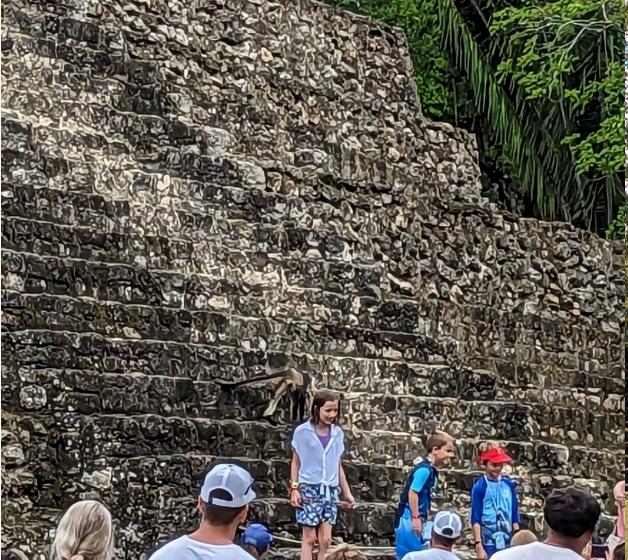


# The Idea

Creating a Mayan Temple was based from my recent trip to the Chacchoben temple in Mexico. I decided to take inspiration from the structure as well as the Chichen Itza - the most famous of the Mayan Temples. I wanted to create something that reflected the unique patterns that are sculpted into the limestone and stick to the measurements of the structure where possible.



The patterns from the temples are still influenced in modern architecture, and due to these long lasting designs I wanted to honour that and try to create a similar temple that reflects the Mayan architecture. Although I wanted my environment to be a take on a temple I felt it was important to gather references to make sure it is kept accurate to the original structures.



# Structure Planning

Planning the temple with the right dimensions would be key to replicating the Maya architecture. The Maya made well thought out decisions when it came to their temples, to understand the architecture I wanted to further my understanding about their history regarding these temples. Their pyramid shaped temples were put in place for ceremonies, rituals and had astronomy in mind when being constructed. The Chichen Itza was built with 91 steps on each of the 4 sides of the pyramid built for each day of the year, it is small details like this that was important in understanding what specific details to include in my model.



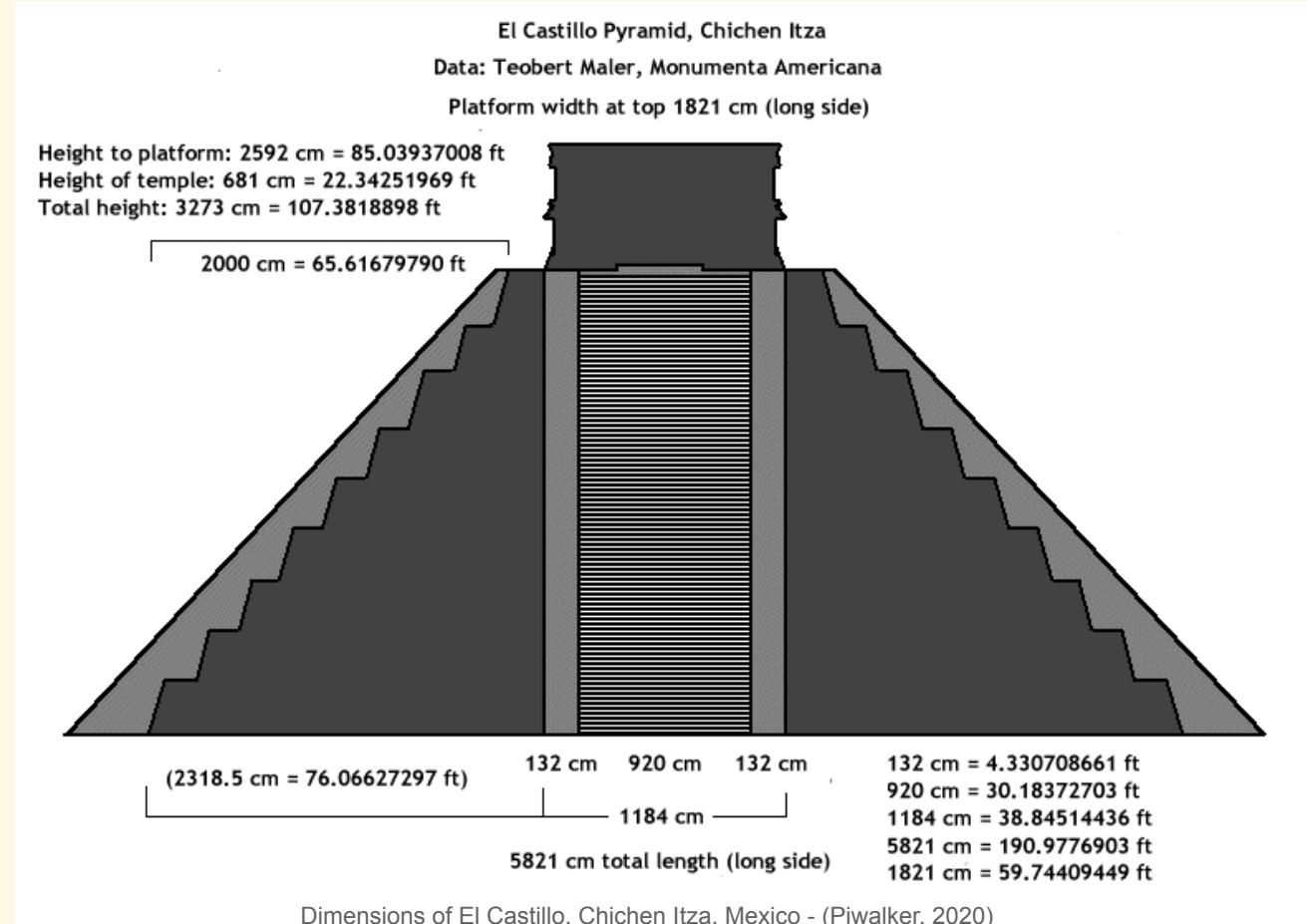
Stonework of Chichen Itza - (Tabbah, 2014)

