UNAM

Facultad de Ingeniería

Computación Gráfica e Interacción Humano-Computadora

Documentation

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Requirements

This project wants to make a virtual tour made on OpenGL, could be seen at the house Lon Lon Ranch from the videogame Ocarina Of Time for Nintendo 64.

The objective is have a environment like the original game, the original environment is on the images below:

House Outside

Inside House

First Room

El siguiente es uno de los cuartos que se va a elaborar, el objetivo para este cuarto es tener una repisa, un barril, una pala, un jarrón y al menos una gallina.

Next one is one of the rooms to make, the goal is make a barrel, a vase, a chicken, a shovel and a shelf.

Second Room

This is a bedroom, will have a bed, chairs, a table, a cabinet and finally the iconic master sword from the same game.

Resume of the requirements

The code must be implemented with the following elements:

- Synthetic camera
- Textured models
- Fourth animations

We must do the necessary elements to make the tour in OpenGL:

- House Model
- Rooms Model inside of the house
- Object Models from every room

Es necesario crear texturas para los modelos creados.
It is necessary make textures for the models and assign them for their correct visualization

Design

Software

The software used will be the following

Blender

Blender is a 3D model with multiple tools, his learning curve could be hard, however blender have a great community and is free

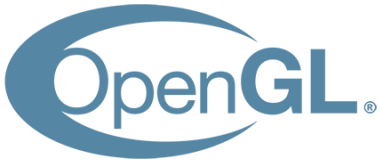
Krita

Krita is a digital illustration software that is also free, it is very powerful and has different tools, it is possible to make illustrations to make animations, for this project it will be used to create textures.

Visual Studio 2022

This is the iconic IDE from Microsoft, is very powerful and they have integrated tools very useful like Git or testing, even if is not totally free under some circumstances, will be useful for us and free because we don’t meet the conditions to have to pay.

OpenGL



OpenGL is not a Software from himself but have instructions that we could use to make the virtual tour, the coding will be on C++.

Hardware

The Hardware use for this project are the following:

1. Video Card GTX 1650 SUPER
2. Micro- Processor Ryzen 5 2600
3. Power Supply EVGA 450W Bronze 80 Plus
4. SSD 240Gb Kingston
5. Motherboard Asus B450

Textures

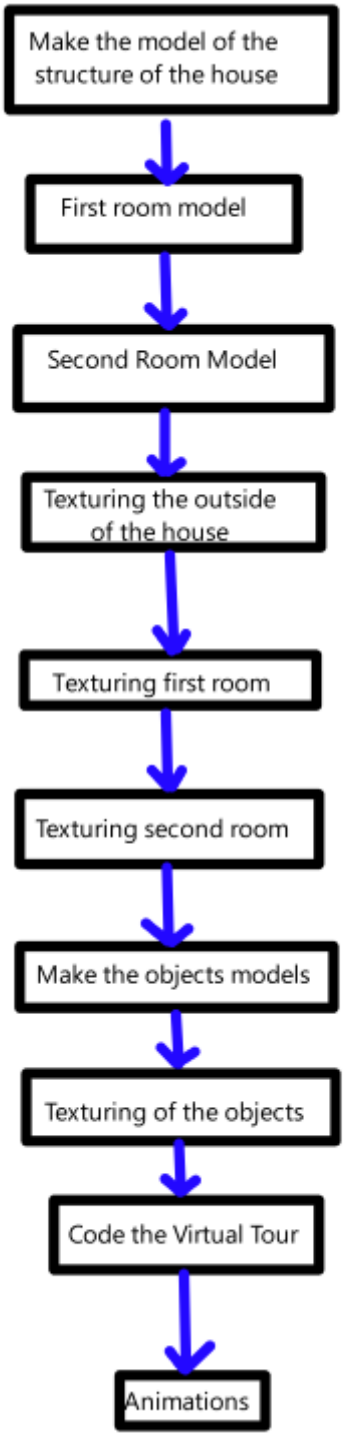
We will have in mind the following for the textures

- Powers of 2 sizes will be used, that is, 2x2, 4x4, 8x8, ... 256x256, 512x512, 1024x1024, this in order to optimize memory access.

- The textures will be mostly done by the team

Project development

The workflow will be as follows



Each step must be completed before moving on to the next.

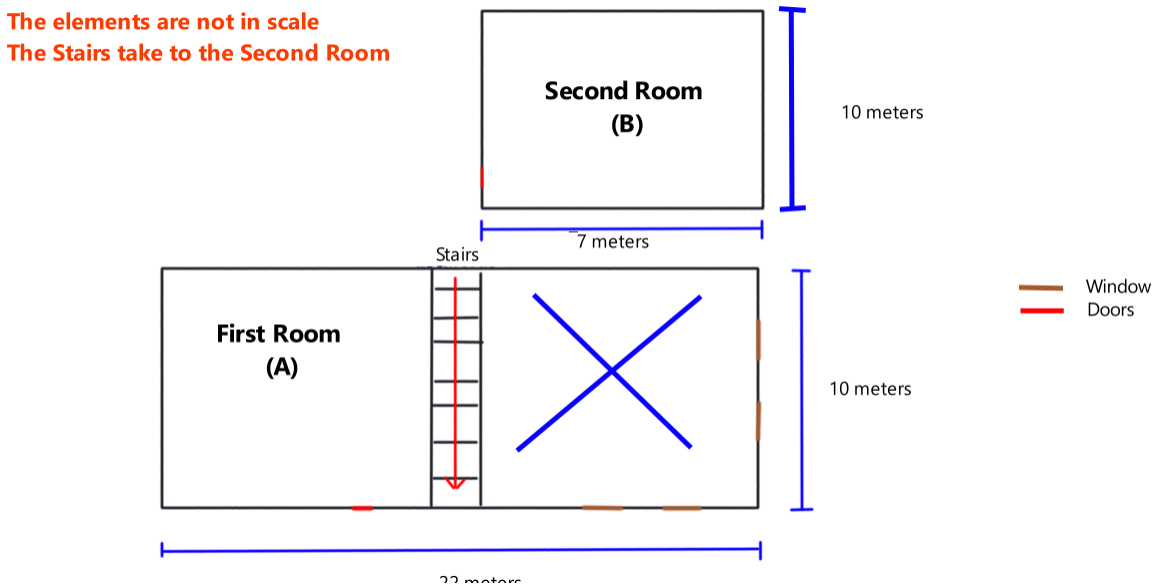
Models

Models in general

We will try to use basic figures to be able to have a good performance and ease when texturing.

House Model

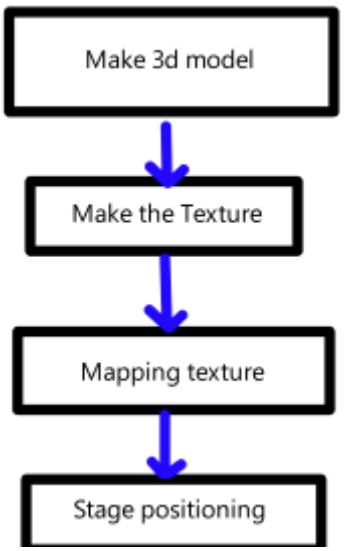
We will make a plane to have a reference that make ease job when the time of modeling comes



Before proceeding, some clarifications

- It will try to make most of the models
- The textures will be mostly done by the team, to avoid clashing
- If a model that has not been made by ourselves is used, it will be textured in a simple way

The process to every model will be the next:

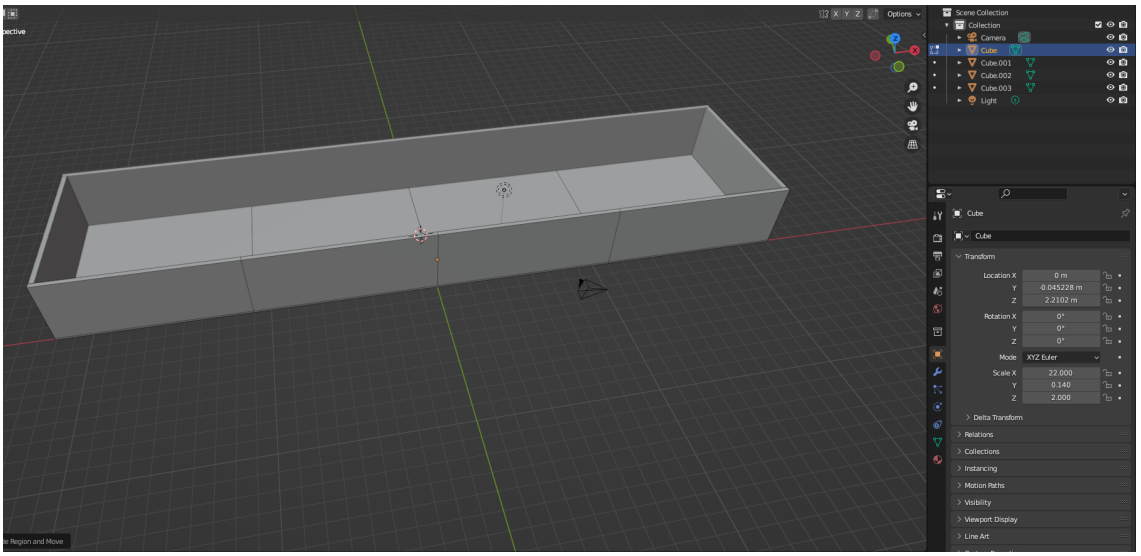


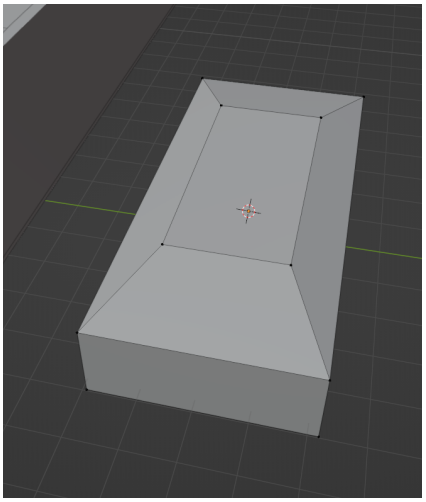
Every model will have this workflow. The textures will be made mostly by the team to maintain a homogeneity

Implementation

Model and textured for the outside of the house

The house modeling is easy, we used cube and with the scale tool, make a wall form.

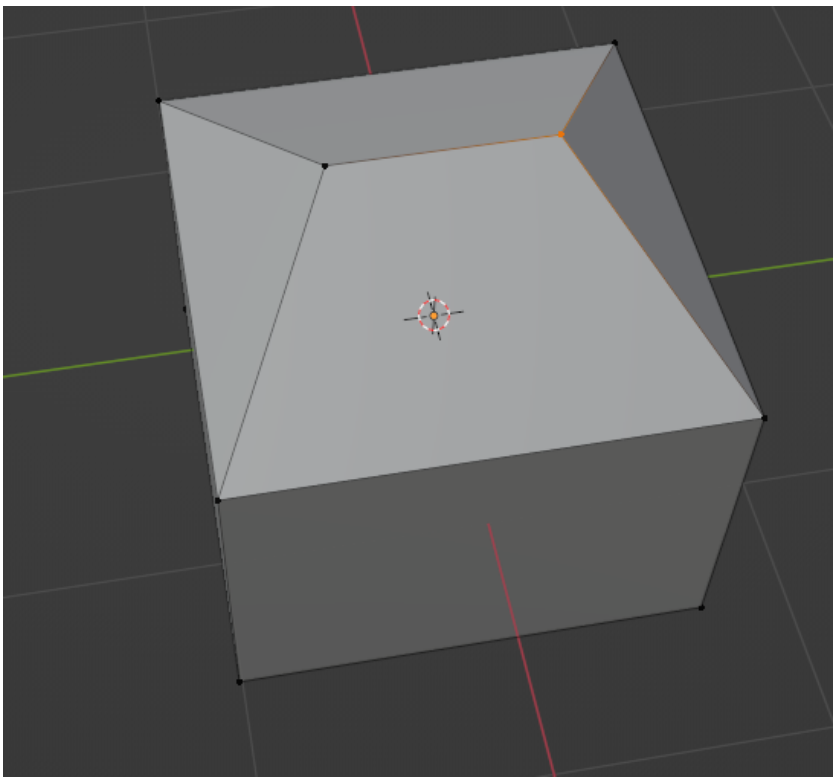




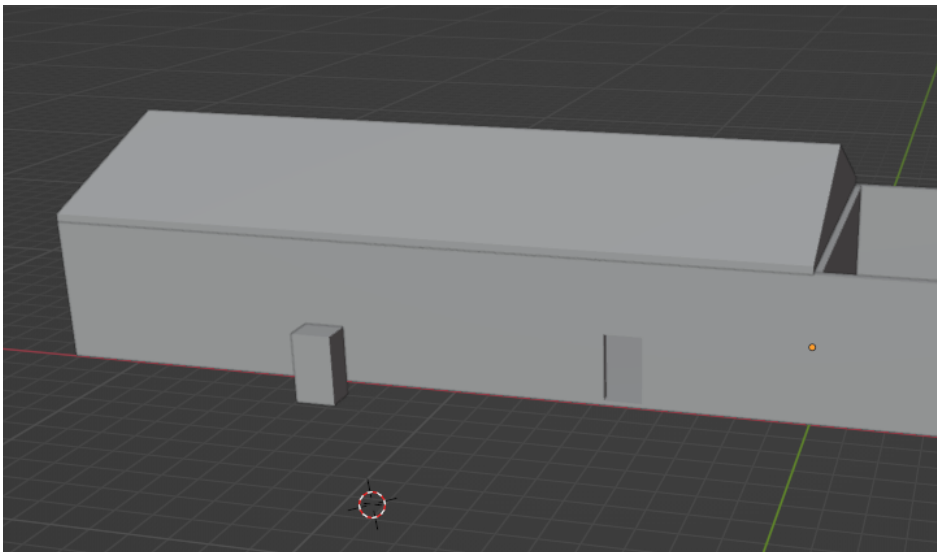
The house needs a roof, to make it we will take a triangular prism as a reference.

Unfortunately, blender doesn't have a Triangular Prism but if we create a Cube, and if we use a Bevel tool, and link the vertices to join in the middle, we have a Triangular Prism.

Still need to make adjustment but we have a Triangular Prism to make the roof.



