

# CGI Report - Clifton Cathedral

Luke Sakaguchi-Mawer

<sup>1</sup>Department of Computer Science  
gq20332@bristol.ac.uk

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## 1 Introduction

When determining the location for which I would like to model, I began looking into locations near the university that I was in close proximity to, especially in the Clifton area. Some early candidates were cafes and restaurants. I was later dissuaded from these locations, as I wanted to choose an interior that was less likely to also be modelled by another student, and one that could show what I had learned during this course to a greater degree. I explored blogs online that highlighted the most picturesque locations within the city, and saw that Clifton Cathedral (1973) was listed.[4].

Looking further into images of the building online, in particular the Sanctuary, I was impressed by the grandiose and extensive structure which was encompassed in the cathedral. The building incorporates a large amount of brutalist design, signaling the popularity of the architectural style from the decade prior. Brutalist architecture is characterised by the Tate Institution as implementing 'simple, block-like forms and raw concrete construction'[9], which is certainly shown within the cathedral. Hexagons appear throughout the building, especially surrounding the altar, which architect Ronald Weeks explained with



Figure 1: Clifton Cathedral interior

'The arrangement of the different parts of the church placed those of least liturgical importance on the periphery leading progressively to the more important elements and to the High Altar' [13][14].

In mid-February, I visited the Cathedral and acquired permission from a member of the church to take images and model the building. Taking pictures was an extremely useful step when modeling, as I was able to photograph areas that were not always clearly visible from photos already online, providing me quick references to all angles of the scene.

## 2 Objects Modeled

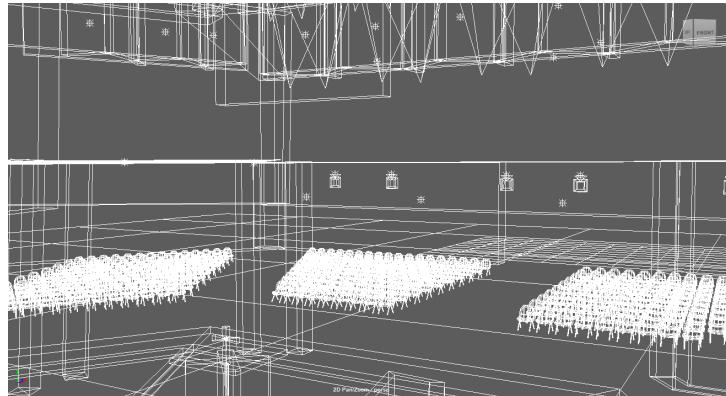


Figure 2: Wireframe

### 2.1 Enclosing Region

To begin my modeling process, I first found an image of the Cathedral's floor plan, that was available online. In addition, I measured the dimensions of the building using Google Maps in order to set my Maya grid settings to be on a 1:1 scale. This proved to be very useful as I could create a model that accurately reflected the location, and I did not have to physically measure the building myself.

With some of the more complex geometry within the scene, such as the concrete walls that appeared to curve seamlessly in different directions, I attempted to construct this using bevels and extrudes applied

to cubes. I quickly discovered that this was not viable as the extruded side from the beveled face would not match the proportions of the rest of the shape. In addition, when texturing the object, the texture would be stretched due to the extrude. To combat this, I later used an linear EP-curve tool, and then applying the sweep mesh function to convert the curve into a three-dimensional object, Adjusting the height and width of the generated faces to match the dimensions of the rest of the walls. This proved to be far quicker.

In the walls above the altar, hexagonal holes are present. Given that a hexagonal prism could easily be created by placing a cylinder in the scene and setting its subdivisions to 6, I was able to apply a boolean subtraction operation on the walls, removing the instance of the hexagonal cylinder.

## 2.2 Chair

Contrasting the straight lines and large structures are the chairs which seat the congregation around the altar. The chairs are one of the few objects within the scene that are not constructed of solid lines.