To understand my dimensions of the bricks and carvings on the temples I needed to compare to other parts of the build. The doorway was the clear option for this as many sources report the average height of a Maya Male was 5'2. This helped gauge the size of each pattern and brick size that I was going to use in my project.



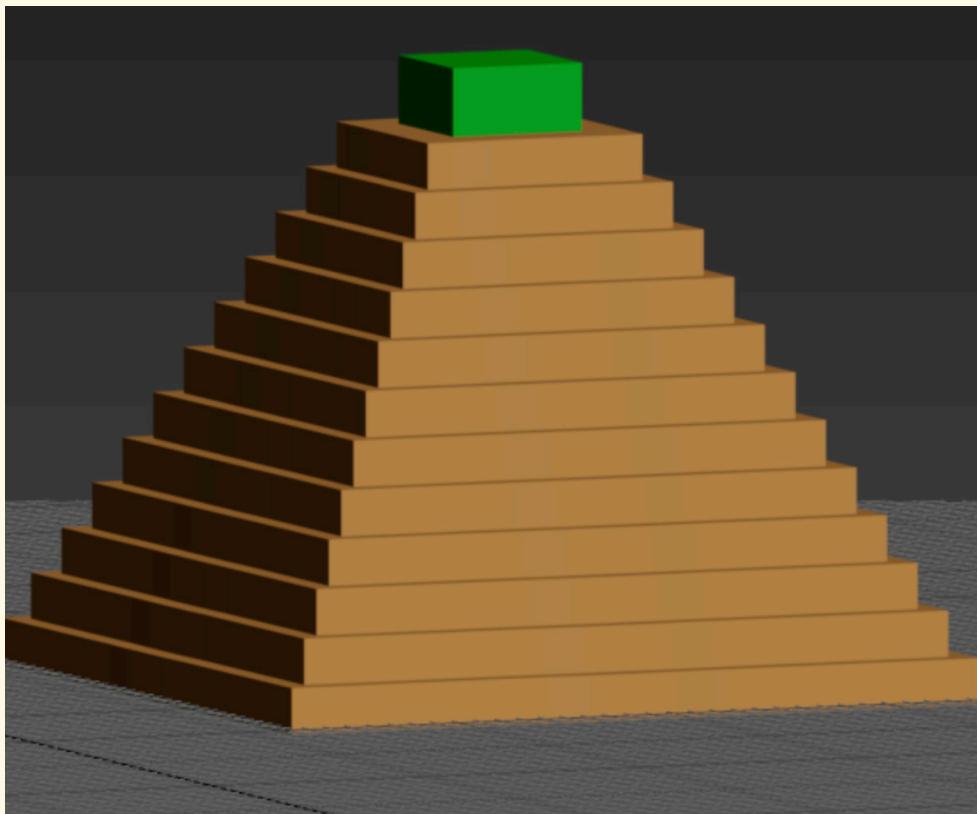
Nunnery at Chichen Itza - (Fernández Solano, 2024)

Maya architecture varies based on location, it can largely differ in patterns and carvings. To keep this project true to the original architecture I collected my references from structures from the same area. This building is the nunnery palace built in the area of the Chichen Itza, it has strong carvings with many patterns influencing my project. I wanted to show these carvings in a higher regard by placing a similar structure at the top of a pyramid. I felt due to this building being part of the Chichen Itza based in Yucatan Mexico, it was important to get the specific dimensions of El Castillo to keep in with the similar architecture.



## Scene Block

This project's hero asset will be the temple itself, I considered looking at different options with having buildings in different areas in the background however this set up would highlight the temple in its own light. The area in the background that will be seen from the camera will primarily be the sky and tops of trees, due to the top of the temple being 25m high it will unlikely show much in the background particularly from an upwards angle. It is still important to understand what would be in the scene in the background to gauge the lighting and reflective light on the models.



