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Design, creation and implementation of characters for video games Final Degree Work report

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And above all to my parents and my sister for their love and support without which I would not have gotten here.

ABSTRACT

This document has been created in order to explain the process of character modeling for video games and its implementation in a game engine. Its main objective is that the reader can understand, without going into technical details, the general process followed to develop a character of these characteristics. It is interesting because many people do not know the effort and work it takes to make the video games they consume.

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INTRODUCTION

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1.1 Work motivation

The creation of this game arises from the previous existence of two characters that I made some time ago. The names of these characters are Lucy and Anna. The first one was Anna. I draw her for first time at 2013 (see figure 1). I made this design because I was tired of realism and wanted to try new styles.

In 2015 I changed its appearance again. This time with a style following more realistic proportions but keeping the cartoon style with references to Tim Burton. It was the same with Lucy. The first time I drew it was in 2014, a little after Anna. But even though I did it later, he ended up being the most important character. It was in 2016 when the characters underwent a total redesign, while retaining some key aspects of the original designs. The style still maintained dark lines with clear references to Tim Burton but the color is much more worked and the characters more detailed in general. These redesigns were conceived with the idea of creating an album or illustrated story about both. In the end, this idea was discarded because it didn't work. That year I was already in my degree and, like everyone else, I wanted to develop my own video game. I started to think about what kind of game could work with them as protagonists. In the first ones I used some of the first designs, with a more cartoon aesthetic. The idea was to create a narrative game with some sections of 2D platforms. Taking advantage of some

of the subjects of the degree I made a prototype but it wasn't what I was looking for. The next idea I had was to make a game in 2.5 D, that is, a 3D game but with lateral scrolling. The idea, in essence, was still the same, a narrative game with a platform component, but this time with more puzzle components, as in games like *Inside*. In a previous game that I made for the subject "Juegos Web" the story was only about Lucy, stories about her life and her traumas. But for this new project I decided to include Anna's character, since both characters had always been united. So, I created a story for them. I didn't want to tell an epic story in which you have to save the world from an evil villain. What I wanted was to tell the story of two girls who fall in love but must face a series of problems caused by the intolerance of the people around them. With this in mind, I began to redesign, again, the characters because the dark aesthetics did not fit with the style of the new project. This redesign still maintains a clear cartoon style, but this time it loses references to Tim Burton and becomes more influenced by Pixar's style. With these designs I began to model the characters in 3D. Lucy's model was the first one I did and, also, it was the first 3D modeling I made. A year later, with more knowledge, I made Anna's model. This was quite different from Lucy's, because at that time I had improved my modeling skills. So, I redesigned Lucy's modeling to match Anna's modeling. In 2018 I started my last year of the degree and therefore I had to start thinking about what work I wanted to do at the end of the degree. Because I already had the characters done, I thought it was a good idea to use them to carry out the project.

At first, I kept the idea of developing a 2.5D game, as I described before. But by the time I started the end-of-degree work there were a lot of games that had abused this kind of development and new ways of telling stories had emerged. So, I thought of another way to do it, but keeping the idea. To create a game with a great artistic and narrative load. Although this time leaving more aside the cartoon style and opting for a realistic style but stylized. Therefore, I made again the models of Anna and Lucy. The motivation that has led me to create this game for the end-of-degree job is to tell the story of Lucy and Anna in a way that only video games allow, create that empathetic bond between the player and the characters, as we have seen in games like *The last of us*, *Life is Strange*, etc.. For the development of the work of end of degree, in a first moment I decided to focus the attention in the artificial intelligence that would use the game, since in great part of it one of the two characters will follow and/or guide the player. But later, seeing that most of those options are already implemented in the Unreal Engine 4, I decided to focus on the techniques followed for the development of the visual aspect of the game, using the technologies that are used today in the development of triple A productions. Of course, the story still has a great weight in the development of this work as in the original idea.

Much of the project will focus on the procedures followed for the creation of the main characters. From its conception, which has been summarized above as the main cause of the creation of this project, to the sculpting and modeling of these characters and the necessary **props**, optimization of the meshes, texturing, creation of the rig and animation. It will also reflect the process of creating the environments and props that

will be part of them.

1.2 Objectives

- Create Lucy and Anna characters, ready to use in a Game Engine.
 - Body's Base
 - Body detailing
 - cloth creation
 - Baking and textures
 - Rig
 - Animation
- Implement the characters in the engine.
- Environment creation
- Implement mechanics
 - Movement
 - Interact with item
 - Open/close door
 - Push/pull objects
 - Change character
- Artificial Intelligence
 - Follow Player
 - Guide Character
 - Control character behavior
 - Enemies AI
 - * Chase player
 - * Seek player
 - * Patrol

1.3 Environment and initial state

At the beginning of the development the plan was to make a project that would focus more on the player's partner's artificial intelligence, in addition to art and history. It was also intended to make the gameplay more complex. At first it was silver plated like that because the time available was much longer than it ended up being and I was going to have the help of a partner to develop artificial intelligence. For professional reasons, this colleague was unable to help me. Luckily, the Unreal engine includes tools for the creation of artificial intelligence, which although they are not as flexible as an artificial intelligence specially designed for the game, covers the needs. But being already developed beforehand, I have decided not to delve deeper into this aspect. Another reason why this idea was discarded, along with a more complex gameplay was because of time. At first, I had more time but due to a series of circumstances related to the external practices at the end I had much less time. Due to these circumstances I have changed the approach of the work to focus more on the process of creating the characters and the rest of the graphic elements that make up the videogame.

Decisions prior to development:

- It's going to be a game focused on the visual aspect and narrative.
- The aesthetics will mix realism whit stylized elements.
- The game will be linear, the story will follow a marked course and the actions of the player will not have consequences in the story.
- The gameplay will be based on the overcoming of obstacles making use of the elements on the stage. To overcome many of them will be necessary to make use of both characters.

PLANNING AND RESOURCES EVALUATION

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2.1 Planning

The planning is carried out taking into account that eight hours per day will be devoted to the project.

2.1.1 Modeling and Design

The first week of March will be devoted to modeling the base of the body that will be used for the final models of Lucy and Anna. The modeling will take between one and three days and the retopology of this between one and two days. The second week of March will begin with the detailed body of the characters. This process will take about a week for each character, ending in the third week of March. Then the modeling and detailing of the clothes will be done, this process will take about two weeks, ending in the first week of April. Once this task is finished, the bakes and textures will be made in the second week. The bake process is very fast and will only take a few hours. The textures will take a week for each character, ending in the fourth week of April. At the same time that the textures are made, we will also start with the rig of the models. This process will last about a week, ending in the first or second week of May. Once the rig is finished, the models will be animated. This process will end in the third week of May.

This concludes the creation of the characters. Now that the characters are finished we will proceed to implement them in the engine, this will take about a week.

The process of creating the environment will be done in parallel to the creation of characters. The first weeks of March will be dedicated to deciding which elements will form part of the stage and to designing them. Once this task is finished, each element will be created. This process will last about a month and a half. Once finished the objects will be placed on stage, which will take about a week.

2.1.2 Programming

As programming is an independent process to the creation of the characters, it will start at the same time. The first week of March the project will be prepared and uploaded to the repository. The preparation of the project also includes mounting the level of tests to start implementing the mechanics. Once completed this task will begin to implement the game mechanics. This process will take about a month or a month and a half. There are very simple mechanics, such as making the characters move, which can be done in one or two days. The mechanics to push an object will require more time to be implemented, about a week and a half. Once the mechanics are implemented, artificial intelligence will be implemented, which will last until the end of the project.

