



Videogames as a tool. The player as artist.

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INTRODUCTION

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1.0.1 Keywords

- Minecraft
- Architecture
- Gothic Style
- Art

1.1 Work Motivation

I think the correct way to start writing about my TFG is to tell the idea that I got to do it, and that is that I consider the concept that a player can create what he is playing. It may sound like a complex and abstract thing but that's because it is.

1.2 Summary

The basis of this project, the possibility of being able to use and create video games in such a way that the user can generate art while playing and at the same time can use what they have designed and created for other purposes, so that they are not left alone in one amusement or temporary entertainment.

This is why, although the idea could be to create a great program that provides a solution to all possible scenarios, that idea is far from being ambitious, so the most appropriate approach will be to test the most appropriate existing tool for this task in a large-scale project, and when considering it, see what the requirements of things that it would need would be and what advantages and limitations the selected tool has. This entire process will serve to gather information on what the tool can offer and what it cannot, pointing out all the limitations that have caused me problems. In this way, the generation of said "guide" will be the final result of what things would be necessary to make a game that would allow my original idea. That is why in this project the idea is to explore that concept, I will use the tool that is closest to the concept I thought of, which will be Minecraft.

Minecraft is a survival game with a Low-Poly aesthetic made up of cubes, or at least that was when it was created, the truth is, that today, Minecraft is whatever you want it to be, with enough mods and addons, became the ultimate Sandbox.

1.3 Objective

As for the process, I will develop, as I said, a large-scale project, build a cathedral in the Spanish Gothic style between the 12th and 14th century, as rich in detail as it can be. Develop this project as I already said in minecraft, trying to make an exhaustive report of the limitations, advantages and key points when developing a work of this magnitude. In addition, said process will imply certain own decisions, which will limit and shape the final result, I will talk more about it later.

1.4 Environment and Initial State

The truth is that during the development of this project Minecraft has changed a lot, and to give some examples, at the beginning of the project, the close-ups were not even possible to do due to limitations, some examples are the maximum height (which happened from 255 to 424, the first being somewhat distant from my first ideas in terms of the height of the project) or the number of available shades and usable materials.

PLANNING AND RESOURCES EVALUATION

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This chapter is the most technical part of the work. All engineering work must be understandable and assessed from objective information that should follow a given pattern. Such information should appear in this chapter.

2.1 Planning

When I decided to build something like this I also had some concepts and self-limitations in mind. That is why the cathedral must have certain properties:

- It will be built in such a way that its construction is "possible", with structural schematic coherent, no floating beams or impossible walls.
- It will have the idea that I know it was designed today, which is to say that even if the style of constructions of the 12th century were imitated, it will be as if it had been built today, with techniques and materials that could be used today.
- As a challenge, it will be twice the height of any other cathedral built at the time, since one of the bases of the Gothic style in architecture is altitude.
- The color palette will be dark tones such as black and gray on the outside, and inside there will be whiter, pearl and light gray tones so that there is a clear

contrast between the rooms, in addition the lighting will be yellowish tones during the day and purple at night.

- The entire interior of the cathedral will be passable on foot, including some exclusive maintenance areas.

The ease when it comes to building and capturing ideas will be one of the highest priority requirements and it will be the one we will focus the most on when finding the positive and negative sides. To develop a project of such proportions I need a good number of preliminary sketches and plans, which I made on paper in external tools such as Photoshop, some of them can be seen later in the sketches section.

Another important point when it comes to taking advantage of the work is the option that it can be used for another purpose, that is, that it can be exported so that, for example, a 3D print of the model can be made or that it can be implemented in another program is that it would be necessary for the concept that I propose. The idea is also to be able to establish and work with aspects such as lighting, so that it is more comfortable to capture the player's ideas on the canvas itself.

Going into more detail, if, for example, this cathedral were to be used in a "Shooter" type video game, the cathedral would have to be a wide space and at the same time be a solid structure, in order to develop an adequate level design. For this type of game (proposing the appropriate coverage, locating places with possible ambushes, areas where they could find loot...), that is why once the large structure is built, if you want to export or import the project building, to propose other aspects of the design from another tool, should be able to be done in a simple and comfortable way, in a way that facilitates the work and management of various programs.

2.2 Time management

In this section I describe the way in which I had thought that the project would advance as time went by and what was the reality.

Task	Estimated Time	Observation	Used Time
Basic Art	5 Hours	Put simple ideas on paper quickly	5 Hours
Search	10 Hours	Research and locate references	20 Hours
Approach	15 Hours	Creating plans and taking measurements	35 Hours
Design and construct	220 Hours	The "main" of the project, the entire construction and creation of the cathedral	255 Hours
Edit and finish	20 Hours	Modify and adapt the last details	275 Hours
Memory of development	20 Hours	Finish and refine writing during development for presentation	295 Hours

Figure 2.1: Figure 2.1: Tasks and times

Putting a bit of context, "Basic Art" were the first simple sketches, although it is true that I put them at the beginning, because that is when I did the most, I created more of them as the construction progressed.

Then was in the Search part that I was looking at the most important elements that represented the contrition that I had in mind, I already studied during high school (In art history class) the basic principles of Gothic architecture, but I had I had to investigate more. It was when I began to look on the internet for the most relevant cathedrals of this style and I went to personally visit some of them, for example the Cathedral of Plasencia. Also this was where I read a bit about basic architecture, to learn the

principles of materials and structures, not that it's the highest priority but I wanted to do a good job.

As for Approach Design and construct, it was then when I started with the shape sketches, which you can see in 3.3 *Sketches*. I proposed the elements and forms that the façade should constitute, taking as references façades of other cathedrals such as the one in Burgos, and I decided on the materials. Between that and the contrition process, 60 of the 220 hours I had planned were gone, but since the facade of a cathedral is the most important element of it, it would be worth it. Once the facade was finished, I considered that the cross shape that I had in mind in a dining room would not fit me as much as I wanted with my idea. I made some more basic sketches and plans and decided again the general shape of this and divided it into parts and made time estimates for each. (It was at this moment that I made the prototype in minecraft to see what general shape I was going to give it.) About 60 hours of it was spent on the main sides, columns, buttresses and flying buttresses. Each side with its stained glass windows would take about 20 more hours and another 20 for the dome. The remaining 40 went to build the back of the cathedral. In doing the interior decorations, stairs, putting on the lighting, balconies... etc. It took 35 hours that I had not originally planned. Once all this process was finished I had to finalize the details, despite the fact that I had already been working with the shaders, finding the right lighting took time, in addition to adjusting some minor construction errors. Like 20 hours.

2.3 Resource Evaluation

Here to analyze the costs and production times of the project in my specific case, the costs would have varied under other conditions so that it would give an average market value and what would have been a very real cost. Throughout the development, I estimate that some 200 hours of work were those corresponding to the most artistic facet of the project, while some 35 were the most technical part, combined with the fact that the average salary of an artist in Spain is about 12€/ hour and that of a computer scientist is 14€/hour gives us a total of $2400€ + 490€ = 2890€$ The tools that we have used are not many, since the idea was to centralize the work as much as possible, but I have used:

- Hardware:
 - My laptop with these characteristics (799€ when I bought it, 699€ current market price):
 - * CPU: Intel Core i7-9750H 2.60Ghz
 - * GPU: Nvidia GTX 1650 8GB
 - * RAM: 12GB
 - Digital drawing tablet "Artist 12 Graphic Display" (100€ when you buy it on sale, 200€ real market price): Useful to the sketch.
- Software:

- Minecraft (8€ when I bought it in the "Beta" in 2010, 20€ real market price): It is the main tool.
- Adobe Photoshop (20€/month): I use it mainly for sketches, plans and conceptual arts.
- "Chocapic" Shaders (free): Some popular graphic Shaders that apply to Minecraft, I use them for lighting management
- Forge Litematica Mod (free): A popular Mod, It is used to clone, represent, move, simulate... structures, being a very useful tool for building.

2.3.1 Tools

This section is not necessary to understand the rest of the project, but in it I will talk a bit about a couple of tools which are exclusive to Minecraft without which some parts of the project would have taken much longer, been much more difficult or impossible.

- Litematica (and Forge, necessary for it to work), are tool-type mods that allow you to do things like rotate, clone, move, preview, save... In general, all kinds of useful options that a digital creative process needs and that minecraft, or grants in a very poor and limited way, and directly does not even have that option.



