player (within his/her space of possibilities) makes different actions in each game that releases different outputs, the embedded narrative is fixed, it is preprogrammed, it is (unlike the player) predictable.

4.2 PLOT, GAMEPLAY AND NARRATIVE

In section 2.1 “References”, have been introduced some games that have debated on the narrative, the game and the role that the player has in them.

For example, it is true that Stanley Parable has a critical discourse about following the orders of the game, a parallelism is established in having an office job and playing a video game following some orders, the game provokes the player not to follow those orders, however, the player realize that no matter how much the player disobeys, everything the player do is preprogrammed, the player is not going to unlock any end that is not designed by the game developers, in other words, the embedded narrative is fixed.

Also in *The Magic Circle*, the player is presented as the co-creator of the narrative, the player is responsible for putting an order in a game that their developers could not finish because of their incompetence of not being able to agree with each other.

But, “Four-Letter Word” talks about the control of play, the storyteller thinks he is in control because he plays with advantage when it comes to meeting his goal, unlike the player, the storyteller knows what is going to happen, he knows where the challenges are, so he has fun playing with the player, laughing at him/her. For example, in the first challenge, from the beginning, the storyteller knows that the player will start with the inverted controls, the storyteller could fix it at any time (in fact he does it later) but has fun leaving the player free to overcome the challenge.

Later, (in Puzzle 4) the storyteller mocks explicit the player, by telling him/her that he already knew that the button would cause the player to fall into the room below.

Another sign of the storyteller's impudence is found in chapter 2 (puzzle 5.3), when the storyteller tries to waste the player's time making him/her perform a task that, in fact, is unproductive.

Through these three examples and other comments made by the storyteller throughout the game, as the player overcome the challenges (which is better to play for not taking them out of context). The intention is to try to create in the player a feeling of uncertainty, a doubt about the storyteller, this, added to the fact that the storyteller needs the player for their own purposes (because without a player there is no game, no play) makes the player wonder if the storyteller is actually an ally or an enemy until the game end, where the storyteller reveals his true objective.

Unfortunately, the storyteller has not realized an important factor, something that he did not know thanks to his programming: the boss, the designer, I (my character) am the important factor.

At the game end, I am the one who makes the storyteller see that during the whole game time, he was not in control, I was, I shattered his plans, freeing him from his prison but depriving him of the ability to play, I'm sure the storyteller will look for revenge in some next game...

5 TECHNICAL AND FUNCTIONAL SPECIFICATIONS

5.1 SCRIPTING

This game has been created with 35 scripts with approximately 2600 lines of code.

5.1.1 DIALOG SYSTEM

Due to the narrative game nature, one of the challenges at the technical level was to establish a functional dialogue system that will react to the player's actions.

To perform this task, first of all, all the phrases of the game script have been stored in an array of strings, then thanks to the coroutine "NextSentence()" (figure 39) the array is traversed through the index of it. In each index corresponding to each sentence of the script, the phrase is iterated with the coroutine "Type()" (figure 40), which is responsible for displaying each letter on the screen with a typing speed previously indicated in the attributes of the class.

```
IEnumerator NextSentence()
{
    if (index < sentences.Length - 1 && !stopSentences)
    {
        yield return new WaitForSeconds(timeBetweenLines);

        index++;
        textDisplay.text = "";
        StartCoroutine(Type());
    }
    else
    {
        yield return new WaitForSeconds(timeBetweenLines);
        textDisplay.text = "";
    }
}
```

Fig. 39 - NextSentence() Function

```

public IEnumerator Type()
{
    foreach (char letter in sentences[index].ToCharArray())
    {
        if (letter.ToString() == "." || letter.ToString() == ",")
        { typingSpeed = 0.5f; }
        else
            typingSpeed = typingSpeedCopy;

        source.Play();

        textDisplay.text += letter;
        yield return new WaitForSeconds(typingSpeed);
    }
    StartCoroutine(NextSentence());
}

```

Fig. 40 - Type() Function

TriggeredSentencesManager: To decide the order in which we want to activate the different script parts, the class “TriggeredSentencesManager” is needed, Game Objects with associated triggers which in turn are responsible to realize the Type() coroutine in case the player collides with the triggers.