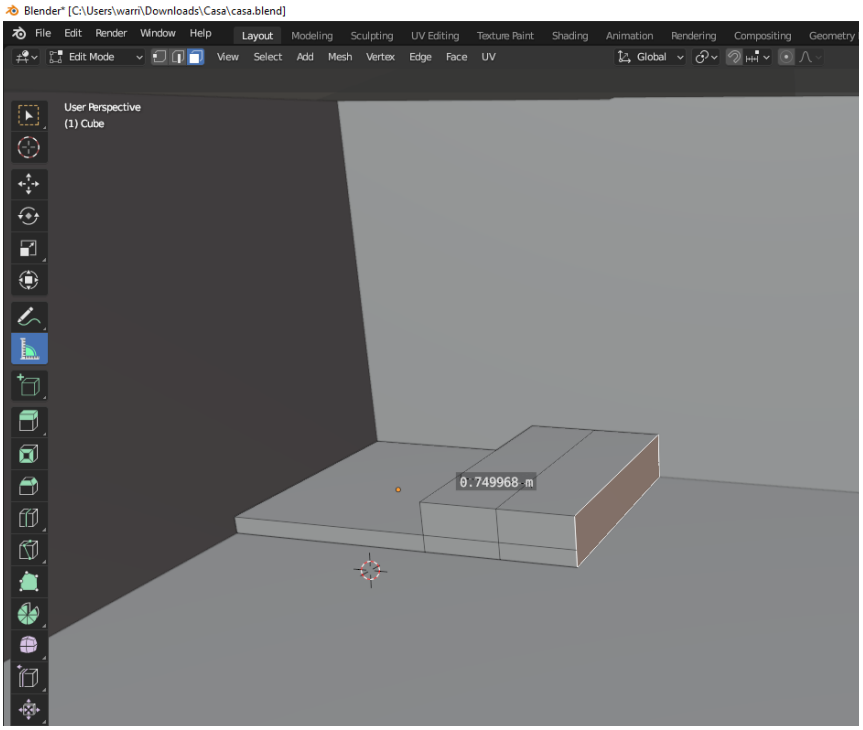
With that form we just need to adjust some positions.



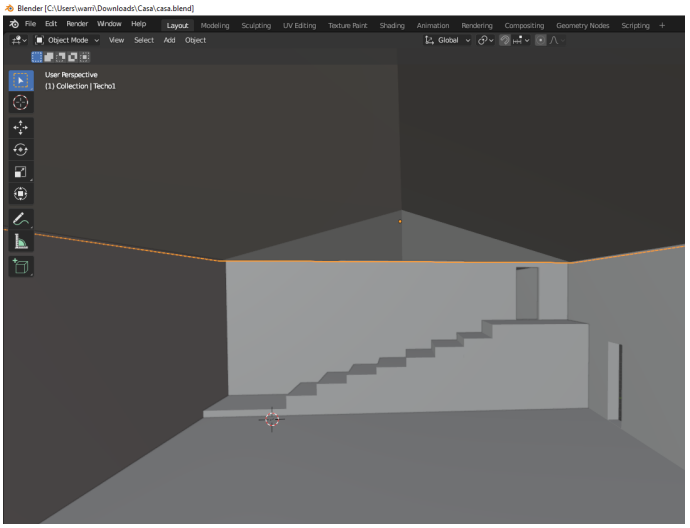
With the Triangular Prism we only need to duplicate it to make the others.

First Room

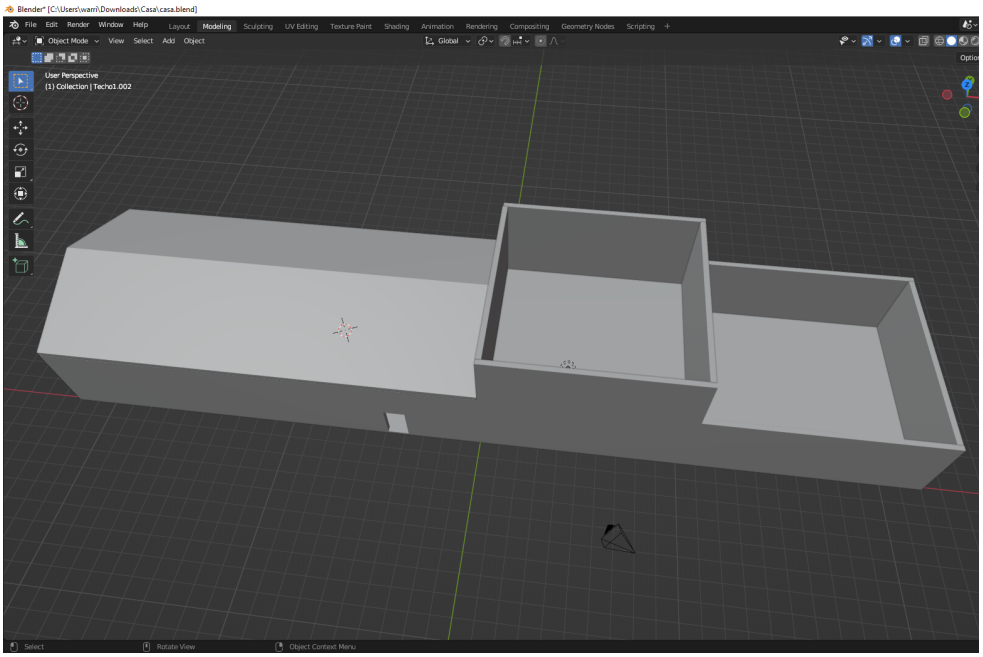
We will make a stairs that lead to the second room.



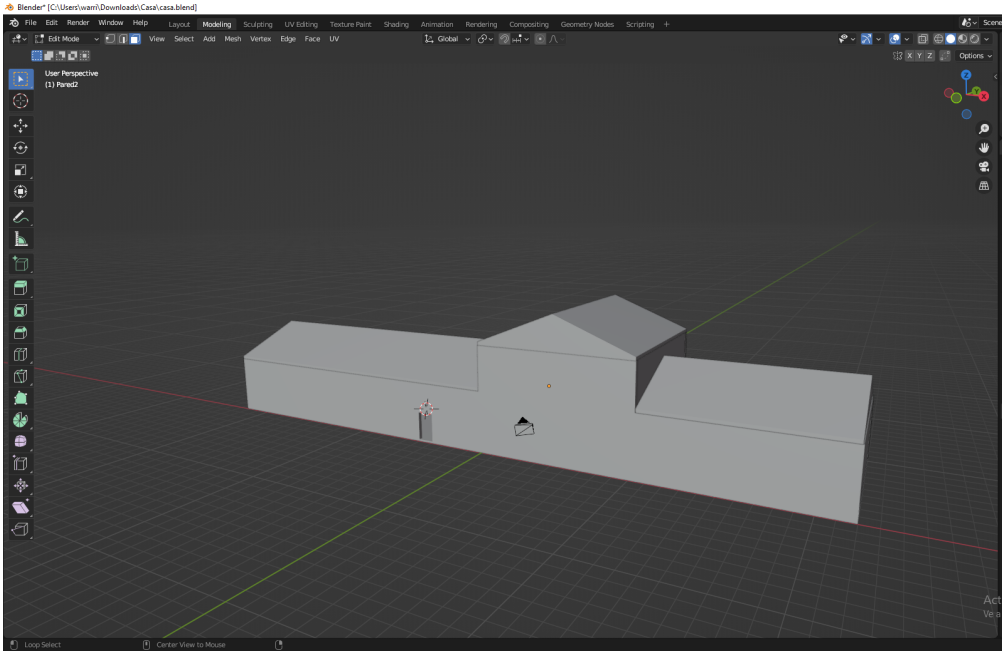
Result:



Second Room



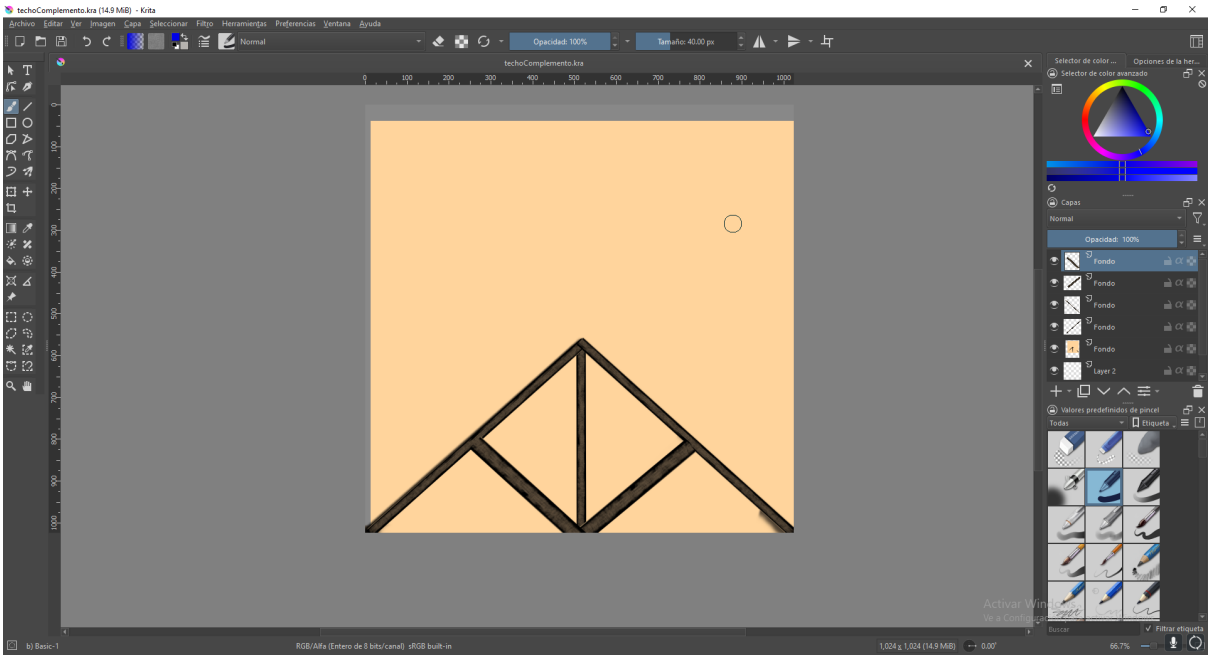
With the first room we can calibrate the position for the floor and walls

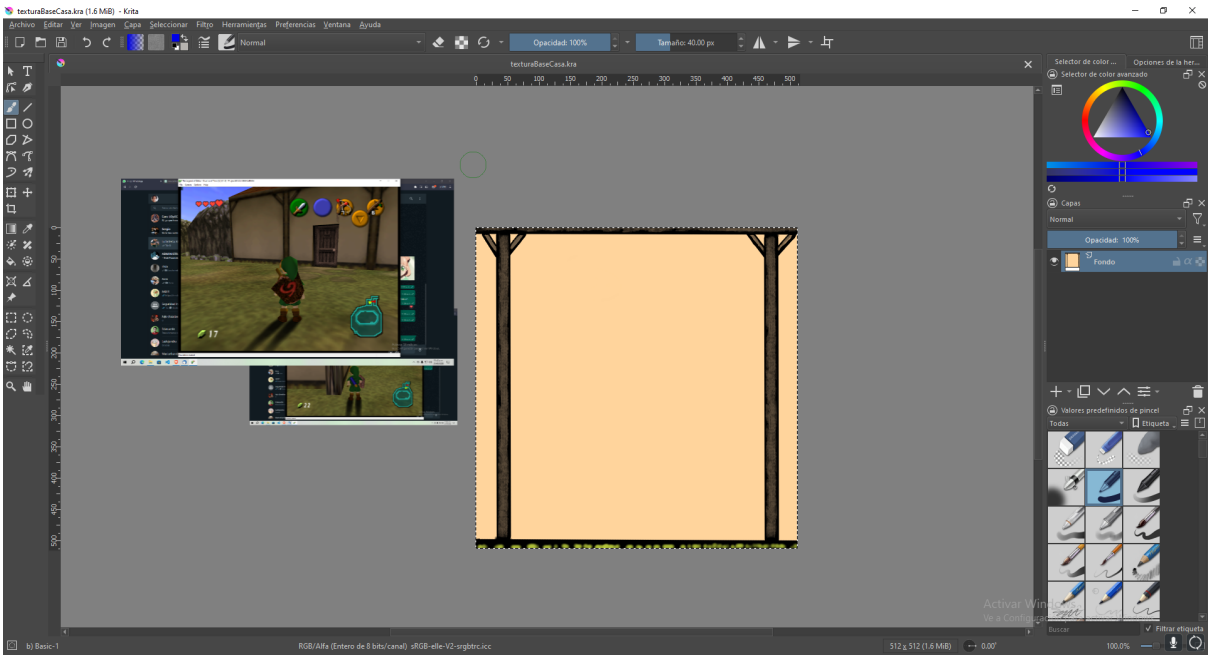


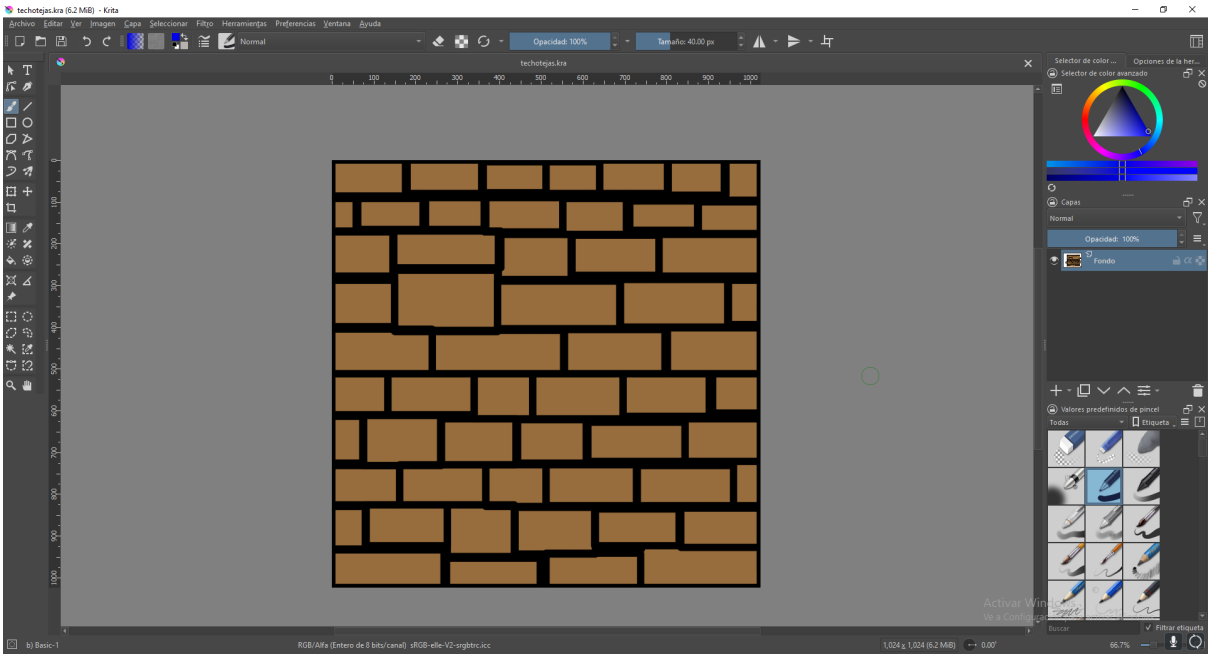
The holes that we can see in the images are the result of applying a Boolean operation between the object and the wall.

