



DESIGN AND DEVELOPMENT OF A REALISTIC 3D

GAMEWORLD IN ORDER TO DEVELOP A HORROR  
VIDEO GAME IN UNREAL ENGINE 4.

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## 0.1 Acknowledgements

To my parents, Eliseo and Rosa, my brother Diego and my friends, I am surrounded by people who believe in me unconditionally. It would be nothing without you.

## 0.2 Abstract

The hereby document represents the Final Report for a bachelor's thesis on Video Game Design and Development. The following work consists of the Design and Development of a Realistic 3D Gameworld in order to Develop a Horror Video game in *Unreal Engine 4*. The project consists of the development of a horror video game based on the design of artificial intelligence, that would be able to perform differently depending on the player's decisions and experiences through the game, operating with automatic learning. The game will be developed in *Unreal Engine 4* for PC; The player will be placed inside a closed house in which his skills will have to maintain the artificial intelligence alive. Personally, I will focus on explaining the part that I have worked on: The development of the environment, 3D art, materials, textures and lightning.

## 0.3 Keywords

Hyperrealism, Interaction, PBR Materials, Immersion, Unreal Engine 4.

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# Chapter 1

## Introduction

In this section, we will explain the bases upon which the project has been set up, what were the initial objectives, the modifications we made throughout the development, and the final results of the video game. In addition, we will talk about the initial planning, the reference subjects, the estimated cost and the graphics engine used.

The general idea of the project was born due to the possibility of working in pairs. My partner, *Miguel Fernández-Montañés Domínguez*, and I shared the same project's objective, with some minimal distinctions such as the fact that my partner was deeply interested in the design sector, whereas I'm more focused in the art discipline. We were able to find a perfect balance that concluded in this work.

Nevertheless, we have both worked on all the areas this project encompasses, specialization allows us to get deep into what we are most interested in.

### 1.1 Objectives and Unreal Engine 4

For a better introduction of the project, it is important to understand the proposed objectives beforehand. Due to the fact that my coworker and I, as we noticed, were looking to get deeper into the art and design areas, we were able to find the faultless solution: acquire knowledge of the video games graphics engine *Unreal Engine 4*, which seems to be the most appropriate tool to make our objectives meet efficiently.

Furthermore, due to our interest in having realistic graphics in this game, *Unreal Engine 4* was chosen. As it is oriented perfectly towards this realism we were after, for example, it has pioneering tools such as RayTracing compared to the lack thereof in other engines. In terms of the performance, despite it being a really heavy engine, it appears to be just as good as any other. *Unreal*

*Engine 4* help pages are impeccable, their official courses page was a great help in the project [3]. As for the programming, *Unreal Engine* provides us with the blueprints tools, which consists of a sequence of visual concepts shaped as nodes, that you can connect to make different elements. This tool allows us to make video games effortlessly and with more visual aspects covered. As for the editors, *Unreal Engine* is infinitely more complete than the others. An example of this is how we can apply effects over a sound or even chain effects without writing any string of code, modify properties of a 3D object like the collider or the UV is or even use an editor to compose the artificial intelligence through behaviours trees. Regarding teamwork in *Unreal Engine*, we can confirm its utility thanks to controlling versions tools such as Git. Even so, *Unreal Engine* becomes handy to people who are not in programming, allowing them to participate in the development of the video game using the engine without the need of a programmer. The applications of *Unreal Engine* are improving day by day, better and better, leading it to be one of the best engines used in the industry. *Final Fantasy VII Remake*, *Ark*, *Fortnite* or *Dragon Ball Z Fighters* serve as examples of this quote. Lastly, the stability is getting better and faster than any engine. Actually, *Unreal Engine 5* has been recently announced; its launch will bring revolutionary changes, especially in graphics aspects. We can see more information in [1]

According to everything above, *Unreal Engine 4* has become one of the best choices to develop video games. Due to the pursuit of reaching the fullest potential in video games graphics tools, the choice of using this engine was made. Usually, engines like Unity are related to mobile or 2D video games, meanwhile *Unreal Engine 4* is usually associated with realistic video games, although it could be advisable and convenient, it may not follow the trend.

Therefore, the process of understanding the workings of this engine was arduous, taking our efforts to the limit and armouring ourselves with patience and perseverance for the sake of getting sufficient knowledge on these topics and being able to apply the advantages this engine provides.

Furthermore, another of our objectives was the development of a video game with autonomous user learning, a dynamic game to play repeatedly without being tedious to the user. Artificial intelligence was created as a solution to this difficulty, impersonating the main character and making the entire emerging narrative flow around it. In other words, the video game was designed to focus on a dialogue system between the user and the Artificial Intelligence, both trapped in a house. The user's exploration of the environment modifies the dialogues with the character, and therefore, the narrative. Artificial Intelligence was developed by blueprints.

The development of an immersive environment was our next purpose. Taking into account that not everyone has the same immersion capacity, nor many people have the spatial intelligence which allows building visual models mentally,



scrupulous care of Visual effects (VFX), the illumination, the materials, the textures, the particles, the movement and sound had to be carefully crafted, to help the player make assumptions about the presented world and feel it vivid and real. The lack of incongruous vital signs in the game world is one of the most interesting aspects of space presence and having that in consideration, the decision made was that the unique environment that could enhance this component was a house as the game's stage since we are also looking for absolute immersion and presence of the player as an absolute entity of our fictional world. The decision was to create a totally polished and consistent environment that allows the player to feel completely involved. As concluded that the project is, at this moment in time, it can be affirmed that the proposed objectives have been met accordingly.

## **1.2 Initial Planning**

The project planning has been volatile throughout the process of development and adaptations have been made, along with reorientations in directions. Here we present the final planning and the hours invested, although in section 9 we will explain it in more detail. The initial planning can be seen in the figure Initial Planning and the final one can be seen in the figure Final Planning.

Team member	Task	Time (in weeks)
Both	Search of assets	2 weeks
Sara	Implement animations	2 weeks
Sara	3D modeling of missing assets	2 weeks
Both	Implement sounds	2 weeks
Both	AI design	1 week
Sara	AI movement	2 weeks
Sara	AI implementation (in-game)	2 weeks
Both	Narrative script	1 week
Sara	Main and pause menu	1 week
Sara	Save system	1 week
Sara	Interactive conversations	2 weeks
Both	Interactable elements	3 weeks
Both	Lighting	1 week
Both	Record dubbing voices	2 weeks
Both	Edit dubbing	1 week
Sara	Accessibility	1 week
Both	Testing	3 weeks
Both	Each one's memory	3 weeks

Figure 1.1: Initial Planning

Task	Time (in hours)
Game Design	20 hours
House Building Blueprints	15 hours
House 3D Model	30 horas
Assets 3D Model	30 hours
Restoring assets from libraries	25 hours
Metahumans	15 hours
Narrative - Dialogues	15 hours
PBR Materials	30 hours
Unreal Engine 4 Imports	30 hours
Landscape	10 hours
Illumination	20 hours
Reports	20 hours
Final Report	40 hours
<b>Total</b>	<b>300 hours</b>

Figure 1.2: Final Planning

In the foreground, there were major changes in the organization of the project because finally the scenario was not taken from Internet, but I personally took care of its development. Due to also the exit of Metahumans, I dedicated a large part of my work to the study of these. This focused my project and did not leave time to touch the programming of the Artificial Intelligence and the Menus that my partner took care of in its entirety.

In the background, there was also no time to record the voices of Artificial Intelligence, this is a very expensive process since we need a recording studio

that external institutions had to provide. Also, a voice actor agreed to record its voice. For lack of time, it could not be implemented. However, if the project continues, it is a part that will not be dispensed with.

### 1.3 Related Subjects

- VJ1216 - 3D Design
- VJ1218 - Hyper Media Narrative and Video Games Analysis
- VJ1221 - Computer Graphics
- VJ1222 - Conceptual Design of Video Games
- VJ1226 - Character Design and Animation
- VJ1231 - Artificial Intelligence

### 1.4 Estimated Cost

In this section, an estimation of the expenses of the project development will be represented, analyzing its dimensions. Giving an exact figure is almost impossible since variables can present ambiguity, although we can make an approximation.

The game would consist of 4 months of part-time development, 600 hours entirely, 300 hours for each worker. It is predicted that we would need a junior programmer and a junior artist. They get paid about 1400€ for month. About 9000€ approximately in workers salary for game development.

If you invest in the development of the game on your own, the intermediaries would not be taken into account but even so, we must take into account other variables such as purchases of licenses for the programs in which the game will be developed.

- Autodesk 3DStudio Max: 267€/month.
- Unreal Engine 4: Free but takes 5 percent in case of profits.
- Photoshop: 24,19 €/month.
- Audacity: 0€
- Mixamo Animations: 0€
- Mixamo Animation Converter: 0€
- Quixel Bridge: 0€
- 3D models from Epic Games MarketPlace: 0€

In conclusion, the estimated cost would be around 12.300€ roughly.

## Chapter 2

# Research and References

### 2.1 Game Concept

The main referent consists in *Hello Neighbor*, a sneaky horror video game where the player has to raid the neighbor's house and find out the secrets he hides in the basement. The player plays against artificial intelligence that modifies its behaviour, for example, placing traps along the paths the player chased during the previous attempt. The concept of this video game project, however, focuses more on narrative aspects of the game and affective ties, therefore, the similarity between these two game concepts is dizzying.



Figure 2.1: Hello Neighbor

## 2.2 Narrative Design

This section will be explained in depth at point 5, however, it is important to have into consideration that this narrative does not intend to disclose a significant matter of mental health and that is why the narrative focuses on making the player aware of the existing mental discomfort that father suffers - or really- his own mental alteration. Nonetheless, topics such as diseases, treatments or technicalities, are presented during the game, the player is not even supposed to know if the father is mentally ill or not. Despite this, the game does emphasize that there is a problem, a duel, a past, a resentment, which leads to consequences in the present time, whatever happened, resurfaces, which is not banal.

It must be highlighted once again that this narrative does not investigate, nor does it seek to do so, in the processes of mourning, the aftermath of this process, or in child abuse because this TFG does not seek to be a research work on mental issues, as it is not the job of the video game industry to do so and there is no pretense of falling into labor intrusion, likewise it seeks to make the player live an experience. The narrative promotes and drives this experience.

One of the principal references which follow this train of thought would be *The Beginner's Guide* (2015) [10] by the creator of *The Stanley Parable* (2013), whose game describes the story of Davey, a narrator who is not convinced about games Coda develops and modifies them, turning Coda into a symbol. Coda, tired of being pigeonholed, develops a final video game to Davey that functions as a farewell, his final creation, before dropping out of the video games development industry. What is actually happening is that Coda does not exist, the narrating Davey and the original Davey are in effect, the same person. The commitment is this game has two premises, **premise 1**: the game is not real, **premise 2**: the game informs the player that it is not real, in figure 2.2, a fake room can be seen. These premises have been presented along with the narrative of the video game and it is not only intended for the player to read the narrative but also to be punished in small tests during the game that checks if he is becoming self-aware of what is happening around him. Coda is a fictional point just as the father's illness is a fictional point. How is it possible Coda does not exist? How is the father not sick? Are these feelings reflected from something that did occur and was used to channel it into the game?



Figure 2.2: Fake Room - The Beginner's Guide

All these discussions of authenticity tend to obscure any discussion of simply accepting the game as fiction, and moving from there, to what the game has to say. This could be caused because what these types of games are trying to say is very slippery, as intended by the game because the game is very meta. This manipulates the player about how meta his commitment should be in the game. In other words, the player does not know if the developers are playing with him and where they want to guide him. For instance, coming back to *The Beginner's Guide*, Davey clearly suffers from the impostor syndrome, the game is narrated from his perspective, which leads us to think that the player's job is to feel identified with that anxiety, that is portrayed through the figure of the narrator and that the player inhabits in some way.

But the game clarifies around the end that he is a fictional character who, indeed, has done a good job. Now, the player's next question might as well be, does Davey want me to question the fact that I reflexively identify with a bad person, since they suffer a type of pain that I recognize and that somehow my point of view is being distorted?, which may lead to thinking, if Davey wants me to question the fact that I have been questioning myself, only to project that intention on him later, leading to rumination on these ideas.

At the moment in which the player is put to the test, guiding him towards a story that is false and is in need of his ingenuity and skills in order to be conscious and act accordingly, the player may as well become aware of all the signs given by the game, doubting each one of them. Everything the game is saying could also be a meditation on the fact the game is saying that. "If the

father is not really ill and what I perceive is the consequence of my own personal aftermath, how much can I trust myself? And how much can I trust the game?



Figure 2.3: Coda to Davey - The Beginner's Guide

## 2.3 Artistic Design

To understand the artistic design of this game, it is necessary to remember that the only scenery presented in the game is nothing more than a house, which intends to create absolute immersion for the player. This is the reason why the artistic references are primarily architectural. The artistic references are split into two large groups that were united creating a less ordinary style. The first referent was based on a luxury style as it can be seen in figure Modern Architecture or modern architecture and the second one was rustic architecture as it can be seen in figure Rustic Architecture.

Furthermore, due to the fact the narrative demanded to work in a closed space that acquired life on its own and transmitted to the player, the project was forced to involve itself actively in the study of neuroarchitecture. The question made for the construction of the house was, is it possible for a space to condition the player's feelings? more so, can space modify its behaviour? Can it even modify our minds and thoughts? To all these questions, neuroarchitecture claims: yes.





Figure 2.4: Modern Architecture

Neuroarchitecture is a discipline that takes into account how context modifies the brain, and therefore, behaviour. This is what we call the dialogue between mind and space that is based on the feedback happening between what space proposes and how the mind recodifies it. For centuries, architecture has been used to stir people or either to cause an effect on them. During design, architects have the capacity and ability to act indirectly in our brains. So the question is, in what position are video game developers? The video game is an art composed of multiple other arts (considered the eight arts [8]), and as games have evolved, the subdivisions that accompanied them were also required to evolve, therefore, architecture (first art), music (fourth art), or narrative/literature (sixth art) and others, were required to change too.