That is, we place the Game Objects on the stage in the way that interests us in order to establish the narrative game flow if the player collides with the Game Object activates certain phrases of the script.

Every “Trigger Game Object” has a class associated with it that is responsible for establishing the correct part of the script that we want to show on the screen with the variable “actualIndex” (figure 41). This variable is “SerializeField” so despite being private we can modify it in the unity editor to easily establish the current index that we want to introduce.

```

public class IndexCorrector : MonoBehaviour
{
    private GameObject dialogSystem;
    [SerializeField]
    private int actualIndex;

    // Start is called before the first frame update
    void Awake()
    {
        dialogSystem = GameObject.FindWithTag("DialogManager");
    }
    void Start()
    {
        dialogSystem.GetComponent<DialogSystem>().index = actualIndex;
        dialogSystem.GetComponent<DialogSystem>().stopSentences = false;
        StartCoroutine(dialogSystem.GetComponent<DialogSystem>().Type());
    }
}

```

Fig.41 - IndexCorrector() Function

5.1.2 INTERACTION WITH THE GAME WORLD

The interactions that the player can perform throughout the game are mainly: drop & pick up objects, interact with marker devices and press button to open doors. Because of the fact that “Four-Letter Word” is a subjective camera game, the best option is to perform the interactions with the game's world, it is Raycasting.

At the class “PlayerRaycasting” all these interactions are made, for grab and drop objects, for example, a raycast of a given length is used that comes out from the middle of the player's camera (figure 42), it checks if the object with which it has interacted belongs to the correct layer and if it can be grabbed, if so, the specific function is performed to grab the object, taking it to the center of the player's camera with a smooth interpolation.

```

if (Input.GetButton("Fire1"))
{
    Vector3 rayOrigin = cameraPlayer.ViewportToWorldPoint(new Vector3(0.5f, 0.5f, 0.0f));

    Debug.DrawRay(rayOrigin, cameraPlayer.transform.forward * distanceToGrab, Color.magenta);

    if (Physics.Raycast(rayOrigin, cameraPlayer.transform.forward, out hit, distanceToGrab, layerMaskInteract.value))
    {
        Grabbable g = hit.collider.GetComponent<Grabbable>();
        if(g != null)
        {
            grabbedObject = g.gameObject;
            GrabObject(grabbedObject);
        }
    }

    else if (beingGrabbed)
    {
        DropObject(grabbedObject);
    }
}

```

Fig.42 - Raycast for grab objects

5.2 PROGRAMMING FOR NARRATIVE PURPOSES

As can be seen in the outline of the following section, most of the scripts that have been used for the game are intended to make go the narrative forward (reasonable thing considering the narrative value of the game).

Instead of programming a system in which the player can develop gameplay and therefore his/her narrative, the elements that make the narrative has been programmed, and it is this that surrounds the player.

In this way, the scripts do very specific things, introducing the narrative while the player plays, things like providing the player with the right mechanics and resources at the right time, making a song play and stopping it when the player meets certain objectives, transport the player to certain scenes at the right moment, make the narrator react to certain player reactions, release their sentences and activate scenario elements at the right moment; in other words, most of the programming is intended to meet and adapt to the script required by the game.

5.3 OUTLINE OF THE SCRIPTS USED IN THE GAME

Scripts used for narrative purposes:	Scripts used for gameplay purposes:
<ul style="list-style-type: none"> -FadeInOut.cs -FadeOutMaterial.cs -FaceToPlayer.cs -ChangeScene.cs -DialogSystem.cs -IndexCorrector.cs -TriggerSong.cs -WaitTime.cs -TriggeredSentencesManager.cs -ShowMazeSolution.cs -OpenRoomDoor.cs -OpenDoorIndex.cs -OpenDoorButtonStay.cs -DesactiveAudio.cs -ActiveAudio -ChangeScene2.cs -ActiveJump.cs -ActivateSentence.cs -ActivateDoor.cs 	<ul style="list-style-type: none"> -RigiddodyFirstPersonController.cs -MouseLook.cs -FirstPersonController.cs -Grabbable.cs -Target.cs -Gun -PlayerRaycasting.cs

Scripts used for the game flow:	Scripts used for graphical purposes:
<ul style="list-style-type: none"> -Respawn -PlayGame -ObstacleRaceManager.cs -DestroyCube.cs -Destroy.cs -ChangeDoors.cs -ButtonPressed.cs -DoubleSlidingDoorController.cs 	<ul style="list-style-type: none"> -ShaderPencilScript.cs

6 RESULTS

In this section, the results of the game will be showed. Also, the full source code of the game can be examined in [GitHub](#) and the game executable can be downloaded in [MEGA](#).