House Texturing

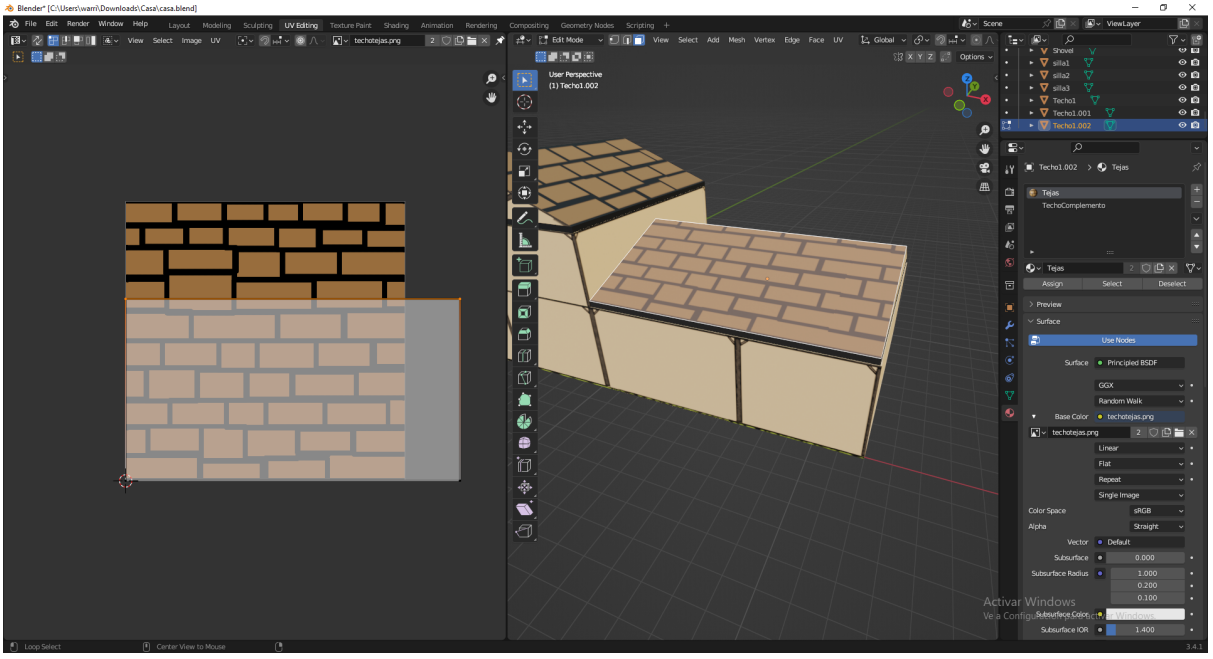
To make the textures we use references images to make it look like the game.



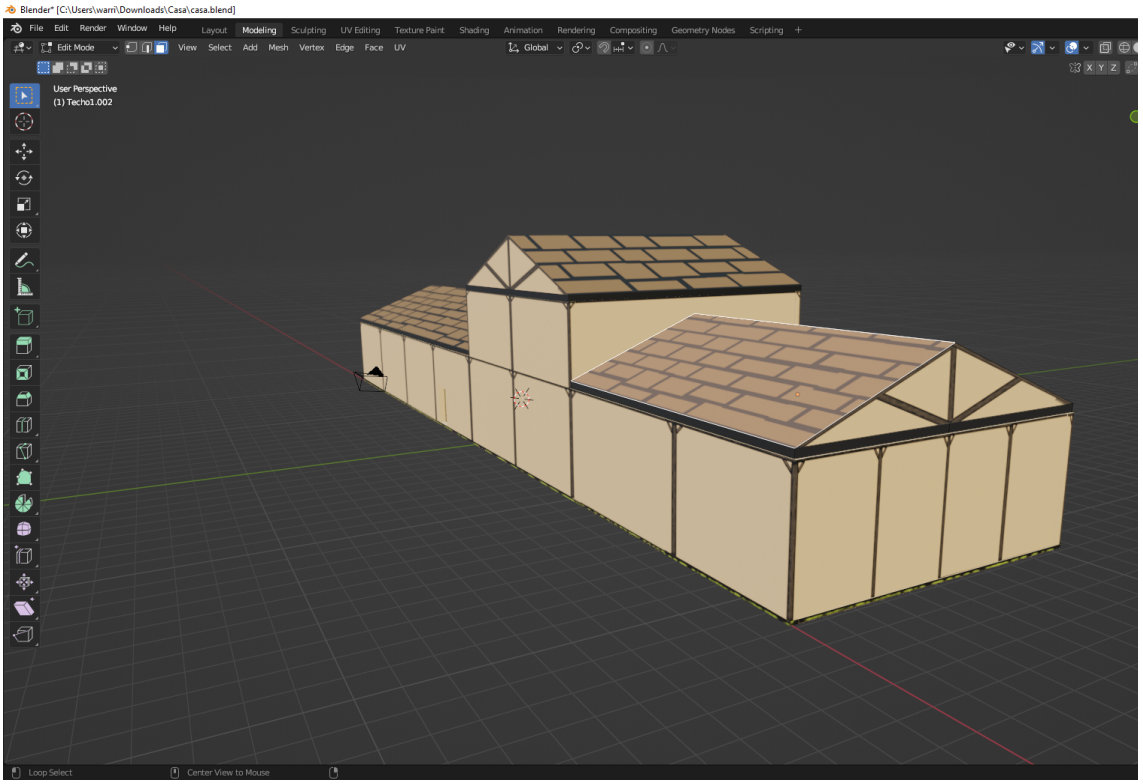




We need mapping in the U-V space for a correct display

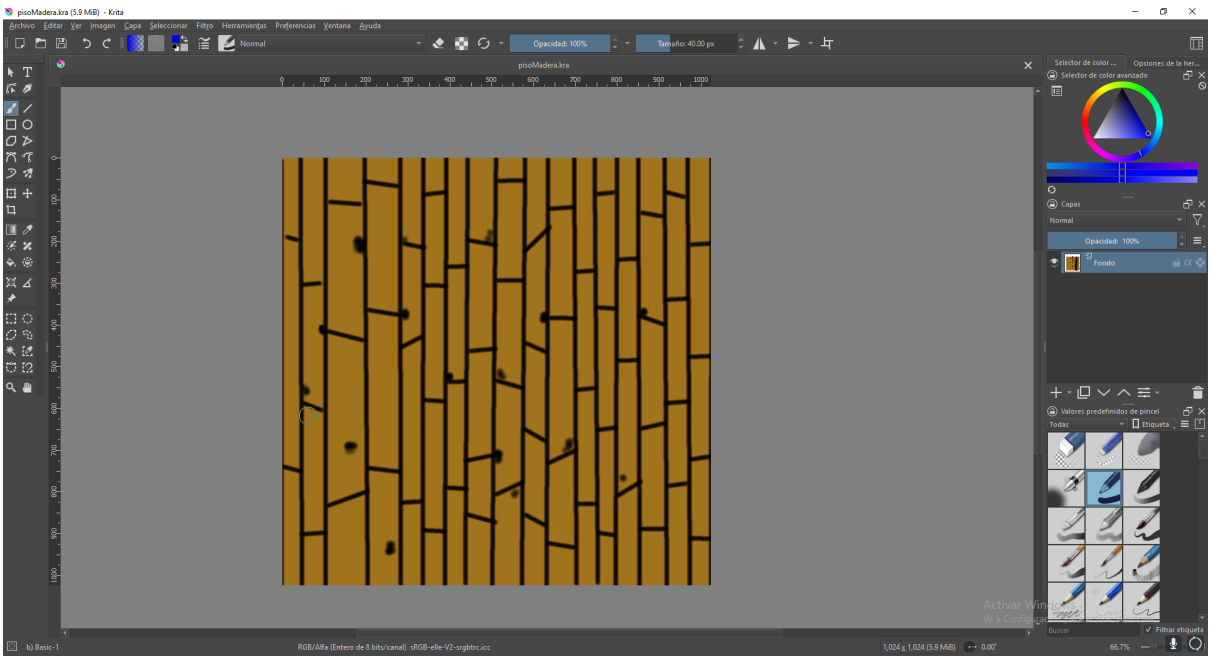


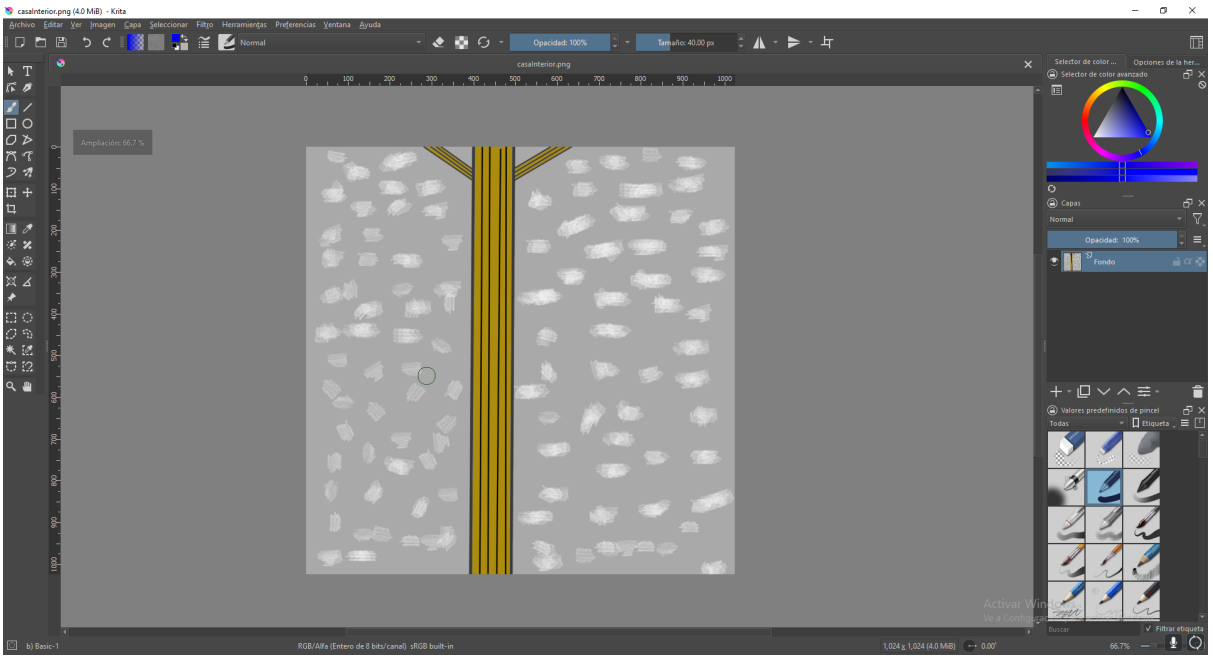
The mapping process has to be applied to every object and every face of the house.

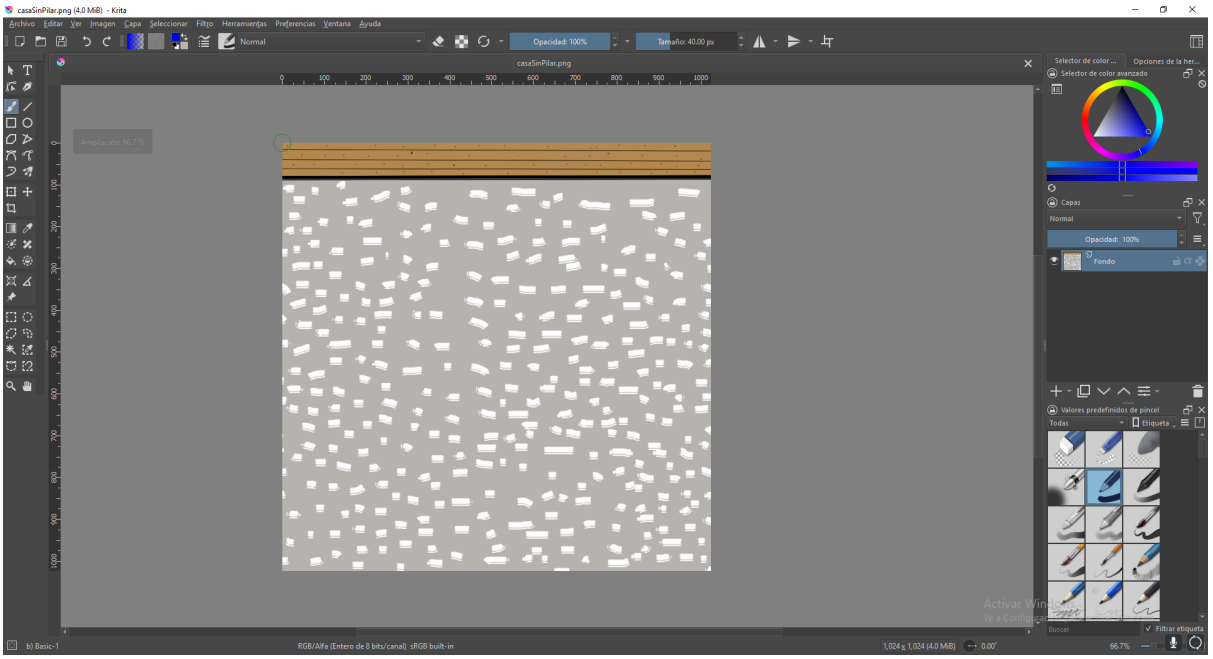


Texturing of the rooms

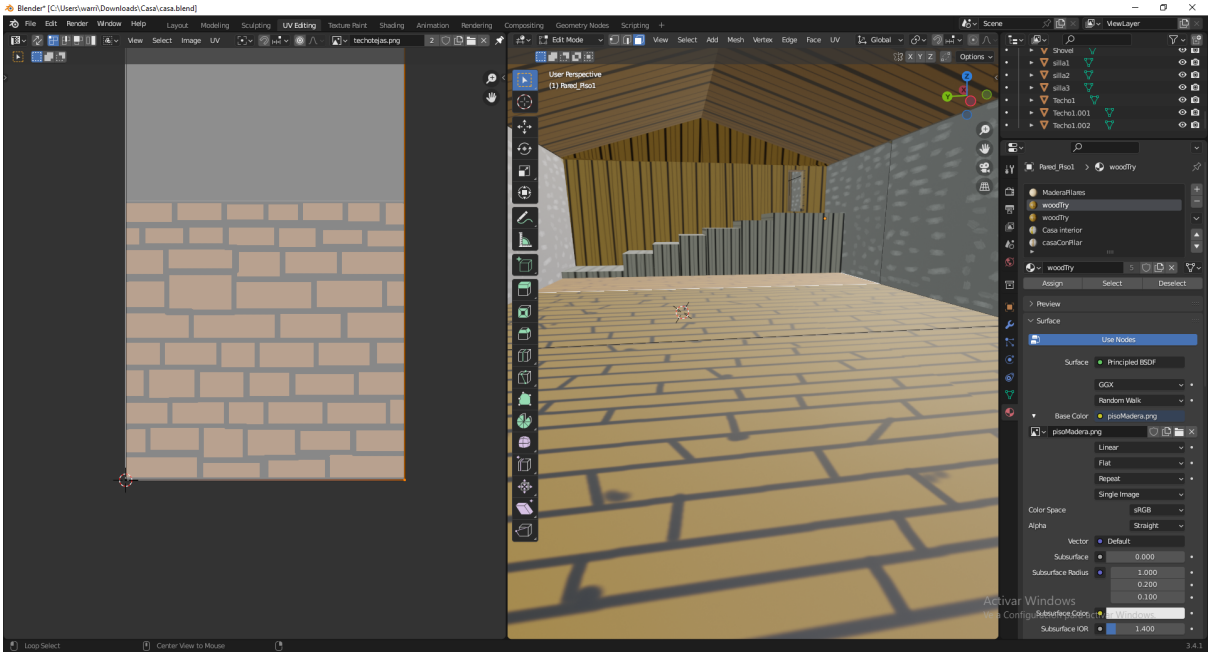
The process is the same as the house, but we have to make other textures to have the appearance of the rooms from the game.