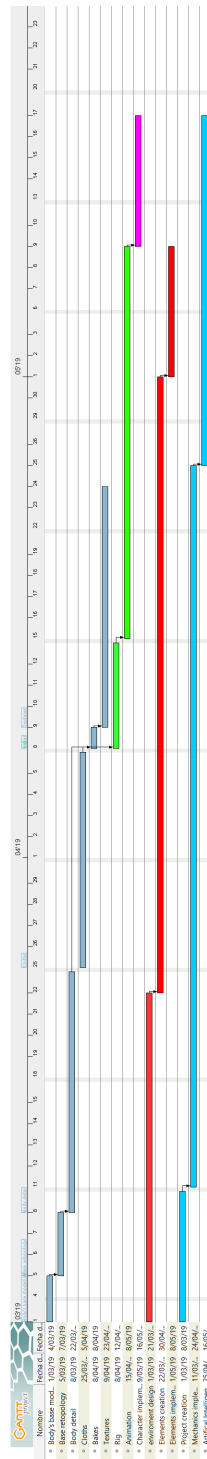


Figure 2.1: Gantt char

2.2 Resources evaluation

2.2.1 Hardware

Computer

- CPU: Intel Core i7 8700K - 339,90 €
- Graphic Card: Nvidia GeForce GTX 1060 6GB - 279 €
- RAM: DDR4 16 GB 2666 MHz - 183 €
- Mother Board: 129,90 €
- Other components: 150 €
- Total: 1080,9 €

Other hardware

:

- Graphic tablet Wacom Intuos 4 - 329,99 €
- Display - 150 €

2.2.2 Software

- Zbrush - 895,00 €
- Marvelous Designer 490,00 €
- Substance Painter 19,90 €/ month
- Autodesk Maya - 254 €/month
- Adobe Photoshop - 24,19 €/month
- 3D Coat - 379,00 €
- Unreal Engine - Free

SYSTEM ANALYSIS AND DESIGN

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This chapter presents the requirements analysis, design and architecture of the proposed work, as well as, where appropriate, its interface design.

3.1 Requirements analysis

3.1.1 Game functional requirements

- The game will display a home screen
- The player will be able to start a new game.
- The player will be able to exit without starting a new game.
- The player can exit the game.
- The system will save the game automaticly.
- The camera must follow the player
- The player will be able to load a game.
- The player will be able to move through the 3D space in the horizontal axes.

- The game will have enemies.
- The enemies must follow the player
- The enemies will be able to catch the player.
- The enemies won't be able to kill the player.
- The game ends when the player is captured.
- The player will be restored at the check point.
- The player will be able to hide.
- The player can run away from the enemy.
- The player can't kill the enemies.
- The player can move some objects.
- The player can jump.
- The player can change between the two characters
- The player can interact with some objects.
- The player can interact with some characters.
- The system must load the game.
- The system must provide information about the game.
- The system will limit the player movement.
- The system must save the game.
- The player will be able to move the camera freely.

3.1.2 Game non-functional requirements

- The game must be playable on PC.
- The game must be playable on Windows.
- The aesthetics of the game will mix stylized with realistic elements.
- The game must run at 60 fps with a resolution of 1080 on devices that meet the recommended requirements.
- The start menu will show in the background a scene of Lucy and Anna next to the options.

3.1.3 Character non funcional requeriments

- The models used in the game of the two main characters must not have more than 60K tris.
- The low resolution meshes must no have triangles.
- Texture size must be 4K at most.
- Textures must be PBR.
- High resolution models will be made with Zbrush
- Cloths will be made with MArvelous Designer
- Textures will be made with Substance Painter and Adobe Photoshop
- The characters will have stylized and realistic elements.
- Materials and textures must be realistic.