Behind video games questions regarding mortality, time, duel, or relationships are found. This emerges due to the mix and the encounter of high and low culture. The provocation, the curiosity, the innocence and the laugh of a child, all of these mixes inside the video game, and the complexity that lays behind them should be recognized. Videogames are a genre that recognizes itself as a bastard, before postmodernity artistic laws were organized hermetically (paint-architecture-literature) and sometimes people were allowed to combine them, but only if the distance between them remained. Mozart was permitted to write an astonishing Opera such as “Las obras del Fígaro” (1786) from librettos that are romantic comedies, however, music still positioned words and meaning in the background. For example, paintings were good paintings when they distinguished themselves artistically, independently from the theme, since themes were more naturally expected to form part of literature; nonetheless,

when videogames emerge in the middle of all that chaos, they become part of the bomb that launches itself against the world of art, videogames are bastards because they loot from all disciplines and combines them without any problems: Zombies acclimated in world war two, platforms inspired by Van Gogh. The more time passes, the harder it is to sort out its gender. Humour, amusement, play predominates without maintaining any kind of coherence or adequation. This project itself was based on glorifying and dissociating the limits between games and architecture. Architecture, which is an art itself, is being frequently referenced since this video game considers it a fundamental part that must be treated accordingly and meticulously, as the character will inhabit it and make it his own.

To observe the effects of architecture in our brain [2], examples such as the biologic institute of Salk come to mind, where a small resting area was built with dark-coloured walls, the objective of this kind of architecture building was to make the people that inhabited the living room uncomfortable so that they would not wish to enlarge their resting time.



Figure 2.5: Rustic Architecture

In what measure has the game taken into account architecture in order to model and texturize the house? To further elaborate this, two of the main decisions regarding architecture will be explained in full detail. The first choice was to implement modern architecture. People tend to consider luxury architecture a form of art bathed in fantasy and artificial properties, and that's exactly why it is loved and hated at the same time. It is important to remember that ar-

chitecture is still matter and the relationship that the house sustains with the characters is key. This type of architecture stands out for modeling an interior atmosphere of resistance through spaces that end up intertwining, creating an environment that provides a sensation of fluidity, space and satisfaction. In the section of Artistic Design the process of creation of the house will be thoroughly explained. Despite what modern architecture represents in these present times, the player arrives to the house after many years and it belongs to the father, the person who goes through all those fluid spaces, there is no room for the player to feel that it belongs inside that space, the mobiliary and the objects that compose it are destroyed and are not exactly positioned conventionally where they belong.

The house is transparent, white, and it offers diaphanous spaces that are high and very well lit. It's attractiveness is imminent. Everything seems to point out to the fact that the house should be a place that makes you feel welcomed, protected and sheltered. However, the first shock that the player encounters is the fact that this is further from the truth, the furniture is old, baroque and lackluster, typical of rustic architecture which prevents the player from feeling as sheltered as it could. On the other hand, even though the house is full of windows and clean and white materials that give away a sensation of amplitude and lots of direct sunlight, regardless of when the game is started, the game already has a series of hours saved and all of them are in almost absolute darkness. Since the beginning of the game, the player finds itself locked in an environment that inhabits a cognitive dissonance itself, the whole place is trying to make you channel a specific emotion and the complete opposite one, you never really get to feel in harmony with the environment.

This dissonance pretends to be the one who accompanies the player through the narrative and the dynamics of the game, never allowing the player to let his guard down or rely on what is presented in the game, always doubting everything that happens in its surroundings. The architecture also possesses a narrative.

## Chapter 3

# Game design

### 3.1 Flow diagram

The game is composed of five screens: **Main Menu**, **Options Menu**, **Pause Menu**, **Inventory Screen**, and **Game Screen**.

The **Main menu** is the start screen of the game, the first one the player will be in contact with. Four different options can be selected: to start a new game, to continue the started one, to go to Options Menú, or to exit the game.

The **Options Menu** allows the player to change graphics quality, game volume, and a function that permits to highlight the outline of interactable objects when the player is next to them, designed both to accommodate the game to the player as a measure of the accessibility of those who may have any type of visual function diversity. Ultimately, the Main Menu button can be pressed in order to go back to the main screen.

The **Pause Menu** consists of many different options like resuming the game, returning to the Main Menu, accessing the Options Menú, or quitting the game altogether. When the player enables this screen, the game will pause completely along with the time-flow of the game, showing the player a blur effect over the game screen.

The **Inventory Screen** will contain the player's collectibles and narrative items, which will serve to give narrative clues to the player and display in which part of the game the person is positioned.

Ultimately, regarding the **Game Screen**, this is the primary screen of the game where the player will experience the course of the story, on which you can access the inventory and the Pause menu.

The schema in Flow Diagram is a visual representation of the flow of the game:

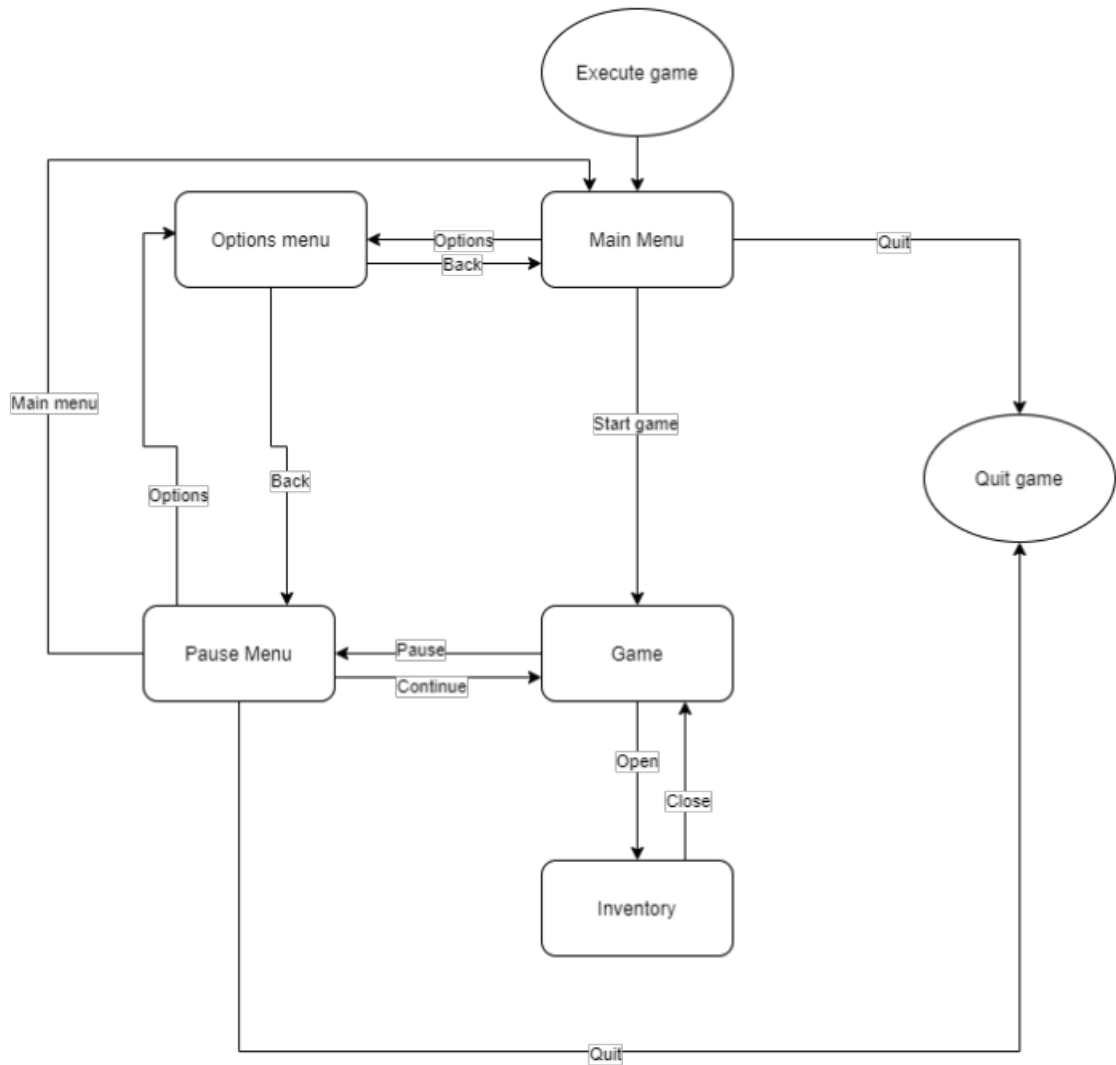


Figure 3.1: Flow Diagram

## 3.2 Mechanics

The player will have two control options according to his preferences: **Mouse and keyboard**, or **joystick**. Now we are going to explain the control mecha-

nism of each one:

- **WASD keys // Left joystick:** Player's movement.
- **Mouse movement // Right joystick:** Camera control.
- **X button // E key:** To select and interact with different functionalities such as dialogues, item interactions.
- **A button // Mouse left click:** To select in menus and dialogues, house tasks.
- **B button:** To cancel or go back to the previous menu.
- **Shift key // B button:** To run inside of the game.
- **Y button // Q key:** Access to achievements menu.
- **TAB key // Start button:** Access to pause menu.

Gamepad example in 3.2:

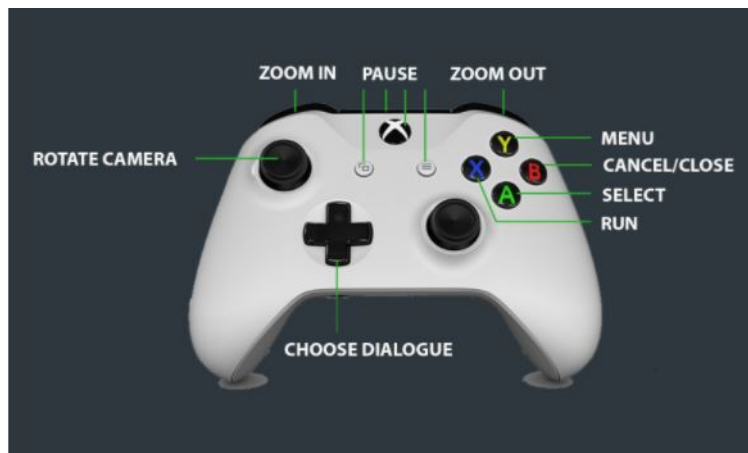


Figure 3.2: Gamepad Controls

Keyboard 3.4 and mouse 3.3 example:

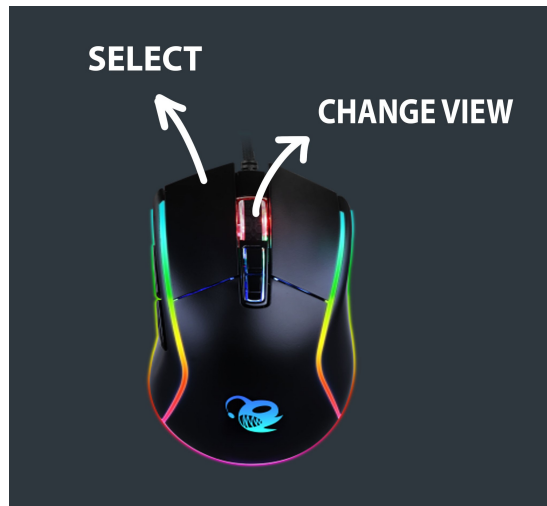


Figure 3.3: Mouse Control

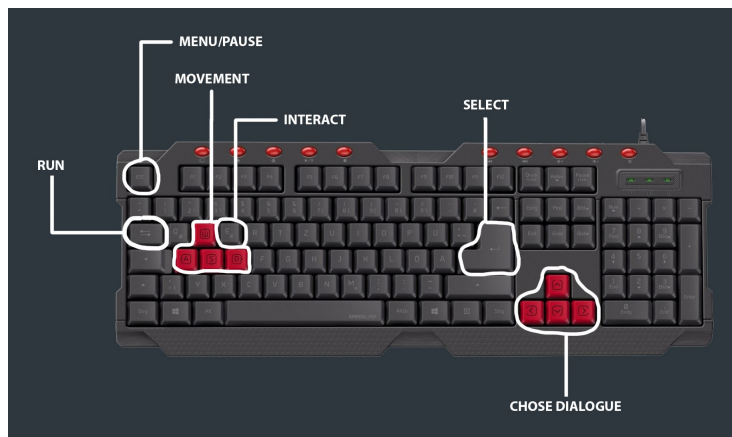


Figure 3.4: Keyboard Control

### 3.3 Menus

The game has for principal menus: Main Menu:

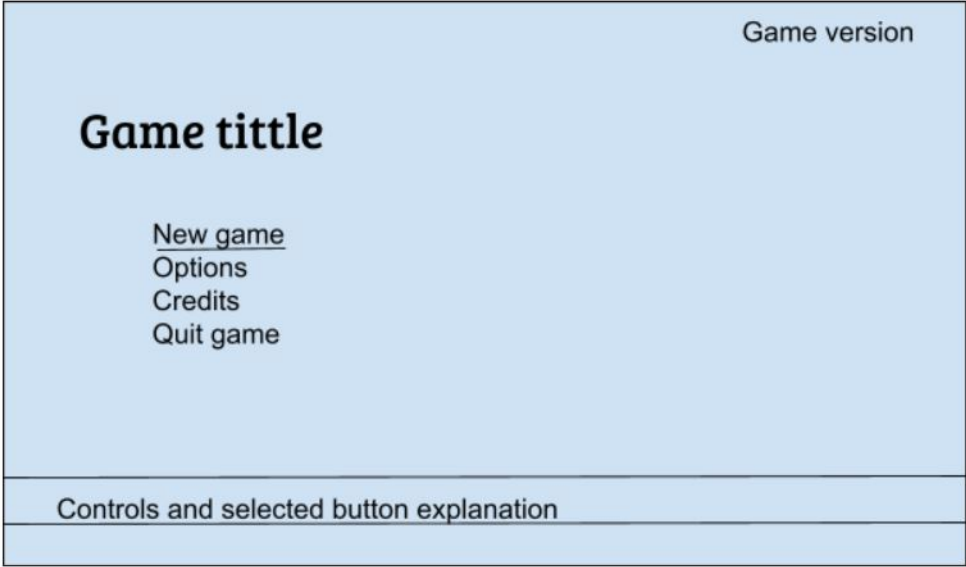


Figure 3.5: Main Menu

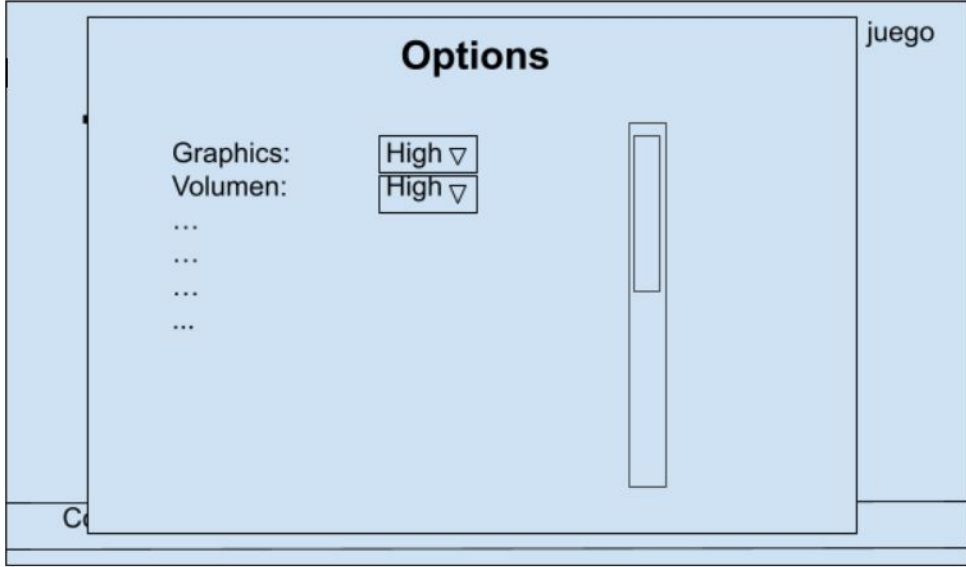


Figure 3.6: Options Screen



Pause Menu:

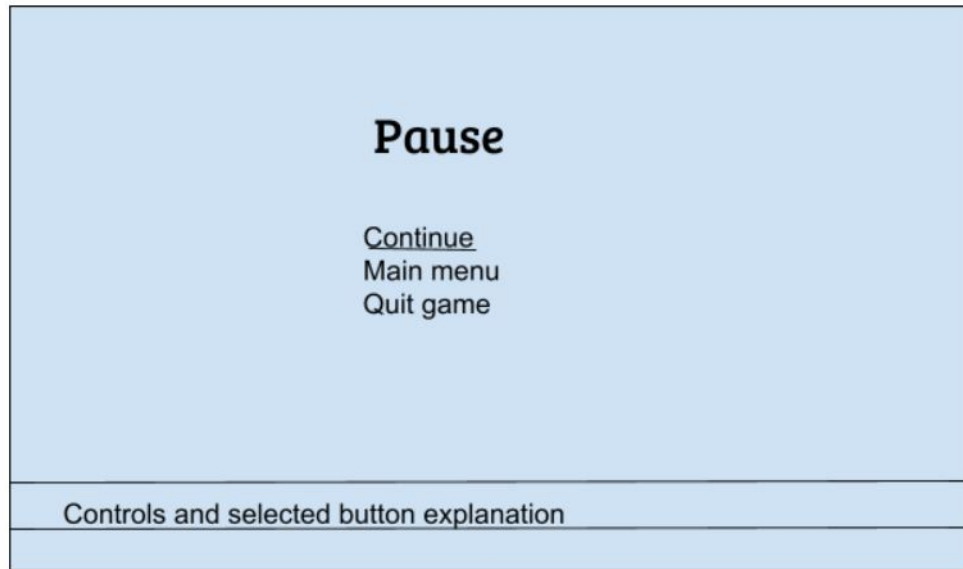


Figure 3.7: Pause Menu

In-Game Menu:

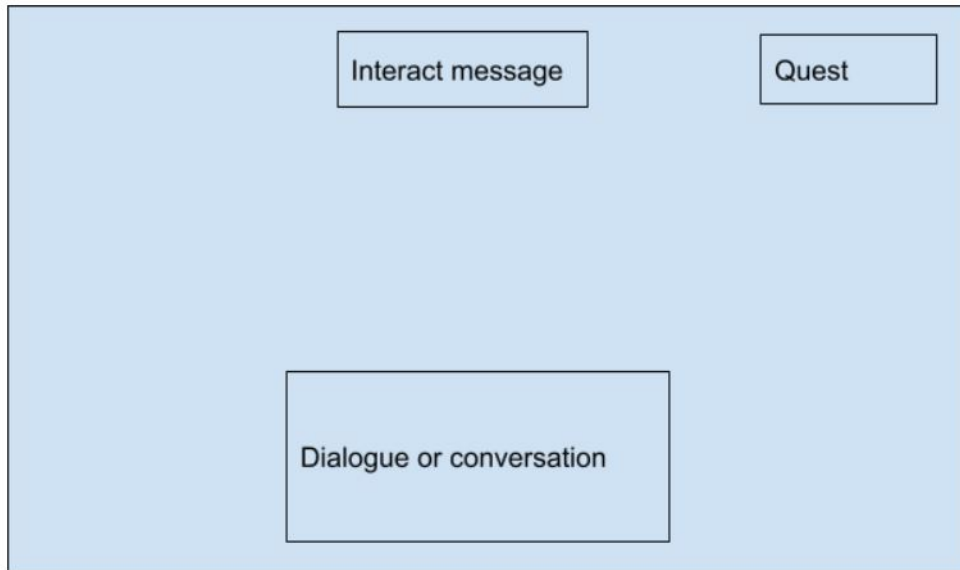


Figure 3.8: In-Game Menu

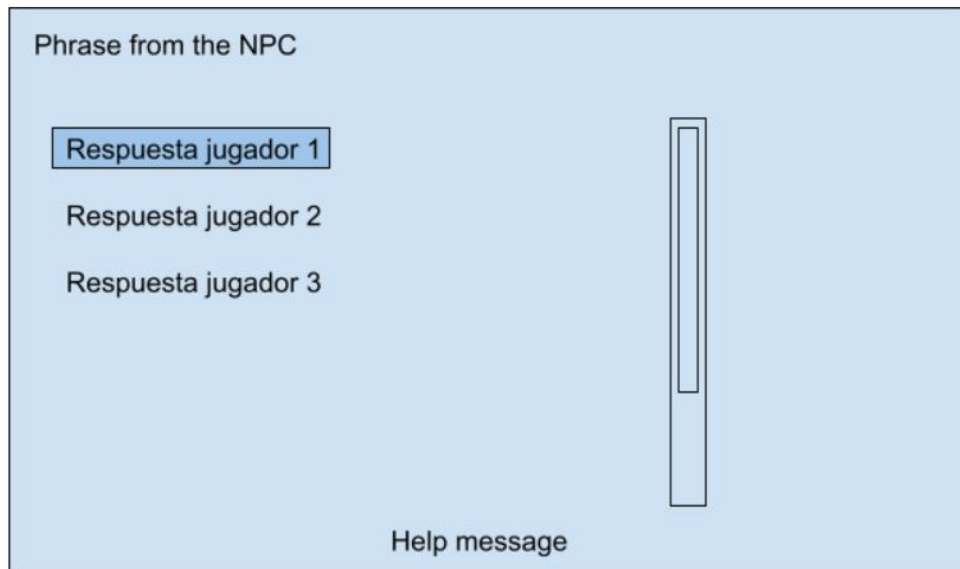


Figure 3.9: In-Game Menu

Inventory or Notes menu:

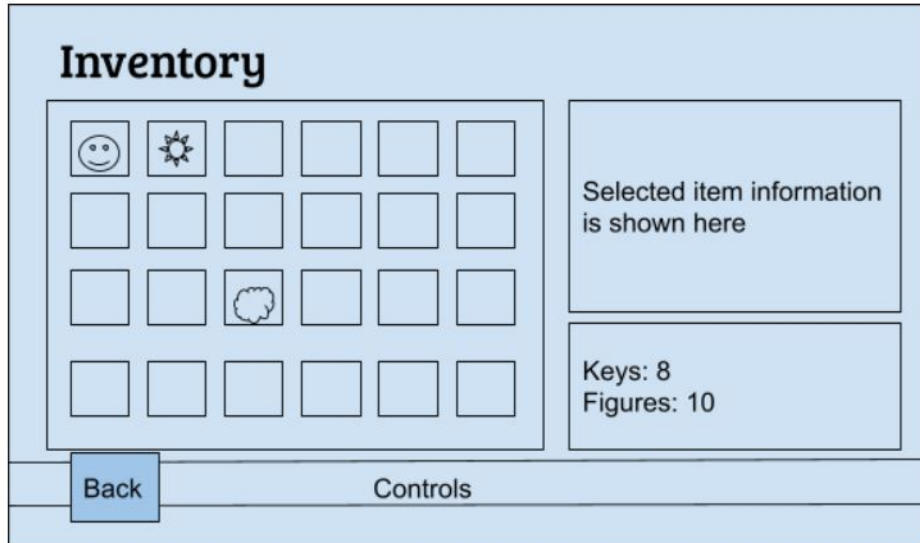


Figure 3.10: Inventory or Notes menu:

## Chapter 4

# Technical Art

### 4.1 Import 3ds Max to Unreal Engine

Assets importation was one of the biggest challenges this project has brought down due to *Physically Based Materials* (PBR), which are not supported by Unreal Engine. At 7.1 section, it is explained why it is so important to work with, meanwhile it will analyze the advantages and disadvantages this choice provoked. More information can be found in [6]

3D modeling and house architecture was done with 3ds Max which is a modeling software with infinite possibilities and highly specialized in realism, in terms of architecture it is almost mandatory to work on it. The V-Ray rendering engine was installed, more information in [12], widely used in infoarchitecture that is constantly advancing. It powers the research and development of hyper-realistic image creation as well as the research of materials which compose the landscape of digital design.

Commonly, it is used to work with V-Ray-3ds Max-Unreal Engine work pack when dealing with complex scenes that host thousands of polygons and dozens of lights, it needs a rendering engine to match. Adaptive lights, proxy objects, distributed rendering: V-Ray has an arsenal of production-proven features. Because the project had such ambitious dimensions, it had to work with software that could support it.

Thanks to this decision, the opportunity to work with the V-ray tool was real with V-ray Asset Browser. It consists of a toolbar with filter and quick search options, a V-Ray material library, a preview section and a favorites section, with which it can be chosen a rather complex library of PBR materials, through which it was possible to texturize the scene or start from PBR materials from which it would later arrive at other more complex or better adapted to the needs.

## 4.2 Problems

Despite how common it is to work with these three softwares, *Unreal Engine 4* is not compatible with PBR material. This fact constituted a formidable challenge as all of our work was jeopardized.

Nonetheless, developers have proposed multiple solutions to this conflict. First of all, one must install plugins on the rendering engine: Datasmith importer (figure 4.1) and Datasmith importer FBX. After installing the application of Datasmith exporter (figure 4.2), Epic games is reinstalled, this permits the tool in 3ds Max to export archives in .udatasmith format. Exporting this format and importing from the plugin Datasmith, one can sort out the problems that arise and implement PBR materials built from V-Ray without losing any kind of quality.

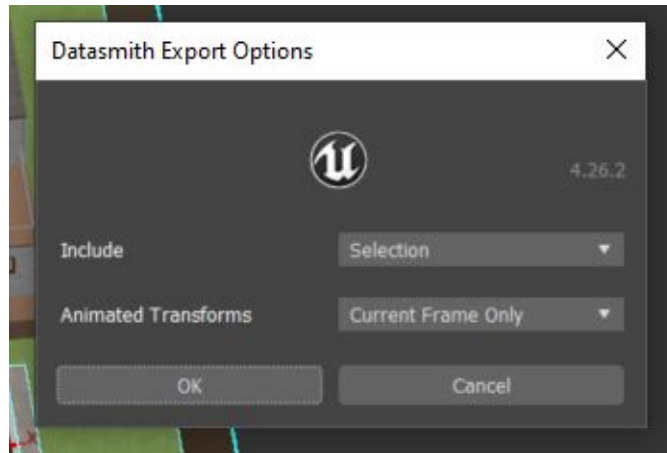


Figure 4.1: 3ds Max Export with Datasmith

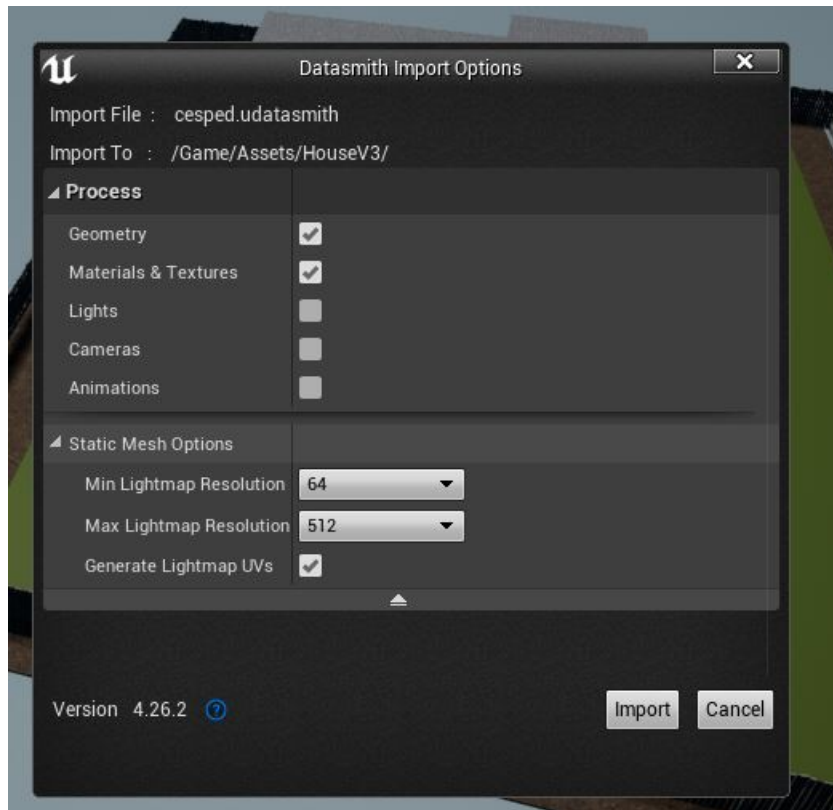


Figure 4.2: Unreal Engine Import with Datasmith

Foremost, the protagonist of another of the problems that arose during the elaboration of the project were the proportions. Unreal Engine functions with centimeters as standard, whereas 3ds max, specialized in infoarchitecture, converts centimeters into meters as default. This error is very common among 3ds Max operators, especially since it is vital to work in the same unit system.