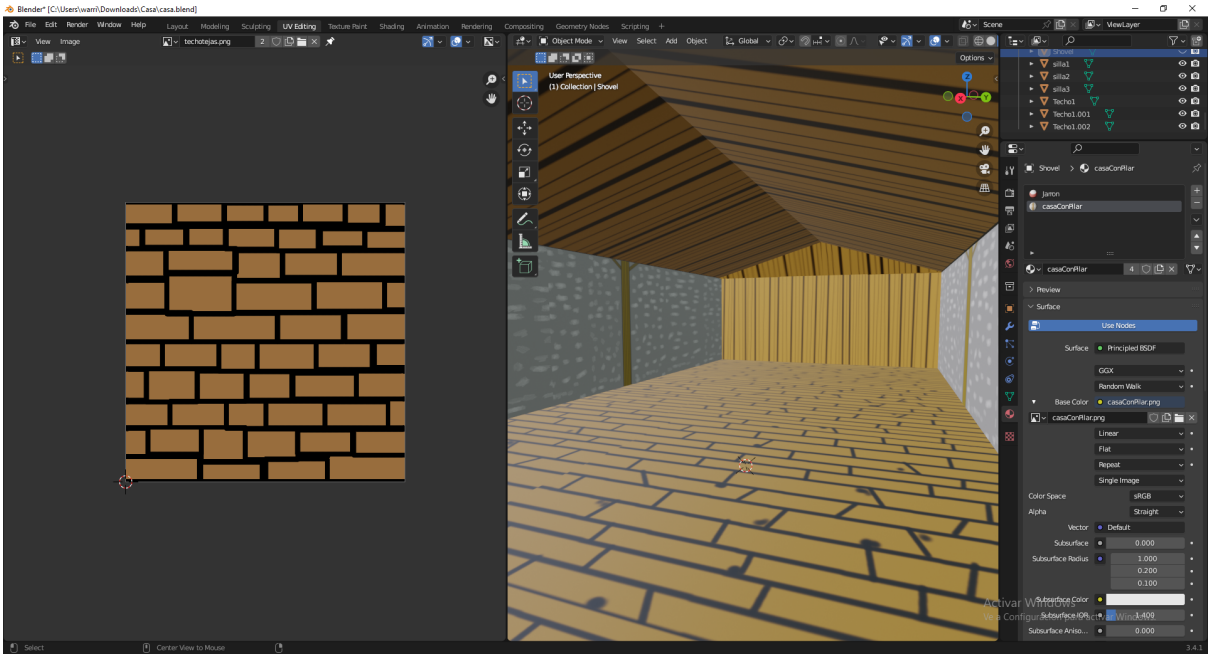

casaInterior.png (4.0 MiB) - Krita
Archivo Editar Ver Imagen Capa Seleccionar Filtro Herramientas Preferencias Ventana Ayuda
Normal
Opacidad: 100%
Tamaño: 40.00 px
casaInterior.png
Ampliación: 66.7 %
Selector de color...
Opciones de la her...
Selector de color avanzado
Capas
Normal
Opacidad: 100%
Fondo
Valores predefinidos de pincel
Todas
Etiqueta
Buscar
Filtrar etiqueta
b) Basic-1
RGB/Alfa (Entero de 8 bits/canal) sRGB built-in
1,024 x 1,024 (4.0 MiB)
66.7%


casaSinPilar.png (4.0 MiB) - Krita
Archivo Editar Ver Imagen Capa Seleccionar Filtro Herramientas Preferencias Ventana Ayuda
Normal
Opacidad: 100%
Tamaño: 40.00 px
casaSinPilar.png
Ampliación: 66.7 %
Selector de color...
Opciones de la her...
Selector de color avanzado
Capas
Normal
Opacidad: 100%
Fondo
Valores predefinidos de pincel
Todas
Etiqueta
Buscar
Filtrar etiqueta
b) Basic-1
RGB/Alfa (Entero de 8 bits/canal) sRGB built-in
1,024 x 1,024 (4.0 MiB)
66.7%

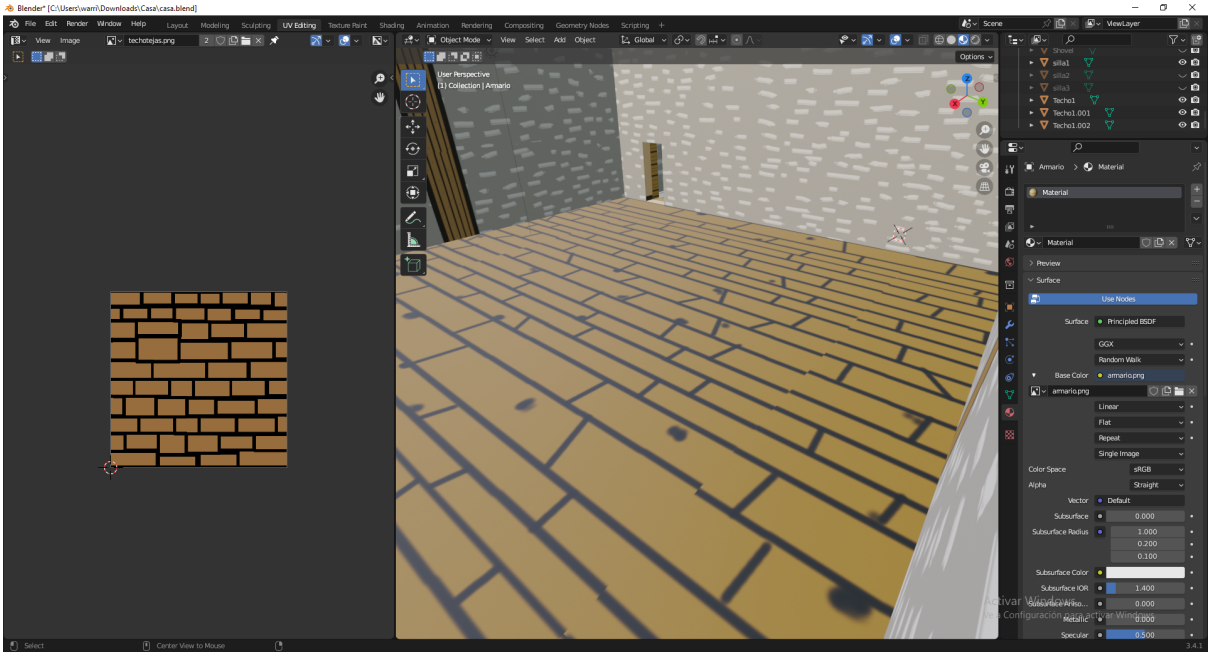
First Room Texture Mapping



We have to ensure that the texture looks good and makes sense

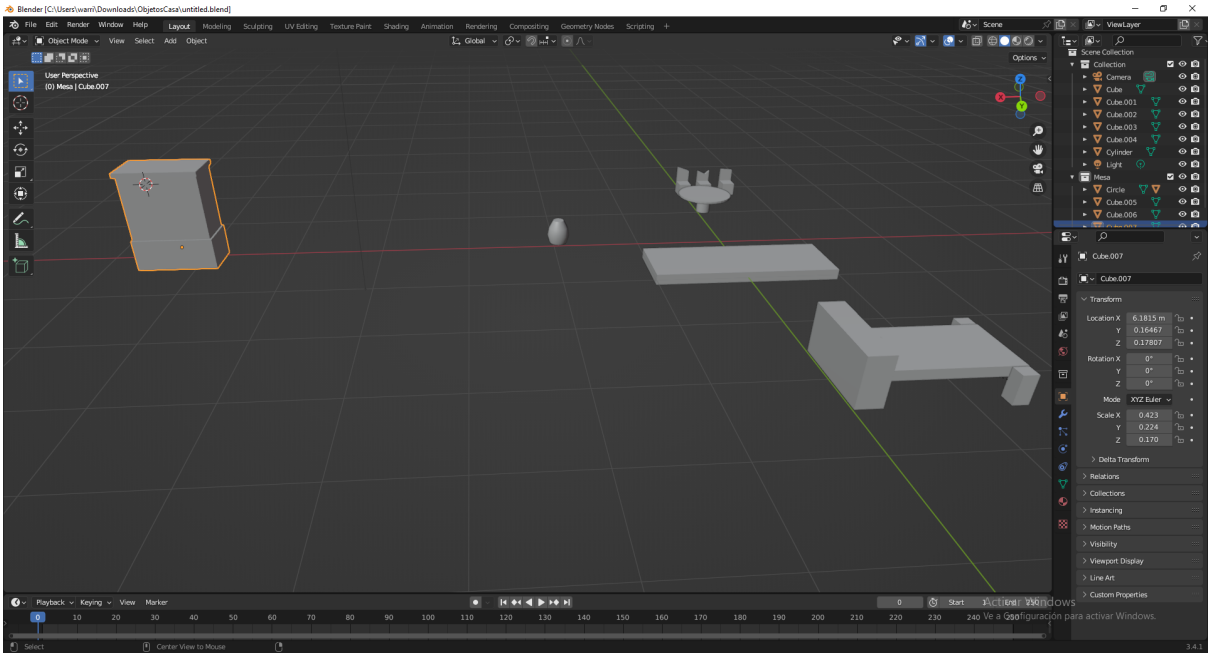


Second Room Texture mapping

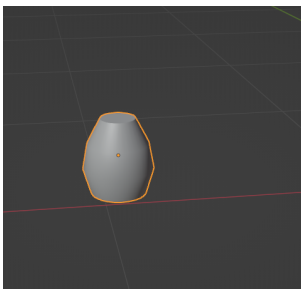


The process is the same as the first room.

Object Modeling



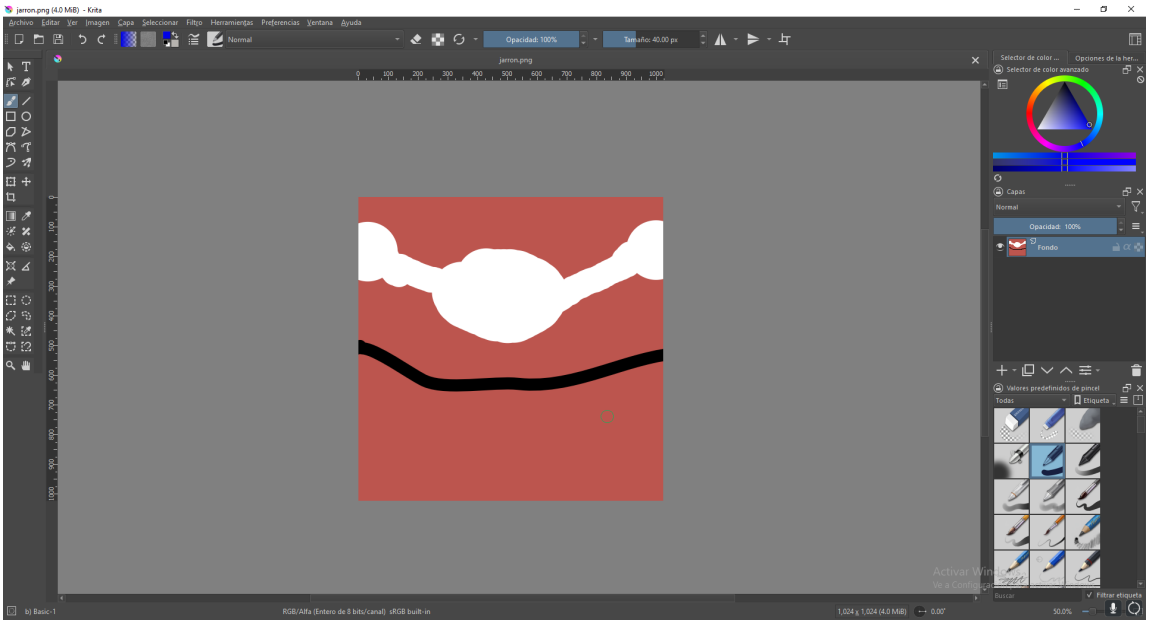
To facilitate processes, the aim is to model the objects as simply as possible, although some objects are somewhat more complex, such as the vase to give the sensation of having curvature.