3.2 System Design

3.2.1 Use Cases



Figure 3.1: Case use diagram

3.2.2 Classes diagrams

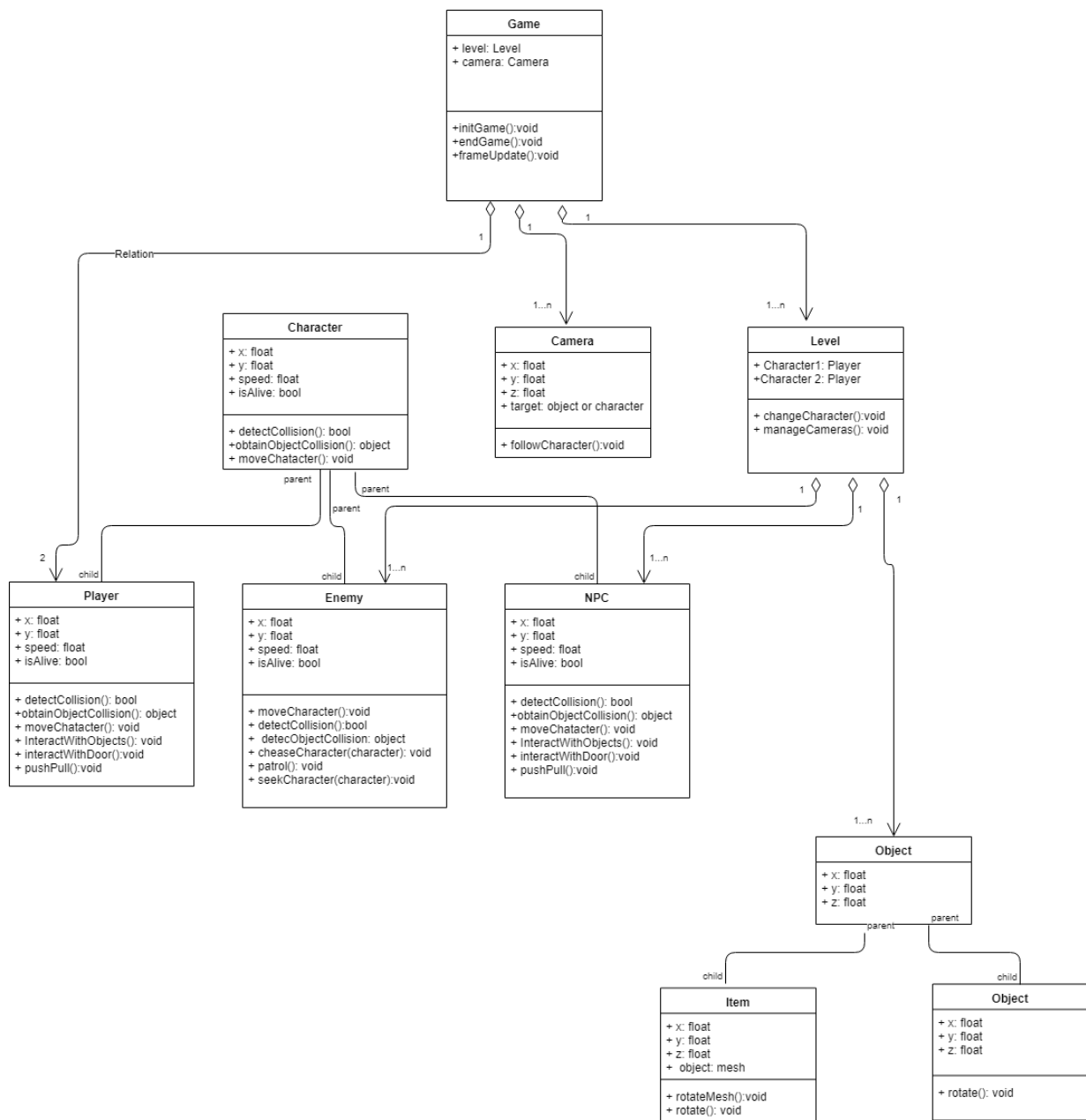


Figure 3.2: Class diagrams

3.2.3 Activities diagrams

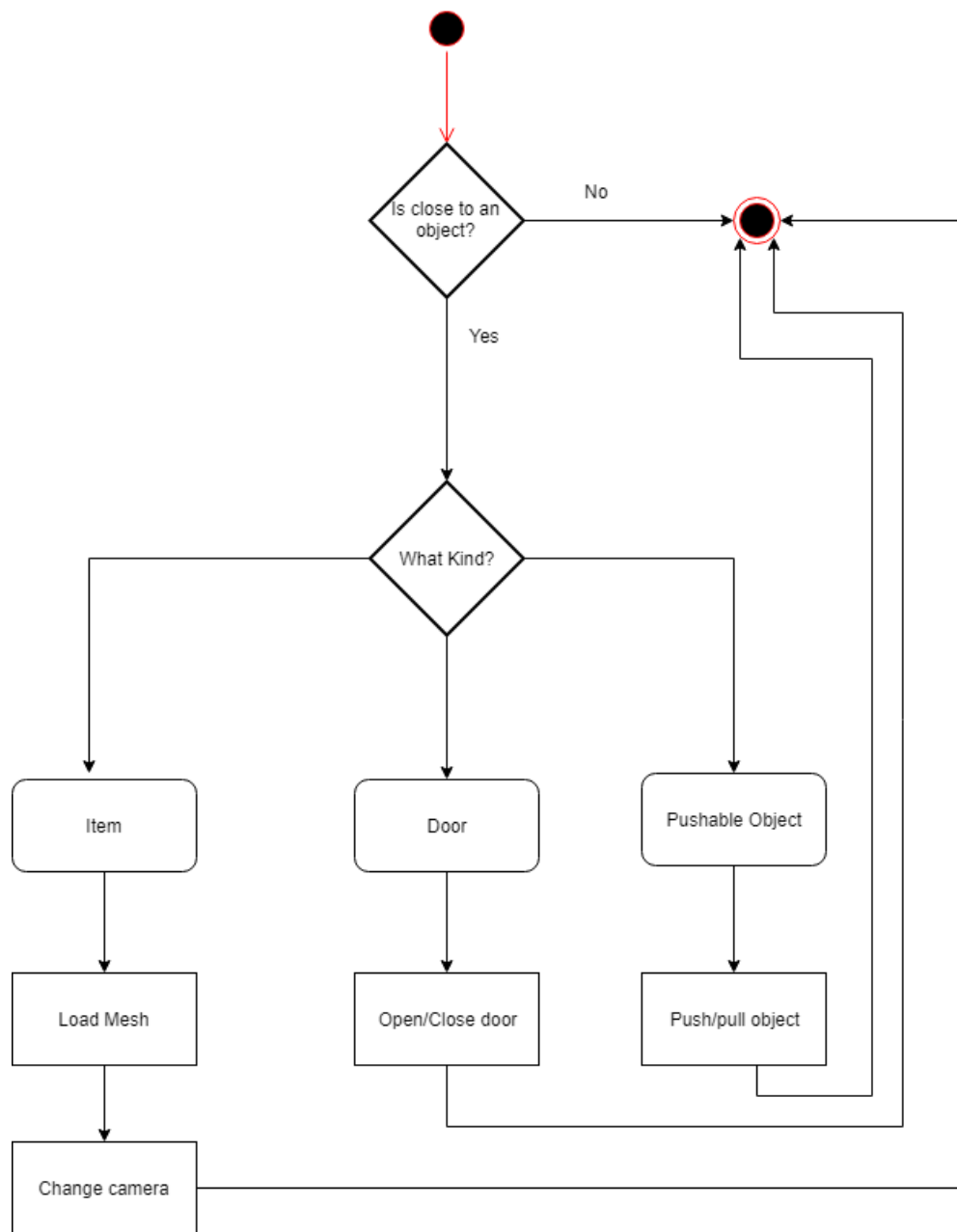


Figure 3.3: Activity diagram of Interaction with an object

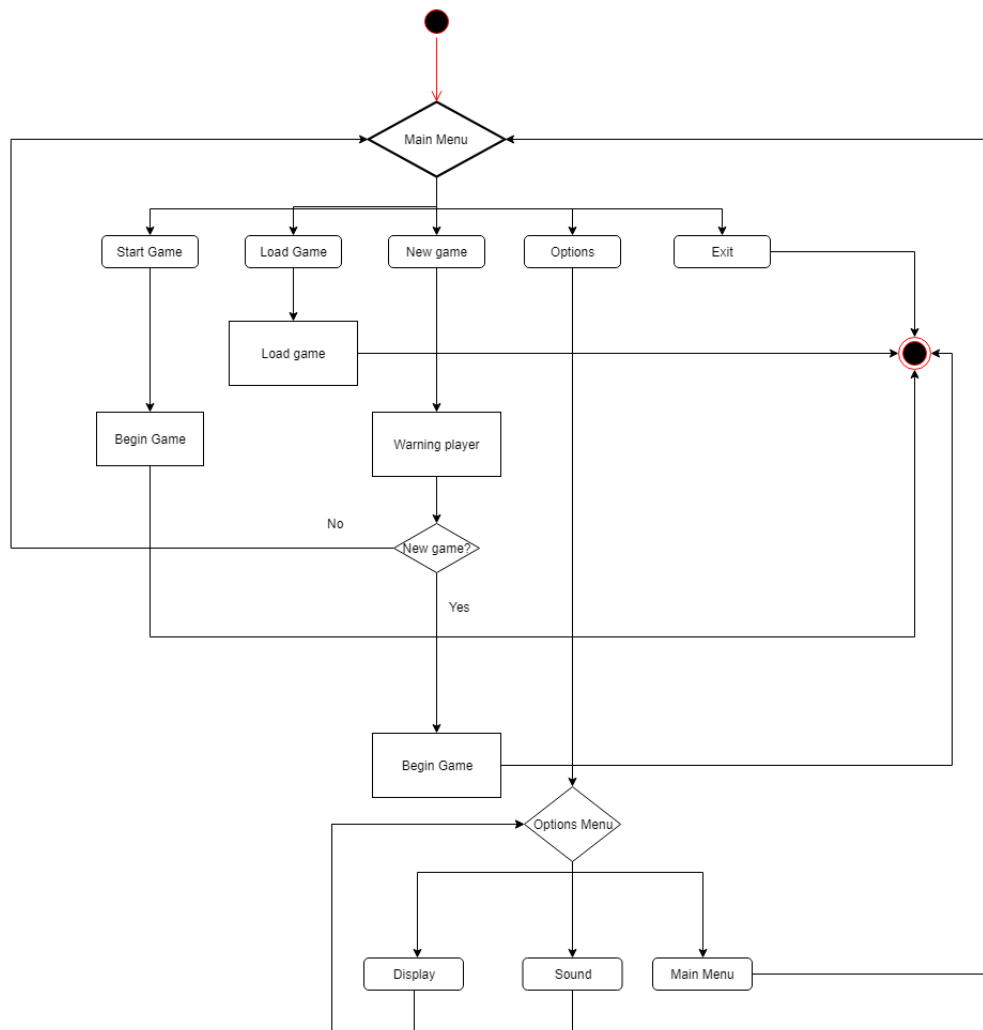


Figure 3.4: Activity diagram of main menu

3.3 System architecture

3.3.1 Minimun System Requeriments

- CPU: Intel Core i5-2400/AMD FX-8320 or better
- RAM: 4 GB
- OS: Windows 7/8/10 (64-bit versions)
- VIDEO CARD: NVIDIA GTX 660 2GB/AMD Radeon HD 7970 3GB or better
- FREE DISK SPACE: 10 GB

- DEDICATED VIDEO RAM: 2 GB

3.3.2 Recommended System Requirements

With this requirements the game should work at 60 fps and 4k resolution.

- CPU: Intel Core i7-4770/AMD FX-8350 or better
- RAM: 8 GB
- VIDEO CARD: NVIDIA GeForce GTX 1060 6GB/AMD Radeon RX 480 8GB or better
- FREE DISK SPACE: 15 GB
- DEDICATED VIDEO RAM: 6 GB

CHAPTER 

WORK DEVELOPMENT AND RESULTS

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4.1 Work development

4.1.1 Character's concept art

As explained earlier in section 1.1, Lucy and Anna's characters were created before I had the idea of creating a video game. The first sketches were made in 2014 (see Figure 4.1 and 4.2). From that year until now have suffered many redesigns as my style was changing.



Figure 4.1: First Anna's concept



Figure 4.2: First Lucy's concept

Although the style changed, during that time the characters kept the essence of the first sketches. Dark lines and a lot of Tim Burton influence. The following images show these concepts and you can see what was said before. The first redesign of Anna maintains its dark essence but it's more stylized (see figure 4.3). After this redesign, after a while, I redesigned both characters again (See figures 4.3, 4.4 and 4.2).



Figure 4.3: Anna's redesign, more stylized



Figure 4.4: New redesign of Anna



Figure 4.5: Redesign of Lucy

With these designs I made a prototype of a 2D video game, although the game was only about Lucy. At first, when I decided I was going to make a game about them for the project, I thought about using the designs I had before, because at first the game was going to keep the lateral displacement although it was going to be in 3D, and the aesthetics dark. But, in the end, I decided to change the type of camera and do it completely in 3D because the other way was not in line with the way I wanted to tell the story. I wanted to give it a more adult appearance, but without leaving aside the cartoon essence. Therefore, the designs I already had were not useful for the game, the appearance of Lucy and Anna was too cartoon and childish. In this redesign (see figure) although they kept much of their original appearance (although Anna did suffer a big change in his appearance, the influence on the style became closer to Pixar and away from the influence of Tim Burton.