Figure 2.2: A scene where it can be seen as litematica defines the margins of a section that I established to modify it

- Shaders "Chocapic" (and Optifine, necessary for it to work)

In order to adjust the lighting of the project, in addition to giving you more realistic visuals, shaders were necessary. These are very taxing on the graphics card so really not all devices would have been able to handle something like this.

In my case, I have modified the lighting to the "TORCH" type lighting (lowering the corresponding RGB and intensity values to give it a more purple tone) which is what can be considered artificial lighting and which becomes more important at night, since difference of the environmental that is the most representative during the day. However, this first one also affects all the interior lighting, in those areas where the exterior light does not reach.

Here you can see some examples of with and without shaders: Drive

SYSTEM ANALYSIS AND DESIGN

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This section is to describe the process by which I analyze and make certain decisions, in addition to making some comparisons and reviewing some elements that I integrated into my project.

3.1 Analysis and structure

When considering the construction of a building as massive as this, the idea of not making formal plans and a reliable structure is not an option. That is why I have had to read and investigate some aspects of pure architecture, both from my own time and today. Based on the research and my knowledge of technical drawing, I have developed different plans and conceptual maps of how the general structure was going to be developed. See 3.3 *Sketches*.

The results gave a building of more than 400 meters long, more than 320 meters wide and about 280 meters high, so the architecture makes it clear to us that we necessarily need weight management mechanisms. Research on the architecture of the time makes it clear that in cathedrals the main mechanisms for this function were arches, semi-arches and columns for the interior and buttresses or flying buttresses to the outside.

More info of this elements can be found on internet or books, here is a example



Figure 3.1: Comparison of flying buttresses on Notre Dame Cathedral.

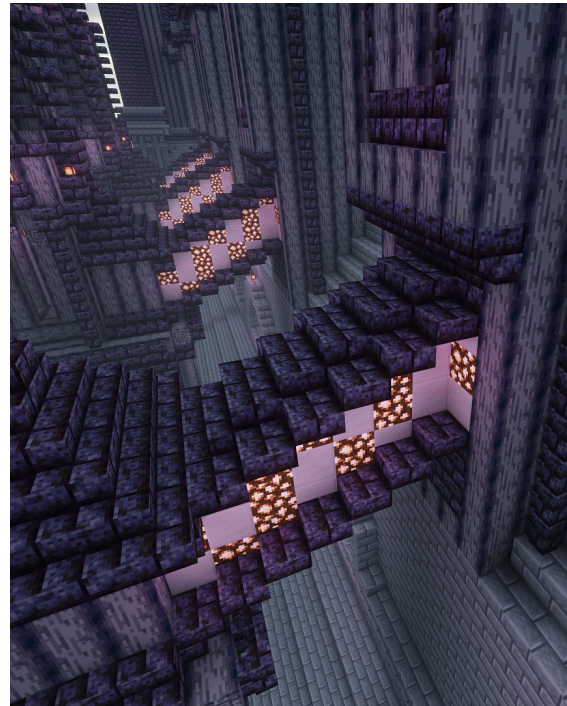


Figure 3.2: A example of my flying buttresses.

As can be seen in this example, my structures are considerably larger and thicker, this is partly due to the fact that, being a much larger building, it needs much more resistant reinforcements and in greater quantity; other reason than minecraft and doing small but precise things is normally not possible.

3.2 Artistic Design and inspiration

As already established in point 3.3 *Objectives*, the reference architectural style is the Spanish Gothic (although it will not be the only one from which I took references), and therefore I took several of the largest cathedrals of that time as a reference. Other than that, my idea wanted to be more ambitious and use materials with more intense colors, as well as different more modern aspects that can be seen in cathedrals today how can it be advanced lighting systems or much more open interior areas. To all this we must add basic elements of this style of buildings such as towers or rose windows.

I will start by describing my main inspirations and which parts are most important of these:



From the Burgos Cathedral, we can observe that it has one of the most outstanding elements of the Gothic architectural style, and it's as if the facade is constructed with a very intense intention of verticality, achieved through the two large towers with multiple pinnacles towards the sky.

Figure 3.3: Cathedral from Burgos. Facade

From the Plasencia Cathedral, we can highlight the use of columns as an architectural element because there are a great number of them used as a structural element due to their unusual structure and terrain.



Figure 3.4: Cathedral from Plasencia. A side

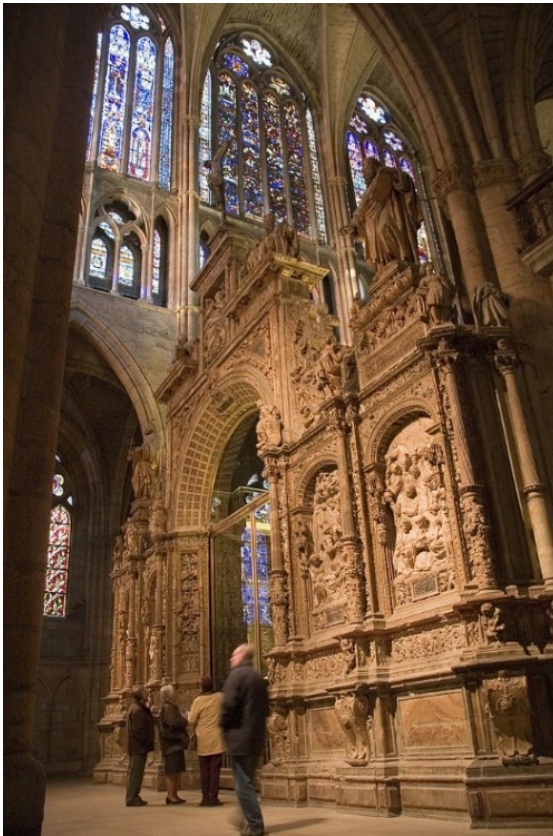


Figure 3.5: Cathedral from León. Inside

Another characteristic that I will use from the most modern cathedrals are the external lighting systems, because one of the principles of this style is that it be striking and stand out to the eye, in this case the lighting comes from the outside but in mine it will be integrated in the structure



Figure 3.6: Cathedral from Toledo. Facade

From the Palma de Mallorca Cathedral, I want to rescue the buttresses and flying buttresses, which are those exterior structures on the sides in the form of an arch that support the structure. They were essential in the era because they allowed the weight of the structures to be distributed towards the outer pillars, being a very characteristic element of this style due to the search for magnitude and verticality that we have already discussed. In my case, as my idea was to take it even further, they must be even more pronounced.



Figure 3.7: Cathedral from Brasilia. Inside

This being one of the examples that I have used to integrate modern elements into the structure, being inspired above all by the concept of those massive stained glass windows that are part of the structure itself.



Figure 3.8: Cathedral from Palma de Mallorca. Inside

In addition, as in its day, some parts of the building were built taking into account elements such as the golden ratio, such as the maximum width and height or the facade itself, in the sense of width by height, these being:

$$425 \text{ (width)} \times \phi \approx 260 \text{ (height)} \text{ and } 173 \text{ (facade height)} \times \phi \approx 107 \text{ (facade width).}$$

Figure 3.9: Application of the golden ratio. Values are not exact

While I was developing the artistic point, I noticed that it was very difficult to adapt certain aspects of a religious building such as cathedrals to one that is not, which somewhat altered the final result. I develop this issue further in point 4.1 *Work Development*.

3.3 Sketches

Being this a work with such a visual character and focused on obtaining a specific aesthetic result, a section of sketches is practically mandatory, in addition to the fact that I will mention and cite them in several sections of this same document.