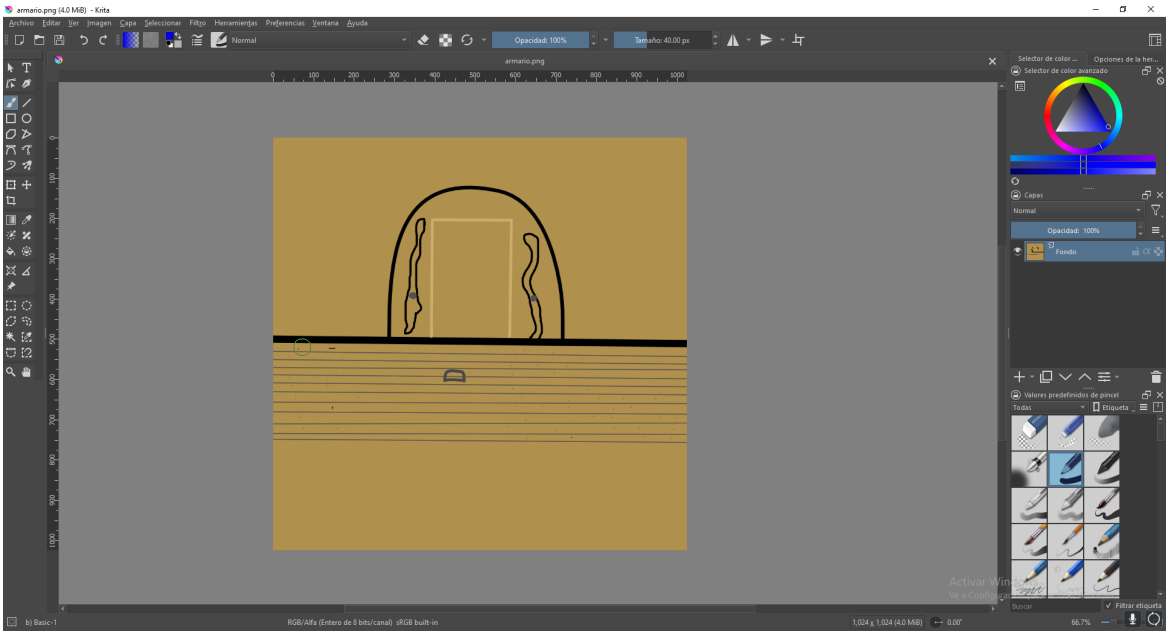
Object Textures

In most cases it was possible to reuse the textures but there are objects that need new textures.

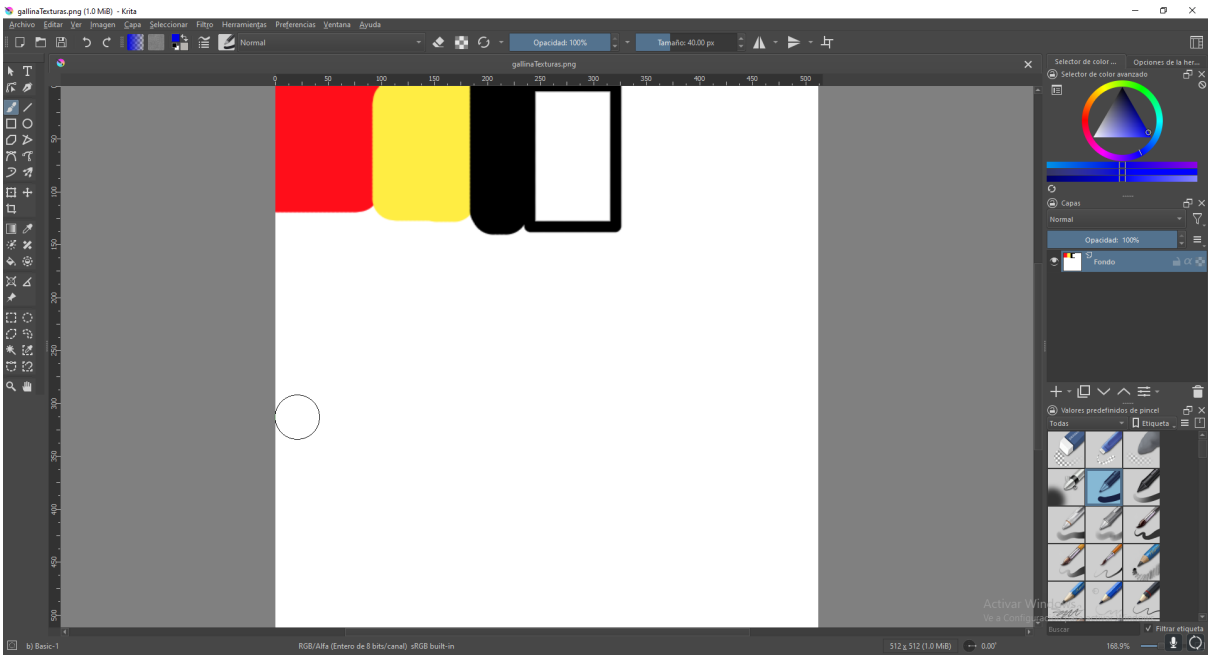
Vase

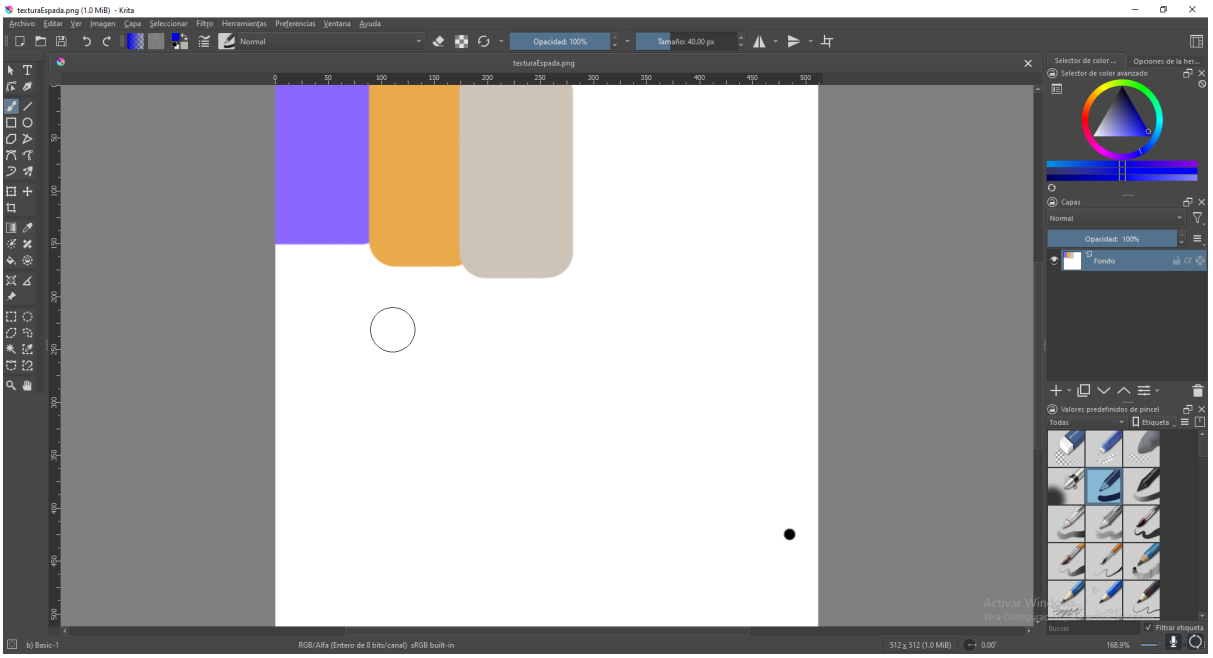


Cabinet



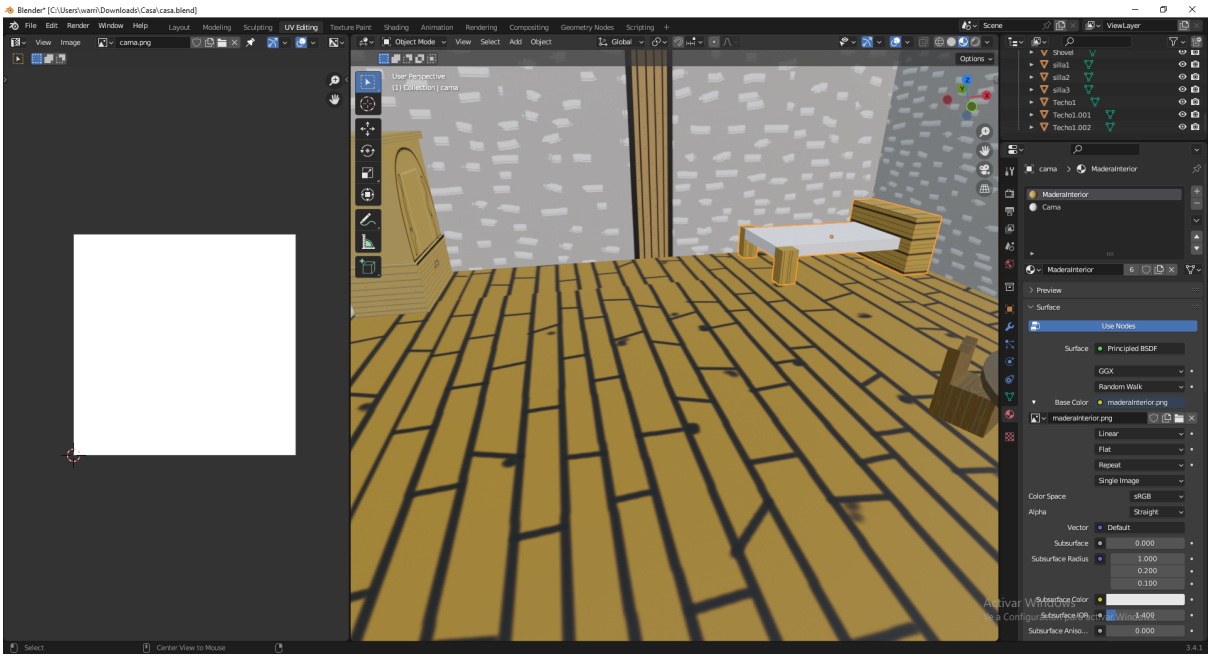
To texturize the objects from the internet we use a simple texture with the colors necessary for the objects.

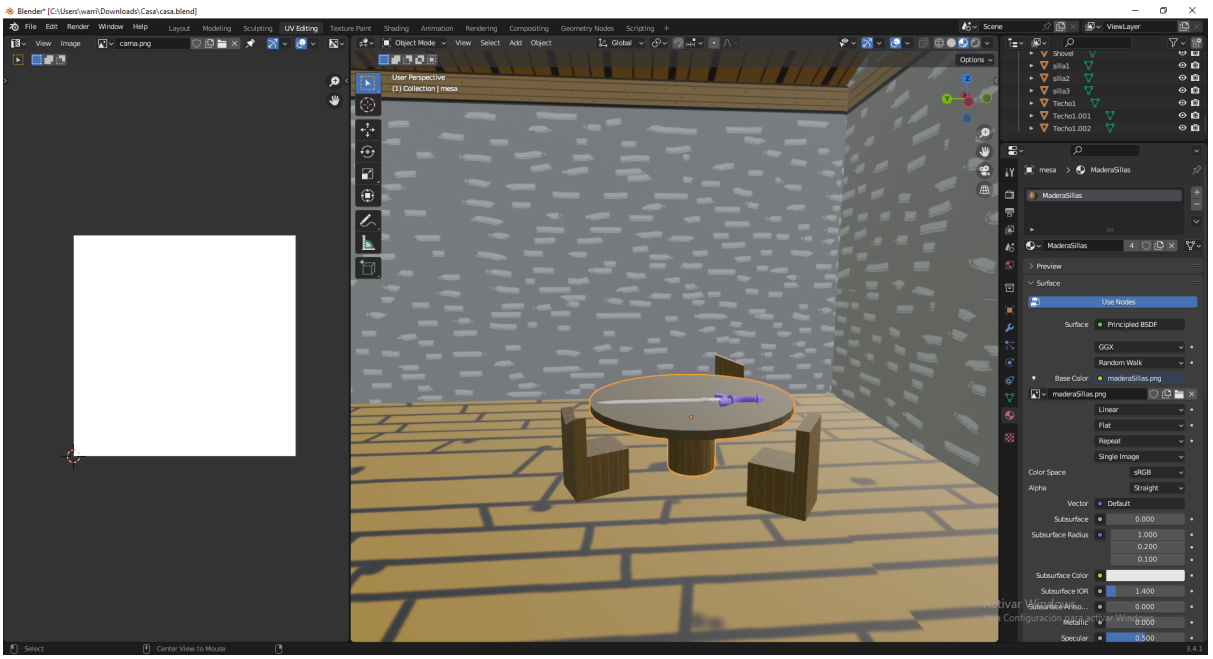




Object Textures Mapping

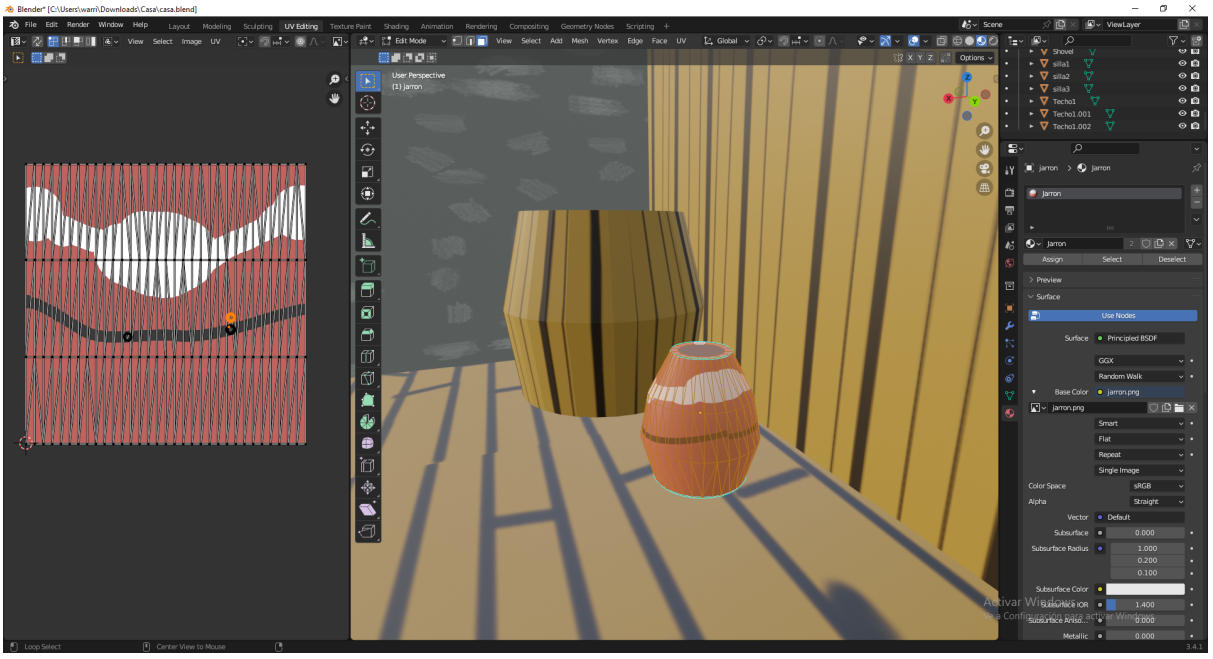
Once we have the texture for the objects we have to do the same as the Outside and the Inside of the house, we have to carefully map the textures for every face on the object to make sense.