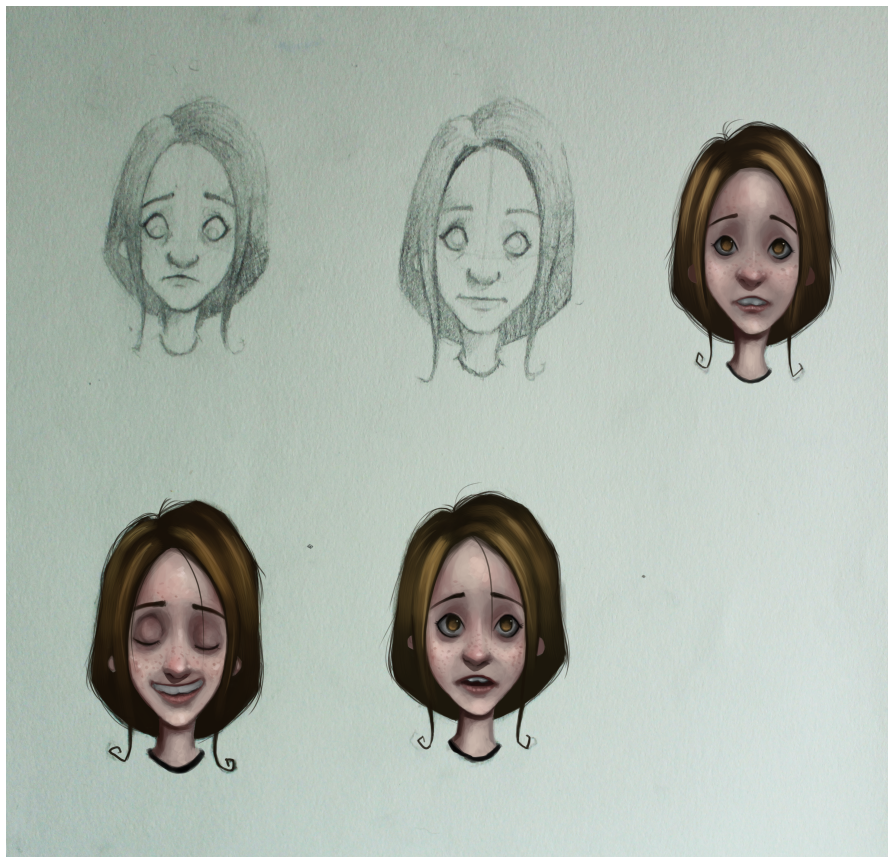


Figure 4.6: Redesign of Lucy

Although these designs were already closer to the look I wanted for them, they still looked very childish for the tone of the story I wanted to tell. But the look in these designs was already very close to what I wanted so I decided to use them as references for the modeling and apply the changes directly in the modeling process.



Figure 4.7: Redesign of Anna

4.1.2 Character Modeling

Character Body Modeling

To prepare the modelling stage, the modelling course at Zbrush [4] by Odín Fernández, art director of Mercury Steam (ref), has been used. The Zbrush [5] course by Rafael Grassetti, art director at Sony Santa Mónica has also been used.

For the body modeling of the characters I decided to use ZBrush(see A.1). Although there are many modeling tools on the market, Zbrush is today the best for organic modeling and the most used in the development of current games. ZBrush, unlike other modeling tools, supports a large number of vertices, which allows to give the models a very detailed finish. In addition, it has a tool called Dynamesh that is able to recalculate the mesh. For example, if you have a sphere and the deforms, the geometry of that sphere will end up being deformed and it will be impossible to continue sculpting in it. With dynamesh we can recalculate the mesh of the sphere so that it is possible to work with it again. For the modeling of both characters I have used the same base, since both share proportions and have a similar complexion. The first step in creating the base is blocking. Blocking consists of defining proportions and anatomy from basic forms. To do this we start with a sphere, which will be the head. Helping us of dynamesh we begin to deform the sphere, with a very low geometry so that it is simpler, to give him the form of the head. By creating more spheres or duplicating existing elements, we continue to model the rest of the elements that make up the body. In the figure 4.8 and you can see the blocking of the complete base.

Once the desired shape and proportions are obtained, it is necessary to weld all the pieces in the same mesh. To achieve this, we use again the dynamesh tool, which also allows to merge objects of the same subtool*.Once all the elements are the same mesh it is necessary to continue giving details to the base. At this stage, the volumes are polished and the possible faults in the proportions are corrected. The anatomy is also defined and the facial features are modelled. The figure 4.9 show the base for Lucy and Anna already finished.

Although the base is already finished, the resulting mesh is not suitable for use. Due to the number of polygons it has will be very difficult to continue working on it, because although you can add details, changing its shape will be very uncomfortable, and we cannot use it in a game engine. In addition to reducing the number of polygons also has to correct the topology. This mesh has a disordered topology without defined loops and, in addition, it is composed of triangles. A mesh with such a topology will present many problems in the animation process at the time of being deformed. In the figure 4.10 you can see in detail the bad mesh.

In order to solve it, it is necessary to create a new mesh over the previous one. This mesh must be low poly and have a topology that allows its deformation. All mesh loops must be complete except in some cases. It must also not contain triangles except in some places such as finger joints. This process is called retopology. There are many programs to perform this process, it is really possible to carry it out with any modeling program. For this project the program that will be used is 3D - Coat. The reason why

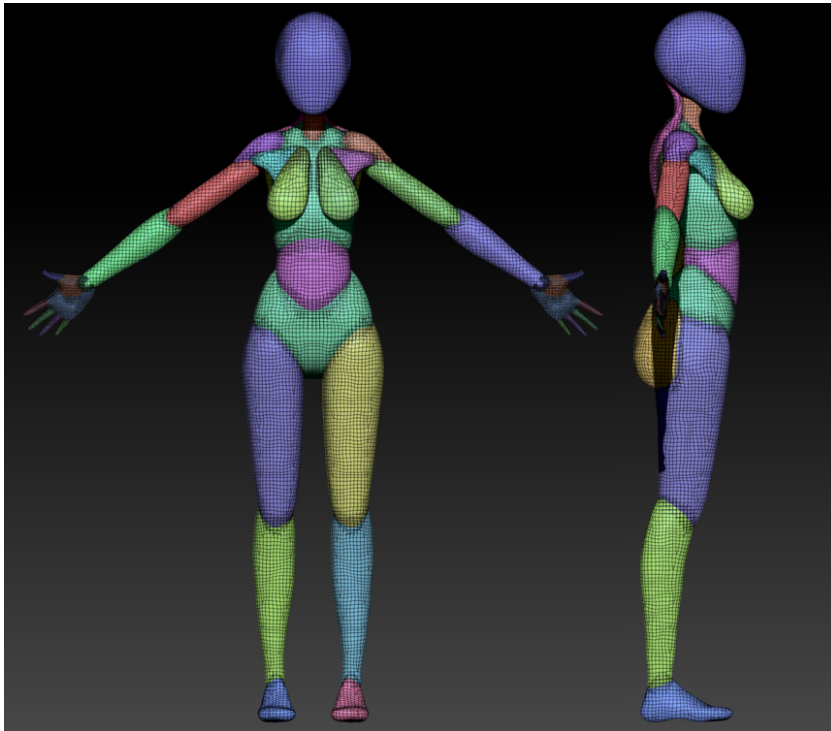


Figure 4.8: **Front view of the block out of the body's base**

this program has been chosen is that it has many tools that speed up the retopology process. In the figure 4.11 you can see the mesh of the body after the retopology. The face requires special mention. For the face it is indispensable that the topology has a concrete form, which follows the muscular structures that form the faces. This is very important and essential so that the face can be deformed correctly. In the figure 4.12 you can see the face with the correct topology.