I began the process by attempting to 'carve' out the shape of the chair from a cube using bevels. I soon realised that this would not provide the shape that I desired. Thankfully, I had found a tutorial online from someone modeling a chair similar in shape to the ones at the Cathedral [7].

I constructed the chair from a polygon primitive. I first added a cube into the scene, and removed 4 of the faces so that 2 adjacent faces remained, which would serve as the base shape for which the chair was to be formed from. From there, I pressed 3 so that the shape would not be a solid angle, and instead more curved. Then, I applied multi-cuts to the plane such that I would be able to shape the chair into a more curved form, compared to the solid right angles I previously had. Adding more edges with multi-cut allowed for more control of the shape of the chair, which was necessary to contort the object to the curved geometry that it has.

I selected the border, and extruded out an edge so that my shape would look more three-dimensional when I moved the new border-edge backwards. I continued this process until I felt that the chair resembled the ones in the Cathedral.

I implemented modular design when grouping together the chairs, as I created rows for which the chairs would belong to. This allowed for me to quickly populate the entire seating areas, as well as scaling a wing of chairs by -1 to reverse the ordering of the seats in the opposite side.

## 2.3 Central Hexagon

Within the middle of the Cathedral lies the central area, where the priest and other members of the clergy would be seated during a church service. I noticed that the chairs here are the same as the ones that the attendees would also sit on, so this simplified the process as I was able to copy over a row here.

I created the cross using a small rectangle, and selecting the edges and moving them inwards to replicate the more complex, angled structure that it has in the Cathedral. This was textured to be metal, similar to the organ pipes.

For the altar where the priest would stand and speak during a service, I constructed a shape from a rectangle, and formed the edges using extrudes and bevels.

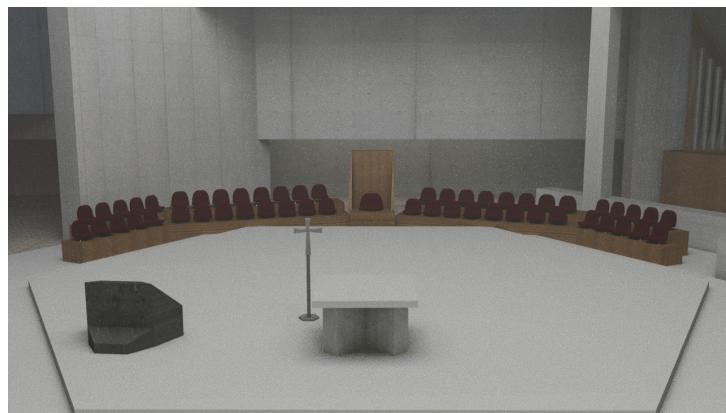


Figure 3: Centre of Sanctuary

## 2.4 Organ

Nestled behind the altar is the main organ. I constructed this later on in my modeling process, as I felt that it would be a more complex task suited to when I would have more experience with using Maya. To replicate the organ pipes, I used cylinders of descending size order, which would be placed in a hollowed out triangular prism, constructed from performing a boolean subtraction operation between a triangular prism and a smaller clone, which gives the appearance of a wooden border.



Figure 4: Organ

## 2.5 Front Door

There are many entrances to the sanctuary, but I modeled the main door which leads to the viewing position in my images. In real life, this is a thin glass door with hexagonal handles. To replicate this, I followed a tutorial online. I created a thin rectangular prism to act as the glass, and applied a glass texture to it. The glass texture was created using a Blinn, since Maya states that it is effective at creating soft specular highlights on the surface which is something that I wanted in my door [8]. Given that the sky-dome lighting was already used to replicate the sky, I required a different image to be placed behind the glass to show the entrance to the building. To do this I used an image of green trees to replicate the shrubbery by the front door [2].

## 3 Textures

### 3.1 Walls

The walls which line the perimeter and also span above the floor appears to be made of a concrete material. However, when I experimented with different concrete textures from Polyhaven, many appeared a lot darker than material the cathedral uses. For this reason, I looked elsewhere for a texture to use. As well as this, I noticed that the concrete in the cathedral had some holes in the surface, presumably from its construction process. I found a texture from Poliigon which showed these holes, with a similar colour, and used this instead [5].