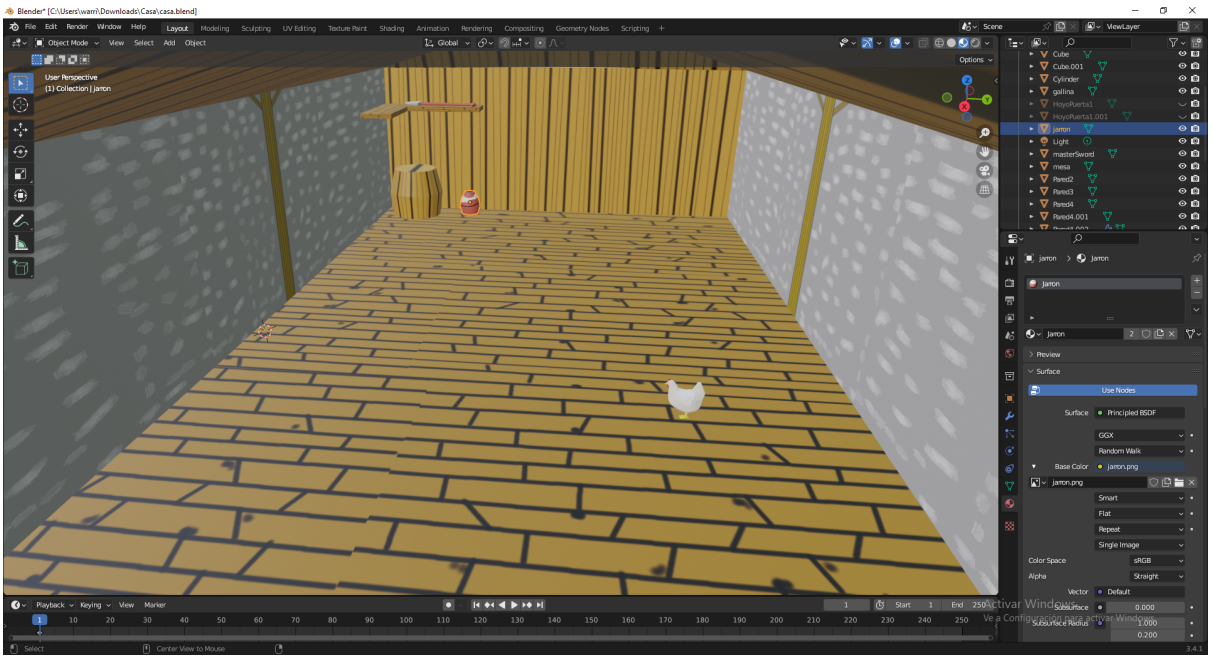
Vase

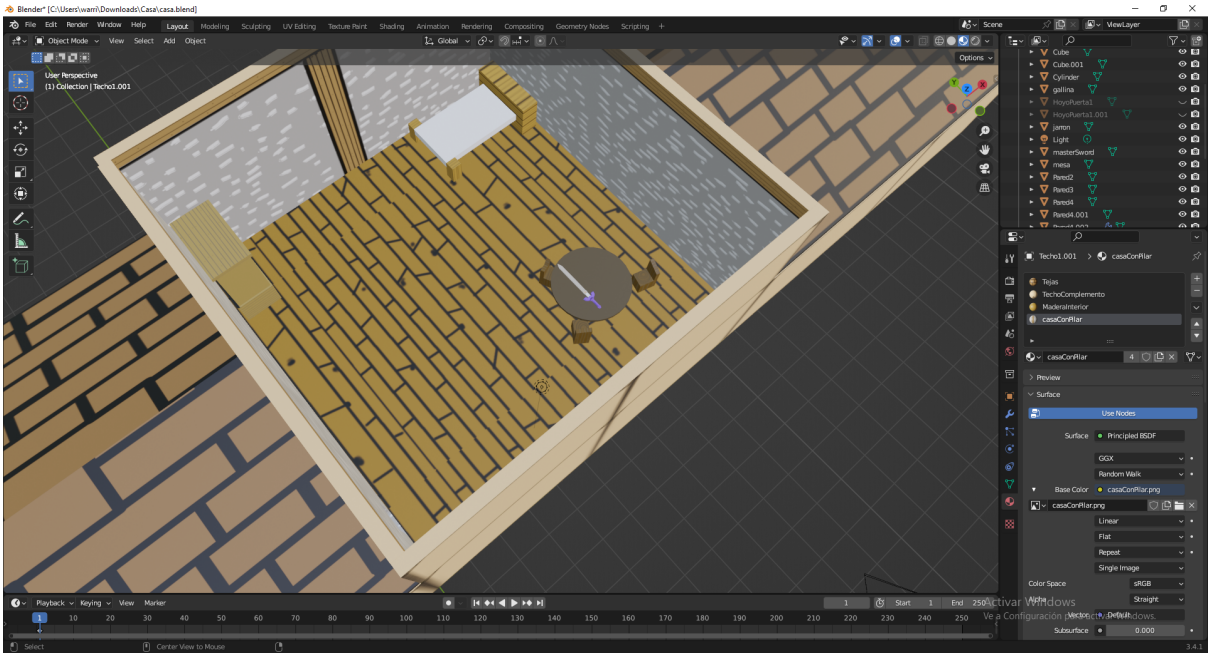
The vase is a special case, because since it has curves, we have two choices, either we could use a spherical projection or, adapt a texture especially to give it that "effect" of having curvature, in this case for simplicity we used a texture that seems to give the effect of curvature.



Object Positions at the house

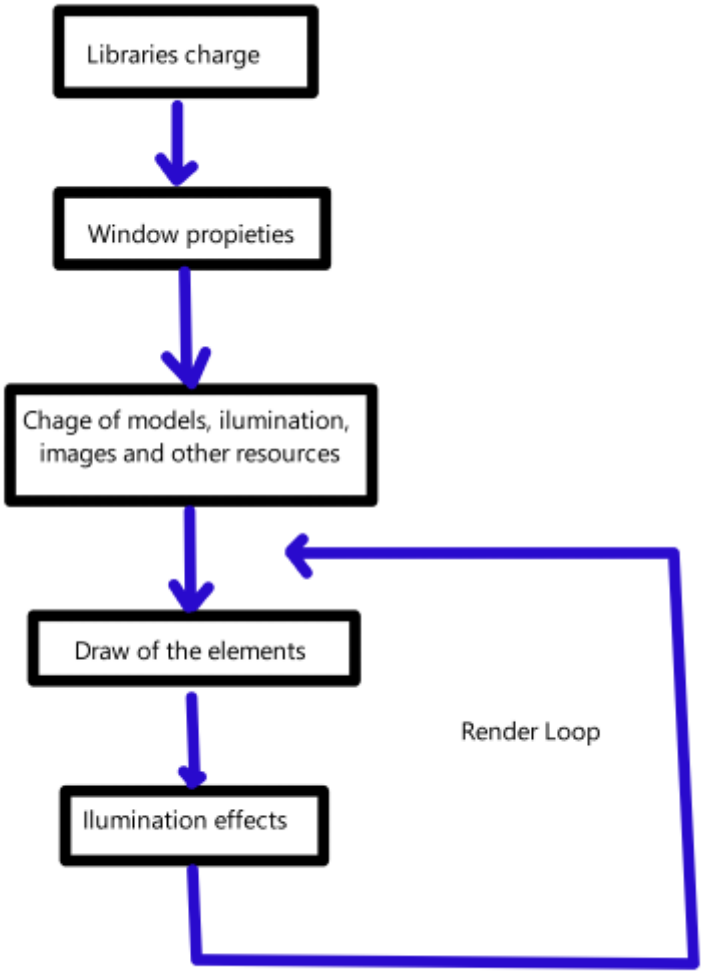
We just have to change the positions in the house to make sense in every room, this is easy to do, and we can use the Model Software blender to make it.





House Tour

The flow of the program will be the following:

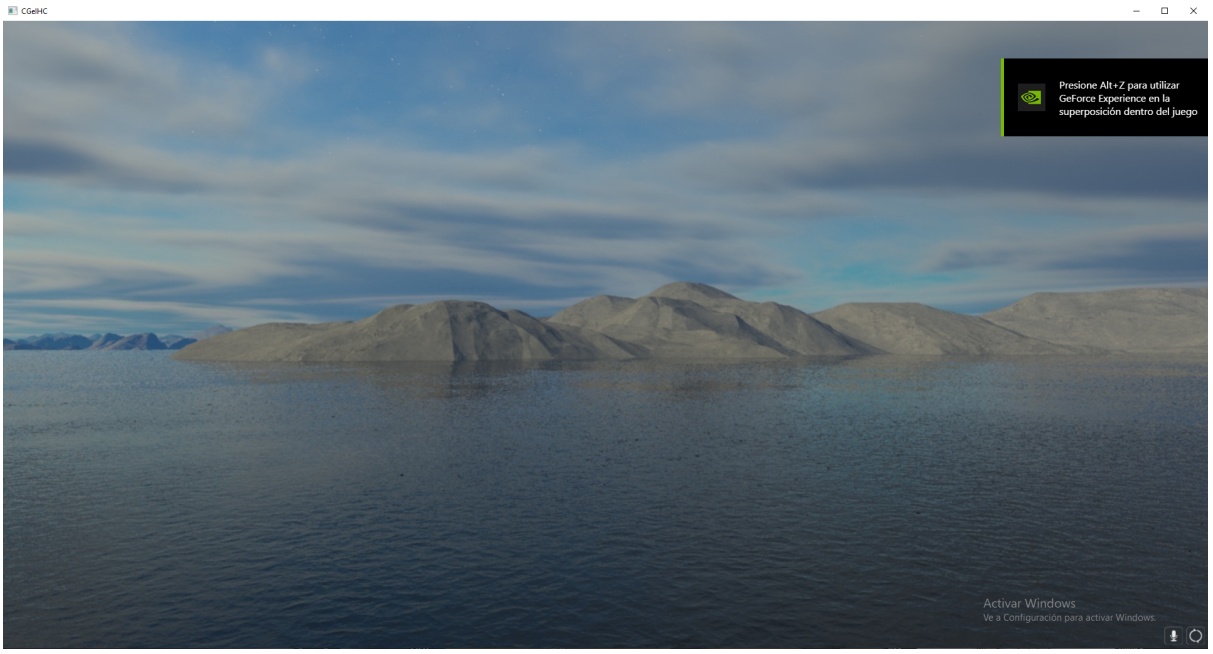


A general description of the activities the program will carry out during the virtual tour is provided below. We must first load all the libraries required to complete the tour. The commands that will gather the data required for the window execution will then be executed in the program's main body. The used models, pictures, and lighting information will all be loaded.

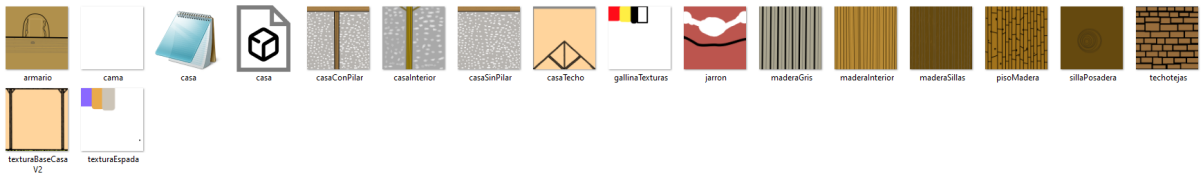
The rendering cycle, which allows for the inclusion of animations, will then begin. If a routine is set up for it, the lighting can be changed continuously, and the objects will likewise be drawn.

After describing the aforementioned, it is now required to comprehend how the software functions and the procedures for making the tour apparent.

Based on that, we have the following scenario, we have free movement, we have a background scenery, so we have to make the code for ours objects.



We need to ensure that we have the .obj model and all the textures we make



The path for the objects is “resources/objects/casa/casa.obj” inside of the project.

Next, we have to write the sentence down below

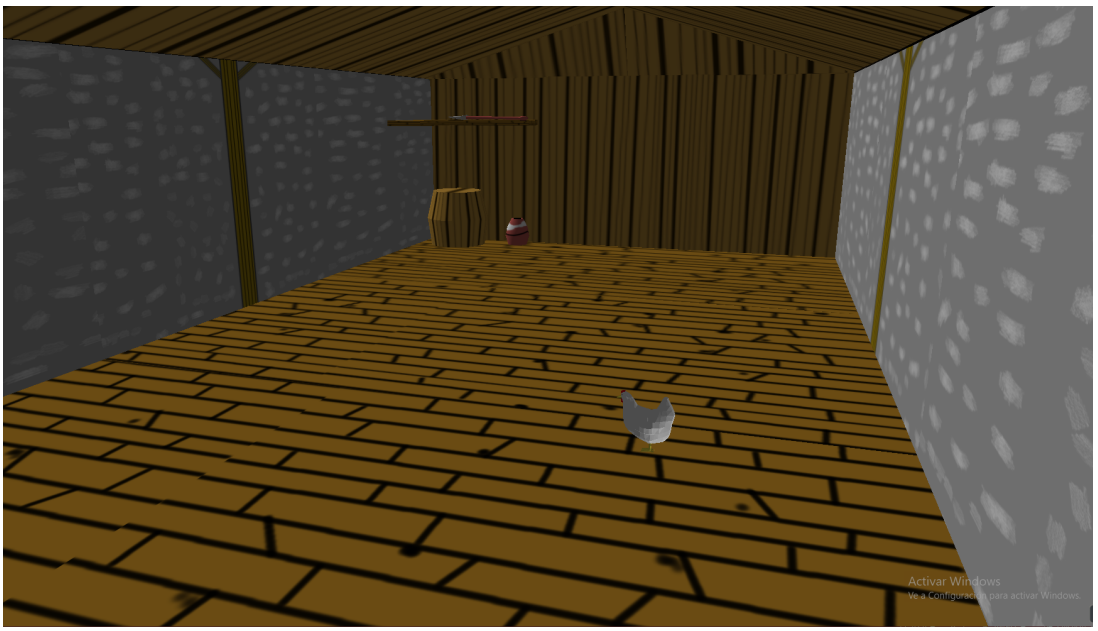
```
302
303     Model casa("resources/objects/casa/casa.obj");
304
```

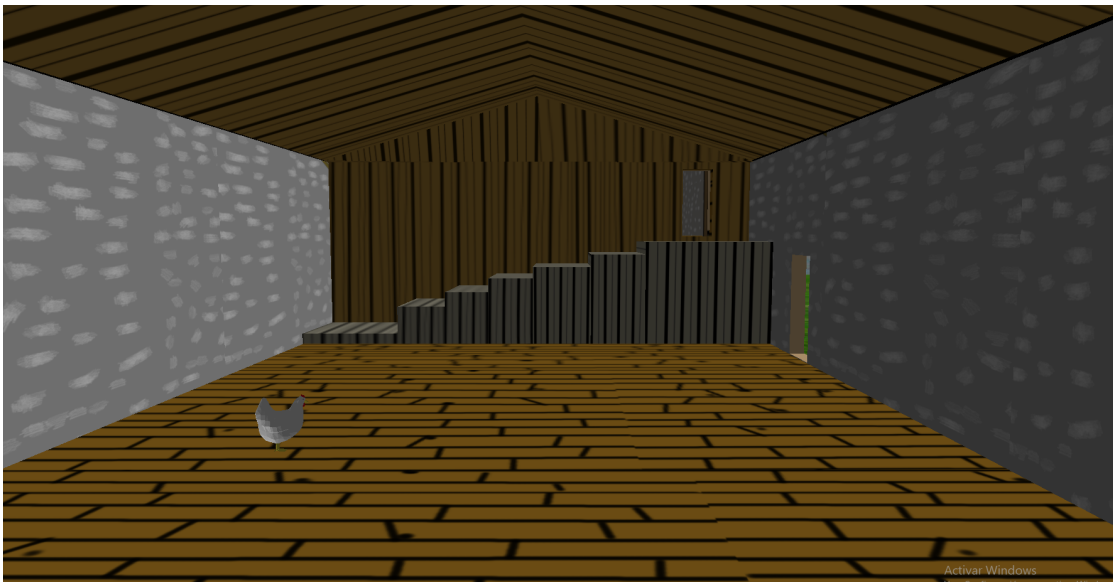
Now we have to change the positions and Draw the object.