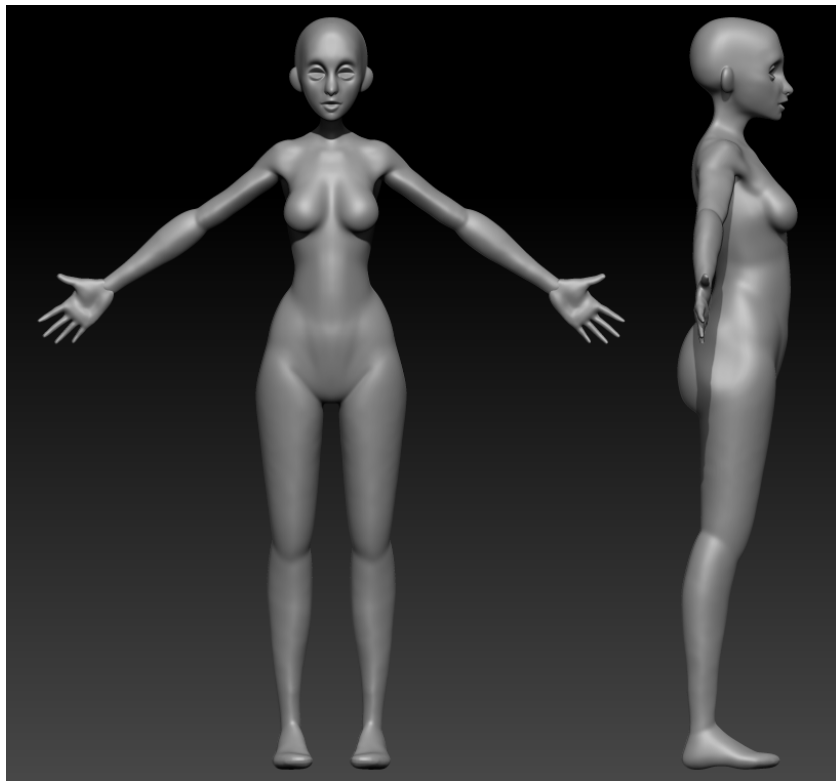


Figure 4.9: **Body's base**

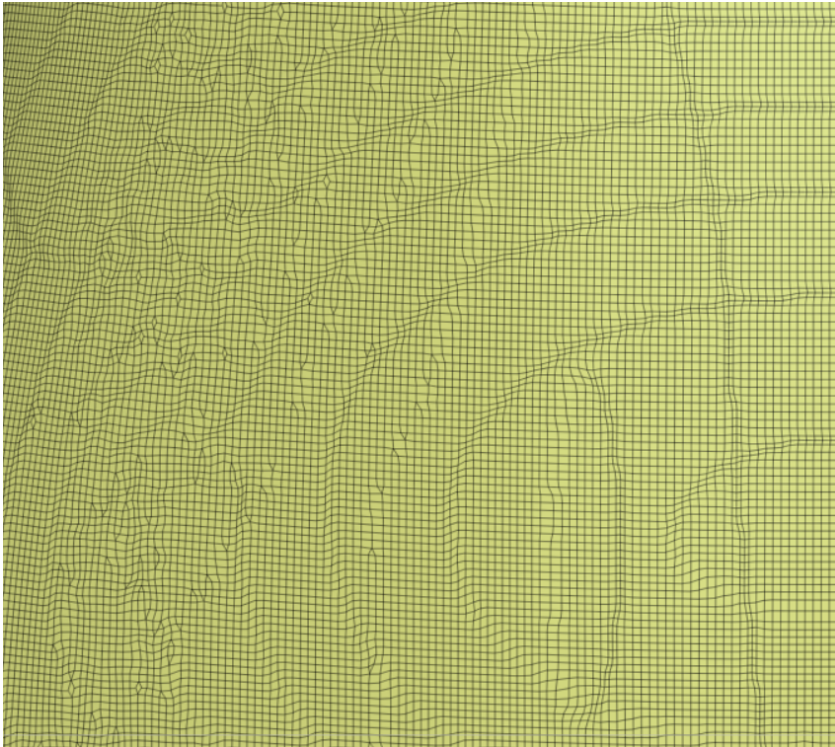


Figure 4.10: Detail of the mesh with bad topology

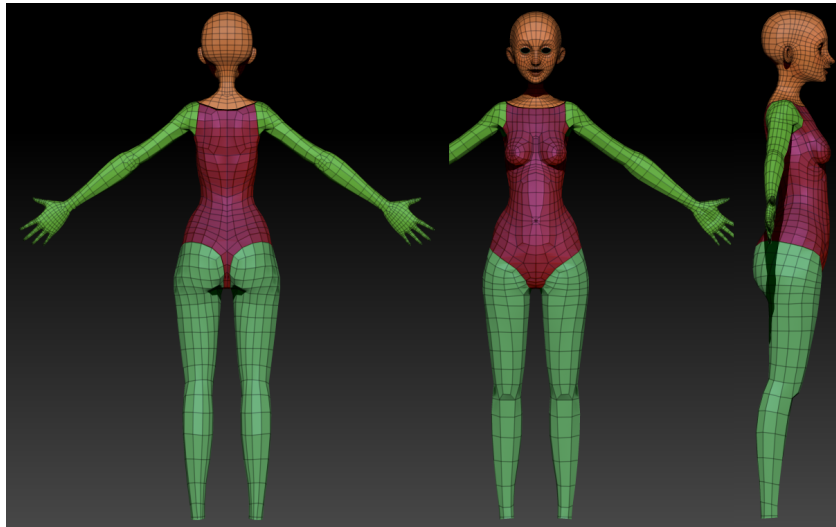


Figure 4.11: Mesh with good topology

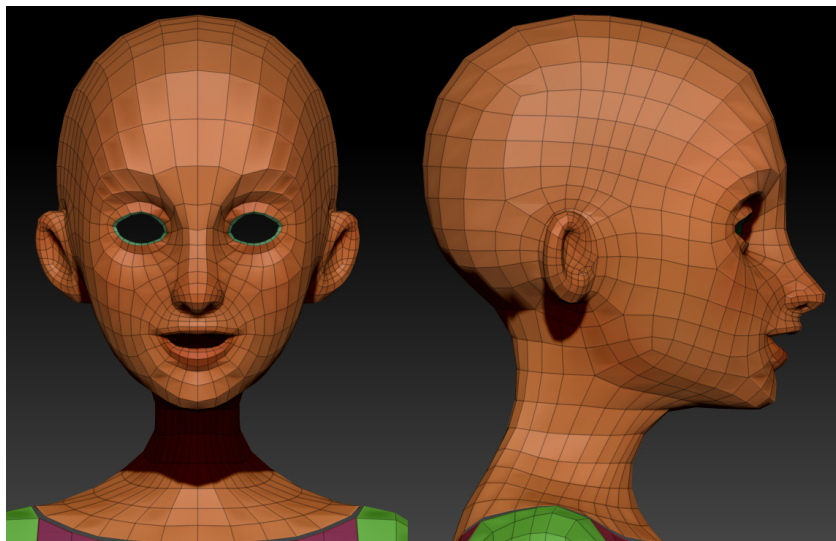


Figure 4.12: Face mesh

Once this process is finished, the base of the body is ready to continue working with it and, in addition, it can also be used in a game engine. The resulting mesh is imported back into Zbrush where the volumes and proportions will be corrected. Now the mesh can be subdivided into zbrush to add all the necessary details. In addition, as the previous division levels are maintained, the mesh will always be easily deformable. At this point in the modeling the eyes, denture and tongue will also be added. The figure 4.13 shows Lucy's finished body and face.