Figure 3.10: First sketches of the facade



Figure 3.11: Sketches of the facade to establish measurements already within the game

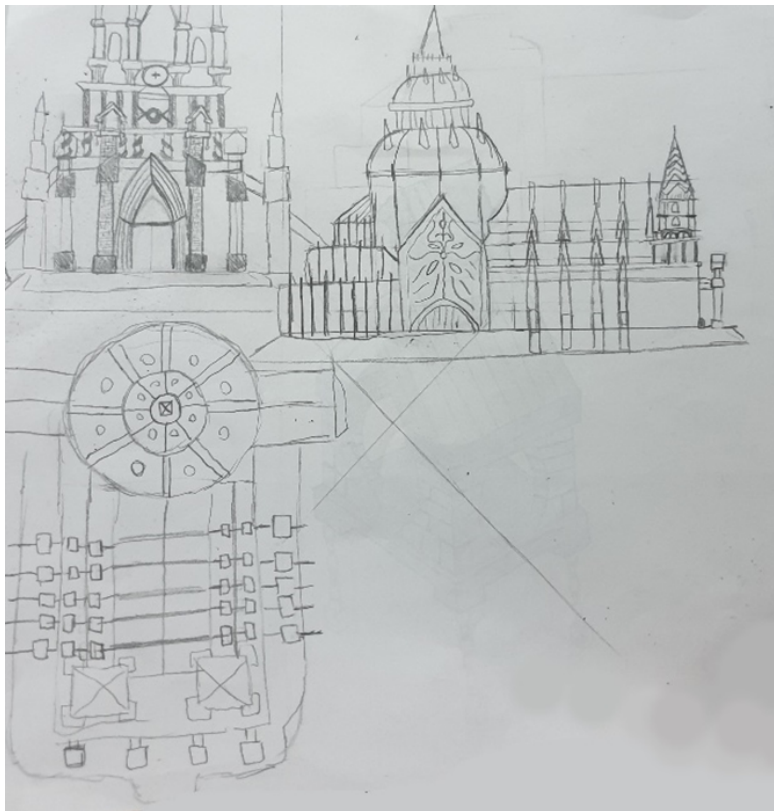


Figure 3.13: The first complete sketch in three views of the cathedral, from the front, side, and above. From this several things changed like the number of side columns with buttresses.

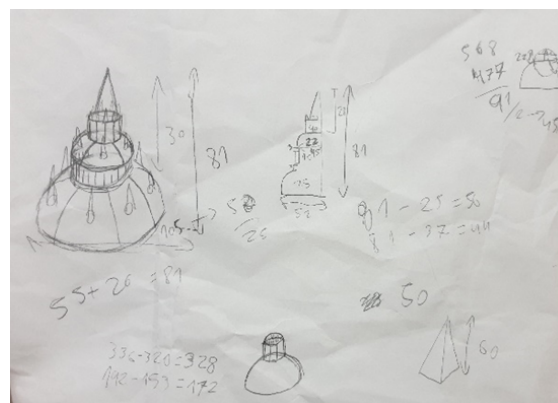


Figure 3.12: Sketches and basic measurements of the main domes

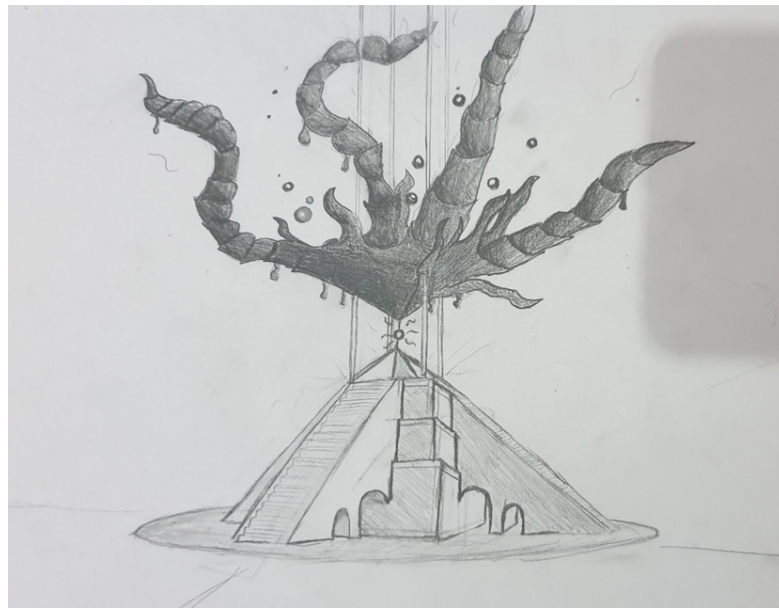


Figure 3.16: Central structure of the cathedral, differs from what is common in conventional cathedrals, see 4.3 *Thought*.

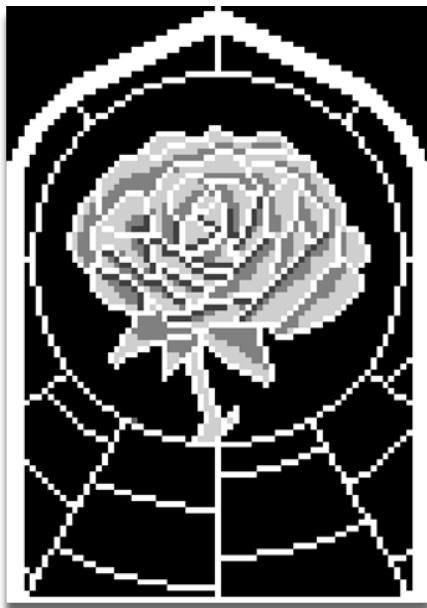


Figure 3.14: Format of one of the large stained glass windows of the cathedral

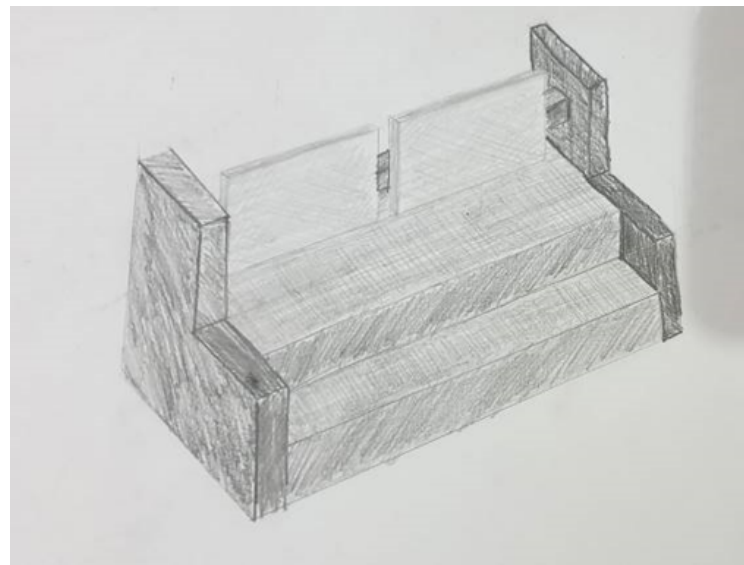


Figure 3.15: One of the models of benches for visitors

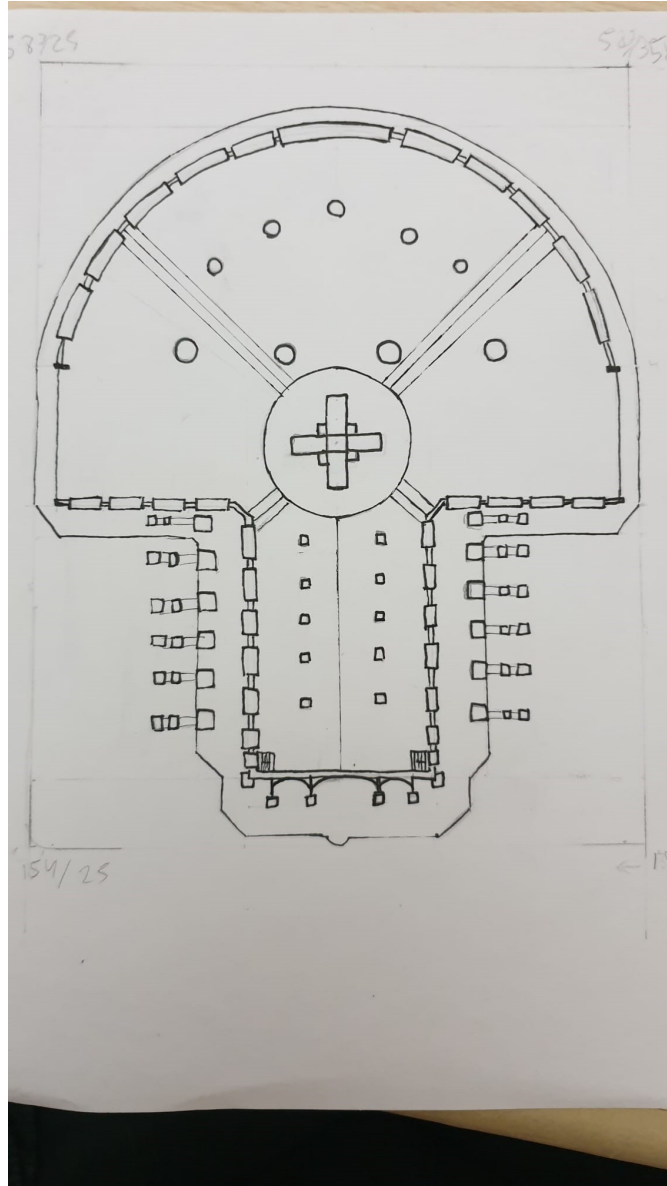


Figure 3.17: Dihedral plan of the ground floor with all its structures

WORK DEVELOPMENT AND RESULTS

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4.0.1 Model

Before starting an architectural project, one of the first things that is done is to make a model, but since the project is digital, I thought that I could make a small reconstruction of what the final result should be.