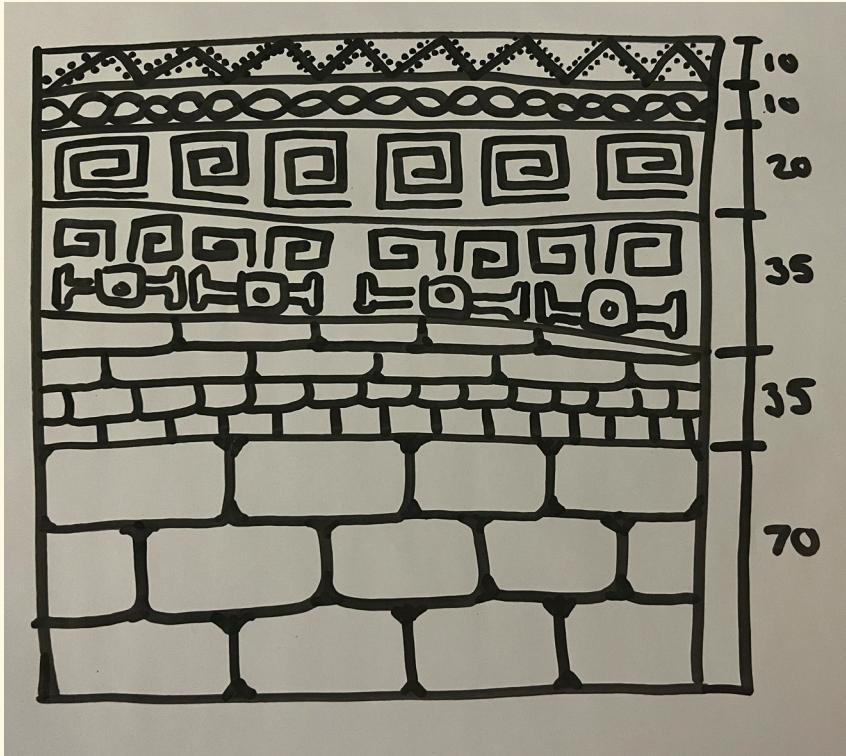
## Trim Sheet - Planning

Planning the trim sheet was crucial to the development of the trims, without carefully measuring out the patterns and laying out the sheet this could have caused issues further down the line when applying to the model. Due to have gone into the history and dimensions of some of the patterns it would have been for nothing should this have not carried through to the final product.

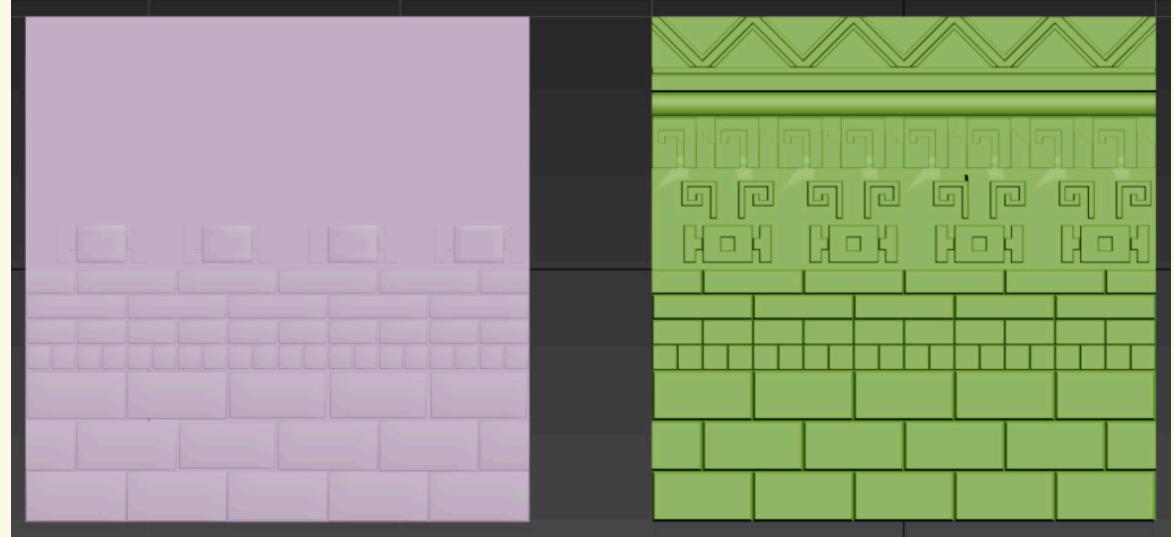
To structure the trim sheet I drew a sketch of my initial plan of my temple to know what was needed and what could be removed. The below image shows the initial sketch with highlighted areas, this indicated where there could be repeating patterns in my project and the brown colour indicates where decals could be present to represent the intricate detail. The scare colours next to the page show how they would fit inside a 0,1 space for when the UVs are applied. This was particularly helpful as it helped reign in the scope of the project by seeing where similar patterns are and order them of importance to prevent too much time taken up in one area of the project.



# Trim Sheet - Production

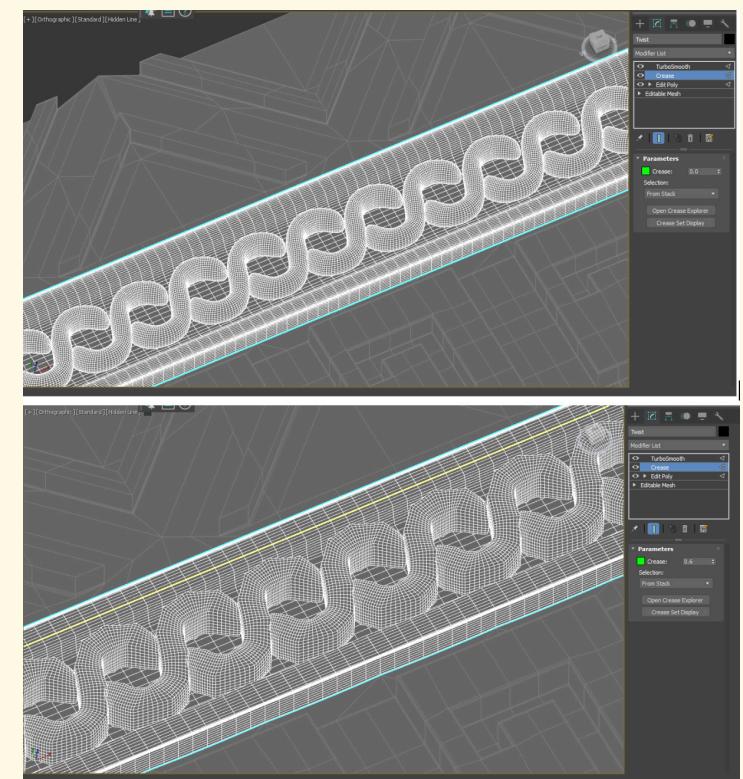


Due to creating an accurate plan of how I wanted the trim sheet to look it made modelling in Max and Zbush much easier. I also made use of the symmetry modifier when it came to some of the patterns as this also saved time having to model the same thing over again. This was particularly useful for the section shown below as it could be split into 8 separate pieces and I could duplicate and attach them across.