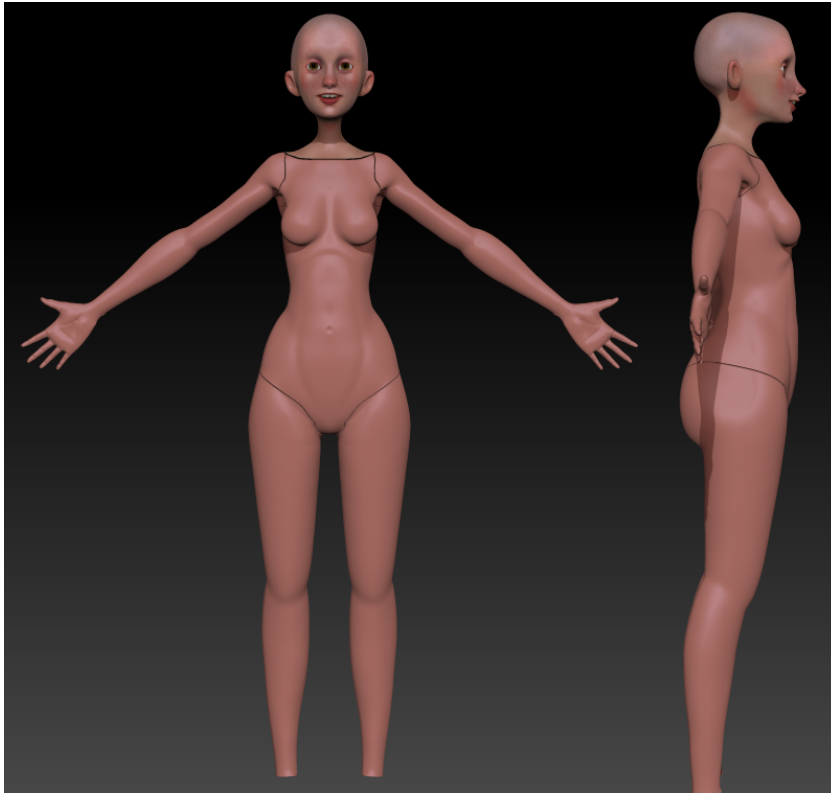


Figure 4.13: **Lucy's body finished**

Cloths modeling

The process for creating Lucy and Anna's clothes is quite different from the process for creating the body. While Zbrush has been used to model the base of the body, the software used to create the clothing is Marvelous Designer (see A.2).

The process to create the clothes is quite simple, although it can be tedious and requires patience. First the pattern is designed in two dimensions. This pattern is the same as the one used in sewing, so you can easily find it on the Internet or create your own. The figure 4.14 shows the pattern used to create Lucy's shirt. In the 3D part the

geometry has appeared with the shape of the 2D pattern. In the 3D viewer the pieces are positioned around the body, previously imported. Once the pieces are in the desired position it is necessary to join them to be able to create the clothes. For this purpose, Marvelous Designer includes a virtual sewing tool. This tool simulates the seams like a real sewing machine. In the following figure 4.15 you can see the seams that join the geometry.

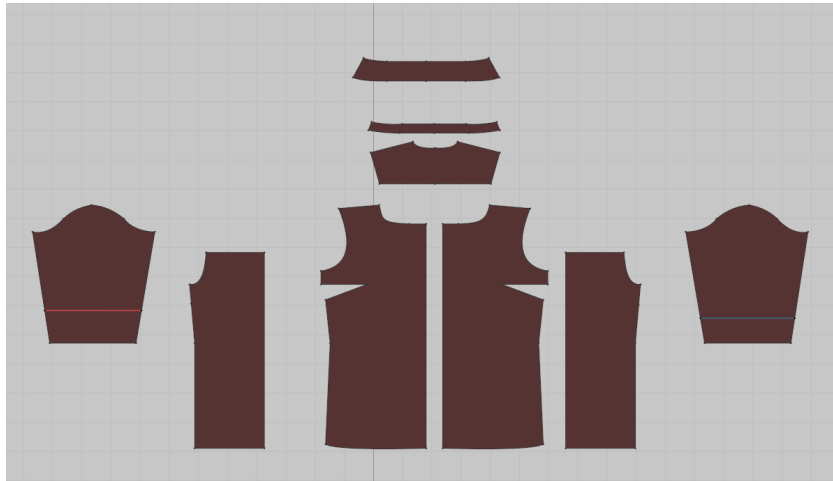


Figure 4.14: **Shirt's 2D pattern**

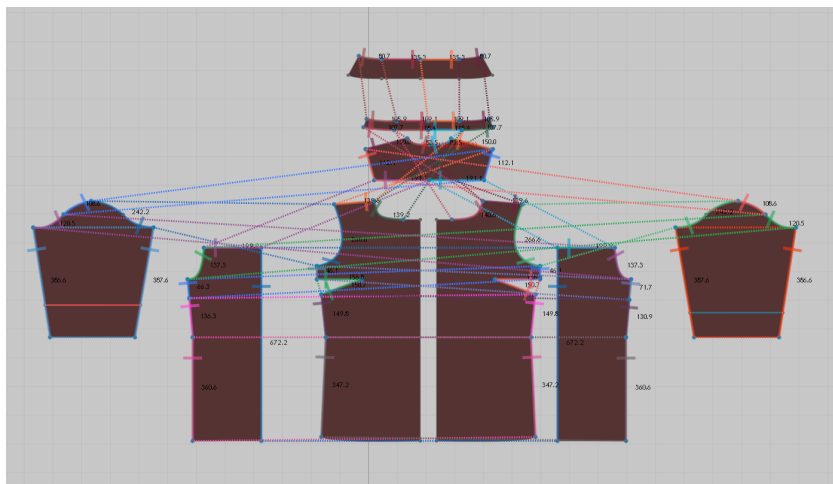


Figure 4.15: **Seams used to join the geometry parts**

Once all the pieces are joined, the simulation is carried out. During the simulation the geometry can be moved and adjusted automatically. This is very useful for adjusting the garment as the garment is usually not adjusted correctly and its position needs to

be corrected. The figure 4.16 shows the top of the finished garment.



Figure 4.16: **Cloth finished**

As with the body mesh, the mesh created with Marvelous Designer does not present a good topology. Therefore, as with the body, it is necessary to perform the retopology of the mesh. In this case, as it is an object with many folds, it would be very complicated to perform the retopology as was done previously. Therefore, for clothing will follow a different procedure to facilitate the process. This workflow consists of performing the retopology on the geometry of the 2D pattern generated by Marvelous. As they are flat pieces, it is much easier to create the new mesh. The figure 4.17 shows the mesh before and after the retopology.

Next, both the new mesh and the old mesh are imported, as well as the mesh from



Figure 4.17: **Mesh with bad topology and with good topology**

the clothes previously created, into Maya. Taking advantage of the fact that the two meshes used for retopology have the same shape and the same position in space, we can transfer the UVs from the old mesh to the new one. Now, both the mesh with the correct topology and the object of the clothing have the same UVs. This allows to transfer the position of the vertices of the object to the new mesh so that it adapts the same shape. The figure 4.18 shows the result of this operation as well as the mesh of the object used as a base.

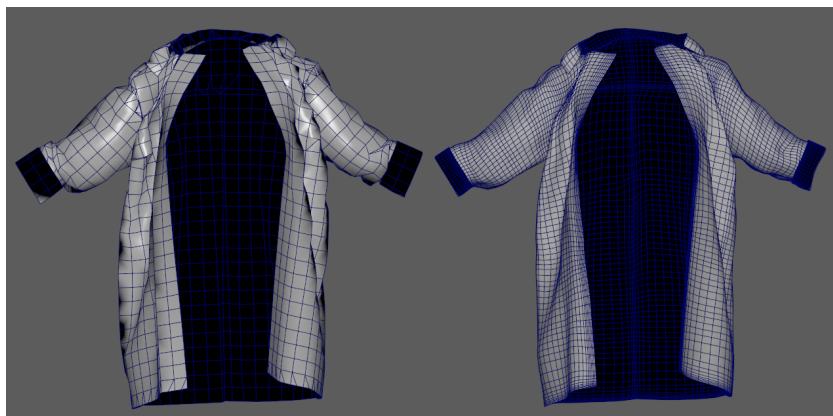


Figure 4.18: **Shirt with bad topology and with good topology**

The next step is to detail the clothing models using Zbrush. In the figure 4.19 you can see the finished clothes.



Figure 4.19: **Cloth's high resolution meshes finished**

Hair creation

The creation of realistic hair is one of the most complex and patient tasks in the creation of a character. Because of this, it has been necessary to look for information about this process. The course [7] of Johan Lithvall has been ideal for this. The most important reason why it is so complicated is due to its own topology. Hair is composed of millions of fibers. In prerendered animation this can be easily simulated with Xgen, which creates geometry for each fiber that makes up the hair. Doing this in video games today is impossible because everything is done in real time and such a large amount of geometry would seriously affect performance. To avoid this there are two options. The first would be to use nVidia's hair simulation technology, nVidia Hair Works, but this tool consumes a lot of resources and would greatly reduce the number of devices the game could be compatible with. The other solution, which is the one to be used, consists of creating geometry planes with very few polygons and using textures with transparencies to simulate the hair effect.