### 3.2 Chair

The chairs were more complex to texture due to it having more than one material. This meant that I would have to apply a base texture to the object, and texture the different faces as appropriate. To simplify this, I textured the red fabric for the seat using an image of a book cover, which was green. I then adjusted the colour gain on this to make it appear red. [10]. I chose this because I felt that despite being a texture for a book, it actually resembled the fabric on the chairs very closely.

The back of the chairs appears to be a reflective white plastic material, so to replicate this I applied a standard surface shader, using a white colour with a 0.3 level of 'Metalness' to give a shine, counteracting it with a 0.2 roughness so it didn't appear too mirror-like.

Finally, the chair legs are made of a reflective metal standard surface shader, which I was able to construct following directions for making a shiny chrome surface on the Autodesk Maya website, however, I adjusted metalness to around 0.4, and the specular weight to 0.8 to closely replicate the chair metal.



Figure 5: Front of chair



Figure 6: Back of chair

### 3.3 Floor

The hexagon theme continues along the floor as well, as it is tiled with a hexagonal pattern. This could have been tiled from creating a 2D hexagon shape and repeating it, or by using a texture. The texture option was far quicker, and the free texture I had downloaded included a bump map. This would allow the lights involved to accurately reflect and reflect based on the shape of the tiling [6].

As per the image of the stained glass in the lighting section, we can see that the floor is reflective, and is able to reflect the transmitted light. This meant that I needed to adjust the settings of the floor such that light encountering it would be reflected.

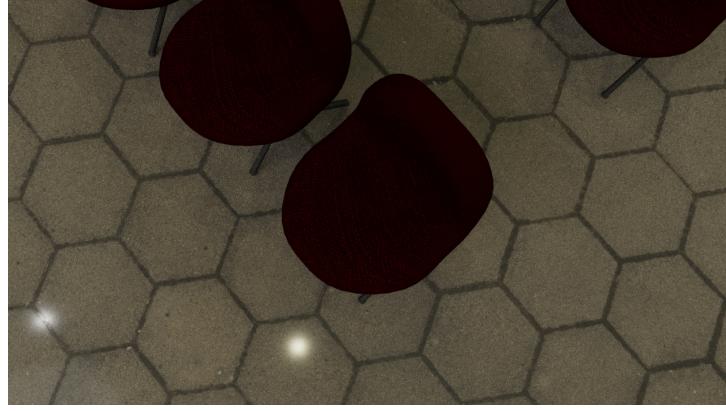


Figure 7: Floor render

### 3.4 Wooden Features

Throughout the building there are wooden aspects that appear to juxtapose the man-made concrete features. This can be seen in the imposing triangular prisms (Plywood Tetrahedra Baffles [14]) that overlook the seats of the congregation, hidden in the concrete divisions of the ceiling in order to aid with acoustics. Also, wood is visible in the casing of the organ, to the right of the central platform.

However, the wood used for either material appears to be different. The housing for the organ is of a lighter colour, and the same as what is used for the elevated surface that the clergy sit on. On the other hand, a slightly darker wood is used for the wooden prisms above the general seating.

I had found textures and bump maps for both the darker and lighter shades of wood on Polyhaven, by Jandre van Heerden [12][11].