I originally created my trim sheet lacking in normal detail, this would have had a low alpha value and wouldn't have had the visual look that was intended.

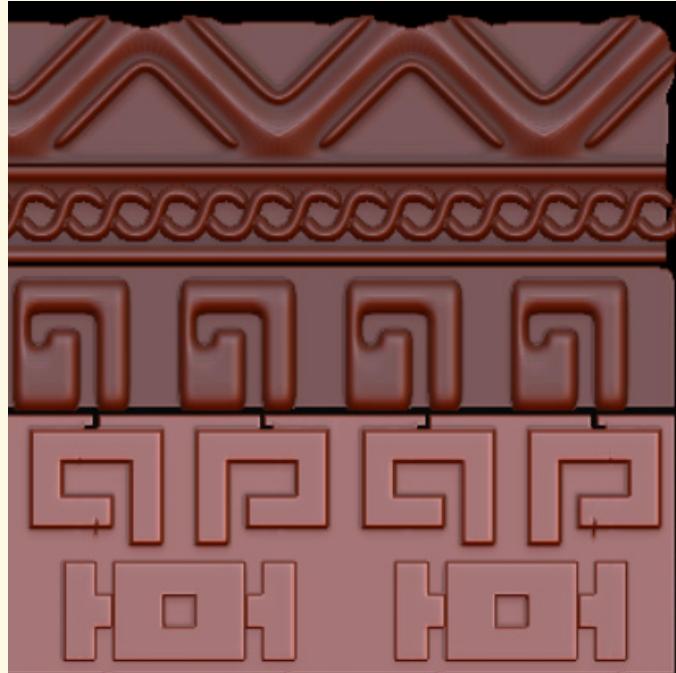
With turbosmooth applied it showed which of my edges were needed creased. To the right is before and after adding creased surfaces to my trim, it shows a lack of detail when turbosmoothed where as the second image shows as it was sculpted and intended to look.



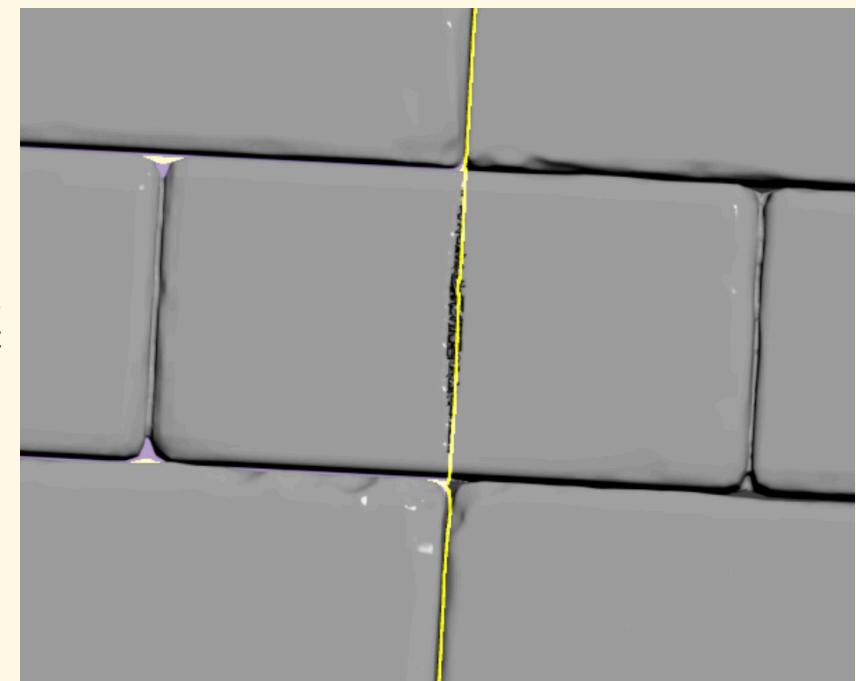
# Trim Sheet - Production

Bringing in the trim sheets to Zbrush was brought with some difficulties as when the trims were subdivided they started pulling in the edges and creating gaps in the model or amplifying the imperfections in the model. This was helped with turning off the smoothing tool before dividing at lower levels then including it back in at around level 3 of subdivide.

Having this option was particularly helpful as I could control how much of the shape of the original structure was still in effect before begining to add in detail.



Another Issue that had arisen with my trim sheet fell with the wrap function in zbrush, it was duplicating across the trim many times. It was not clear as to why this was the case and after much googling I could not find a way to fix this. However I eventually managed to resolve it however I had already sculpted the rest of the model. I tried to smooth it over to prevent the issues shown but I was unable fully align it without messing up the whole mesh. Therefore there is a slight seam issue however I have managed to hide it well in the final outcome.