My original idea was that the cathedral would have the shape of a cross seen from above; as was typical at the time. However, and despite the fact that it is still a bit noticeable in the final shape, I decided to change it, that is why with the simple sketches that I had already made while making these small models, I decided on the final shape. I wanted to keep the main impression of these, so the way I decided was to extend the façade in a subtracting line and crown it with an incomplete semi-circle at the height of the intersection.



Figure 4.1: The most basic schema

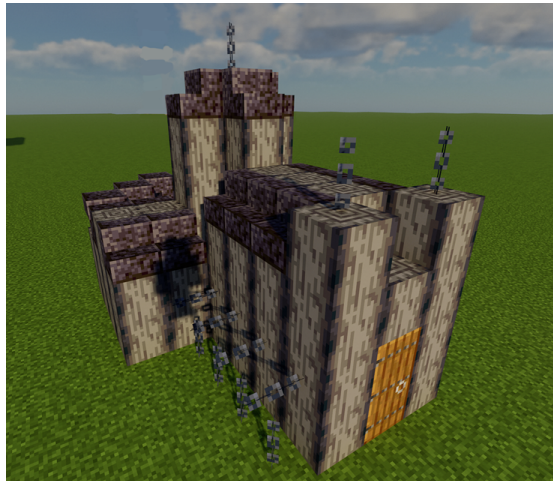


Figure 4.2: Mini-Model, Too small



Figure 4.3: Model from the front.

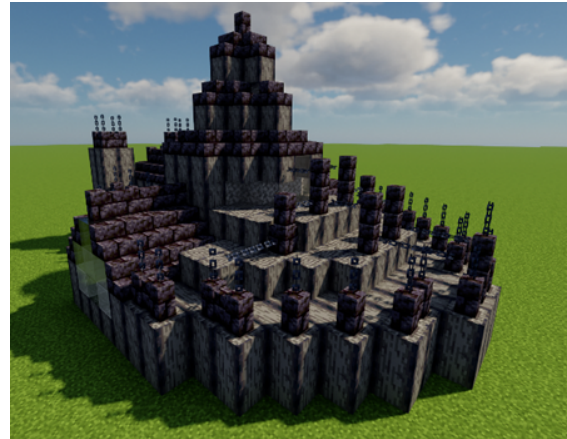


Figure 4.4: Model from behind.

This is a more reasonable model, though not really representative.

4.1 Work Development

The development of the work was basically:

- Look at a characteristic element of the cathedrals
- Sketch the proportions
- Try to create it separately in minecraft

- Then move this small model and implement it in the structure
- Alter it to fit them in the structure
- Repeat it to maintain the similarity

Here you can see a mini-video how i built

4.1.1 Construction

Describing step by step the entire design process and detailed construction of each of the parts of the cathedral would be a tedious process, both to do and to read, that is why for now I will limit myself to showing and citing the construction part of the complete facade at a moderate level of detail, giving reasons why I do each of the parts. Minecraft is a game where you build by placing blocks, there are thousands of different ones, which is why there are many materials to choose from, but at the same time the system has its limitations, no cloning, scaling or rotating, for example.

The key elements that a facade of this type must have are, according to my research, are: Columns, towers, balconies, arches, large gates and more generally, an imposing presence. That is why I will take care that these elements are present, also distribute the construction by layers to facilitate the simple.

To begin with, build some of the small elements that I later used in the final construction and that I already had in sketches. In-game models that I built apart because their shape and size were altered block by block and then simply copied to the corresponding place in the building. Many of them are key parts and were used to decide the final shapes, sizes and materials of elements such as columns, windows or arches, among others. These are some examples:



Figure 4.5: Arch and columns that I would later use on the 3rd floor

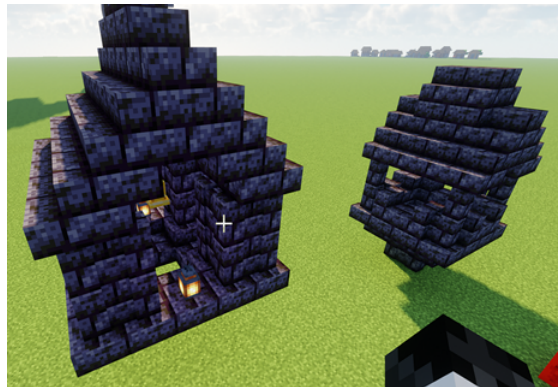


Figure 4.6: Top Bell towers



Figure 4.7: These windows were later used for the lateral

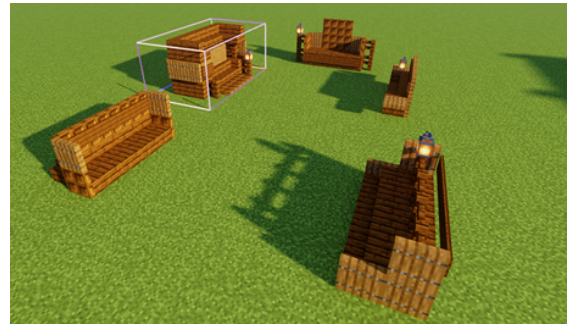


Figure 4.8: Different bench designs I tried

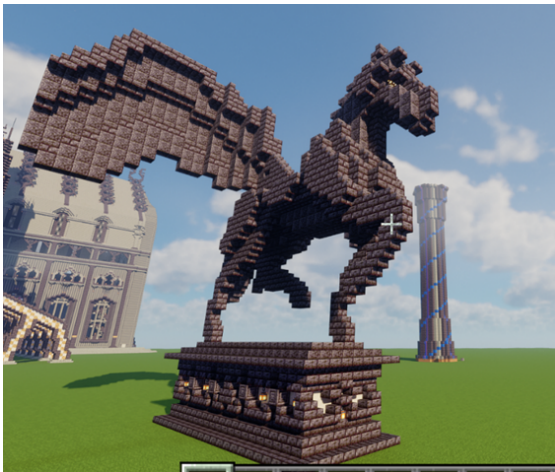


Figure 4.9: A black pegasus

Some of these structures that he later created could not be used, either because they did not fit the aesthetic or the idea, or because they were of inappropriate sizes, like this statue of a black pegasus. (At the bottom right you can see a diagram of the main columns inside the cathedral)

Now yes, we start with the construction itself and the first thing is a triple entrance, the one in the center being the largest, very characteristic of this type of construction, such as the Burgos Cathedral (see Fig 3.3). All buildings of this type have large columns in front, normally attached to the wall itself, but since my construction was intended to be on a much larger scale, I had to remove them from the wall to increase the radius of the center of mass, since at being so high with some embedded columns the structures would suffer more risks of twisting and collapsing. In this case I used 4 large pillars that help distribute the weight of the front.

The cathedral's facade is designed in such a way that it can be divided into layers by altitude, specifically 6 of these, of different sizes and functions.

- The first is the 3 doors, being the largest and containing the obvious.