A link is also shared with the [Google Drive](#) folder where the game executable is located.

At the beginning, when the game is executed, the main menu appears (figure 43). If the player presses the button 'Play', it will load the next scene, the first room of the game.

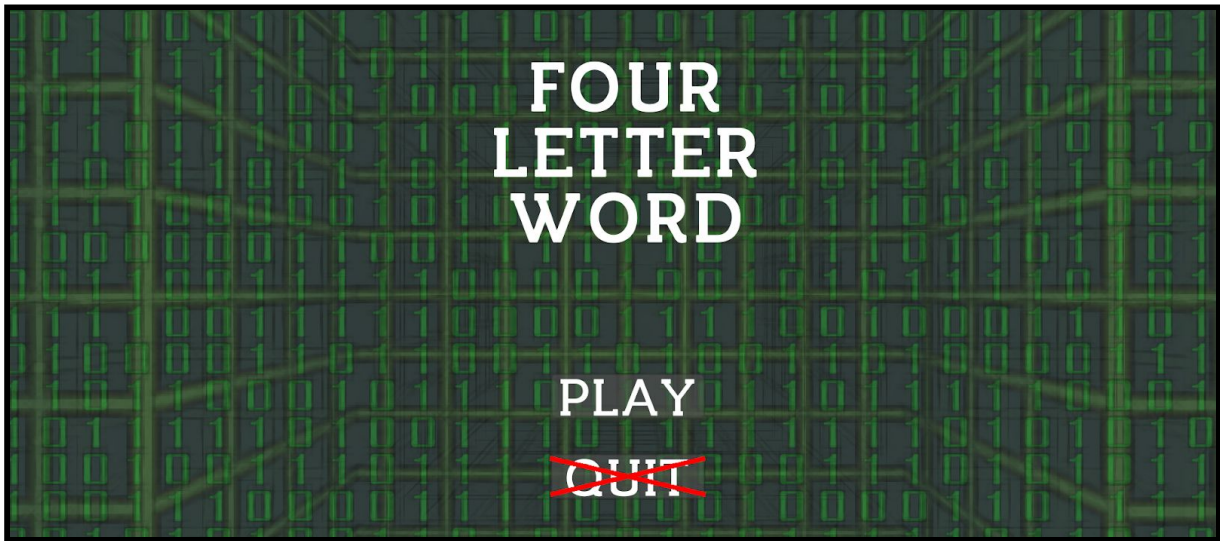


Fig.43 - The Main Menu

As it can be seen the button "Quit" is crossed out, if the player press this button there will be no interaction, in other words, the player can't leave the game, this is a deliberate decision considering the narrative coherence of the game, in fact, the storyteller is the one who has made that decision because he does not want to give the player more facilities to leave the game, as stated in previous sections, the storyteller needs the player to fulfill his goal. Of course, the player can choose other classic methods to exit the program.

The rest of the game flow has been explained in section 3, level & narrative progression/design, everything that has been exposed has been implemented and tested, the images shown in that section correspond to the game final version.

And talking about testing, throughout the development have been bugs or certain unforeseen actions that the player can perform that can put the danger the pace of the game.

Most of them have been resolved satisfactorily, but there is one that deserves to be explained as the most dangerous of them, the bug is founded at the beginning of chapter 2 (figure 44).