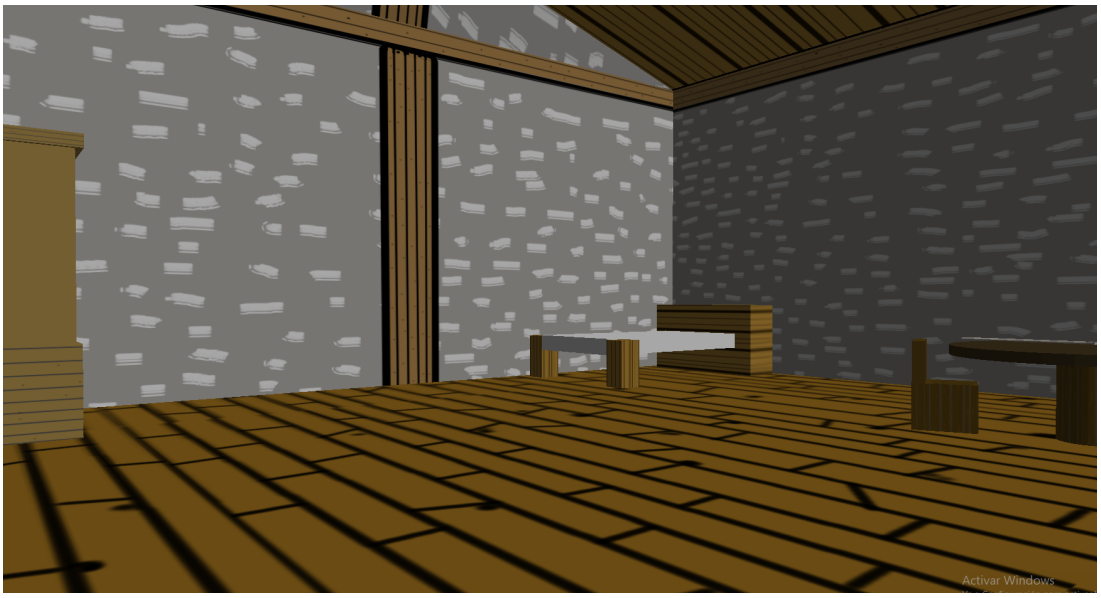
```
model = glm::mat4(1.0f);
model = glm::translate(model, glm::vec3(0.0f, -1.75f, 0.0f));
model = glm::scale(model, glm::vec3(1.0f));
staticShader.setMat4("model", model);
casa.Draw(staticShader);
```

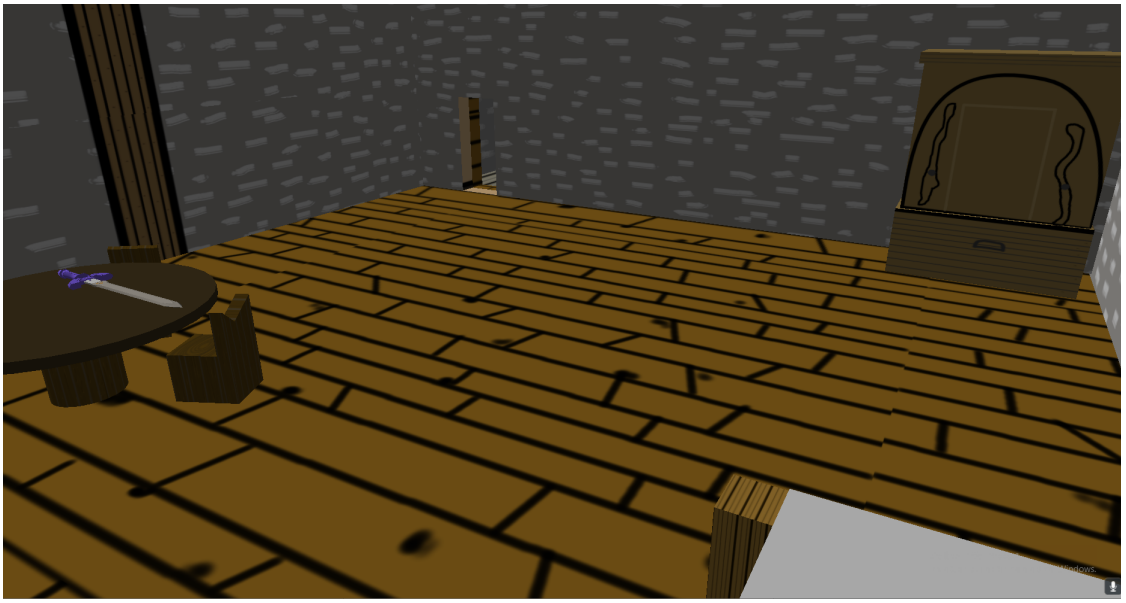
With the steps before, we must see the house and the rooms inside of the house

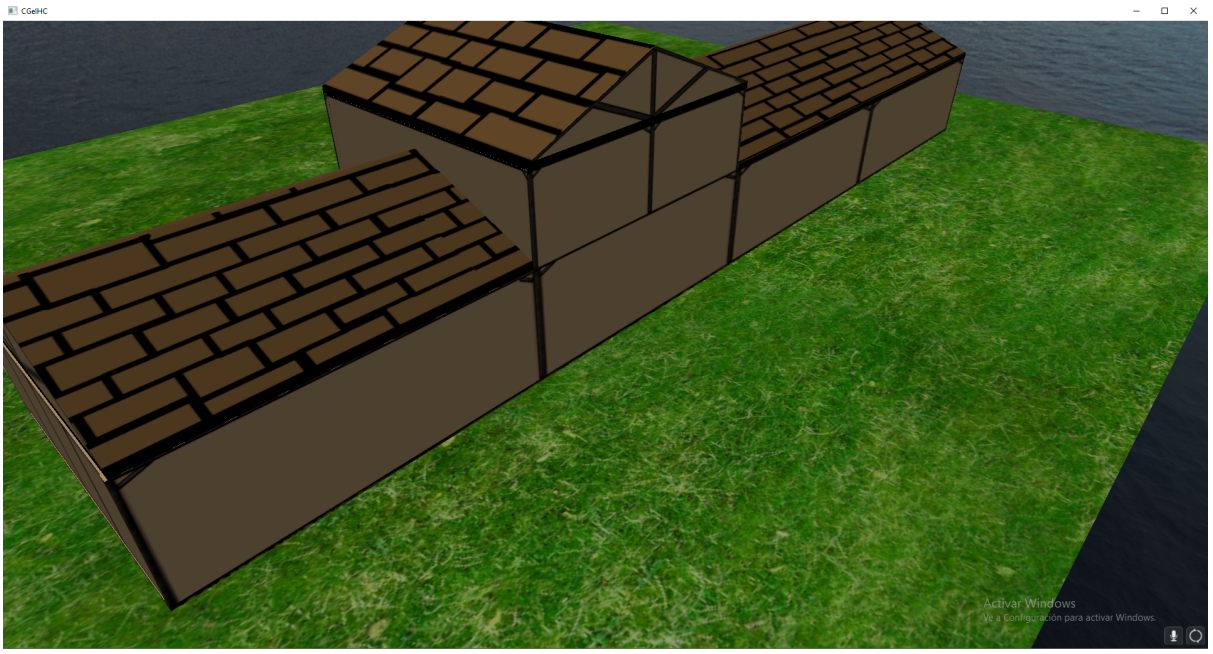
If we go inside the house we can see every room with his objects.


Activar Windows


Activar Windows


Activar Windows

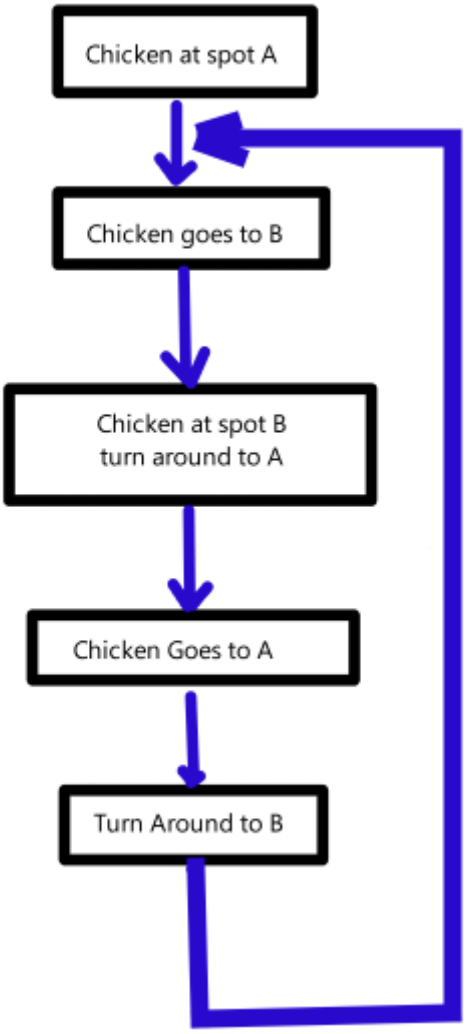



CGeIHC
Activar Windows
Ve a Configuración para activar Windows.

Animations

It’s important in the process, because once we have all objects we can prepare them for the animation process.

Chicken animation:



The diagram above describes the path of the chicken, however there are more things to have in mind but we make the diagram easy to understand.

To make the animation we just need the chicken model

```
Model gallina("resources/objects/gallina/gallina.obj");
```

```
model = glm::mat4(1.0f);
model = glm::translate(model, glm::vec3(-15.0f, -1.4f, -9.0f + zGallina));
model = glm::rotate(model, glm::radians(rotarGallina), glm::vec3(0.0f, 1.0f, 0.0f));
model = glm::scale(model, glm::vec3(1.0f));
staticShader.setMat4("model", model);
gallina.Draw(staticShader);
```

It must be positioned, variables will be used that will help us to change the position according to the conditions we need, in this case we want a displacement and a rotation, the idea is that the chicken is in an infinite loop walking from one part of the house to another because it is a chicken in a barn.

Result


The chicken begins at spot A and walks to a B spot and returns.

Gold Skulltula

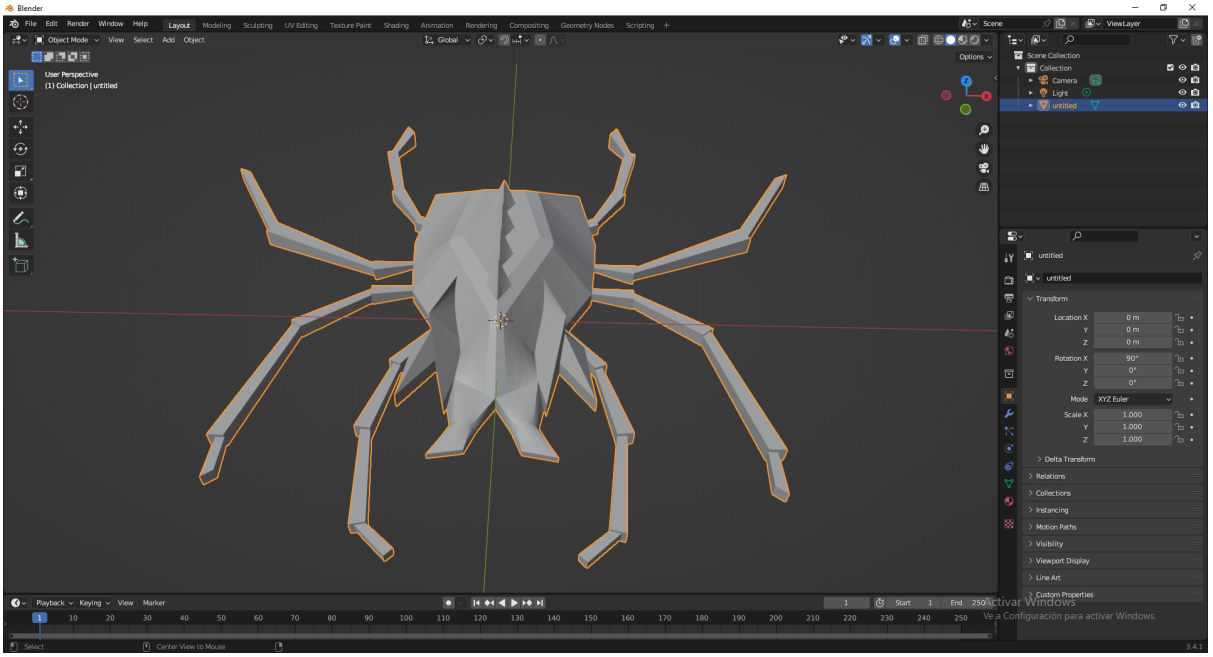
The Gold Skulltula, are spiders that appear in the video game as a result of a curse that torments a family, they are scattered throughout the map and when you find them they make a characteristic noise in addition to constantly rotating without stopping.

The process to be able to make its constant rotation animation is the same as the chicken with some changes, the model is loaded and it must be positioned.