- Above is the smallest layer, which is an open space with many columns and arches that will be passable later
- Then there is what would be the part that would be described as the part prior to the rose window (large circular stained glass window normally centralized in the facade), but this facade will have two so it will be the one prior to the first rose window. This layer is not walkable and has a large number of columns with structural importance as they support the weight of the upper balconies.
- This is the layer of the first and smallest rose window, it has four very ornate pillars as well as multiple arches to the outside that support the towers, as well as being the entrances to be able to go through the main balconies of the facade.
- Above are the two main towers of the cathedral and in between the Great Rose Window visible from much of the interior. You can see the subtle resemblance to the rose window at the back of the Palma de Mallorca cathedral.
- And above these are the pinnacles, with a pattern of contrasting colors ascending to enhance the feeling of altitude.

I have refrained from using as little technical language as possible, but here is a Youtube video which summarizes the basic elements that I took into account.



Figure 4.10: Version 1.0 of the principal entrade



Figure 4.11: Version 1.1 Low angle view of two 4 pillars already finished and the upper part in progress.

As the pieces fit together, it begins to take shape. In the images of this document, you can see how some elements are changing, even after they have already been placed in the final model, because for one reason or another, they did not quite fit together.



Figure 4.12: Bell towers

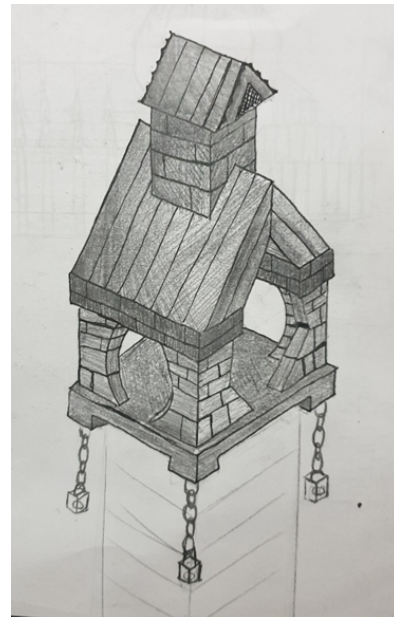


Figure 4.13: Bell towers sketch

Comparison of top of the pillars in game and top pillars in sketch.

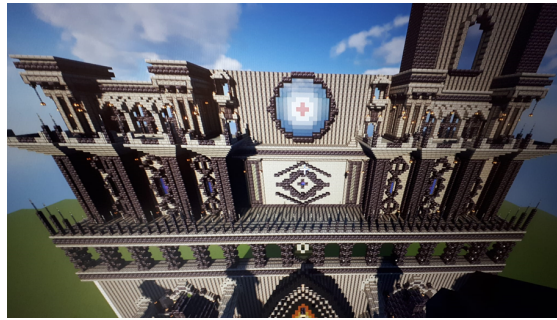


Figure 4.14: Version 1.3 The mid of the facade

In this picture we can see one of the principal towers in construction, a lower rose window and below it, a decorative part what change a lot in the final version.



Figure 4.15: Version 1.5 Day

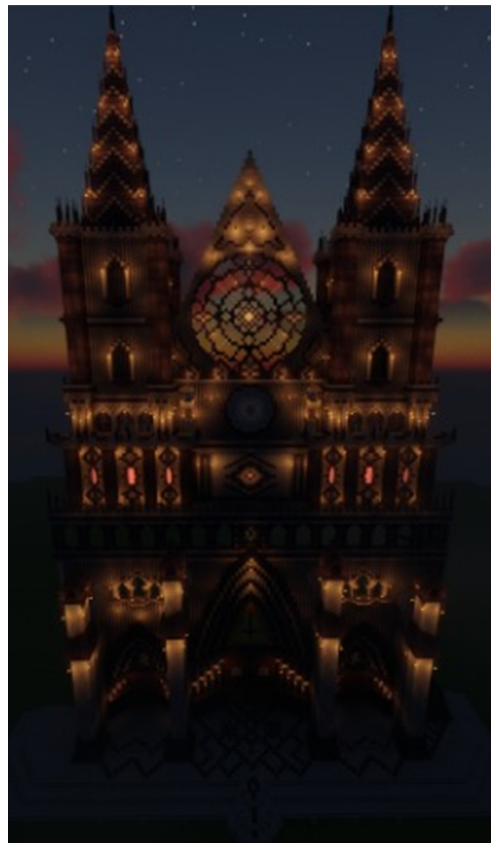


Figure 4.16: Version 1.5 Night

That is a version close to the final with the finished facade, day and night version with the lighting still unchanged.

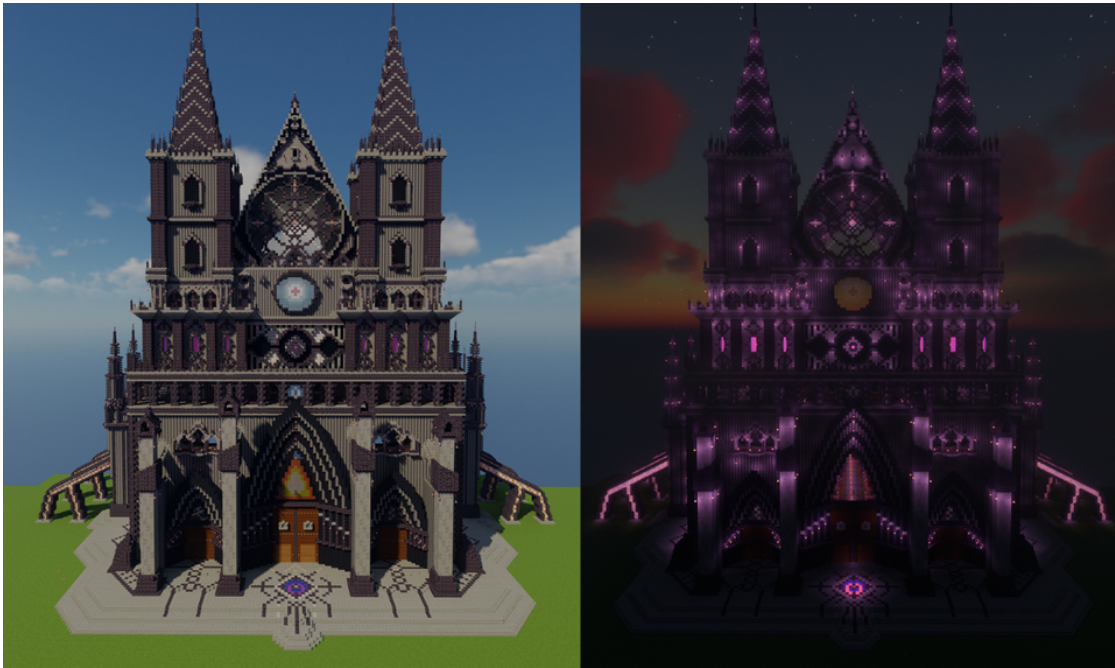


Figure 4.17: Version 3.0 Facade ready but with the lighting already adjusted but not finished

Once this process was finished, we had finished the facade, but the construction involves many more parts, which I will now divide into segments of more or less equal weight in terms of work

Once the facade was built, the shape decided and therefore, I could know the approximate measurements of the final construction (bearing in mind that I was trying to keep the golden proportions), I used the game maps as a tool, combined with photoshop to make myself in the floor with cube-pixel ratio, an outline of the basic shape of the cathedral, although to be fair, it changed a lot as I built it.