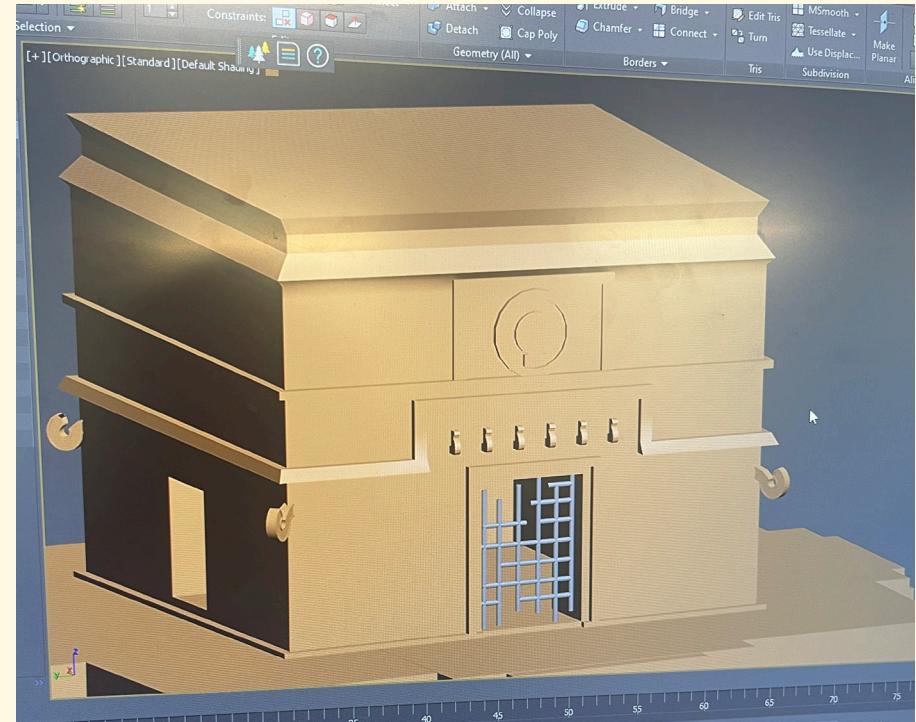
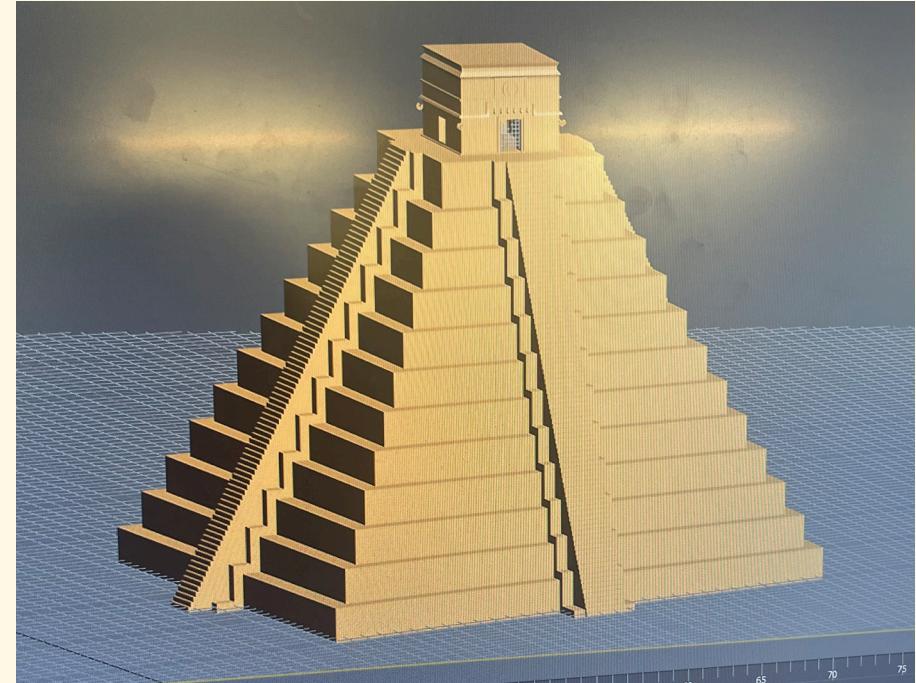
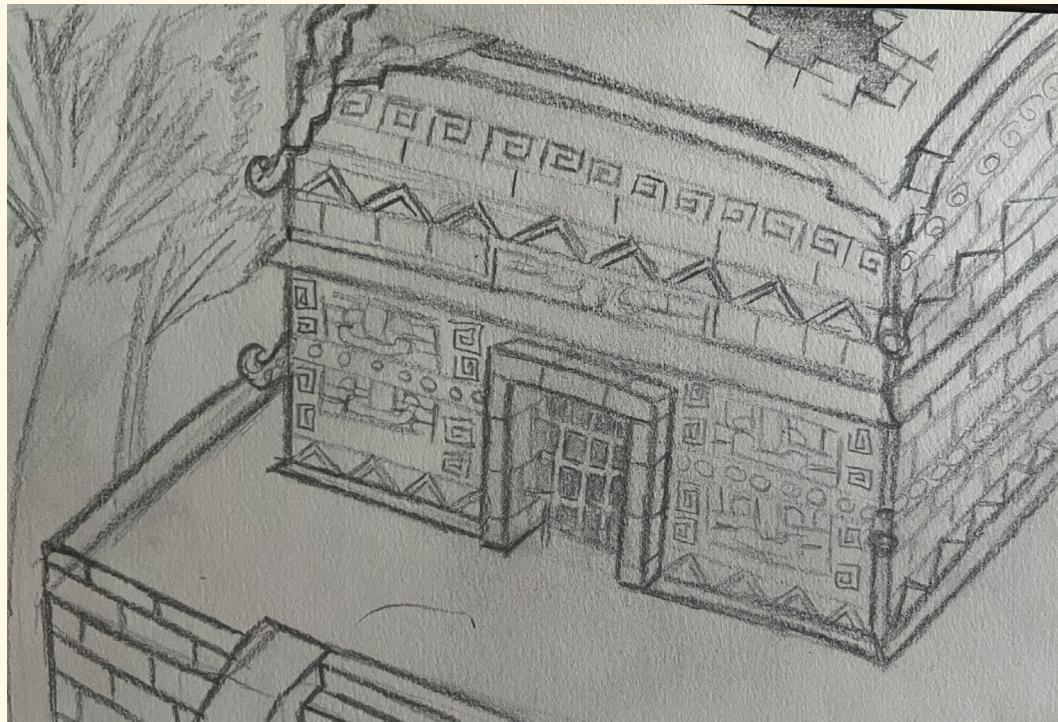