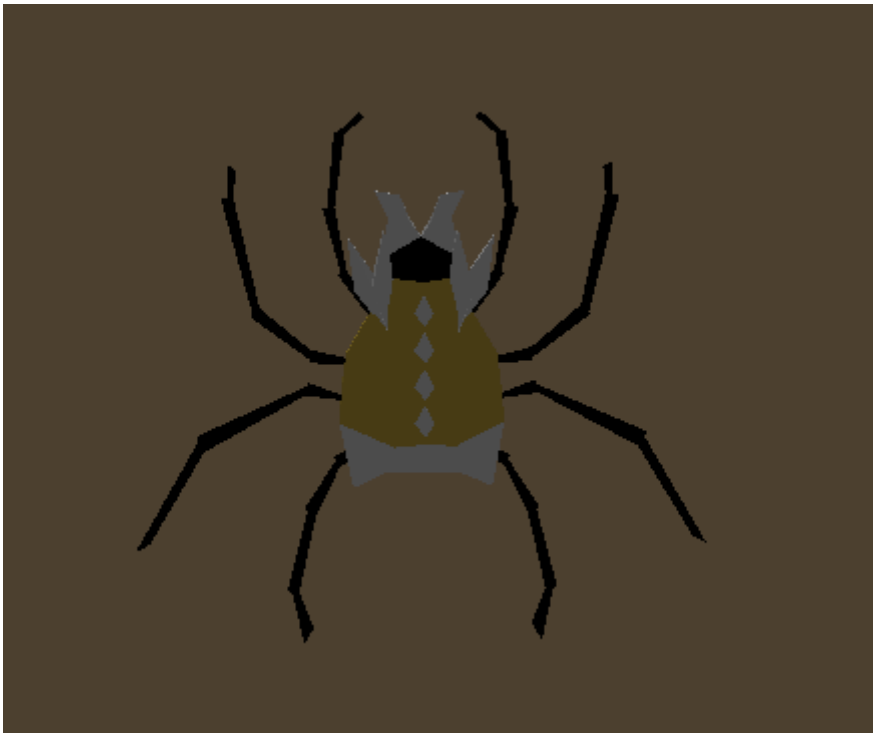
```
Model gold("resources/objects/golds/goldSkall.obj");
```

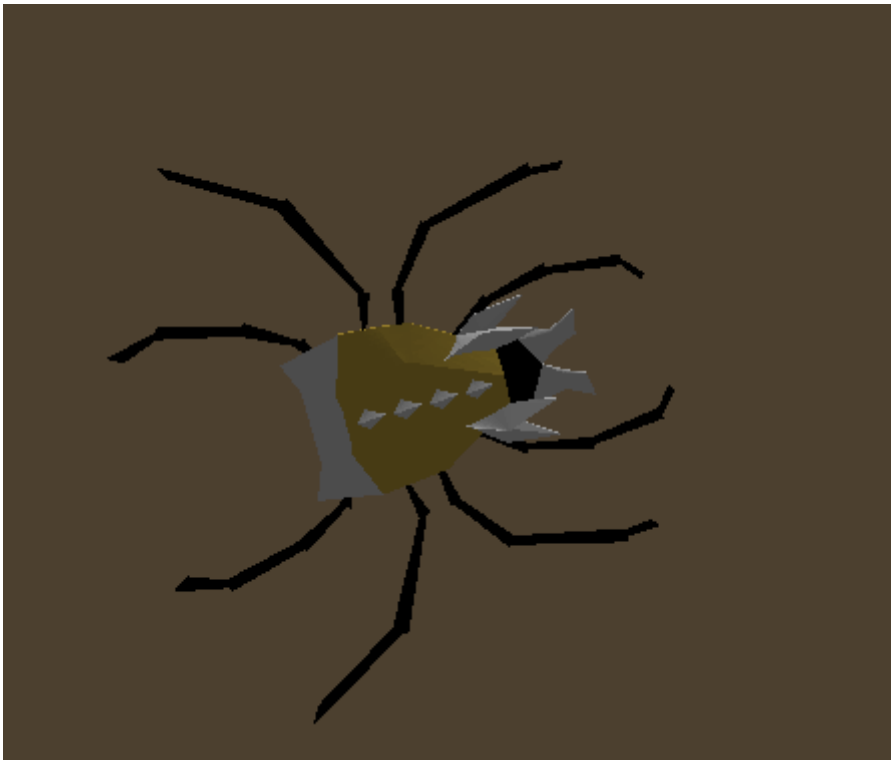
```
model = glm::mat4(1.0f);
model = glm::translate(model, glm::vec3(-13.0f, 1.6f, -10.30f));
model = glm::rotate(model, glm::radians(270.0f), glm::vec3(1.0f, 0.0f, 0.0f));
model = glm::rotate(model, glm::radians(rotarGold), glm::vec3(0.0f, 1.0f, 0.0f));
model = glm::scale(model, glm::vec3(1.0f));
staticShader.setMat4("model", model);
gold.Draw(staticShader);
```

We don’t need that the Skulltula moves, we need that the Skulltula rotes on y axis to imitate the videogame. We applied two rotations, one to make it close to the wall and other to rotate without stopping.



At the end we have this result:





The Gold Skulltula is behind the house

Conclusions

It's my second time enrolling in this course. The first time, despite finishing the laboratory project, I didn't receive a grade high enough to pass both the lab and the theory.

It was a long road when I had to complete the computer graphics project for the first time. To generate the necessary textures for the models, I suddenly had to learn modeling, mapping for texturing, and even picture editing and painting.

I even had to "animate," either in a straightforward manner or by utilizing trickier methods like KeyFrames. In the end, all that work was exhausting, but even if I didn't succeed, I was still able to master all that material in what, for me, was a rather short period of time.

Yes, there were further problems. A complete cost-benefit analysis was not taken into account, and the material was improperly organized. With this project, I chose my method and the stages I would take before even starting with the first model, even if I must admit that I didn't begin the documentation until the very end. That was sufficient to give the impression that the job was moving along more quickly, and setting targets early on gave the impression that there was less work remaining to be done as each goal was accomplished.

In addition, my modeling background was apparent. It didn't take me long to finish building the entire house, and this time I realized that keeping things as straightforward as possible worked best for me. While other factors like texturing and mapping undoubtedly had an impact, it wasn't the first time I had to start from scratch.

I gained a lot from using the waterfall methodology. It is really simple, and it is, which is the main reason I initially chose it. It was incredibly useful for this project that I could finish one stage before going on to the next. But there were just as many failures as there were successes.

In relation to the deadlines...

Task	Start date	End date
House Plan	21/05/2023	22/05/2023
Outside Modeling	23/05/2023	26/05/2023
Model room A	27/05/2023	30/05/2023
Model room B	31/05/2023	02/06/2023
Objects Room A	03/06/2023	04/06/2023
Objects Room B	05/06/2023	06/06/2023
Animations	07/06/2023	08/06/2023

Several deadlines on the short Gantt chart depicted in the preceding image were in fact met, including those for finishing the home plan, the exterior model, and partially the animations. However, this initial layout omitted the timetables for texturing, producing textures, and other associated processes. While in this instance they might only lose me a few points (hopefully), in a business they could result in catastrophic failures. Proper time management is essential, especially in the independent sphere, whether things are being done too quickly or too slowly when working independently.

All of the aforementioned serves to illustrate my point that projects heavily depend on planning and time management. It serves no purpose to have talented folks who can model quickly or produce graphics in a matter of hours if everything must be adjusted as a result of bad planning. There are numerous instances of how poor time management and planning may result in serious problems in the world of video games, such as CyberPunk 2077. The game has an attractive appearance, and its suggested gameplay sound interesting. But because it was rushed into being released, it turned out to be a huge failure. Despite the fact that there are other factors at work than organization, one point sticks out: **the person in charge had no idea about the essential procedures.**

They were solely concerned with making money and didn't care about fixing faults or adding missing functionality, which is instantly obvious. Economic factors, at least in this instance, can be used to explain the divergence, but they are not the only ones. It sets the stage for disaster when someone is in control of a project but lacks the knowledge or motivation to investigate and understand every step that must be taken. A large portion of the software business is currently in this situation, where there is a hurry to release software quickly to satisfy market expectations, but it ultimately produces unreliable and insecure software. We must put better management first and avoid omitting any critical project components as prospective future owners of significant software components.

If you own a business, you'll need to pay for things like staff, inventory, rent, and utilities. Even if you don't, you'll still need to pay for things like maintenance, food, and the internet. Ultimately, this endeavor has taught me the value of making an effort to organize and properly taking pricing into consideration. There shouldn't be any room for compromise when it comes to undervaluing the task, as it entails not only the time spent using computer equipment but also priceless moments in your life that cannot be recouped. In the end, this project is about more than just the models, texturing, and programming; it's also about properly and responsibly managing a project.

Credits

Master Sword:

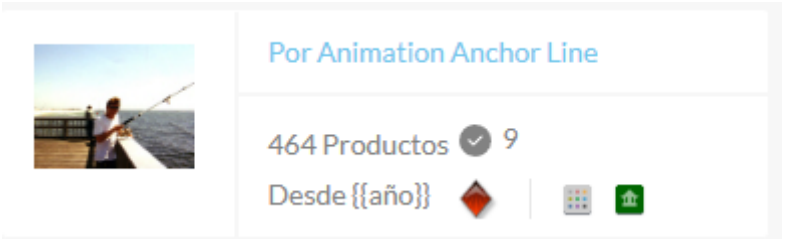
This model was found on Turbosquid his author:

You can access with the following link:

https://www.turbosquid.com/es/3d-models/free-master-sword-3d-model/465528

Shovel

This model was found on Turbosquid and his author is:

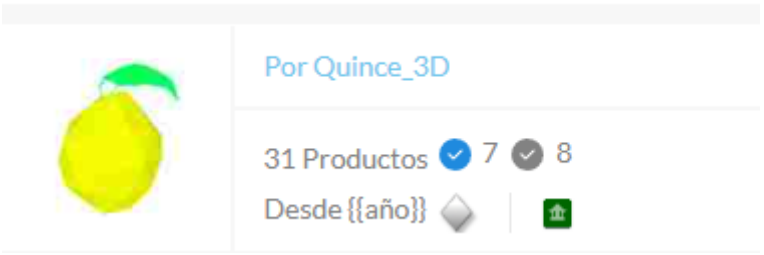


Link to the object:

https://www.turbosquid.com/es/3d-models/shovel-tool-digging-3ds-free/420306

Chicken

This model was found on Turbosquid and his author is:

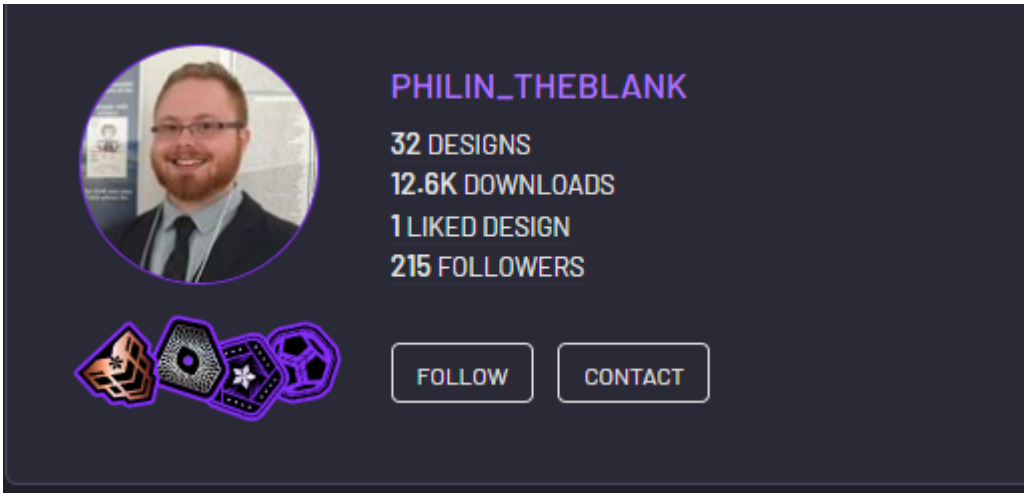


The link to found the object down below:

https://www.turbosquid.com/es/3d-models/chicken-cartoon-3d-model-1511315

Gold Skulltula

The model was found on Cults 3D, the author is:

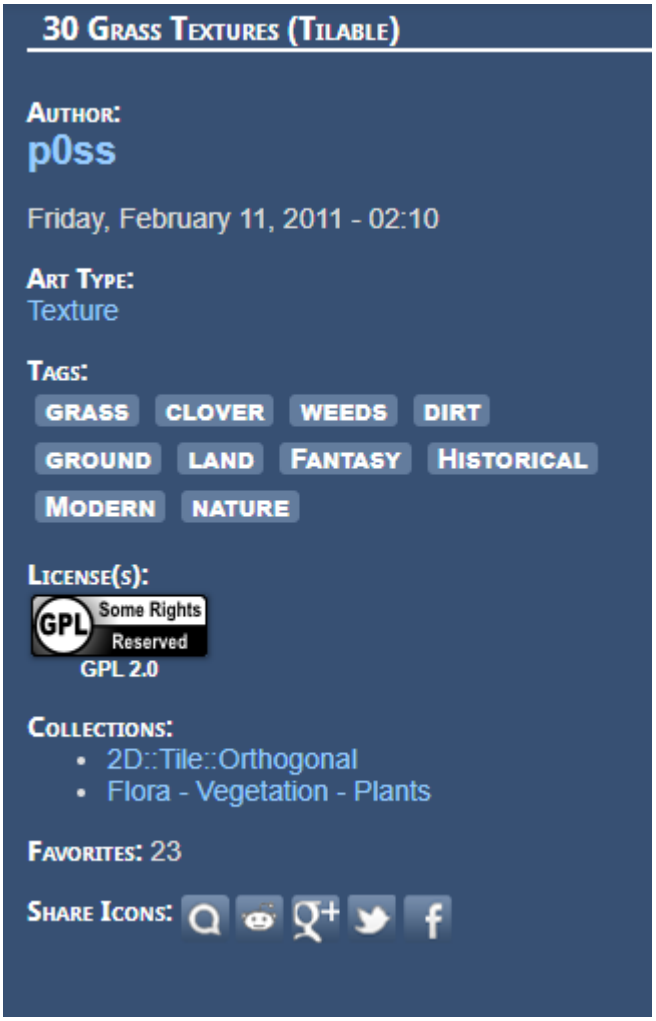


Link: https://cults3d.com/en/3d-model/game/gold-skulltula-with-token

Grass

The texture was found on:
https://opengameart.org/content/30-grass-textures-tilable

His author:



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Waelput, B. (2022). ¿Qué es y para qué sirve un diagrama de Gantt? *España*. https://www.teamleader.eu/es/blog/diagrama-de-gantt