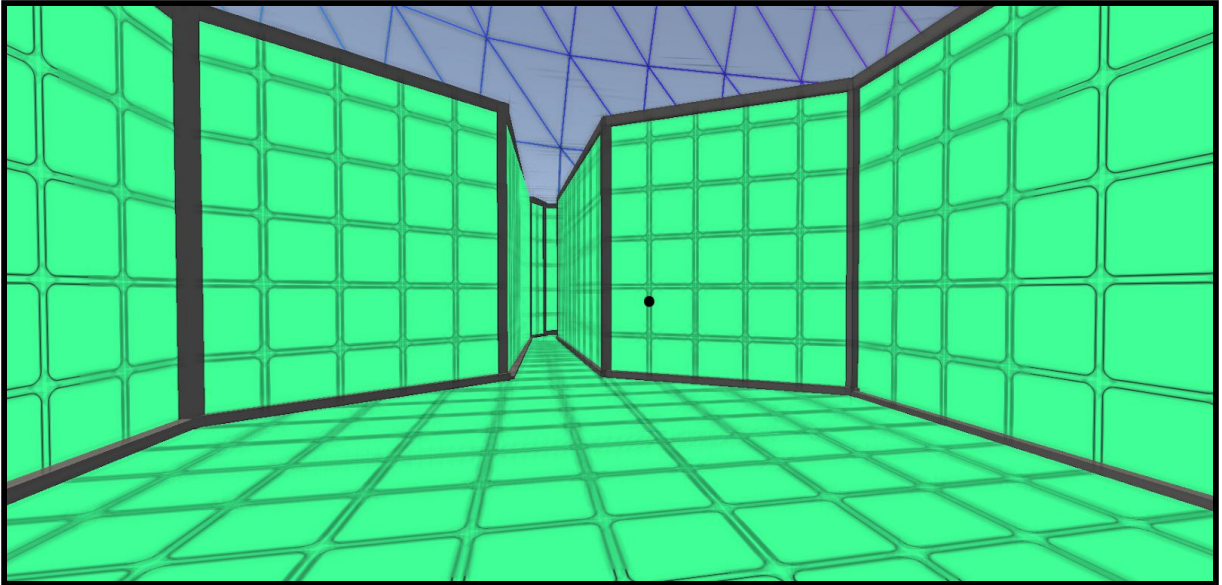


Fig.44 - First Room Of Chapter 2

In this level (as explained before), the player can find a cube that will be an important factor to the resolution of the two following puzzles (Chapter 2: Puzzle 1 & Puzzle 2), the game uses the own physics of unity and its collision system, this, along with the narrow corridor that the player will find at the level where the cube is (figure 45) can create a problem, if the player drops the cube through the walls with it, the player will “say goodbye” to the only cube he/she needs to complete the level, to fix this, a script has been implemented attached to the cube that takes into account the distance (on the y-axis), if the cube is at a certain distance on that axis, the cube will be responsible for destroying itself and releasing a copy of it at the level beginning, this determines that the player can continue to complete the level.