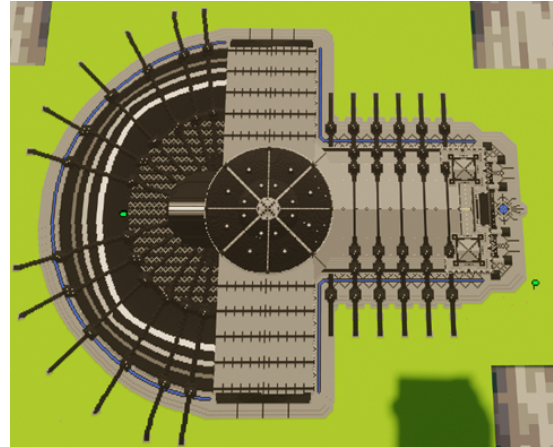


Figure 4.18: In-game map of the cathedral. Top view

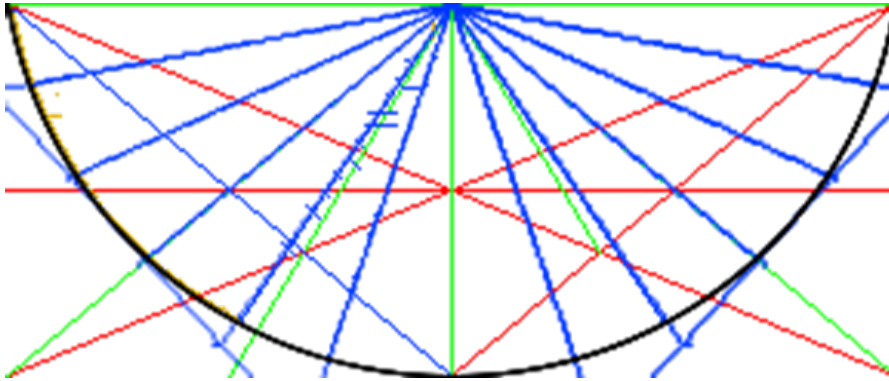


Figure 4.19: One of the many "plans" that I had to make in photoshop, to be able to draw the lines that would later be the corresponding elements of the interior

4.2 Results

Some images of the finished cathedral or in a very advanced state.

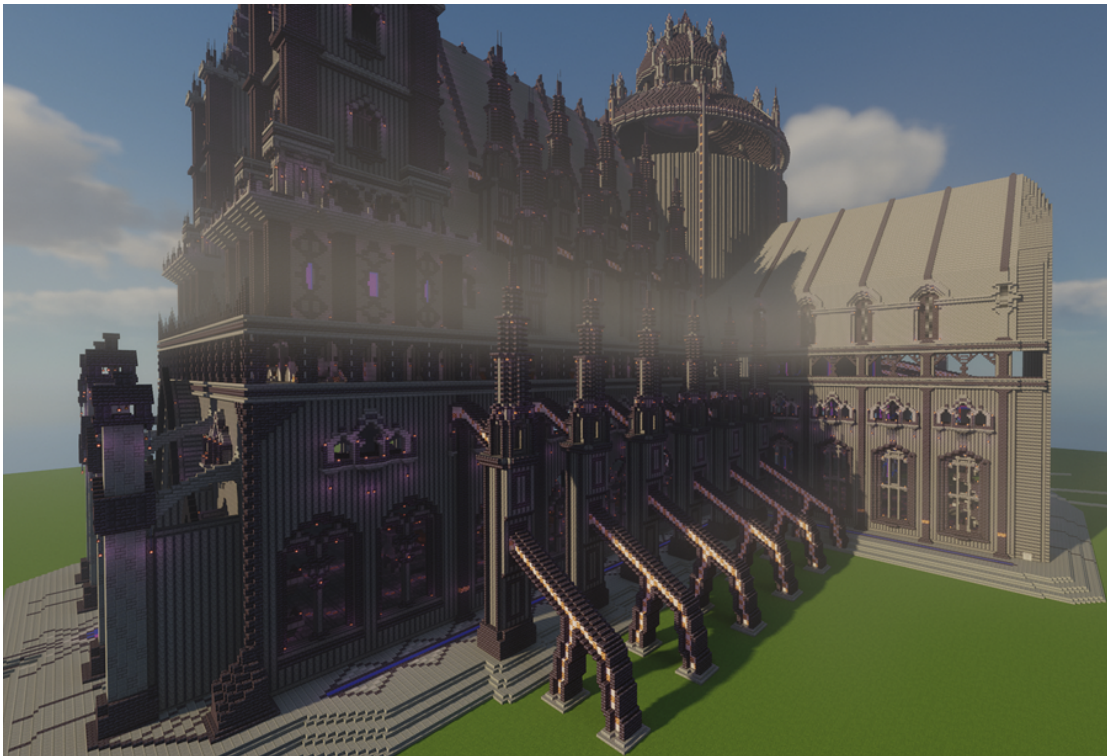


Figure 4.20: Right side with their buttresses and flying buttresses

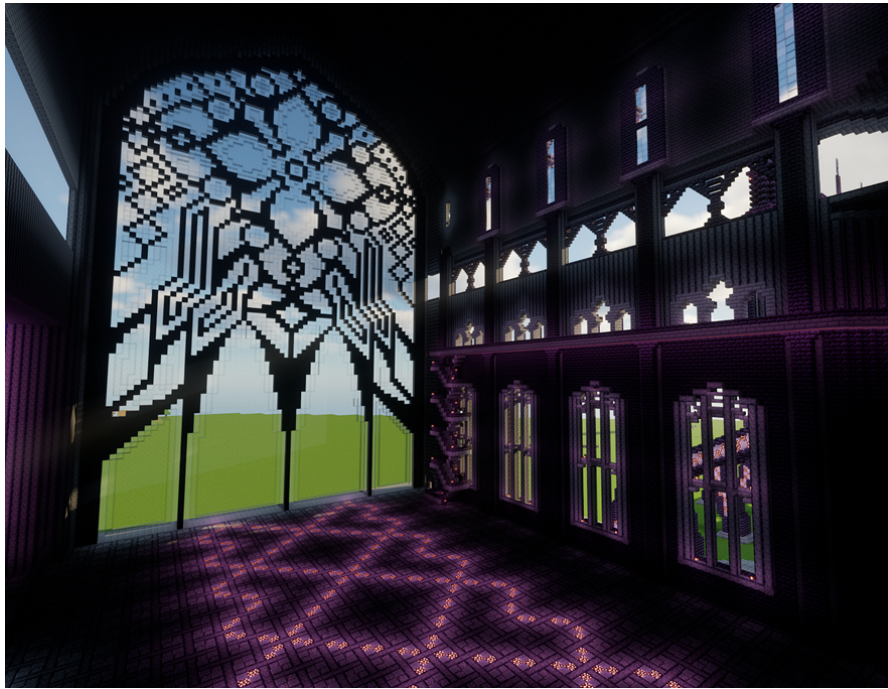


Figure 4.21: Inside of the right side, massive stained glass window

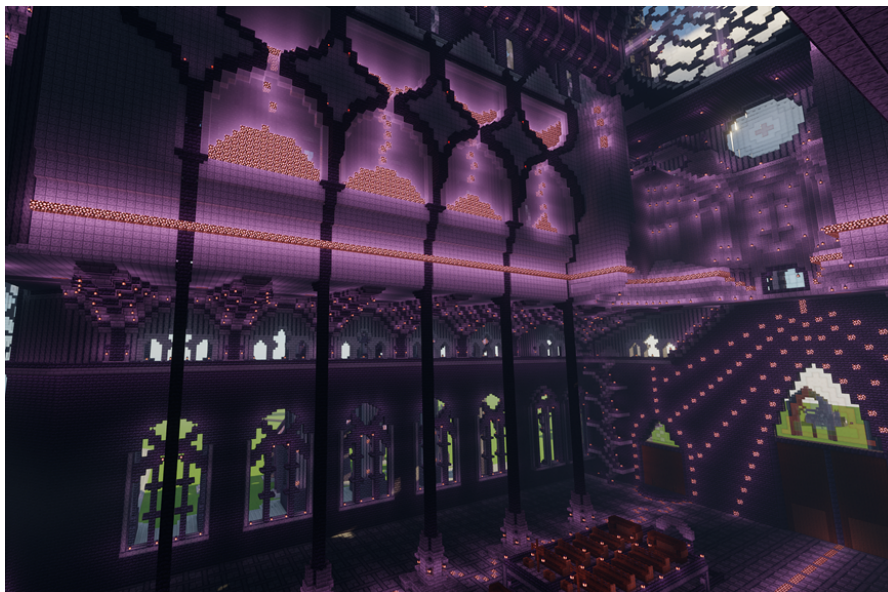


Figure 4.22: The interior on the left side, with its time-themed decorations (reference to this in the relate at 4.3 *Thought*) with hourglasses and the interior columns that hold the entire structure, you can also see the balconies of one of the walkable corridors.