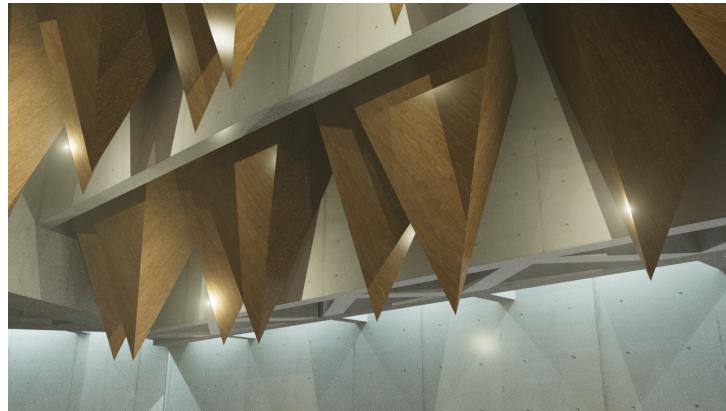


Figure 8: Plywood Tetrahedra

### 3.5 Altar

For the dark-grey altar, I used a texture of a concrete floor, which I felt closely resembled the colour of the altar [3].

## 4 Lighting

One thing I find especially impressive about the Cathedral is how light is incorporated into the scene. Brutalist architecture often gives connotations of gloomy, overcast surroundings, however, lighting has been carefully considered within the building, with the altar and chairs for the clergy being clearly illuminated, with the outer edge of the building being darker; drawing your focus to the center.

### 4.1 AiDomeLight

The overall lighting is originating mainly from a glass opening in the spire of the church, allowing in light from the sky to highlight the altar, as well as the outer-most chairs, which are covered by a glass ceiling that allows in light in the same manner.

To replicate the lighting, I used an image of a sunny blue sky, with some clouds to emulate a British summer, which is when I suspect most of the images of the interior of the cathedral were taken.

### 4.2 Man-made Light

Dotted around the scene are physical boxes that emit light. These appear to be used even during the day, as seen in images online. I decided to add these as well, because they produce a warm, yellow light around the edge of the building that is otherwise not produced from the natural light of the sky.

The shape of the box is a simple hollowed out cube, with a cone fixed atop which holds the light source. This was simple to model, and compliments the lighting produced from the glass in the ceiling of the building.

Again, there is a repeating theme with this object, as it is also used inside of the spire, above the hexagonal cut-outs in the walls. This allowed me to place the lights across the perimeter of the sanctuary, as well as within the spire.

### 4.3 Stained Glass

When visiting the Cathedral, I was impressed with the stained glass feature on the left hand side of the main entrance, so I elected to feature this in my animation as well. To create the stained glass, I first

removed the area that the glass is positioned in from the wall using the boolean operation. I added in a plane to act as the window, and textured the plane using an image of stained glass I had found online.

To allow for light to pass through, I set the transmission to be the max value, 1. I replaced the colour attribute with the same image, so that the reflected light on the concrete surface will accurately show the light's colour and pattern.

I then added spotlights positioned directly outside the glass to allow for the light's coloured reflection to appear on the floor. For the larger glass, I added 3 spotlights, and for the smaller one, only 1 was required.



Figure 9: Stained glass render

I searched the internet to find a stained glass texture that most resembled the one in the Cathedral, and found one from Adobe Stock Images, which I used in the rendered materials [1]. Unfortunately, this had a watermark that I was unaware of until my render.

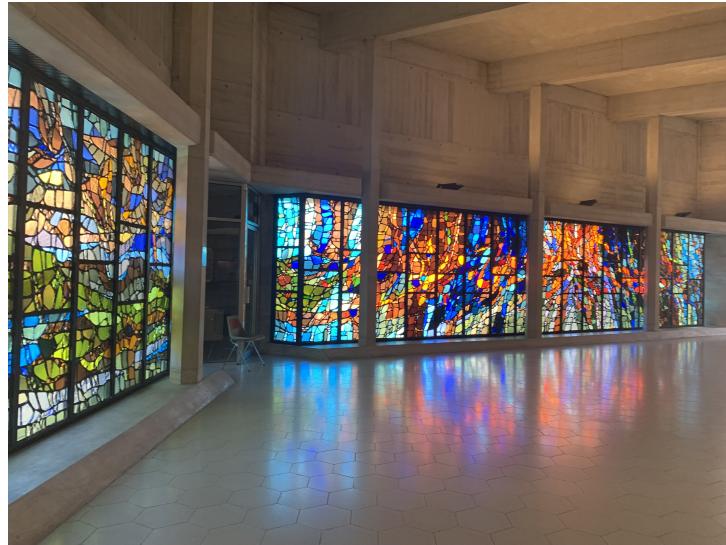


Figure 10: Stained Glass

## 5 Rendering

### 5.1 Image

After constructing, texturing and lighting my scene to a position that I was happy with, I then began the render of my spherical image. I added a camera that would render the image as well as record my animation later on. I changed the camera type to be spherical, and the resolution to be 3840x1920.