# Modelling

To achieve any environment project it is important to make a list of assets needed to be modelled. This helps reign in the scope preventing extra elements getting created that don't provide the scene with anything.

- Temple
- Base
- Stairs (x4)
- Gate
- Corner Hooks (x4)
- Front Hooks (x5)
- Mural

From here all assets were modelled in 3Ds Max, each of the assets that had duplicates were fully unwrapped before duplicating to prevent having to do this again. In this process I ensured that I kept with 91 steps that El Castillo has, I felt this was a nice homage to the original. The only issues that had arisen during this process was the interior room. Originally I was going to just extend the door inwards, however after understanding how unreal lighting worked I felt it was important to include this due to the light bouncing off of the inside of the temple. As it was not planned and the doors had already been modelled there were a few issues with aligning the edges to the door however the bridge tool aided this.



# Texture - Planning

When it came to planning the texture for the project it was clear that there would only need to be one material attached to the trimsheet as the entire structures were typically made from just limestone. However there was a large variation of the colours due to the structures standing for over 1000 years. Structures in this time also seemed to grow vegetation on them, presenting in moss and grass on the floors. I made a list of materials needed to be created to allow for vertex painting.

- Clean Limestone
- Mouldy Limestone
- Mossy Limestone

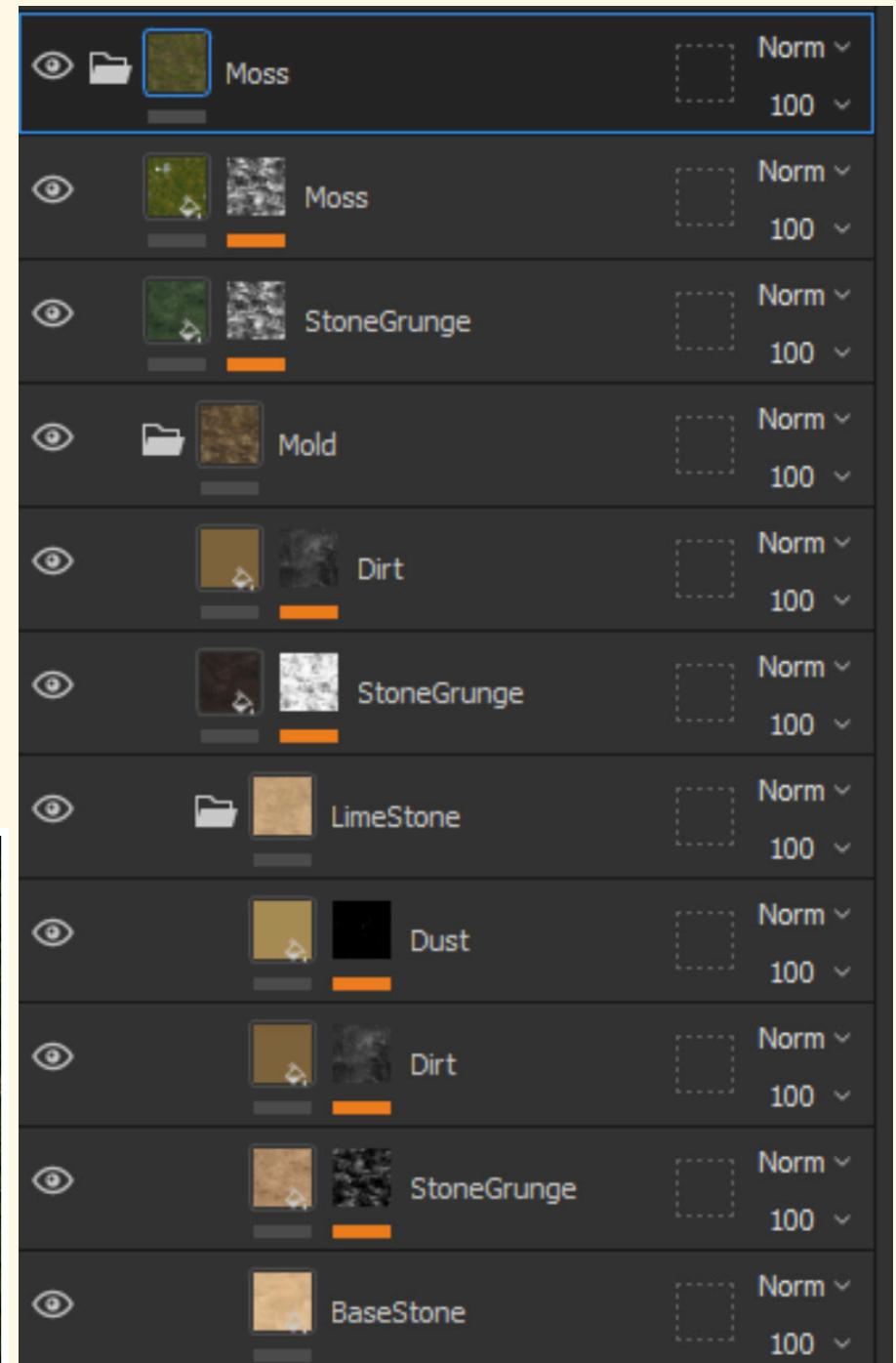
Each one of these variants were to be applied to any limestone texture so that vertex painting could be carried out across the structure. Mould is a large problem in these structures due to the humid environment Wilford's entry (1989) in the New York times goes into detail of the deterioration of the structures and how they could potentially worsen over the years being exposed to the elements. Due to this I want to make sure there is deterioration displayed more prominently in the areas where it is more exposed to the elements. To do this I would need to consider where the building would be most likely hit in relation to its location in Mexico.