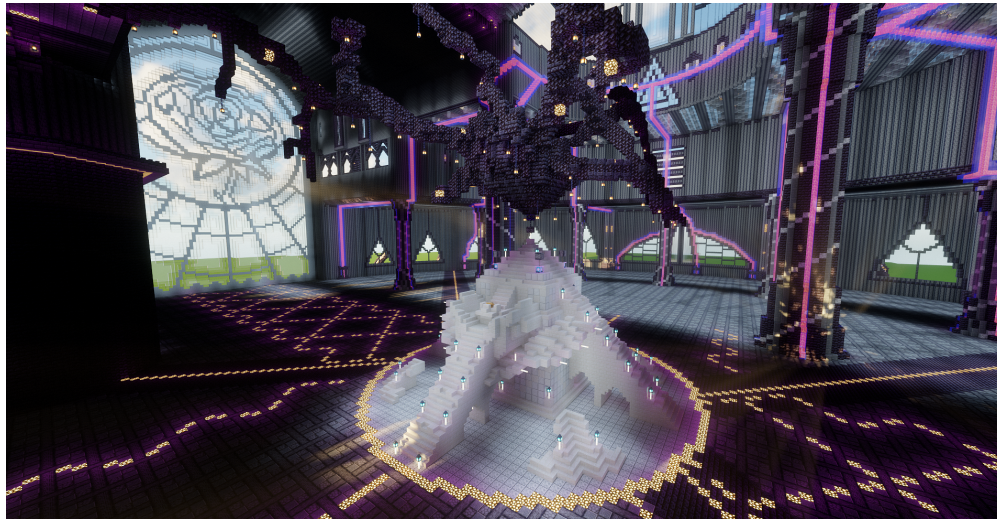


Figure 4.23: Central structure of the cathedral, differs from what is common in conventional cathedrals, you can see the sketch at 3.16. In this image, you can also see various elements that I spoke about before, such as the column (on the right) that I mentioned in the image of the black pegasus at 4.9, or the large white stained glass window (on the left) that has its sketch in 3.14.

One of the objectives when designing and building it was that the cathedral had to be possible to go completely on foot, here I make a small video where a small part of them is shown: [Drive](#)