Although it is normal to first create the geometry of the object and then texturize it, in the case of hair the opposite happens. The textures are done first because they will be used as a base to create the hair cards and, in addition, they will make the process of placing them much easier. To create the textures xGen will be used. As explained before, the geometry generated by xGen (figure 4.20) cannot be used in video games but is very useful for the creation of textures. Simply bake this geometry on a plane without subdivisions to create a texture atlas. The figure 4.21 shows the result of this operation. This texture will be applied to the previously used plane, which will be subdivided and cut to create hair cards, which are combined to create "locks" of hair. These locks of hair are placed one by one until reaching the desired shape. The figure 4.22 shows Lucy's finished hair.

Pay special attention that there are no gaps through which the scalp can be seen. Also be careful with the number of hair cards used and their subdivisions.



Figure 4.20: xGen hair used for the textures



Figure 4.21: Textures used for hair creation

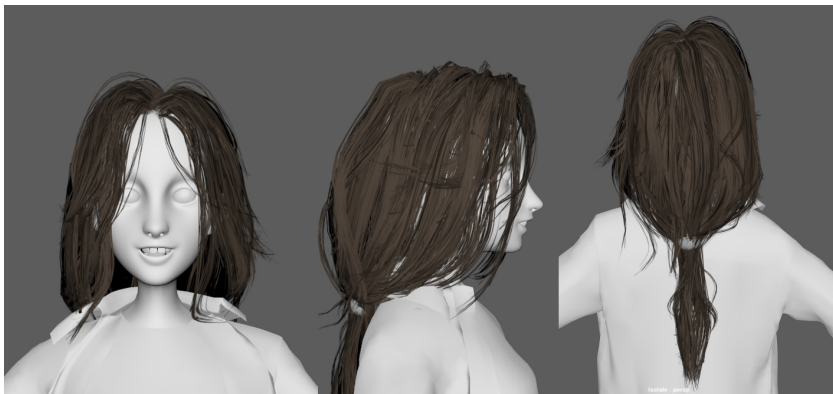


Figure 4.22: Lucys's Hair

boots

The modelling process of the boots is very similar to that of the body. This is the final result of Lucy's boots (figure).



Figure 4.23: Boot's high resolution mesh

4.1.3 Baking and texturing

The next step is to make the bakes. This is nothing more than projecting the details of the high resolution mesh into the low resolution mesh. For this we will use Substance Painter (see A.4), since it will be the tool that will be used to make the textures, so it is more comfortable to do it directly in the program. But, as our objects are right now, it is not possible to do this process because they lack UVs. So the first step is to remove the UVs for each model of the characters. UV Layout will be used for this, a very simple tool but that allows to remove the UVs easily and quickly. Once we have the UVs we can import the models in Substance and make the bakes. This process generates several maps. The most important is the normal map, because this is the one that allows to simulate the details in the low resolution mesh. In the figure 4.24 you can see one of the normal maps. Then, in the figure the mesh in low resolution before and after applying the normal map.



Figure 4.24: **Head normal map**

Now that we have the uvs and the maps the next step is to create the textures. In order to facilitate this process and achieve a better result, the course [1] of Marc Brunet has been followed. For the skin the conference [2] of Magdalena Dadela has been very useful. This process is very long and requires patience but for this project we are not interested in making a description of it, except for some details. To create the clothes we have used materials created with Substance Designer and then we have added the details by hand, for example the sewing of the pants. On the other hand, the leather

has been painted completely by hand. In the figure 4.25 you can see the result of the skin and in the figure 4.26 the rest.



Figure 4.25: **Face textures finished**



Figure 4.26: **Cloth textures finished**

4.1.4 Rig and Animation

The Rig (see A.3) and animation process is perhaps the longest of all and one of the most complicated as any failure can result in an animation that is unnatural and unattractive. The course [6] of Justin Harrison, has been indispensable to be able to create the setup of the Rig. In a beginning it was proposed to create the animations completely from scratch to be original but, due to problems external to the project, the working time was drastically reduced and, therefore, it was no longer viable to make the animations this way. Yes, the Rig setup was done, but later it was discarded because it was no longer necessary. The figure 4.27 shows that setup.

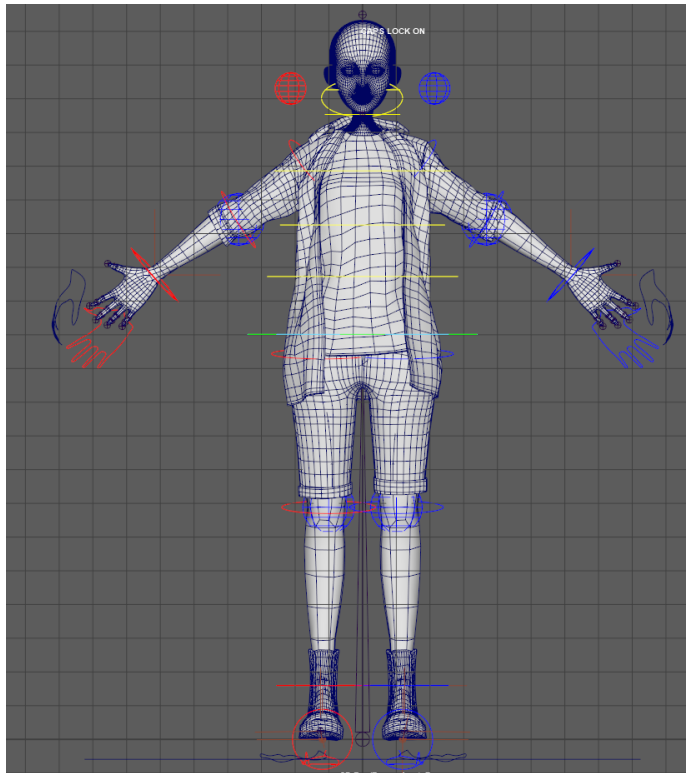


Figure 4.27: **Boot's high resolution mesh**

Therefore, we looked for another solution to make the animations, even if they were provisional. For this purpose, an Adobe tool called Mixamo was used. This tool performs the Rig and skinning process automatically. It also has an extensive library of free animations. Although the result of the tool is quite good, it is still necessary to make some adjustments in the weights of the skinning and in the animations. The figure 4.28 shows the skeleton generated by Mixamo for Lucy's model. Thanks to this tool a process that could have taken months could be solved, albeit temporarily, in a few days. Once we have the rig done and the animations we can import everything into Unreal Engine to start implementing it.

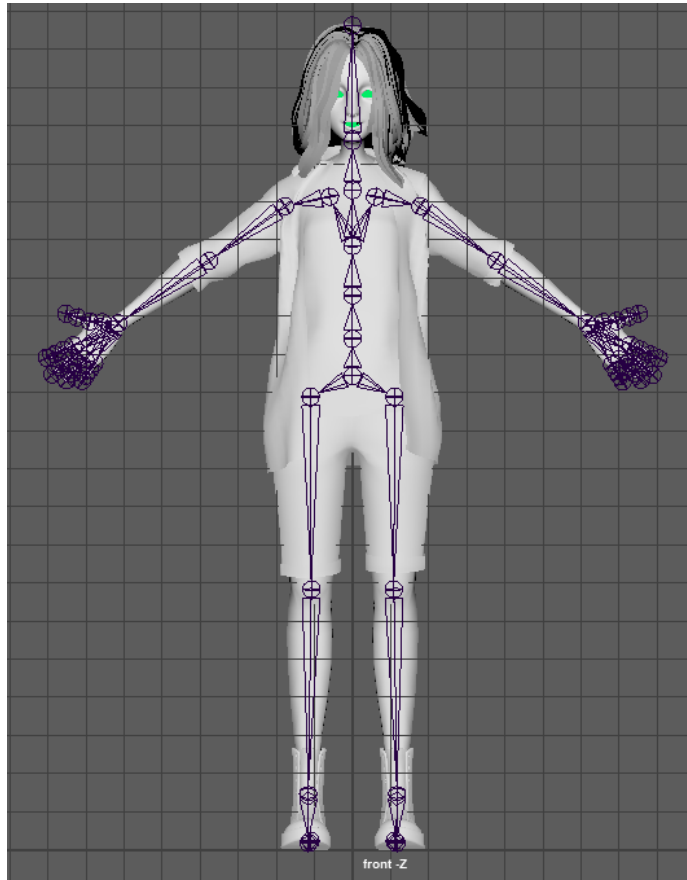


Figure 4.28: **Rig created with Mixamo**

This process is very easy to do thanks to the tools offered by Unreal Engine 4 and it's not worth stopping to explain it. Simply mention that the change between animations is done with a state machine.