In this case, the problem was rooted in working in meter units on 3ds max, which opposed many problems. First, the assets of the libraries were too big, and when scaling the measures uniformity ended up being collateral damage, deforming large objects since instead of working on a 1:1 scale, you labor with 0.03125 scales, the smallest scale that Unreal Engine admits. In order to solve these problems, rescaling the house on 3ds max was required and translocating it to Unreal Engine. As a consequence, all assets were imported once again and furniture accommodation adrifted. Many labor hours were lost, but even so, it was still an inversion for future work.

### 4.3 Illumination

A sun is the initial item to set in a scene in order to provide ambient lighting. The implementation of a real time sun was not possible since it needs an excessive amount of power and provokes a really noticeable fps downgrade. Nevertheless, in every new game, the luminosity information of the sun is chosen randomly in a range of hours between evening and midnight, which makes the player unable to play during daytime and get away from the immersion. Information about illumination can be found in [11]

An Atmospheric Fog component is also added, which dissociates the boundaries between the background and the sky and gives a more realistic feeling, an example of a scene lit only with a static sun and a fog component could be seen in image of Unreal Scene with Solar Illumination and Fog:



Figure 4.3: Unreal Scene with Solar Illumination and Fog

The lighting is made up of a great diversity of objects to enhance its realism, which are of vital importance in order to work with a scene that pretends to be realistic.

In the first place, a volumetric light map density volume should be placed for the sake of providing local control over the density of the samples within the scene areas and increase the number of samples in specific areas, which will be a volume of about 10x10x10 centimeters. Secondly, a Lightmass Portal is placed at transparent volumes as windows, it works by forcing Lightmass to send rays toward the portal. Then, *Sphere Reflection Capture* stands on the scene. Many of these can be placed around the world with almost no performance impact as they are calculated before run time. The *Sphere Reflection Capture* captures how the environment looks from that point of view. That capture is then used as reflections on the surfaces that are inside the influence radius of that reflection capture actor. The following element is the *Box Reflection Capture* which

has a box shape, and it uses parallax corrected cubemaps. While the box shape is less commonly used in comparison to the sphere shape, it is so adequate for interiors that have a box shape themselves.

The use of lightning is crucial when it comes to represent a scene, an image of the dining room will be shown below in mode Light Complexity of Optimization Viewmode, there will be problems if some lights are overlapped, as in the case of four Points Lights for emulate an interior lightning. It can be seen in Light Complexity

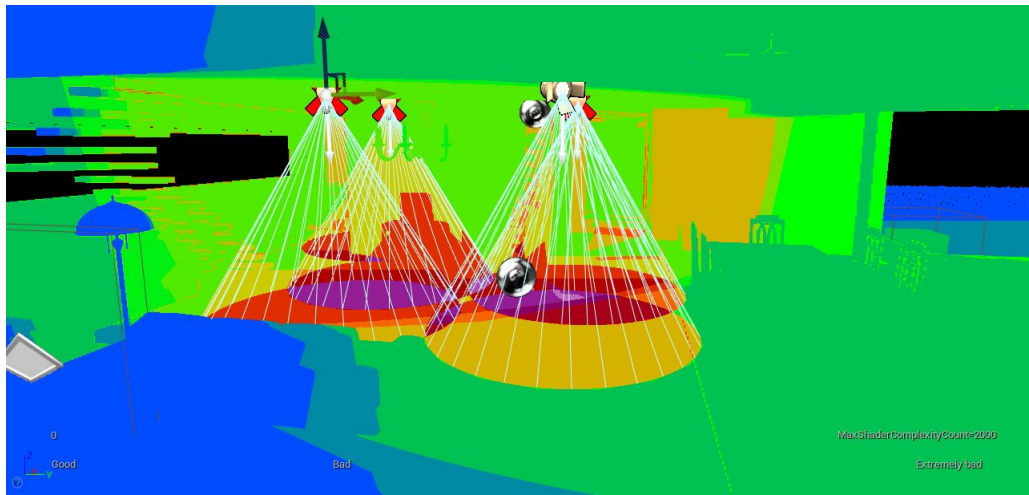


Figure 4.4: Light Complexity

The components of which we have spoken previously simulate an exterior illumination and enhance interior lighting, but there are no rules that should be followed during the structuring of interior light distribution. This project has implemented Point Lights, Spotlight and Directional Lights in order to affect the player as wished.



## Chapter 5

# Narrative design

### 5.1 Runtime Narrative

The game begins with a call asking for help from the mother, a phone call directed to the protagonist in order for him to come back home and take care of his father, but apparently what the game does not tell us is that there is indeed something wrong about the house, something that is not properly working, something that the mother is running from. Not long after arriving home, it does not take long for us to notice that things are not working as they should be. The father -almost- riddles us with dialogues that make reference to the three main topics around which the game revolves: past, trauma, and escape. The game does not delay itself in showing you that the father has abrupt mood changes, gets easily exasperated, and constantly alludes to something that happened a long time ago while behaving in an unconventional way. Besides the dialogues, there are constant references to objects that manifest these four main ideas: pill ingestion, alcohol around the house, a house-made mess, and broken crockery. These elements most likely are not interactive but even so, there are narrative elements with which not only you can directly interact but also reveal what actually happened. These narrative elements not only speak by themselves but also unblock narrative dialogues with the father.

But the important question is, what really happened in the referenced past? We can not explain the narrative of this game without making the distinction between the two big elements that compose it: the son's reality and the actual reality.

Storytelling can be simple or can be astonishingly complex, depending on the genre of the video game and which tools are selected in order to present it. In this case, one of the principal tools is the dialogues in decision making, where the player will, in its own skin, experiment with the consequences of the decisions it takes, be it during the dialogues or the tasks that are entrusted to

the player.

The **son's reality** represents what the game wants you to think at first, what appears at the house, the objects, the story, and what the narrative is revealing. The reality seems to be allegedly true. Once you go inside the house, your father, who you supposedly have not seen in years, starts to entrust you with home tasks. He does not hold back when he has to tell you what he feels or thinks and the game allows you to comprehend that the father is not well; the pills, the alcohol, the dialogues, he appears to be insane, dances in the bathroom, he constantly references the mother and walks as if he was disoriented and unstable.

This is the reality that the game presents us at first sight, but what happens if we go further and beyond that? The story appears to be fixed and static, the story that the house is disclosing. But also there is another story that is not told, that is presented through the dialogues and the narrative elements. It is not hard to realize that two parallel narratives exist in contraposition. The father has dialogues such as "I promise you that everything I did was for you and your mother" or "I do not want to think much about how I neglected your mother, I'm never going to forgive myself for that, son". Throughout these dialogues, the father complains about how you have abandoned him, how he neglected the family for a greater good and all the resentment and rage that is present in the relationship, how he feels repentance, and that he is indeed conscious of what happened which is unlikely of the insane human being that the game wants us to perceive in him.

One of the main values that the game pursues to communicate is that nothing is as stable as it seems, not the word of the father, not the house narrative, and maybe, neither what the player believes nor thinks. The intention is to make the player doubt the story as time passes, ultimately, the final goal is to make them doubt themselves. What if the father is not that evil? Are these the consequences of the child that are toying with him?

How does the game portray the reality of the game, that one which you have to fight for in order to perceive? The true reality is that the father is not really sick and the player is actually distorting reality due to the aftermath and resentment endured during youth. The player is suddenly submitted to small narrative tests where the father asks about the past, and depending on what the player chooses, the father will respond in one way or another while changing his behaviour according to the point in the story the player is situated in. On the other hand, the game includes narrative elements such as notes, the mother's diaries or father's, family pictures, and child drawings. These elements can be stored inside the inventory and the game itself will provide you an objective description of them.

This is not the case of a linear narrative, but a **Runtime Narrative**, mean-

ing that there is not only a specific ending or a sole storyline for the plot. The game flows along one plot line or another depending on real-time events. The narrative that accompanies the user depends solely on the actions or execution time events, these actions or events chosen by the player are responsible for reaching a certain ending of the game, other objects, different dialogs, and a completely different game experience. A runtime environment is in charge of all the actions of the story and executes them on the platform of the game.

## 5.2 Dialogues

The dialogues are distributed on an Excel file as a database and *Unreal engine 4* interprets it accordingly to a keyword that is selected randomly among others.

The first window consists of **tutorials**, these dialogues will only and exclusively display on the tutorial that the player will previously decide to play (or not) at the beginning of each new game. Each dialog includes an ID, a position on the scene, a talking character -usually the father- a dialog script, phrase tone, and an element that activates it. It is shown in Tutorial Dialogues

A	B	C	D	E	F	G	H	I
KeyName	Place	Character	Line	Voice direction	Triggered by	Key Word	Audio Record	Madness
1	Entrada	Padre	¿Otra vez tú por aquí? Pensaba que después de la última vez ya no querías volver a verme	Apenado por su vuelta	Entrar en visión		Collapse01	
	Entrada	Billy	...					
	Entrada	Padre	Como siempre tú tan callado y pasivo. Realmente así nunca vas a superarlo, ven joder, a ver si espabilas. ¿Quieres que te refresque un poco la memoria de cómo va todo en esta casa?	Algo enfurecido	Respuesta del jugador			
	Entrada	Padre	Si.		Elección del jugador			

Figure 5.1: Tutorial Dialogues

The second window presented is **questions**, the father or the artificial intelligence has multiple states: Upset, Search, Upset, Object, Investigating, Waiting for the task, Past, Trauma, Escape, Assign task, Question, and Snooping player. It is shown in Question Dialogues

ID	House Place	Character	Line	Voice direction	Triggered by	KeyWord
1		Padre	¡Billy! Ven aquí necesito que hagas algo por mí	Furioso gritando		Busqueda
2		Padre	Hijo, ven un momento que tengo que decirte una cosa	Neutro gritando		Busqueda
3		Padre	¡Biiiiiiyyyyy!	Furioso gritando		Busqueda
4		Padre	¡Billy! ¿Puedes venir a echarme una mano?	Neutro gritando		Busqueda
5		Padre	Billy no estoy jugando al escondite	Ironico		Busqueda

Figure 5.2: Question Dialogues

Depending on what happens in the game, the player will activate one of the

states of the artificial intelligence that will cause it to jump among certain dialog scripts and others. These will pop up randomly according to what activates the dialog phrase. The database is composed of more than a hundred dialog lines, foremost making it very difficult to be presented with repeated sentences.

Lastly, about **answers**, these are unblocked by default and as the player interacts with other narrative elements that are around the house, it will discover the narrative and the option of asking questions and replying to the artificial intelligence will be unlocked. It is shown in Answer Dialogues

Line	Response	Triggered by
1 ¿Para qué son las llaves?	Abren diferentes puertas de la casa, pero no te quiero ver husmeando por ahí	Llave
2 ¿Para qué son las llaves?	No me gusta que nadie toque mis cosas, Billy, deben estar encerradas	Llave
3 ¿Para qué son las llaves?	¡Mis llaves! Si encuentras una traémela hijo, hace tiempo que no las veo	Llave
4 ¿Por qué tomas pastillas?	Na, nada soooon paaaraaaaa... dolores de cabeza que me dan a veces, sí dolores de cabeza, nada grave no te preocupes.	Pastillas
5 ¿Por qué tomas pastillas?	Ayudan a tu padre a no volver a trabajar	Pastillas
6 ¿Por qué tomas pastillas?	Yo no tomo pastillas, Billy	Pastillas
7 ¿Dónde está mamá?	Te preocupa algo que no está presente, ni el pasado ni el futuro existen, centrate en el ahora y verás como todo va a mejor.	Foto Familia
8 ¿Dónde está mamá?	Mi amor... donde estará mi amor...	Foto Familia
9 ¿Dónde está mamá?	Ha ido a comprar ¡No tardará en venir!	Foto Familia
10 ¿Dónde está mamá?	Lejos de esta casa Billy, por fin tomé el valor para vivir	Foto Familia

Figure 5.3: Answer Dialogues

These dialogues are written with the thought of having a progressive narrative so that the player is not exposed to all of the information of the game in a burst, but gradually and steadily phased in order for the story to be enjoyed fully.

## Chapter 6

# Artistic Design

### 6.1 Gameworld

This section will explain the development process of the house: the main environment of the video game. First of all, the project's synopsis was designed with a clear premise and direction to focus on. Afterwards, the design, narrative, and art references were structured in order for the elements of the game to be coherent with each other and to compose a harmony that promoted the player experience. Plans are shown in figures First Floor Plans and Second Floor Plans

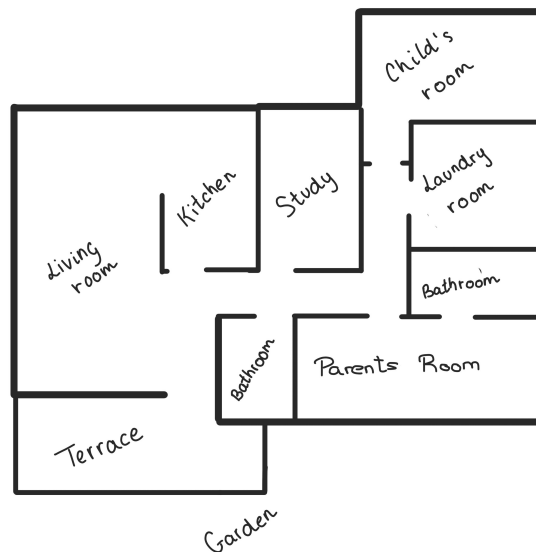


Figure 6.1: First Floor Plans

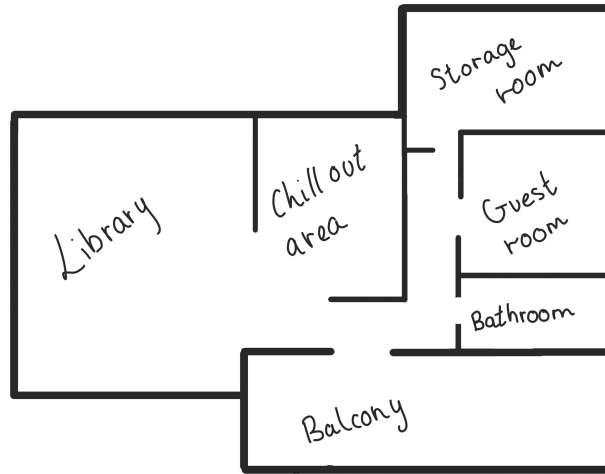


Figure 6.2: Second Floor Plans

These plans are designed for a two-story house (plus basement), with large windows and a large garden. These plans were imported into 3ds Max and the walls of the walls began to be erected from there. The final result can be seen in figures View 1 - 3D Model of the house, View 2 - 3D Model of the house, View 3 - 3D Model of the house and View 4 - 3D Model of the house:

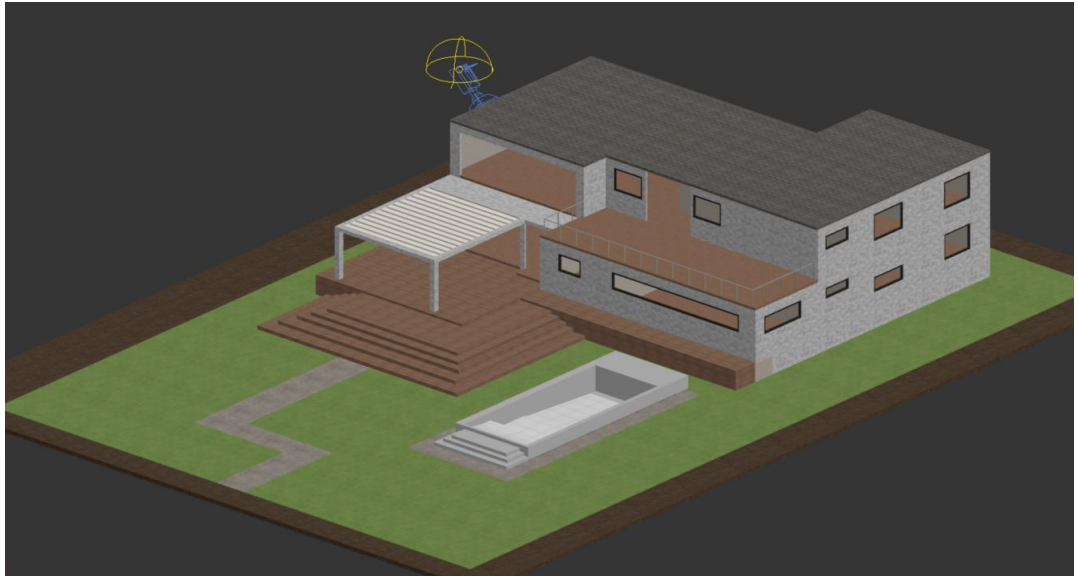


Figure 6.3: View 1 - 3D Model of the house

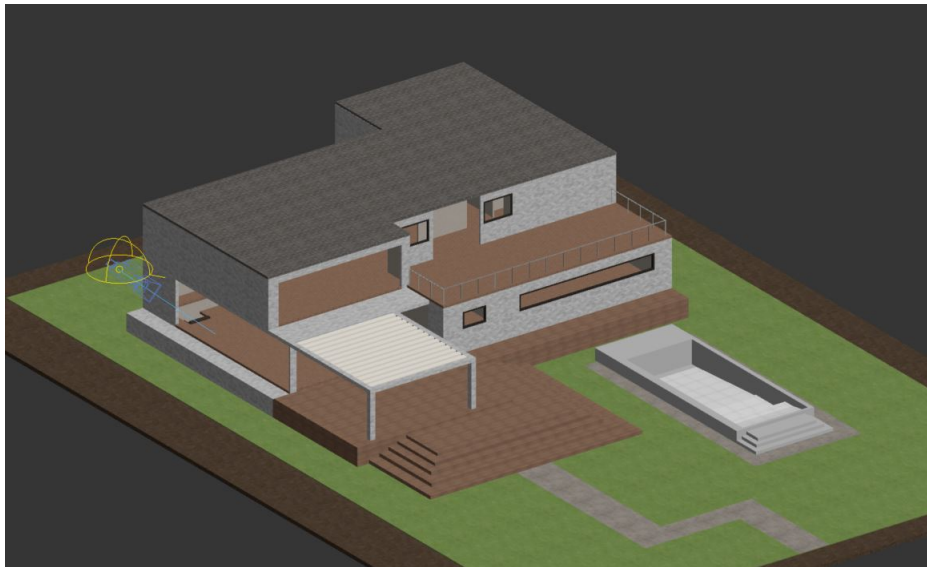


Figure 6.4: View 2 - 3D Model of the house



Figure 6.5: View 3 - 3D Model of the house





Figure 6.6: View 4 - 3D Model of the house

Polygonal modelling was used with editable polys. It was made from start to finish on my own. The house is in units of measurement in centimetres with the standardized proportions of real heights, that is, the doors measure 220 centimetres and the railing 90 centimetres. Each corner of the house has measures related to reality since it was taken into account in order to maintain architectural rigour and to obtain a video game that preserved the proportions to give a better gaming experience.

When the 3D architecture modelling of the house was finished, it was followed by the use of PBR materials and textures that will be explained later in section 7.1. Finally, it was imported into *Unreal Engine 4*, as explained in section 4.1.

## 6.2 Landscape

The landscape is a 3D modelling that acts as a stage, with scenery that generally contains mountains, roads, or vegetation. This model acts as a background but without an inordinate number of vertices that could overload the project. It can be created from scratch or it can be imported from a library. Epic Games provides varied landscape examples that can be easily downloaded and imported

into the project. Once imported, *Unreal Engine 4* provides a range of tools for the detailed design of the environment.

The Landscape system enables you to create terrain for the gameworld - mountains, valleys, uneven or sloped ground, even openings for caves - and easily modify both its shape and its appearance by using a range of tools. The overview that *Unreal Engine 4* provides is figure 6.7:

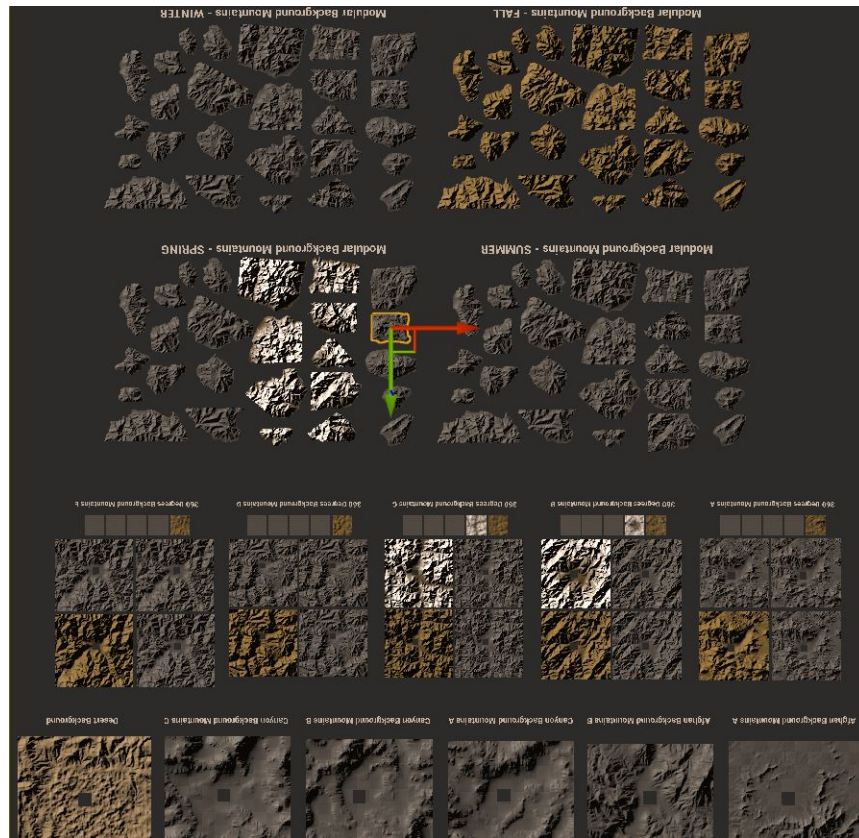


Figure 6.7: Overview of the Terrain used

The Landscape tool has three modes, accessible by their icons at the top of the Landscape tool's window: Manage mode that enables you to create new Landscapes, and to modify Landscape components, Sculpt mode that enables you to modify the shape of your Landscape, by selecting and using specific tools and Paint mode that enables you to modify the appearance of parts of your Landscape by painting textures on it, based on the layers defined in the Landscape's Material.

Landscape Edit Layers [5] enables you to edit Landscape Height Maps and paint landscapes using non-destructive layers, and you can add multiple layers to your landscape that can be edited independently from each other. You can also reserve a layer for splines, which enables you to add and paint splines non-destructively. Adding, moving, and editing these splines automatically updates the non-destructive layer.

Editors looking seems like figure in Landscape Editor:



Figure 6.8: Landscape Editor

The trees obtained when painting with the library used, are in 2D, which brings a lot of advantages to the project due to the low cost of storage. A green hilly terrain was placed and with the Landscape tool, the trees were painted to cover the entire terrain. Painting the terrain near the player's house was avoided because the 2D of the trees could be seen, so that in these parts, with another library, it was covered with more realistic assets, assets were imported from [9].

### 6.3 Metahumans

The creation of digital entities as avatars or video game characters has always been a great challenge for developers, figure 6.9. As the industry evolves, this has become increasingly relevant, as new generations of consoles are creating hyper-realistic characters. Achieving this finish requires not only expert professionals but also a series of resources that elevate the initial project costs.

Epic Games launched this new functionality, a platform that allows you to create hyper-realistic characters. In addition, Epic Games has an agreement with Quixel Bridge, a software that has been used in depth in this work due to the high quality of 3D assets and textures it provides, in the middle of the project it was updated with the metahumans [4], and thanks to this it was possible to work with the first version of the metahumans.

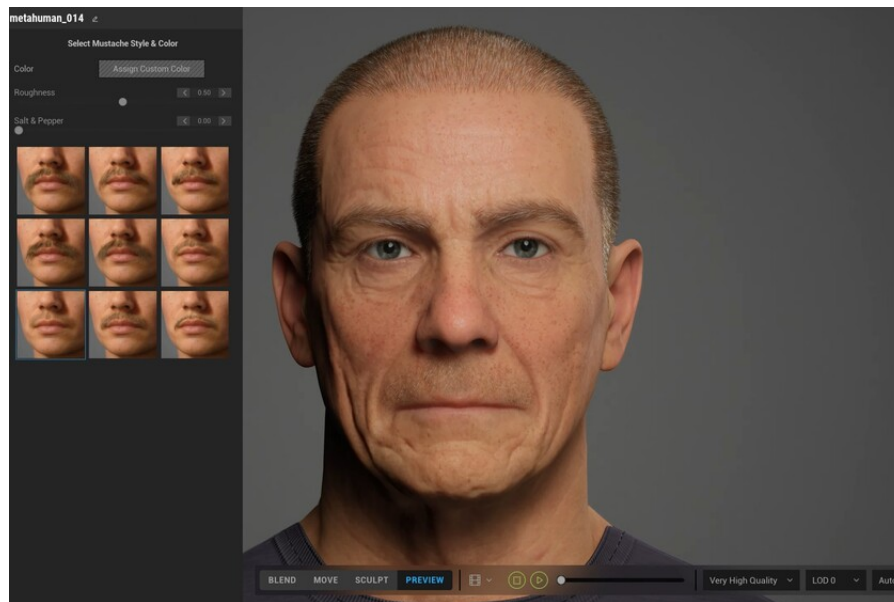


Figure 6.9: Metahumans Editor

What could normally take weeks or months of work, this tool allows it to be done in a matter of hours and without compromising quality. This tool is cloud-based and has an extensive library that simulates human appearance and behaviour.

Epic Games provided through Quixel Bridge, 58 different hyper-realistic human models that could be downloaded for free. It was sought to go one step further and an advance license was requested from Epic Games to guarantee access to the creator of metahumans prematurely. Thanks to the fact that Miguel Fernández-Montañés had official Unreal Engine courses, it was granted access to this creator, so the opportunity to work on the character creator sooner than expected guaranteed a better finishing touch on the project. In figure 6.10 it can be seen a Metahuman example.



Figure 6.10: Metahuman Example

Metahumans use the power of the Unreal Engine to create from the browser itself, without the need to download any software and in real-time, the most detailed and convincing humans ever seen. This creator, supported by Epic Games, represents an inordinate saving of time and resources since in a matter of minutes we have a hyper-realistic digital human with 9 levels of detail (LODs), facial animations, and a skeleton. Not only does it give us all this, but there are accessible and comfortable tutorials with which the metahuman has been imported in ten minutes, with all its levels of details, animations, and skeleton. Likewise, the mechanization that it has to include animations from different web pages is tremendously favourable.



Figure 6.11: IOs Live Link Face Application

Through the IOs Live Link Face Application, face movements are controllable with your own facial expressions. As it can be seen in figure of IOs Live Link Face Application

Due to the final release occurring in a few months, there were problems with the metahumans and they could not be implemented in the game. Metahumans require extreme computer power and cannot fail to discharge into those who come from the creator. However, a digital human was developed by our own and took advantage of visual scripts, so its development was not in vain. These digital humans still have a long road to development, however, no one doubts they will be an absolute revolution.

## Chapter 7

# Functional and technical specifications

### 7.1 Physically Based Rendering Materials or PBR Materials

Thanks to the access to Epic Games libraries, a part of one of the toughest jobs in 3D artistic projects turned out to be significantly easier: texturing. The textures and materials these libraries provide fit perfectly and are specifically designed for the models, which endowed them with an integral quality. However, these assets consist of only a small part of those used for the game. Adan martin was a great help in the texturing work, some of our references are in [7].

Another important part of the 3D art consisted of modelling the house and its specific assets, with which, a grand amount of asset texturization work took place.

3ds Max was the chosen modelling software to fulfil this function with the rendering engine V-Ray for the final retouch. The materials used for this purpose were Physically Based Rendering (PBR). The mechanics of these materials will be explained in more detail to understand what these materials are and why they are the best work tools to achieve this task.

What PBR means and why is it that important? The PBR materials, figure 7.1, are a rendering method based on light physics properties and their interaction with the environment. It is a work methodology that permits us to overlook questions such as how bright the floor should be when we enter a room and take a photograph or whether the walls are painted the right colour. Notwithstanding, when a 3D world has to be created, as it happens in video games, a sequence of the parameters on materials must be configured in order

to correctly recreate it. Without any guide, the number of parameters of these materials would make the results differ from expected, and therefore, the results would not be desirable.