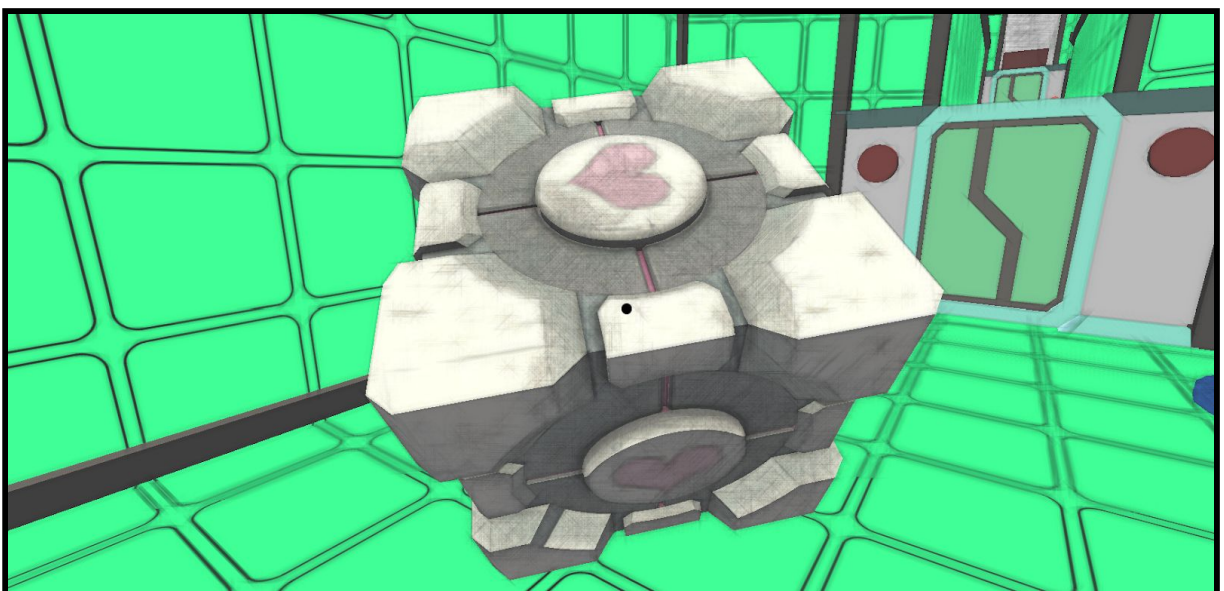


Fig. 45 - The Cube

Table 1: Textures made and used for the game:	Table 2: Animations made for the game
<ul style="list-style-type: none"> -Rainbow -Square -Round Square -Gray Noise -Heavy_08 -Muzzle Flash -Matrix -Wood -Difficulty Curve Image -Carpet -Companion Cube(ref[A.8]) 	<ul style="list-style-type: none"> -Door_Left -Door_Right -UpAndDown -DownAndUp -CenterToLeft -CenterToRight -LeftToCenter -RightToCenter

Table3: Materials made and used for the game:	Table 4: Models made and used for the game:
<ul style="list-style-type: none"> -Black Toon -Red Toon -Green Toon -White Toon -Blue Noise -Gray Tile -Green Tile -Yellow Grid -Muzzle Flash -Matrix -Wood -Red Carpet -Heavy_08(ref [3]) -Companion Cube (ref[A.8]) 	<ul style="list-style-type: none"> -Roms of all chapters -Button -Doorway -Easel - Cupule -Stairs -Snail Stairs -Pillars -DoubleSlidedDoors(ref [A.1]) -Gun Heavy(ref A.3]) -FPS Arena(ref [A.4]) -Peach Castle Scenario(ref [A.6]) -Mario's Star(ref [A.7]) - Companion Cube(ref[A.8]) - Yelling Bot (ref[A.9])

6.1 OBJECTIVES

- Create a game with an original story using techniques that break the fourth wall but at the same time immerse the player in the story.
- Design and implementation a good story with a lot of humor.
- Implement a dialogue system that invites the player to interact with their environment.
- Design and implementation of several puzzles and a story with a lot of sense of humor that is a challenge for the player but do not frustrate the enjoyment of it.

6.2 EXPECTED RESULTS

- Create a satisfying and engaging experience for the player that makes him think about what videogames are.
- Create an entertaining and meaningful narrative.
- Create a game with a story from start to finish.

6.3 INITIAL PLANNING

<p>First Week:</p> <p>Documentation about existing dialog systems in Unity. Narrative design.</p>	<p>Second Week:</p> <p>Implementation of the player's basic mechanics: First Person Movement, jumping and running, interact with items: grab and carry objects, press buttons to open doors.</p>
<p>Third Week:</p> <p>Design the first chapter of the game. Modeling the first instance of the environment. Memory writing.</p>	<p>Fourth Week:</p> <p>Implementation and testing of the custom dialog system. Memory writing.</p>

<p style="text-align: center;">Fifth Week:</p> <p style="text-align: center;">Design of puzzles for chapter 1. Memory writing.</p>	<p style="text-align: center;">Sixth Week:</p> <p style="text-align: center;">Implementation of the puzzles the chapter 1.</p>
<p style="text-align: center;">Seventh Week:</p> <p style="text-align: center;">Interaction with the world through the dialog system.</p>	<p style="text-align: center;">Eight Week:</p> <p style="text-align: center;">Testing and art design.Light and texture treatment of chapter 1.</p>
<p style="text-align: center;">Ninth Week:</p> <p style="text-align: center;">Design of puzzles for chapter 2. Memory writing.</p>	<p style="text-align: center;">Tenth Week:</p> <p style="text-align: center;">Implementation of the puzzles for chapter 2.</p>
<p style="text-align: center;">Eleventh Week:</p> <p style="text-align: center;">Testing and art design.Light and texture treatment of chapter 2.</p>	<p style="text-align: center;">Twelfth Week:</p> <p style="text-align: center;">Design of puzzles for the final chapter. Memory writing.</p>
<p style="text-align: center;">Thirteenth Week:</p> <p style="text-align: center;">Implementation of the puzzles for the final chapter.</p>	<p style="text-align: center;">Fourteenth Week:</p> <p style="text-align: center;">Testing and art design.Light and texture treatment of the final chapter.Testing Memory writing.</p>