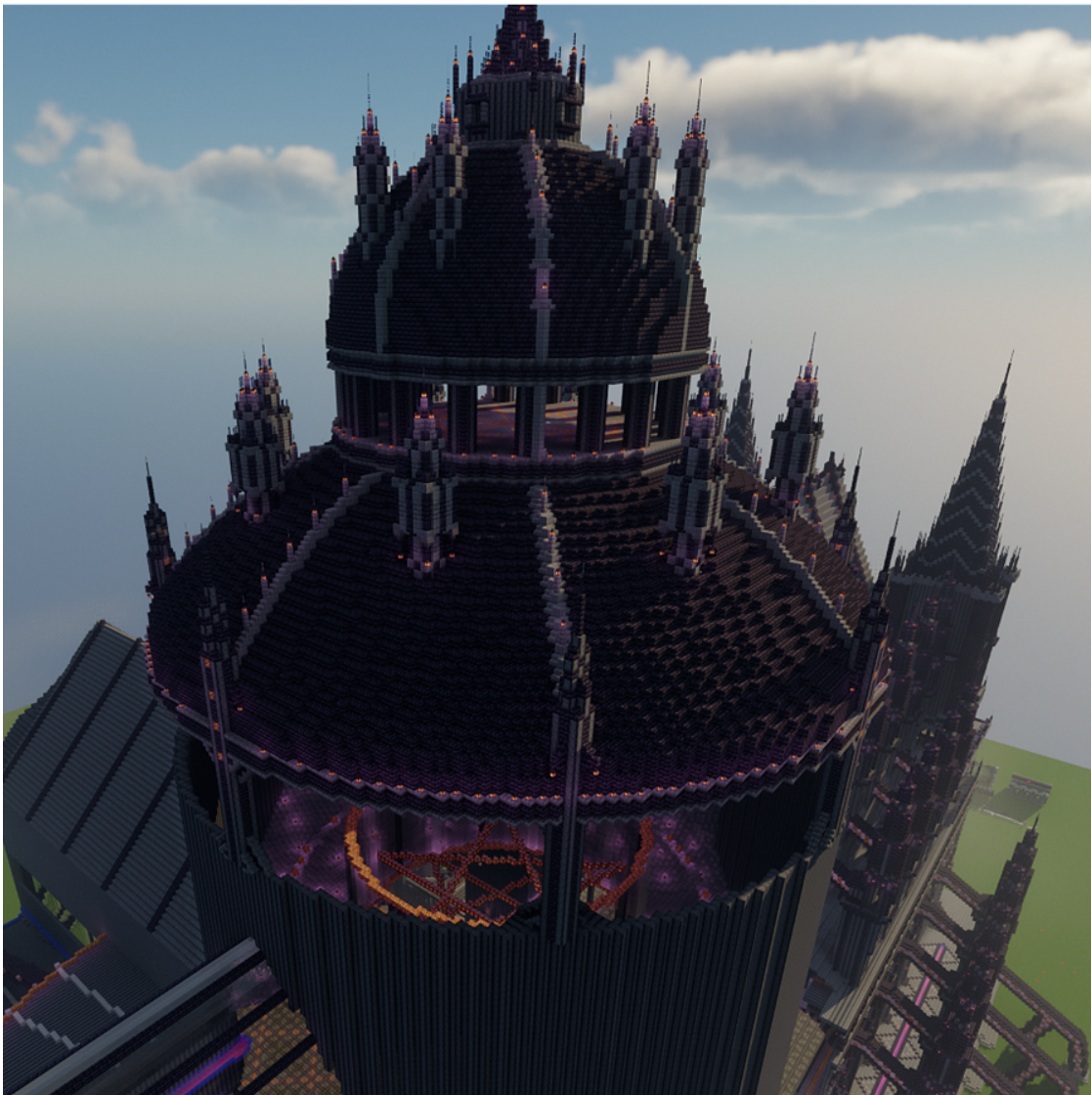


Figure 4.24: Dome and central structure of the cathedral

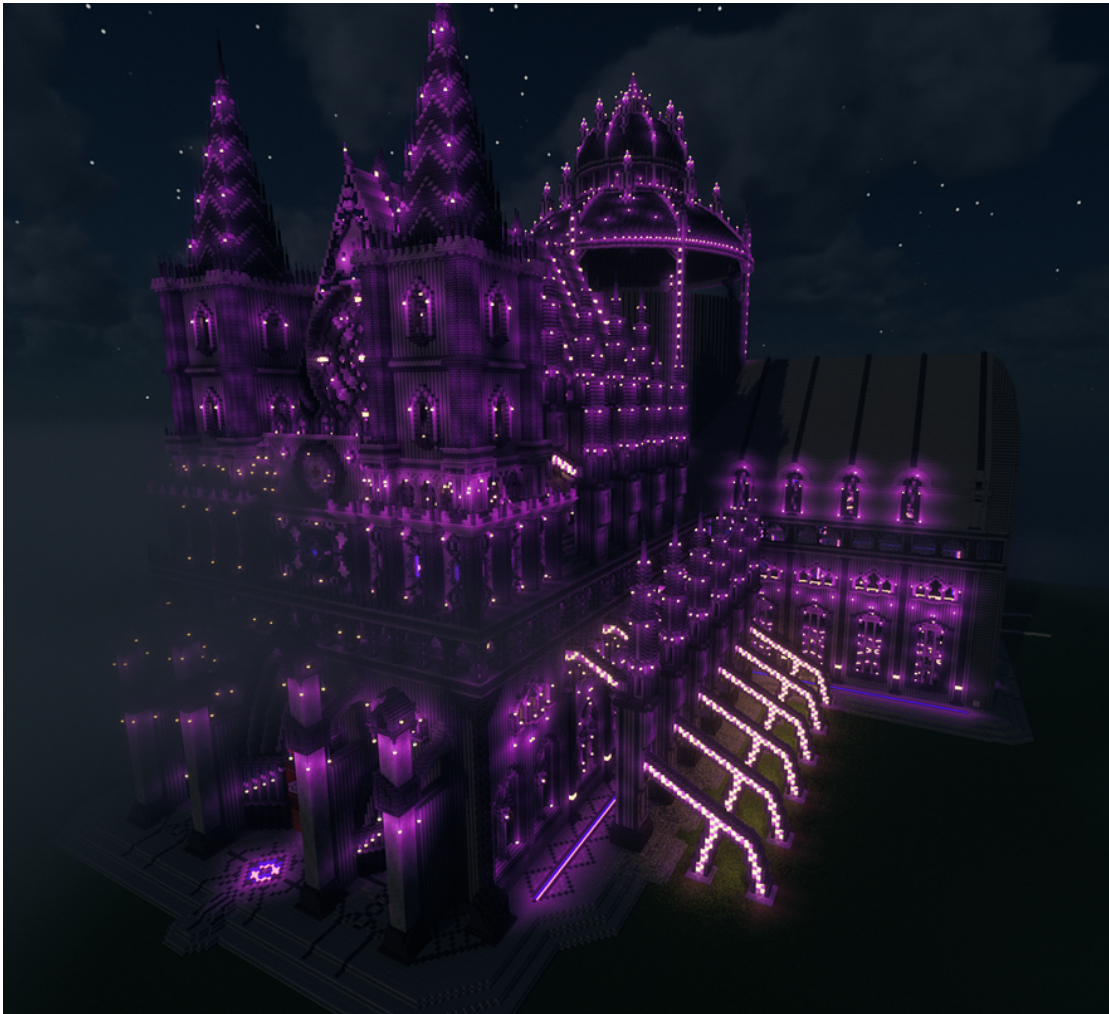


Figure 4.25: Exterior Night

I think the results speak for themselves, the cathedral is fully built and has more sections and details than can be comfortably displayed in a format like this. Many of the things that I had thought to do I have been able to do to a greater or lesser extent, however that does not imply that there have not been problems along the way, which leads us to the next point.

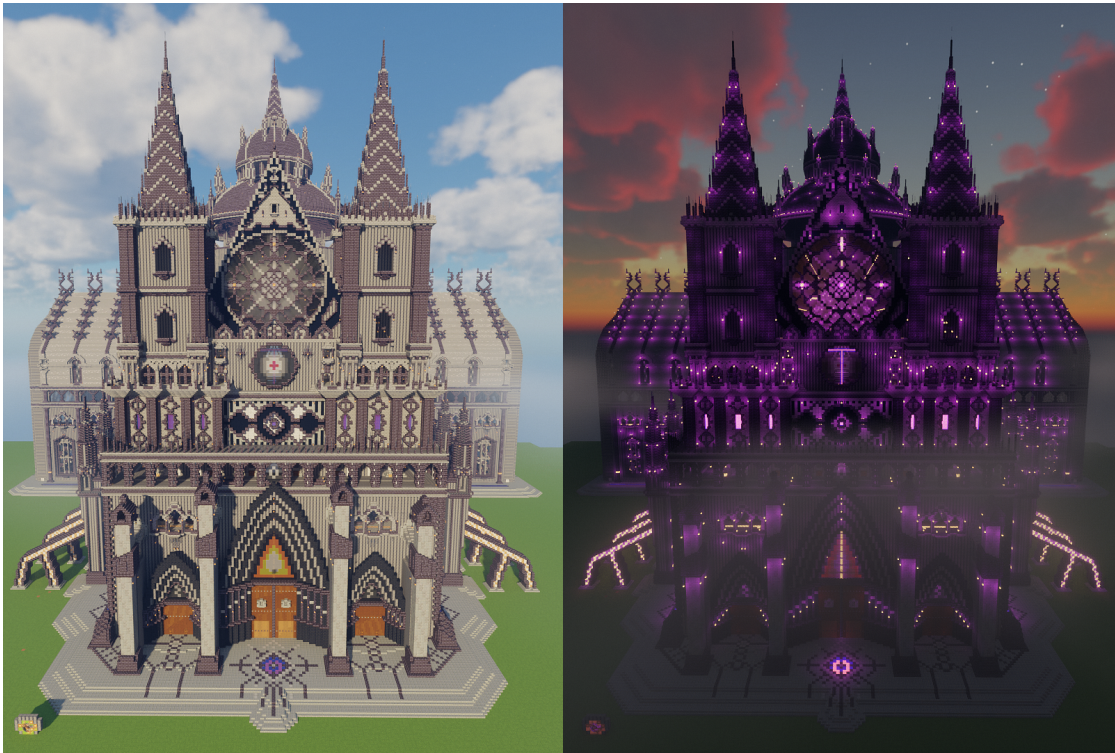


Figure 4.26: The true final version, i lost the count but it's like version 20 more or less

Here you can see the Trailer: [Trailer](#)

4.3 Thought

Thought: During the process of creating the cathedral, a large number of unknowns have crossed my mind when establishing the design; Well, because cathedrals are buildings designed for a religious cult, specifically that of some of the forms of Christianity, they have certain design decisions and certain concepts that are difficult to represent in a fictional element of this type. That's why I decided that the best way to fix that to be as respectful as possible was to cut it at the root, eliminating any kind of religious symbology and despite being a cult building, this will be a cult of humanism itself, and of the ability of human being to create And using one of the game structures, the lectern, I introduced an element of this concept. A small recital that deals with the cathedral itself, its symbology and the greatness of humanity.

*Aquí te hayas, en el centro de tu propio ser,
al sur, el camino recorrido,
pedregoso y fatigoso; pero solo, pasado.*

*Al este, el loto negro, símbolo
de tu fuerza y determinación.
Al oeste, la rosa blanca, muestra de tu esperanza
y pasión por seguir; ambos tu presente.
Al norte tú destino, el más duro de tus enemigos
y el custodio de tu futuro.
Abajo la luz de tu corazón, siempre contigo,
protegiendo tu ser, de caer en las tinieblas.
Arriba toda la oscuridad que tu corazón aún
tiene que enfrentar, pero que nunca tuviste tan a tu alcance.
Tras de sí, las estrella del firmamento,
eclipsadas por la oscuridad en tu corazón,
y precedidas por la cúpula del vacío,
en el que todos nos convertiremos.
Sea así, esta catedral, testigo y testimonio
de aquellos que fueron, son y serán,
los herederos de su forma y lugar,
mas no existe ser más grande que uno mismo,
en el mundo, que cada uno es.*

CONCLUSIONS AND FUTURE WORK

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5.2	End and Future work	36

In this chapter, the conclusions of the work, as well as its future extensions are shown.

5.1 Conclusions

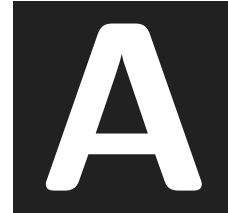
The first thing to note is that this project has been a lot of fun to do, most of the time. And although a good part of the work was satisfactory and comfortable to do, the platform has very clear limitations when it comes to doing more advanced things. As positive points I would highlight that it is easy to learn to use at a basic level, and very intuitive; In addition to doing small things very quickly to sketch. In addition to a large number of very different materials that give many options. It is a tool that allows you to really easily show what you have done and that could help to share an idea, for example. There are many tools in the form of mods and add-ons that help to achieve what you want much more easily, for example I have tried 10 different types of Shaders and there are many many more. As for the negative points There are difficulties copying, moving or cloning objects and complexity to create lines or walls. The blocks are not very flexible in terms of shapes, and complex or highly detailed structures are almost impossible. The basic lighting is unrealistic and even using external programs is not very correct. I have found some external tools that allow extracting the structures to 3D models, but they still do not work quite well, although a couple of them are still in development.

5.2 End and Future work

After all this, you can finally conclude that a tool/video game like the one I proposed during this project is very possible, since minecraft, without being its objective, is really close to achieving it. Even though my idea is a fairly abstract concept, thanks to this project I am convinced that a tool/game like the one I have proposed can be made.

Although my idea is quite an abstract concept, thanks to this project I am convinced that a tool/game like the one I have proposed can be made, which makes me wonder if I should try to work on developing it myself, or if the video game industry itself will have a trend in that direction because after all this part of minecraft arose naturally from the original survival game. In any case, this is the end of my project, it has been much more work than I really expected and although it seems to me that the useful life of it may be short, since Minecraft is "dying" little by little over the years, I think that the conclusions and what I have been able to learn from here, will prevail.

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Salary mean

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All catedral photos comes from

<https://upload.wikimedia.org/wikipedia/>

A.2 Append

Adding all the files, photos, videos and other items created for this project to the game would result in a file so large as to be tremendously inconvenient. That is why many of its files are hosted in the cloud. You can access them from here, and the corresponding links of the document. [Link](#)