# Texture - Production

Creating the Limestone textures was relatively easy as each base was kept the same base of limestone, this was to prevent any difference between the objects in the scene as if the structure were real it would have been crafted with the stone surrounding the area. The best way I was able to keep this consistency was to create a smart material with the finished limestone texture. From here I worked on the mouldy layer, keeping with the same practice as before I created a smart material for this as well as for the moss layer. This was so I could use this texture across the 3 different texture sets I was creating.

Knowing I would need to create different textures for different parts of the structure, I crafted a plain stone, tilable texture with larger bricks and a few detailed bricks and a trim sheet. As the Tilable texture was required for a small part of the project I used the trim sheet I had crafted and pieced it back together to create the tilable texture.



## Unreal Prep

Aligning the UVs were crucial to get a well structured product, as small missaligns could ruin the illusion that they are trying to create in the first place. Due to the entire temple at the top of the building being part of one trim sheet, I felt it was crucial to spend time with this part of the project, however it felt as if I was repeating what I had already done on another side of the project. This is where I utilised the symmetry tool again to only have to texture half of the temple.

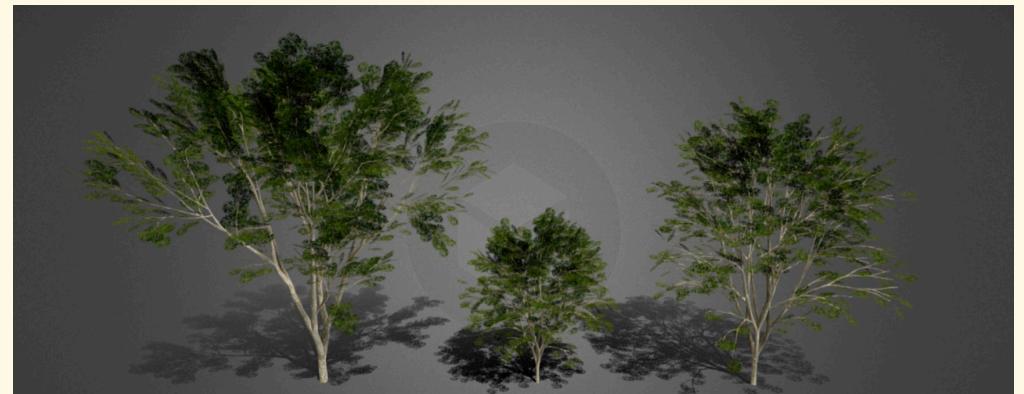


Once my trim sheet was aligned to the UVs in 3ds Max I then made sure everything was prepared for putting into Unreal engine. Getting the project into unreal was relatively easy due to my experience with Unity. Although there were some issues finding how to access different tools I was able to quickly make way in building my scene.

## Scene Development

The scene development was kept to a minimum due to the temple being at such a high elevation and nothing would usually surround these sites, both back when they were built and now. They are often away from modern day cities and can be located in Yucatan, Mexico. Yucatan is generally considered a flat area of Mexico with little mountains or hills. As the temple is so high above everything else and the ideal angle I was looking to take my images from this would render anything other than land and foliage pointless in the scene.

I wanted to use megascans for my project, however I could not get this to work inside Uni as it requested I update unreal to have access to the scans I had saved to my library, this is where I had to look for alternative options to include in my project. This was similar with the foliage I wanted to use, due to previous experience with a game engine I went to sketchfab.com to try and locate models to place in my environment.