PBR consists of establishing limits, first of all, how the light operates and its functioning will be analyzed, as well as its reaction when it comes into contact with an object, a working system will be established based on those physical properties studied. Although these are considerable parameters, a guide will be set to ensure adequate results to reproduce reality.

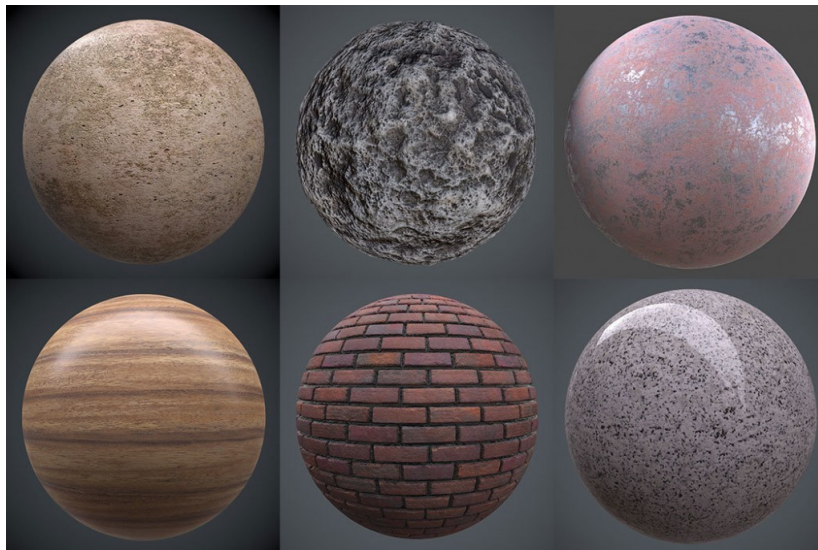


Figure 7.1: PBR Materials

The principal advantages of PBR materials are:

- To create realistic material easily and intuitively.
- The materials work under any lighting conditions.
- The results are consistent.
- Improve teamwork and cross-platform workflow.
- An industry standard.

With the premise of working correctly with physical materials in an essential way, due to the work carried out on different platforms, alterations in the environment that could cause it to visually change should not be allowed, as the environment is an essential part of the game. Environment, lightning, materials,



and its textures must be consistent for every platform. The use of these materials assures us they will always work properly since they attend to a functioning based on reality.

Besides, these materials are a symbol of solid work, which is why they were chosen as a sign of the endeavour since they transmit reliability to the project. In addition, it is an excellent teamwork method because people may have different criteria to create materials and PBR materials are used in practically all the imaging platforms, like rendering engines or applications like Unreal. The learning of this knowledge helps us with colleagues in the sector and neighbouring sectors.

## 7.2 Physics properties of PBR materials

This part may be a bit more tedious but it is necessary to understand the physical properties on which the composition of materials are based. Can be better appreciated in How can we see colors.

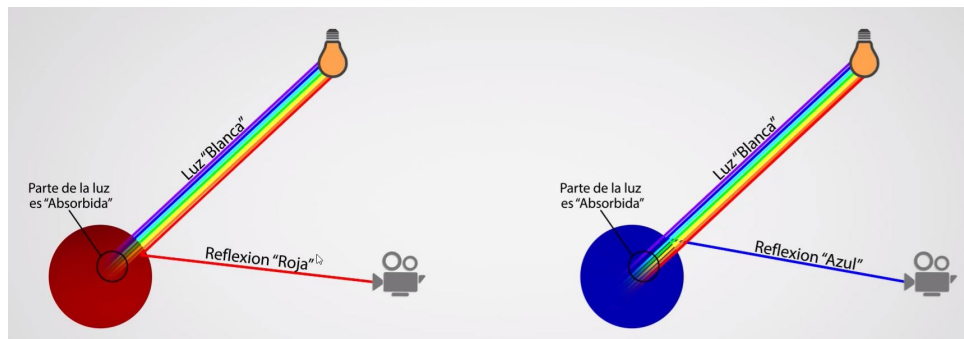


Figure 7.2: How can we see colors

In order to see red colour, the wave frequencies that reach an object are being absorbed by the object itself, meanwhile, the red ones associated are bounced back abroad, arriving at the eyes of the observer and allowing us to perceive that object as red.

The red colour is not a physical property of the material itself, as it is more related to wave frequencies. Those wave frequencies that are absorbed by the material are transformed into heat or other energy sources.

What happens when light changes its medium?

When light travels through the medium and bounces off a wooden surface, a part of it will always be reflected, and this reflection is affected by the imperfections the surface could have. If the surface is polished, varnished, and without imperfections, the reflex will improve, sharpening and acquiring a mirror-like appearance. On the contrary, if the surface is rougher, the reflection could be heavily affected, manifesting itself in irregular and aimless directions, therefore, we would not be able to take a glimpse of our reflection. It is shown in figure Reflectivity and Reflection.

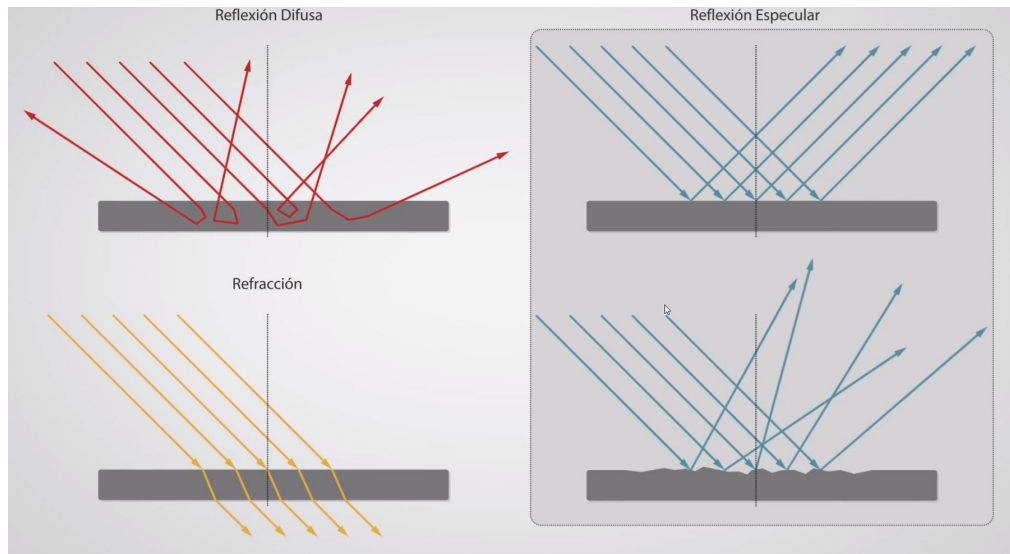


Figure 7.3: Reflectivity and Reflection

All of the previously mentioned above allow us to introduce the terms of specular and diffuse reflections. Specular reflection is the one that is always responsible for the reflection on the objects' surface, which can be sharper or random depending on the material surface. What happens when the light is not reflected? If it does not reflect on the surface, the light is transmitted to the new medium and absorbed by the surface.

This is a very important fact to take into consideration since one could fool itself to think that colour perception of objects takes place on the surface when the colour is perceived as the result of a physical process that happens inside the object.

On the other hand, this light we previously mentioned, and that is transmitted inside the object is constituted by some wave frequencies that bounce inside in multiple directions and end up bouncing outwards, this type of re-

Reflection is known as diffuse reflection and it is responsible for the object's base colour. This is extremely important to remember, foremost because sometimes this phenomenon needs to be reproduced.

The initial law that has to be accomplished to build a physically correct material or PBR is that the summation of the three phenomena that are mentioned above (diffuse reflection, specular reflection, and refraction) can never be higher than the amount of light that has reached the object itself. The duty of an artist is to meet this fundamental requirement.

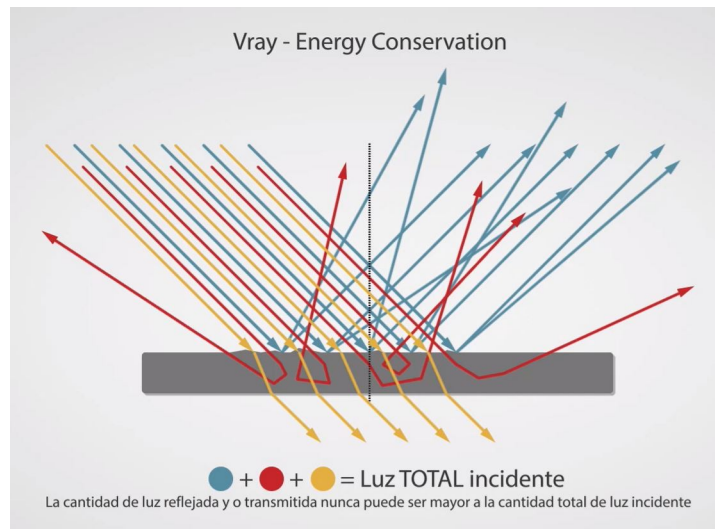


Figure 7.4: V-RAY Energy Conservation

### 7.3 Principal types of materials

After explaining the principles on which light operates, light properties can be bisected into different classifications depending on the type of material it impacts on.

- Dielectric or non-conductive, like plastics.
- Conductive, like metals.

Light does not react equally on dielectric materials than on conductive materials, hence it is mandatory to understand the difference between them to properly recreate elaborated environments and characters.

The most important difference mentioned as the base reflectivity on dielectric materials used to be quite low, close to 2 per cent - 5 per cent, meanwhile

conductive materials reach a reflectivity around 60 per cent - 90 per cent. The reflected light on dielectric materials determines its colour, whereas conductive materials do not portray diffuse reflection properties, as light is absorbed by the material. It can be seen in figure 7.5.

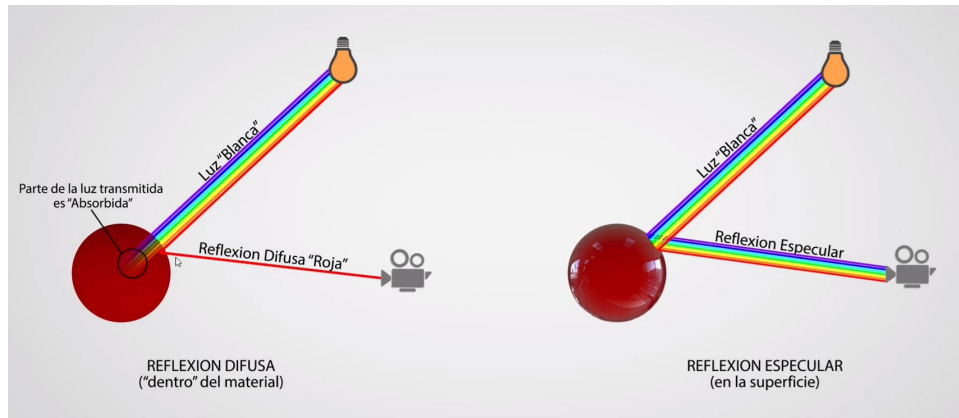


Figure 7.5: Reflectivity in Dielectric Materials

In the specular reflection of dielectric materials, all wave frequencies are reflected equally, this is an important statement because it means that when an observer perceives a red object, it is not discerned as red thanks to what happens among the surface, but rather because the diffuse illumination is no longer the same on all wave frequencies. The rendering engine has two different parameters that are permitted; diffuse reflection (inside an object) and specular reflection (the surface of an object). The variable for specular reflection must be white whereas the one for diffuse reflection must be selected in the colour which we wish to represent.

Nonetheless, conductive materials behave in the opposite way. On the surface of metals, not every wave frequency is reflected equally, and the light that does manage to cross through does not reach the exterior of the material, as all wave frequencies are absorbed. Furthermore, on the surface, not all wave frequencies reflect the same way. Hence, when one wishes to build a conductive material, the parameter diffuse (inside the material) must be a black and specular reflection (outside the material) must have the colour wished to be represented. Ultimately, this is why both materials do work on contrary processes.

Therefore, the criteria of material construction have to be the following in figure fig:color5.

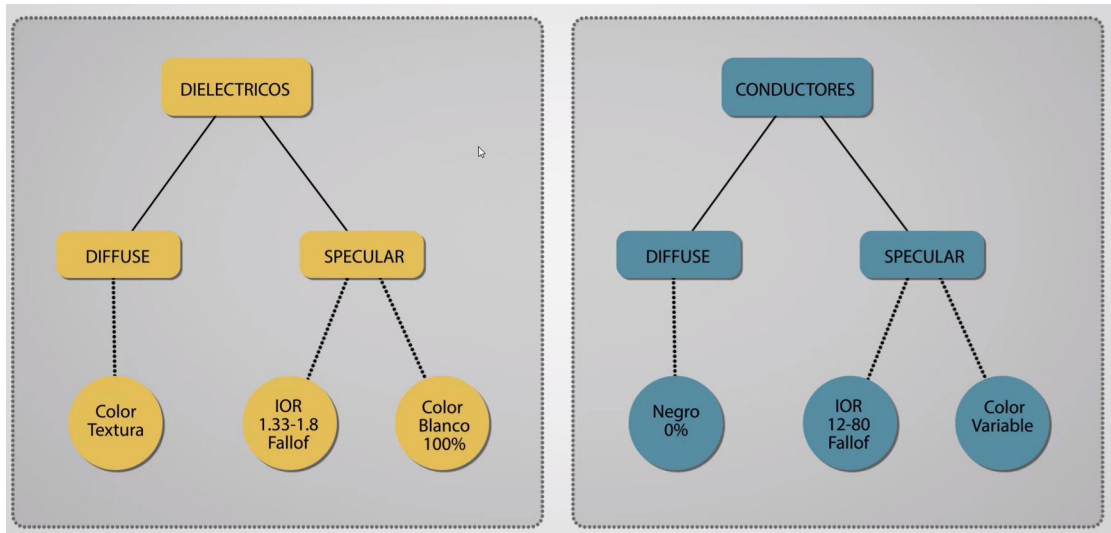


Figure 7.6: Basic Materials

## 7.4 A material PBR example

The process to create a wooden texture of wood PBR in the project is the one in Example of Wood Material:

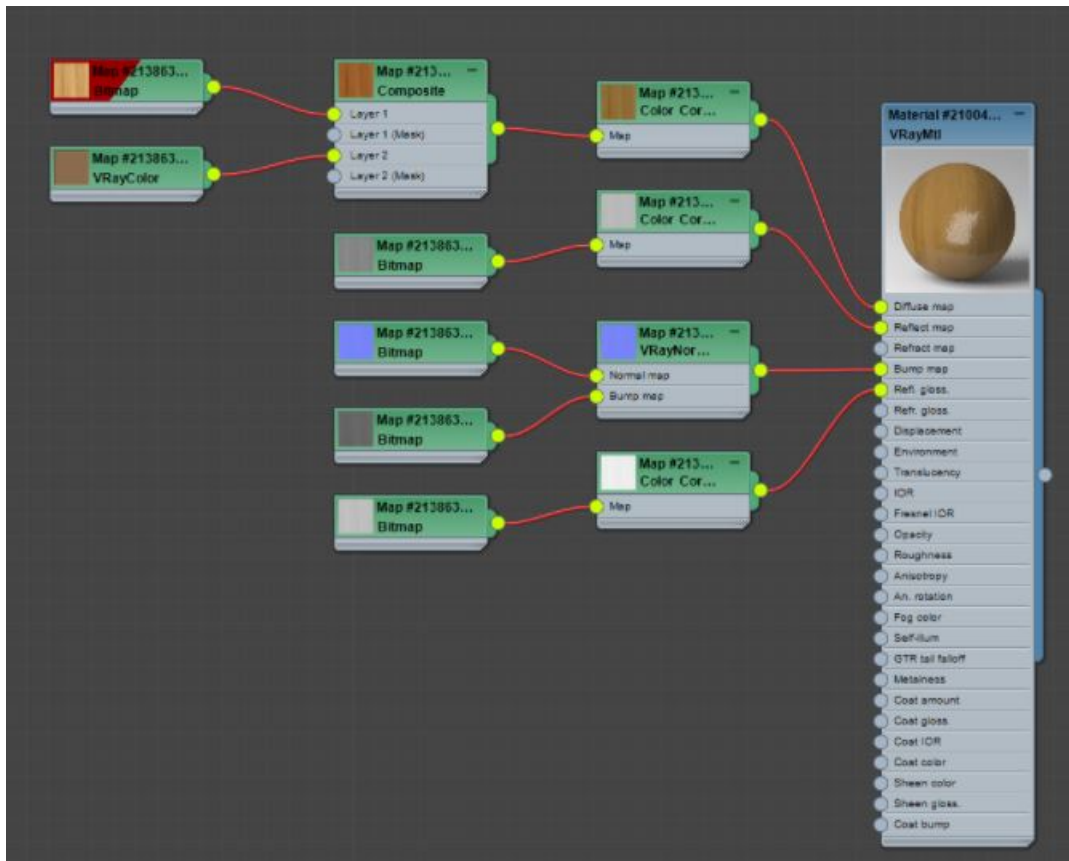


Figure 7.7: Example of Wood Material

As previously observed, a PBR material needs three fundamental maps: The diffuse one to control the colour of the material, the bump or normal one to make the rugosity for the sake of simulate geometry alterations to make irregularities on the surface, and the reflection glossiness one to control the brightness of the material.

These maps are nested to the main material. Photoshop allows in an almost automatic way the creation of normal and glossiness maps. Nevertheless, there are free pages such as Quixel Bridge which provide high-quality maps to the user. It can be created or downloaded but the making material process is always at 3ds Max. As seen in the diffuse, it has variables of composite and colour correction, which may help the material look more complex.

The texture of the fabric is a bit more complex since it is necessary to conceal the patterns with randomization whereby through repetition coordinates, will

model the texture so as not to appreciate its dimensions. The Falloff parameter is also used in textiles texturing, making them have a whitish touch, endowing them with realism. An example of a fabric material is shown in figure 7.8.

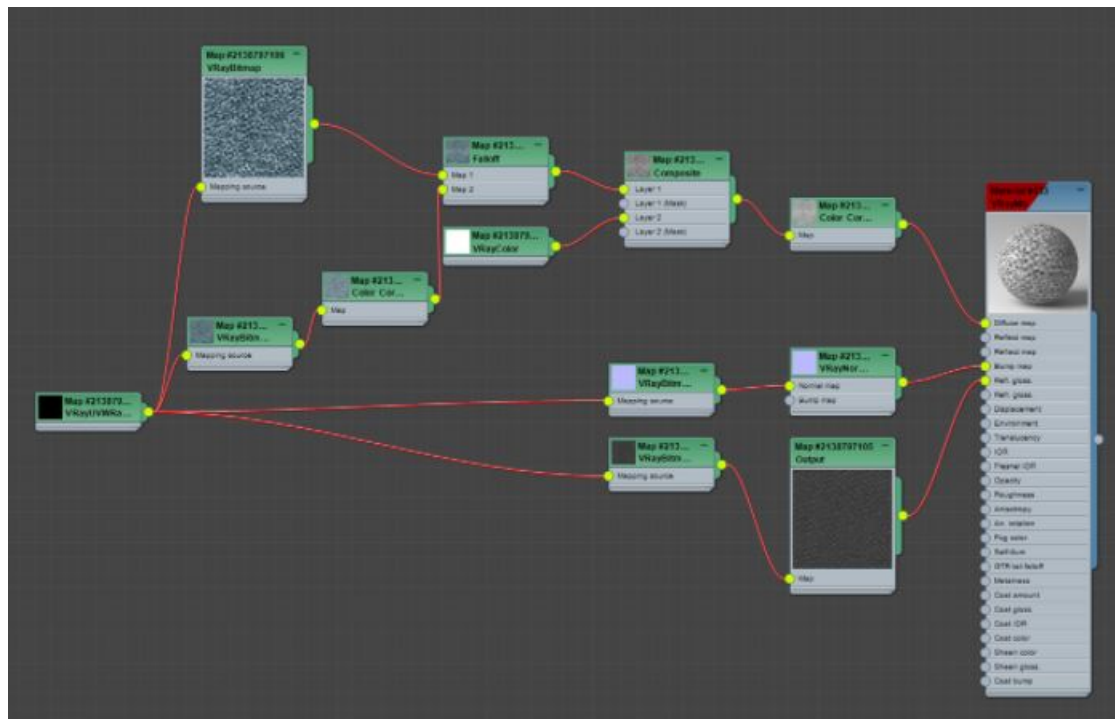


Figure 7.8: Example of Fabric Material

## 7.5 Model optimization

One of the arduous challenges this project underlies was the assets optimization, as is commented before, Epic Games libraries of Edith Finch video game serve as help for the house building. Due to these libraries being meant for another video game and its physics, if a nightstand could not open its drawer, not only would it be completely bonded, but its normals were reversed, the interiors of the object would be empty, and the result in Unreal would be transparent.

Every asset has important adaptation work then they have to be imported in 3DS Max, to get their normals inverted, and in most cases, to fill up empty parts of the objects.

The work not invested in modelling many assets was invested in remodelling some of them. However, it is still worth the amount of time it spends for the better quality of the project.

Another one of the notorious drawbacks related to these libraries was the fact that the models are not correctly modelled, nor an efficient way. They were not modelled by quads, which is more efficient, but with triangles, which produce a lot of problems to fill up the gaps and flip their normals.



## Chapter 8

# Debugging and testing

For the debugging process, the help of relatives and close people was remarkable. On the one hand, counselling of people who share stary in this grade was needed, inasmuch as they have debugging and testing knowledge and they will analyze the game from a more critical perspective, knowing in a better way the issues it could have, the possible solutions to resolve those problems and the priorities we must to focus on.

On the other hand, the project was shared with non related grade people to get close to the mainstream user and see a different point of view of what remains to add to the project to get closer to what is commonly understood as a videogame.

Besides these people tested the game, it was of vital importance due to the fact that they generally provide less powerful computers and it was necessary to see how they supported the graphics.

For the debugging process they answered the questionnaire shown in figures 8.1 and 8.2:

Valore el movimiento del avatar. \*

1 2 3 4 5

Malo      Bueno

Si ha respondido menos igual o menos que 3 a la anterior pregunta, exponga brevemente la razón.

Tu respuesta \_\_\_\_\_

Valore las interacciones del avatar con el resto del escenario \*

1 2 3 4 5

Malo      Bueno

Si ha respondido menos igual o menos que 3 a la anterior pregunta, exponga brevemente la razón.

Tu respuesta \_\_\_\_\_

Valore las interacciones con el NPC. \*

1 2 3 4 5

Malo      Bueno

Figure 8.1: Capture 1 of Prototype

Si ha respondido menos igual o menos que 3 a la anterior pregunta, exponga brevemente la razón.

Tu respuesta \_\_\_\_\_

Valore si consiguió entender el comportamiento del NPC \*

1 2 3 4 5

No lo llegué a comprender      Me resultó fácil de entender

Si ha respondido menos igual o menos que 3 a la anterior pregunta, exponga brevemente la razón.

Tu respuesta \_\_\_\_\_

Valore su progreso de entendimiento de las mecánicas \*

1 2 3 4 5

No llegué a entender casi nada      Poco a poco fui entendiendo lo que tenía que hacer

Si ha respondido menos igual o menos que 3 a la anterior pregunta, exponga brevemente la razón.

Tu respuesta \_\_\_\_\_

Figure 8.2: Capture 1 of Prototype

Depending on the game phase two questionnaires are provided: the first assesses artificial intelligence behaviour's performance, base on which the game is settled. Afterwards, the second questionnaire inferred about the most advanced version of the game. They work as guides and references to pay attention to how unbiased people will understand the game. It was quite helpful to realize what could be improved and test objectively without any slant on the work done.

The results of these surveys were really useful since the people who tested the game demo fully agreed on the flaws that Artificial Intelligence had. These results indicated that dialogues were a bit out of context and that they did not understand how they should interact with the Artificial Intelligence. So this was the part that got stronger from now on.

## Chapter 9

# Project monitoring and management

Planning and management are some of the most essential parts to work on carefully during the preproduction of a video game. Due to the ambitious magnitudes of the project including two unlike planning converging into a single, the planning process involved considerable time and effort meticulously.

The project's organizational structure had multiple modifications for the sake of adapting to the changes the project has undergone, updating the project's planning to be able to follow it. This planning counts with two variants: individual and team planning. Individual planning is found in 1.2, which is a 300 hours project's work. However, the fact that the teamwork cannot be ignored and part of the work depended on both, so plannings had to be communicated. Next, the group planning of the project will be shown in figures Group planning and Group planning:

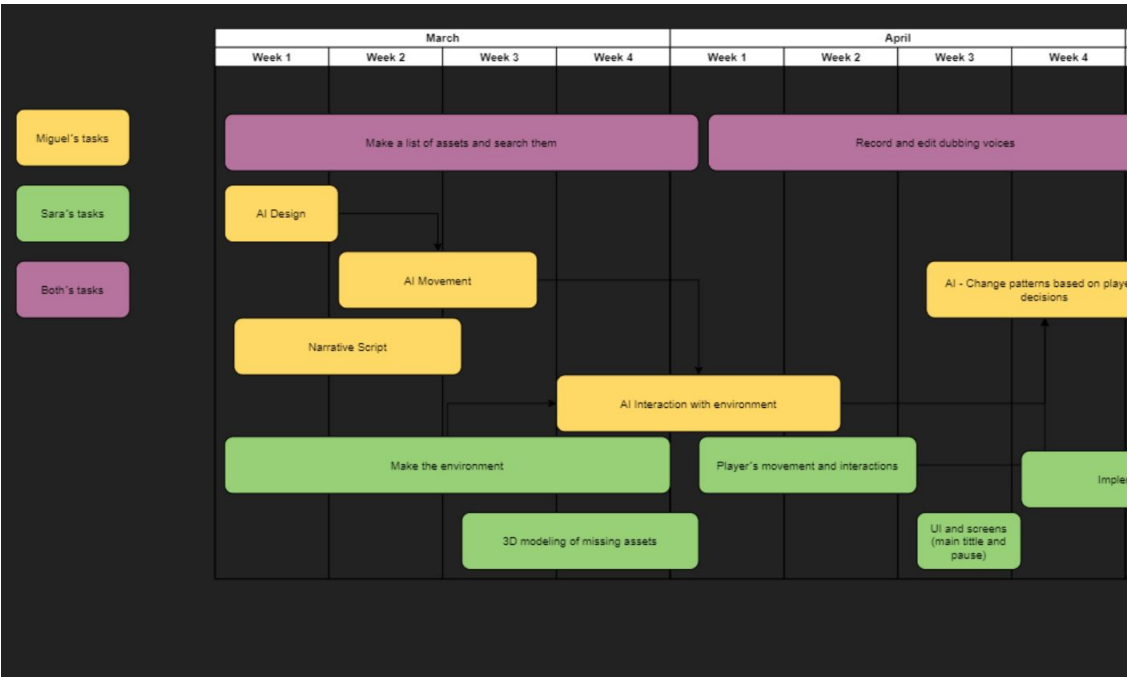


Figure 9.1: Group planning



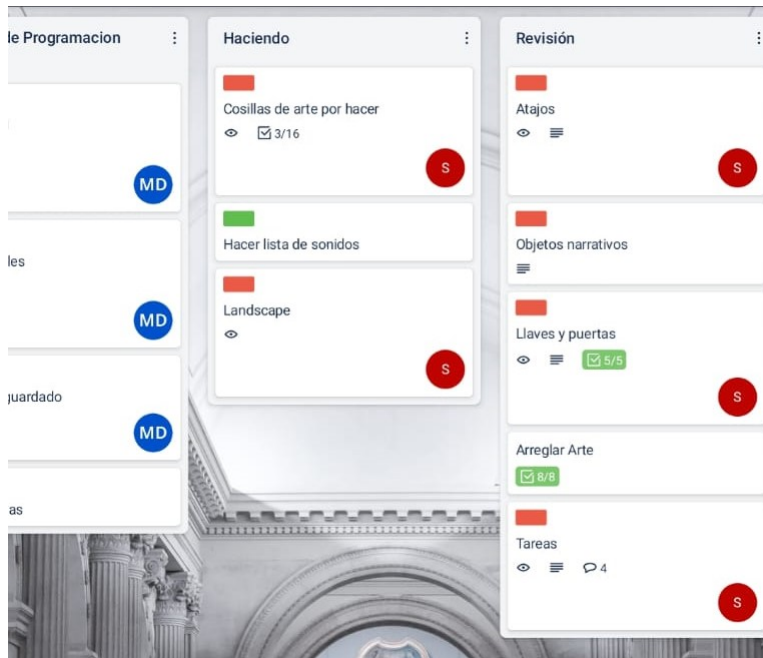


Figure 9.3: Example of Organization in Trello



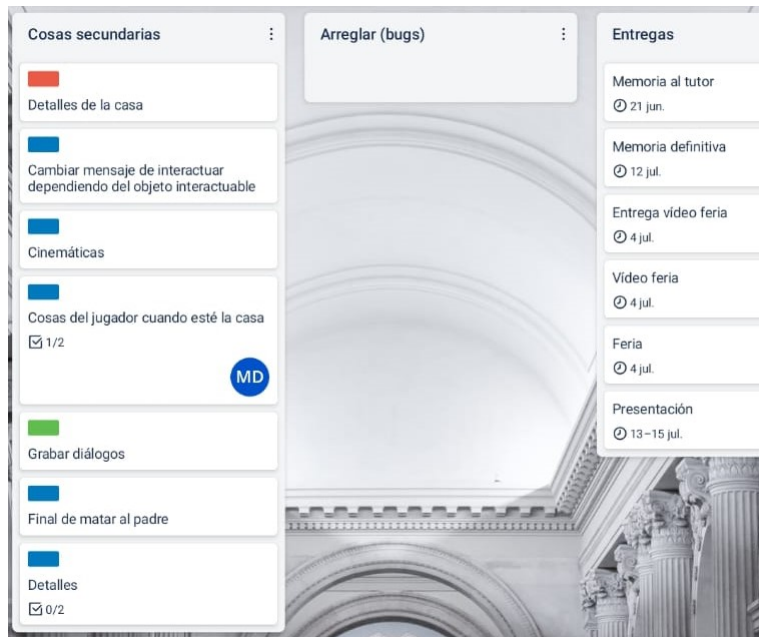


Figure 9.4: Example of Organization in Trello

These tasks also contain their own description, percentages of progress, and deadline related, assigning them to a team member.