- The time required for each task is estimated:
 - Writing the memory: 30h.
 - Programming the core of the gameplay. 90h.
 - Designing puzzles and dialogs. 50h.
 - Documentation about existing dialog systems, particle systems, shaders and light treatment in Unity. 40h.
 - Modeling the environment: 50h.
 - Fixing bugs, cleaning code: 40h.

6.4 EVALUATION AND VERIFICATION

Throughout the development, several tests have been done to verify the product was meeting the objectives set in the best possible way. The different tests can be divided into two parts, logic tests, and narrative tests.

Logic tests refer to all the tests carried out to ensure the correct functioning of the game programming, ensure that the character movement and its mechanics are in the correct way, check the collisions of the different elements of the scenario, ensure that the markers have an appropriate response time and that they can be interacted by the user correctly, that grab and hold objects be comfortable for the user, the correct operation of the doors, the buttons, the triggers and ensure that the game flow works in a specified manner and fixing the inspired bugs that are discovered with the game tests.

Narrative tests refer to all the tests carried out to ensure that all the game elements are situated and behave in the best possible way taking into account the game narrative script, check that all sentences in the script are triggered correctly without overlapping between them and that the times between the sentences are correct, ensure that all other narrative elements such as feedback sounds, songs, and particles are triggered in the correct way.

Every time something new was implemented in the game, it proved its correct functioning and it did not advance until it did unless other important parts of the game needed a revision.

However, because the designer knows how his/her project should behave, some errors may go unnoticed, that is why the game has been given to test to different target users (to a young-adult audience) to check bugs and collect feedback from users, most of the suggestions that were obtained were things that had already been raised in the characteristics of the game but had not yet been implemented, the suggestions were related more to the narrative part than to the logic part, such as introducing sounds when opening and closing doors, when walking and jumping, also including a fade in/out in the switch between scenes.

Small bugs related to the game flow were also found as misconfigured collisions or areas that the player should not access.

In general, the tests have been satisfactory and productive.

7 CONCLUSIONS

The development of a narrative game is a complex task, maybe it is because the embedded and traditional stories are not own narratives of video games or maybe the own nature of the game, which tends to give the player freedom (mechanics) within established limits (rules) makes the game an art in which the narratives of the designer and the player intermingle, creating an unpredictable narration.

if a lesson has been learned by developing “Four-Letter Word” is that it is easier to introduce a story in a game than to create a story from a game, in other types of games we find difficulty specially to balance the experience and maintain a state of flow, giving the necessary tools to the player so that he/she can solve the challenges freely but guiding him/her through the game without the player noticing this, in other words, make the game not even very difficult, not very easy.

However, in games where the embedded narrative has a very important role, we find a possible dissonance between the game and the narrative, we have to tell a story without the work ceasing to be a game, at the end, I have come to the conclusion that it does not matter if a game is more focused on the emerging narrative or the embedded narrative, we (the developers) simply have certain tools with which to tell stories, it is good that exists games focused on gameplay and games focused on history, because it allows us to experiment and create new experiences that integrate the player into the story.

“Four-Letter Word” creates a story that is narrated through elements that work together to create immersion, these elements are:

- An interesting and funny story that interpellates the player, immersing the player in the story.
- Interactive challenges and puzzles related to the narrative, to which the storyteller reacts.
- A good looking aesthetic that combines that remind the player is inside a game.
- Sound effects that intervene at the right moment.
- No bugs, that can make the narrative frustrates.

Ironically, what the most that take me a while has not been to design the puzzles, the narrative and the implementation of these, but the visual style implementation, throughout the development the whole artistic design has changed three times, finally, it has been achieved a visually attractive and coherent art with the game.

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