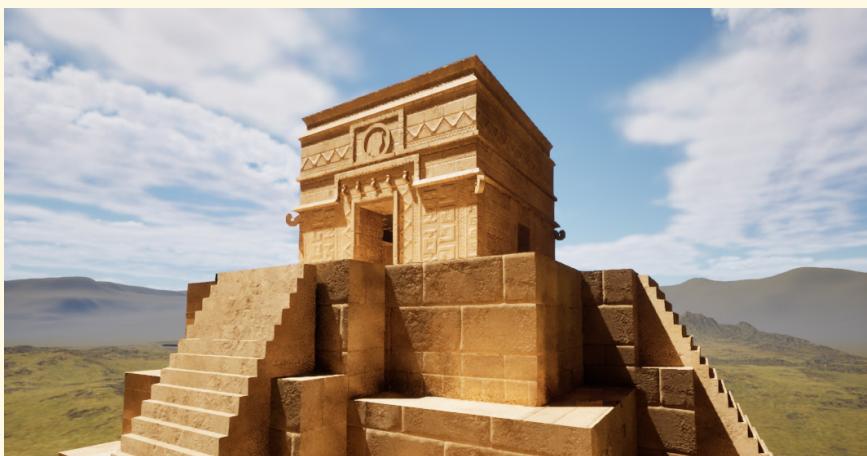
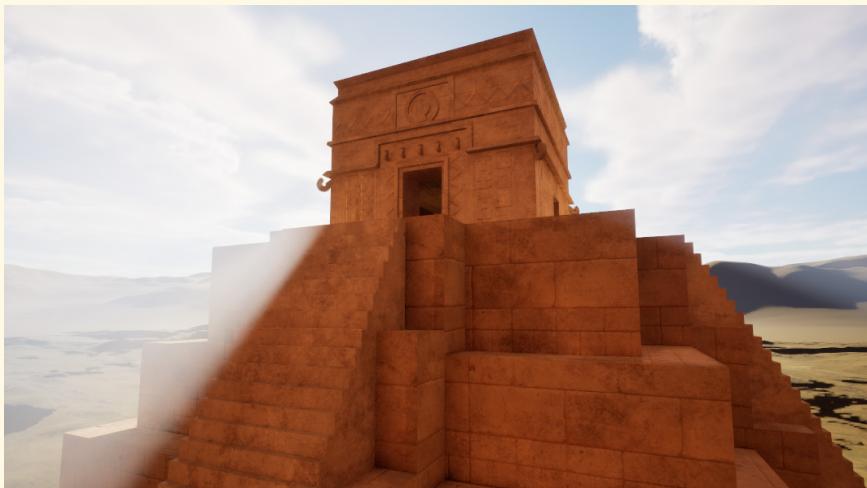


# Lighting

For the scene I knew I wanted to create multiple renders at different parts of the day to show off the detail of the trim sheet on the temple. Although this would be one of my stretch goals I want to create these lighting times:

- Noon - Shining bright on top of temple to clearly show vertex painting.
- Morning - Godrays appearing on the sides of the temple.
- Evening/Sunset - To give a warm glow on the temple highlighting how vauled these structures were to Mayans.

After deleting the preloaded lighting set-up I wanted to create my own setup, I followed a tutorial provided by GCU Learn and adjusted the settings until I found something I liked. I also referred to the table provided in class regarding what lighting settings are appropriate for which scenario.



These images showing the difference in levels of lighting, I had created a high level of bloom which made the scene look unrealistic, I re-evaluated and changed this to the image below. This was originally an angle I was not prepared to light or even consider for the final product. As much as I tried to hide it with light you can clearly see where the UVs had not aligned correctly on the inside. I intend on going back into this project and adjusting the UVs and applying vertex painting to the whole monument.

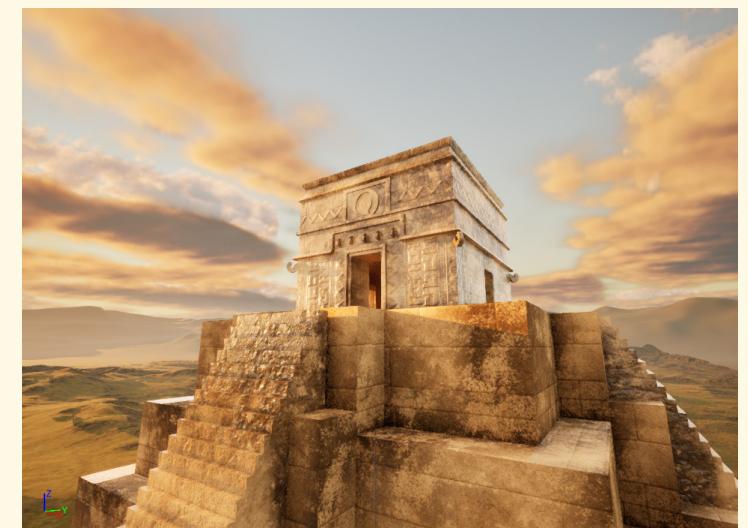
# Vertex Painting

Starting this project I had no idea what vertex painting was or had even heard of it, however due to examining my references I knew this was going to be a crucial part of my project. In the planning stages of the textures I highlighted what different types of texture I was going to need to paint between - as concluded 3 different textures were going to be included.

I followed a tutorial online going through one of the many ways that vertex painting can be set up in Unreal Engine, however this ended up not working correctly and I was shown an error in one of the nodes in the material editor. This is when I looked at a different tutorial from Procedural Minds (2023) he explains in a quick step by step how to set up vertex painting using blended materials. This process was much easier and clearer as I could understand how different parts of the system created the final product.

Unfortunately at this point my project was corrupted and the level had not saved correctly and when I went to reopen my project the entire scene setup were no longer available. Fortunately, this process of vertex painting was easy to understand and replicate and after learning it for the first time it was great to have a second practice at setting it up which was a good opportunity for learning.

After setting up the project again and getting back to where I was before I was able to continue vertex painting between the 3 levels for different scenarios.



# Final Product



# Final Product



# Final Product



# Final Product



# Final Product



# References

## External

### Grass

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### Trees

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