4.1.5 Mechanichs

For the implementation of the mechanics a tool provided by Unreal Engine called Blueprints has been used. This tool is basically a programming language based on nodes, which works internally with C++. This is very useful for profiles more focused on design because it allows the designer not to have to learn a programming language, also one as complex as C++, because it only requires to know the logic of it. It is a very powerful tool that allows to program any mechanics that can be implemented with code. In addition this tool is also used in the creation of materials, animation, creation of artificial intelligence ... Basically everything that can be done programming in Unreal Engine can be done with Blueprints. The figure 4.29 shows an example of a mechanics implemented with blueprints

For the implementation of the mechanics and everything related to a real engine, it has been essential the course [8] made by Mariano Rivas.

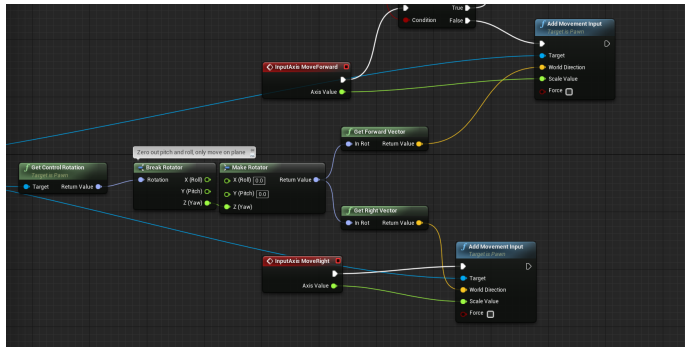


Figure 4.29: Move character Blueprint

4.1.6 Achieve milestones and problems

A continuación se indican los hitos conseguidos:

- Lucy's model
- Lucy's textures
- Lucy's animations
- Anna's Body
- Anna's base cloth
- Object interaction mechanic
- Open/Close door mechanic
- Change between characters mechanic
- Implementation of Lucy's model in Unreal

Much of the development has suffered a great delay because when the planning was done there was going to be much more time available to carry out the project. But due to a problem with the external practices, for which I had to carry them out again, the real time has been much less than initially estimated. Because of this it has not been possible to complete Anna's model and its implementation. The mechanics of pushing objects could not be fully implemented either. This unforeseen event has also affected the initial objectives of the project. In the beginning it was planned to implement an artificial intelligence that would allow the interaction between Lucy and Anna but, due to the

lack of time, it was not possible to implement a sufficiently worked artificial intelligence. So it was decided to do without this AI for now and focus the project on the process of creating the characters.

4.2 Results

4.2.1 Lucy's model

Although the objectives set for Lucy's modeling have been achieved there are some aspects of the model that are not definitive and some props are missing to add. The textures still have to be further polished and some visualization problems fixed. The rig and the animations are not definitive either. Although the work done by Mixamo in this aspect is quite decent, such animations are only acceptable for the initial stages of development. The final product must have much more careful animations that fit the personality of each character. The figure 4.22 shows Lucy's finished model.



Figure 4.30: Lucy final result

4.2.2 Anna's model

Unfortunately, due to what is explained in section 4.1.6 Anna's model could not be finished as it was set in the initial objectives. The body has been finished as well as the base of the clothes and boots. It has also been possible to make some provisional textures, but these cannot be used in the final product. Hair, rig and animations could not be completed. In the figure ?? you can see Anna's model in its current state.



Figure 4.31: Anna final result

4.2.3 Environment

Although in the objectives was set the realization of an environment for the game, due to the shortage of time it has not been possible to realize it. The environment presented in the project is a test bench to implement and test the mechanics.

4.2.4 Mechanics

All mechanics could be implemented with the exception of mechanics for pushing an object and that of hiding. The first, although implemented in another project, due to lack of time and some difficulties in its implementation, could not be applied in the final project. The mechanics to interact with an item, although it has been implemented, still has some details to polish, such as showing the description of the object.

The remaining mechanics have been implemented in accordance with the objectives set out in the section 1.2

CONCLUSIONS AND FUTURE WORK

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5.1 Conclusions

As I explained in section 1.1, I chose to do this project because I wanted to see the characters I had been creating for so long in a real project. After so many years of developing a character, it's very satisfying to see it take shape and slowly come to life. Besides, I've been wanting to make this game for a long time and this project has helped me to start it, which has motivated me to make it happen. The truth is that, although I haven't been able to carry out all the ideas I've put forward, I'm proud of the result. After so many redesigns I have finally managed to arrive at a design that I really like and fits the tone of the game and with a finish that, although not free of errors and still has many things to polish, is close to that of a professional model. In addition, the content of the tfg covers many aspects of the content of the race, especially the art part of it, specifically the subject Art of the Video Game and 3D Design. And of course, being one of the objectives the implementation of the characters in a video game engine, the programming knowledge acquired during the race has also been applied. What I enjoyed most about the project was the modelling and texturing of the characters. This project is very important to me and I wanted the characters to look as professional as possible. To do this, I had to learn many new techniques that have greatly improved the quality of my models as well as making my workflow more efficient. Of course I still

have a lot to learn to reach the level required in the industry. I have also learned a lot about the Unreal Engine. In the race I had only used Unity and wanted to use Unreal Engine because, together with Unity, is one of the most used engines today, especially in the indie scene. In addition, Unreal provides more powerful tools than Unity, especially in the graphic section. And considering that one of the characteristics of the game is its graphic section, it was the ideal choice.

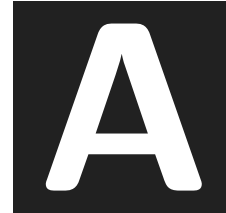
But, although I enjoyed the project, I also had problems, both internal and external, that have prevented me from carrying out everything I had planned. The biggest problem was the lack of time. At first I was going to have almost four months in which I could devote almost all the time to the TFG but due to a problem with the company in which I was doing the internship, I had to do them again in another company. This has drastically reduced the time available to me for the TFG. Even so, I am satisfied with the result, although I would have liked to have polished it further and implemented all the objectives. Overall, despite the problems, it has been a satisfactory process. Creating characters is my passion and seeing them finally moving is very rewarding. Also, for the future, it has helped me to expand my portfolio, which, as a modeler, is essential to find work.

5.2 Future work

In the future I would like to continue improving the characters and continue developing the game to have a functional demo with which to get funding to make the game complete. Of course this is a long-term goal, since I don't have the financial means to hire people to speed up the project, having to do almost all the work together with some colleagues, I'm aware of the difficulty of carrying out a project like this but for now I have it as a personal project to learn about video game development and tell the story of Lucy and Anna. I don't care how long it takes or if it fails.

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OTHER CONSIDERATIONS

A.1 Zbrush

Zbrush is a program that although it allows any type of modeling, has been designed for the modeling of organic figures. This is possible thanks to the fact that Zbrush is capable of supporting a mesh of billions of polygons. Here [11] its characteristics are described in more detail.

A.2 Marvelous Designer

Marvelous Designer is a program specially designed to create 3D clothing. Through 2D patterns created by the user, the program creates the 3D geometry. Then it applies physics to the mesh and through a simulation gives the geometry the desired shape. For more information see [3]

A.3 Rig

Rig is a process that consists of creating a skeleton that adapts to the shape of the character. This skeleton is associated with the mesh and allows it to be deformed. Here [10] you can see a more detailed explanation.

A.4 Substance painter

Substance painter is a program specialized in the creation of textures. Its operation is very similar to that of any digital painting software but focused on 3D objects. The use

of this program greatly facilitates the creation of textures by its ease to apply materials and modify them freely, among other advantages. Here [9] you can find more information about this software.

A.5 Link to repository

<https://1drv.ms/f/s!AkRtOeZyXIz8jbRFkojbfGK8OUzZLA>