I positioned the camera to be located at the entrance of the cathedral, to show the view that someone entering the building would see. This allowed me to encapsulate all of the objects that I modeled, such

as all the chairs, the central hexagon where the alter and the clergy chairs are, the walls at the top with the hexagon holes, as well as the stained glass window in the background.

## 6 Animation

I planned the scenes to show the main aspects of the building falling into place. The central hexagon that hosts the altar and chairs of the clergy fall from the sky into its location, as well as the chairs. The pillars rise from the floor as they connect to the walls from above. As the objects come into place, the lighting is inserted in order to illuminate the scene like my spherical render does.

Unfortunately I encountered an error with my scene immediately after rendering the spherical image, where Maya would crash after setting the render device to GPU. To amend this, I instead rendered my animation by animating 40 frames each across 6 different machines on their CPUs to create my 240 frames.

### 6.1 Motion Path

When planning the steps of my scene, I knew that I wanted my camera to be able to show the main central walk-way of the Cathedral, demonstrating the chairs, and the altar, but I also wanted to include the stained glass windows. This meant that my camera could not just follow a straight line, and would require a different route to follow.

I had saw from tutorials online that a common method was to create a curve that the camera was to follow, and to constrain the camera's movements to follow that path through the animation set menu. I had to adjust the top and forward axes that the camera was aligned to so that it would simulate a human's point-of-view as they walked through the scene.

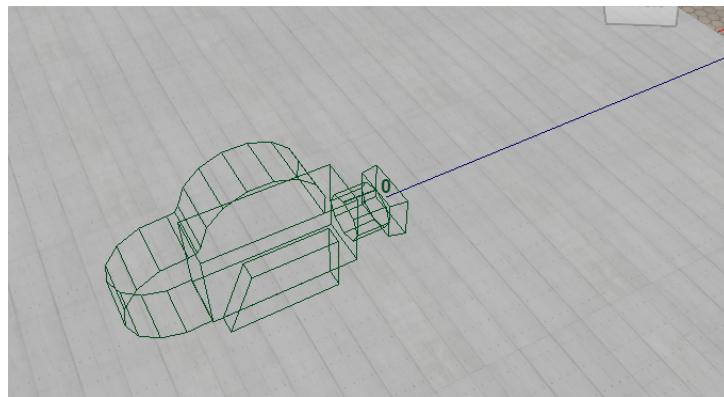


Figure 11: Camera and its motion path

## 7 Evaluation

Overall, I am very pleased with my progress and learning development throughout this entire coursework. I thoroughly enjoyed researching and visiting my chosen location, as well as watching my ideas come into fruition. Studying different techniques that I could apply into my scene to give it a more realistic appearance allowed me to develop a scene that I believe closely reflects the real location. In addition, the vast range of tutorials available online allowed for me to quickly model and texture the more complex objects in my scene.

If I had more time to add to my scene, I would firstly model the rest of the building, such as the outside of the building, as well as regions that are not visible from the sanctuary. This would provide a highly detailed and accurate model of my scene. I would like to spend more time fine-tuning the more specific details in the scene, such as the rubber feet on the chairs, as well as the concrete artwork pieces that are located on the walls on the inside perimeter of the walls.

In addition, I would like to spend more time on the lighting to be more accurate to the images that I had taken when I visited the building. I feel like the lighting is a close simulation of what the true

building has, yet I feel that if I had more time, I would be able to perfect the lighting features to match the reference images.

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