One of the most advantages Trello presents is working in real-time with teammates, allowing it to synchronize tasks, modify them and notify without entering the application.

Nevertheless, despite the dairy management and approximate time costs, an Excel sheet was used to check the work status with the corresponding dates, working time, the category and the description which ease the hour's recount and take the perspective of the work that remained, an estimated time that left to complete the project, the percentage of hours spent on each part and how many hours should be worked a day to reach the objective.

Figure ?? is an example of the Excel document:

	A	B	C	D	E	F	G
1	Date	Start Time	End Time	Time	Category	Task	Total de horas
2	10/12/2020	17:00:00	20:00:00	3:00:00	Technical proposal	Define document content	245:00:00
3	13/12/2020	18:00:00	20:00:00	2:00:00	Technical proposal	Maquetar el documento y revisarlo	
4	8/02/2021	18:00:00	21:00:00	3:00:00	GDD	Propuestas en común del documento	
5	9/02/2021	18:00:00	20:00:00	2:00:00	GDD	Crear índice automatizado	
6	10/02/2021	18:00:00	19:00:00	1:00:00	GDD	Definir los personajes y sus relaciones	
7	11/02/2021	17:00:00	19:00:00	2:00:00	GDD	Definir los controles y hacer sus bocetos	
8	12/02/2021	17:00:00	20:00:00	3:00:00	GDD	Hacer los planos y bocetos de la casa	
9	16/02/2021	17:00:00	18:30:00	1:30:00	GDD	Definir el diagrama de flujo	
10	19/02/2021	18:30:00	19:00:00	0:30:00	GDD	Completar la bibliografía en su formato	
11	11/02/2021	17:00:00	20:00:00	3:00:00	GDD	Revisión del resto de aspectos del GDD	
12	11/02/2021	18:00:00	20:00:00	2:00:00	GDD	Maquetar el documento	
13	11/02/2021	18:00:00	20:30:00	2:30:00	Narrativa	Redacción de la narrativa	
14	11/02/2021	17:00:00	18:00:00	1:00:00	Planificación	Definir tareas	
15	11/02/2021	19:00:00	21:00:00	2:00:00	Desarrollo	Interacción con objetos	
16	11/02/2021	19:00:00	21:00:00	2:00:00	Desarrollo	Organización de la programación del juego	
17	11/02/2021	10:00:00	12:00:00	2:00:00	Arte	Búsqueda de assets	
18	27/02/2021	17:00:00	21:00:00	4:00:00	Arte	Modelado de la arquitectura de la casa	
19	06/02/2021	10:00:00	13:00:00	3:00:00	Arte	Modelado de la arquitectura de la casa	
20	8/03/2021	10:00:00	13:00:00	3:00:00	Arte	Modelado de la casa (vidrios y ventanas)	
21	9/03/2021	11:00:00	12:00:00	1:00:00	Planificación	Planificación del horario	
22	10/03/2021	9:30:00	11:30:00	2:00:00	Arte	Modelado de la casa	
23	11/03/2021	9:30:00	11:30:00	2:00:00	Arte	Modelado de la casa	
24	18/03/2021	10:00:00	12:00:00	2:00:00	Arte	Modelado de la casa	
25	19/03/2021	10:00:00	12:00:00	2:00:00	Arte	Modelado de la casa	
26	24/03/2021	10:00:00	12:00:00	2:00:00	Personaje	Selección del Personaje	
27	25/03/2021	10:00:00	13:00:00	3:00:00	Arte	Modelado del mobiliario de la casa	
28	26/03/2021	11:00:00	14:00:00	3:00:00	Personaje	Definirle los huesos al personaje	
29	30/03/2021	10:00:00	14:00:00	4:00:00	Arte	Montar el mobiliario (trastero y habitación)	
30	01/04/2021	12:00:00	14:00:00	2:00:00	Arte	Montar el mobiliario (biblioteca habitación y baño)	
31	13/04/2121	16:00:00	18:00:00	2:00:00	Diseño	Completar la base de datos de diálogos	

Figure 9.5: Workstates in Excel

The communication channel to work telematically fluidly was Discord platform due to the conditions preventing meeting in the physical plane, creating a channel with a series of sections of both voice and video, allowing it to work most appropriately depending on the situation, even with the possibility of sharing screen if necessary.

On the one hand, a text channel is used to deal with general concepts of the project, clarifications, notices for uploading to Git, etc. It served as a written communication bridge that was kept indefinitely. Two other text channels were created (tutorials and interesting things) with the purpose of sharing videos, web pages, pdf... and useful and inspiring information for colleagues. It can be seen in figure Discord Channel.

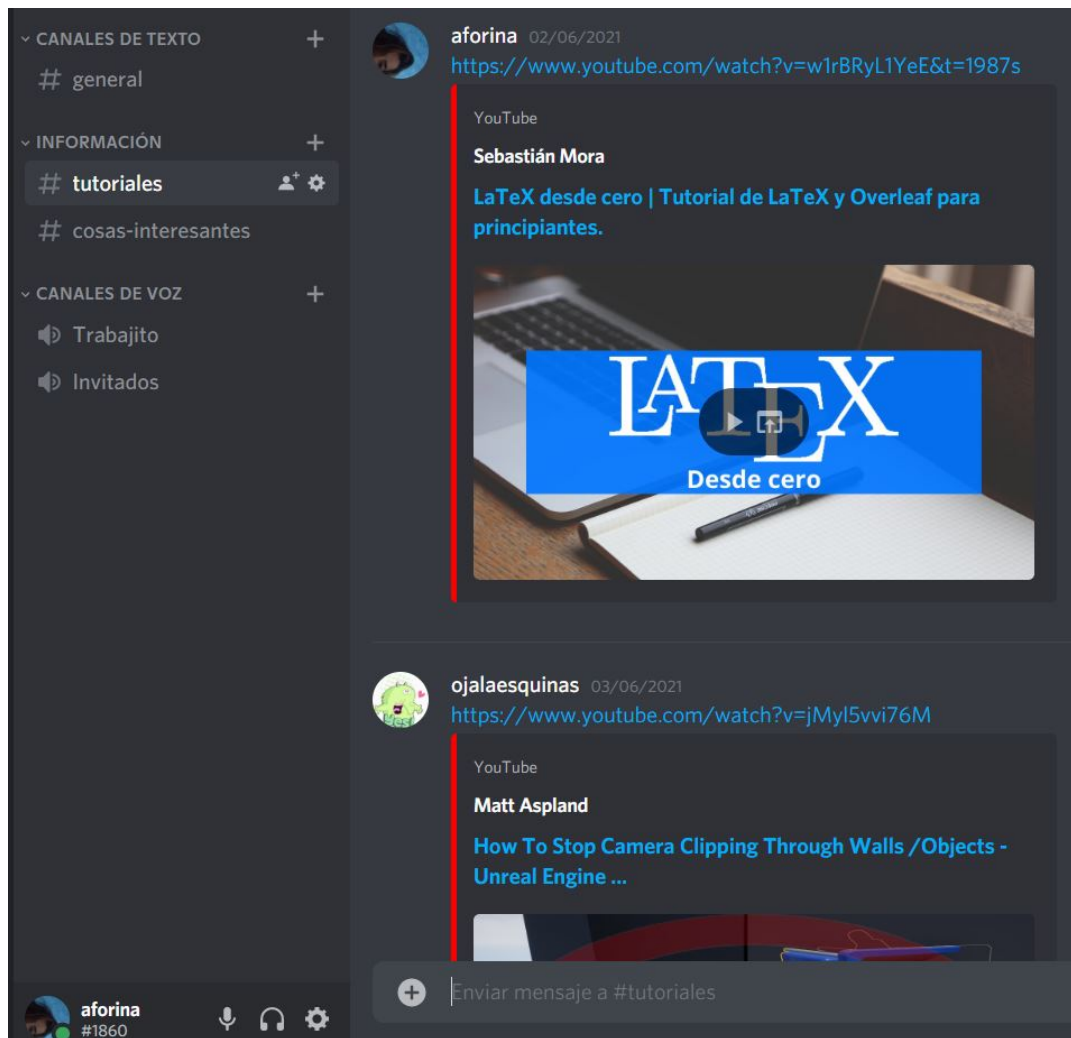


Figure 9.6: Discord Channel

In turn, two voice channels were added, the Work channel consisted of a channel with a fixed schedule from 10 in the morning to 2 in the afternoon, plus specific hours according to the stage of the project, where each student walked in and started the workday.

The purpose of this channel was to force us to remain connected and work as a team in all stages of development, which was of great help because it encouraged good communication, which was vitally important for the project to move forward.

The second channel is Guests, which was used to invite other Discord members, generally known from a college degree, who helped test the game and gave feedback on the work done.

The objective of creating a channel was not only to stay connected or other advantages such as the quality increased in the screen transmission, but to compact and organize all the information to have it at our fingertips immediately. This channel was quite helpful and an effective tool that we recommend to people looking to develop a covetous video game or project.

# Chapter 10

## Results

The results of the project have been satisfactory due to all the objectives imposed in section 1.1, were principally accomplished. Not only have they been fulfilled but they have been far exceeded since the work has been reoriented as it developed, thus obtaining knowledge and training in teachings that were not initially planned.

Mainly it was hoped to create a game with reduced dimensions so that it was polished in time and had no major development errors. Nevertheless, it went further than this since once the bases of complex systems such as the behaviour and states of artificial intelligence were created, programming such as the dialogue system, complex systems such as the tasks artificial intelligence demands or behaviours as exceptions of its main states, and all this not only worked correctly but had a high level, no restrictions were perceived when expanding this small main version.

Thanks to the game base we obtained, it is just a matter of time to expand the game, do more finals, dialogues, tasks to do, narrative elements and artificial intelligence states.

Currently, every round of the game lasts around 10/20 minutes, which is expected as a final project work demo. However, the project can be almost infinitely replayable with a different player experience in each game, which exceeds the objectives of the project, allowing players to play hours of the game.

### 10.1 Project Access

Github Repository  
Executable Link

# Chapter 11

## Conclusions

The results of the project have been so satisfactory that we believe in the possibility of continuing the development after the stage of this subject. It has been a large-scale project, with which it is so satisfying to be able to identify, especially since it has been a project to which we have been able to dedicate a considerable amount of hours and have had a free hand, more than in any other project of the degree, allowing you to get absolute control of all decisions.

It was a rewarding experience to get involved in. Carry out knowledge in the specific branches of the sector we were more interested in, and also, develop a high-level project as a result.

Personally, a part of the job I have enjoyed the most has been the research work. I have delved into the discipline of neuroarchitecture and PBR materials science. I consider this work a turning point in my academic life. At the same time, it has been a multidisciplinary work since I have been able to participate in the design and narrative work, sectors of great interest. It has been quite an experience to investigate ways in which a story can be told, especially when it does not depend on a narrator. There has also been researching work on the game conceived as the eighth art, which made me go back to subjects of the degree and investigations to experts on the subject.

This process makes me feel proud and satisfied with the project. In any case, I would have loved to investigate more in some areas of learning, like I would have preferred to model the 3D assets instead of resorting to the use of an asset library. It would be extraordinary to have been the creator of the art of the house in its entirety. On the other hand, if we had had more time, I would have liked to personally create the texture maps from scratch instead of resorting to texture libraries.

However, there has been a lot of training, research and learning work, never seen in other projects. Both team members are really proud, not only of the

work we have done but of our abilities and the lessons we have learned.

## Chapter 12

# Future work

There are plans to continue game development to get deeper knowledge and finish some areas we would like to dedicate the time they deserve. Besides, it is proposed to bring this project to an audience specialized in the video game sector.

There are proposals to present this project to *Oculus Rift*, an official ceremony of the *Universitat Jaume I*, since we believe the project may be of great interest to our sector, a reference for students and serve as an incentive to others to carry out their projects with absolute control over their decision-making.

We believe that our project can be a reference not only as a project but also in its methodology. We encourage students to work in pairs since it is common to work as a team in a future job and it is a good way to break in games of great scope, a step beyond the degree work. It is always a challenge to work as a team, for this reason, we want to encourage students not to think it is something not only can be done but can be an unlikely experience and encourage better work and its development.

Finally, we are pleased with the results obtained with Unreal Engine 4 and the facilities its tools gave us, with which it is expected to continue investigating the dimensions of this graphics engine.



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