

Lighting Studies

May 15, 2024 – Lighting Exterior Scene: Night

For this task, I created a night time scene using the Rural Australia pack from the Unreal Engine store. The first thing I did to create the scene was remove the pre-existing lights and post process volume from the level so I can start from a blank slate. I then went to the environmental light mixer and added in a directional light, sky atmosphere, sky light and exponential height fog. I then added in my PPV and enabled the infinite extent unbound to affect the entire scene. I then adjusted the metering mode to manual which gives precise control over




The next thing I did was add in the BP_Sky_Sphere which allows you to make a customizable night time sky. To get it working, I first changed the sun height to -1.0. This lowers the sun height below 0 which makes it dark and also adds some stars to the sky. I then went to cloud opacity and increased this to be higher from the default value as I think in this scene, having the clouds reflect into the water makes for a more interesting shot,

so I increased them to make it more prominent. I also increased the star brightness slightly to make them more prominent in the scene.

Directional Light Changes

After this, I went and altered the directional light. I first turned it down to 0.5 to reduce the amount of light in the scene. I then enabled the temperature and changed that to 4100 as when using a Kelvin chart by Wikipedia, this is considered the temperature of moonlight.

Temperature	Source
1700 K	Match flame, low pressure sodium lamps (LPS/SOX)
1850 K	Candle flame, sunset/sunrise
2400 K	Standard incandescent lamps
2550 K	Soft white incandescent lamps
2700 K	Soft white compact fluorescent and LED lamps
3000 K	Warm white compact fluorescent and LED lamps
3200 K	Studio lamps, photofloods, etc.
3350 K	Studio "CP" light
4100-4150 K	Moonlight
	Horizon daylight
5000 K	Tubular fluorescent lamps or cool white/daylight compact fluorescent lamps (CFL)
5500-6000 K	Vertical daylight, electronic flash
6200 K	Xenon short-arc lamp
6500 K	Daylight, overcast
6500-9500 K	LCD or CRT screen
15000-27000 K	Clear blue poleward sky

▼ Light	
Intensity	5.0 lux
▼ Light Color	
R	36
G	76
B	199
Source Angle	2.135701
Source Soft Angle	1.2
Use Temperature	<input checked="" type="checkbox"/>
Temperature	4100.0

Directional Light Changes - The Purkinje Effect

After that, I changed the directional light to be a blueish colour. We learned in the class about the Purkinje effect, where in dim light, the rods in our eyes are more active, which are more sensitive to light and dark opposed to colour. When this happens, our eyes are more sensitive to blue and green light but less sensitive to red light. This means blue light in dim lighting appears brighter. Photographers need to take this into account when shooting in dim lights and sometimes the colours need to be adjusted for a more natural looking scene to the human eye.



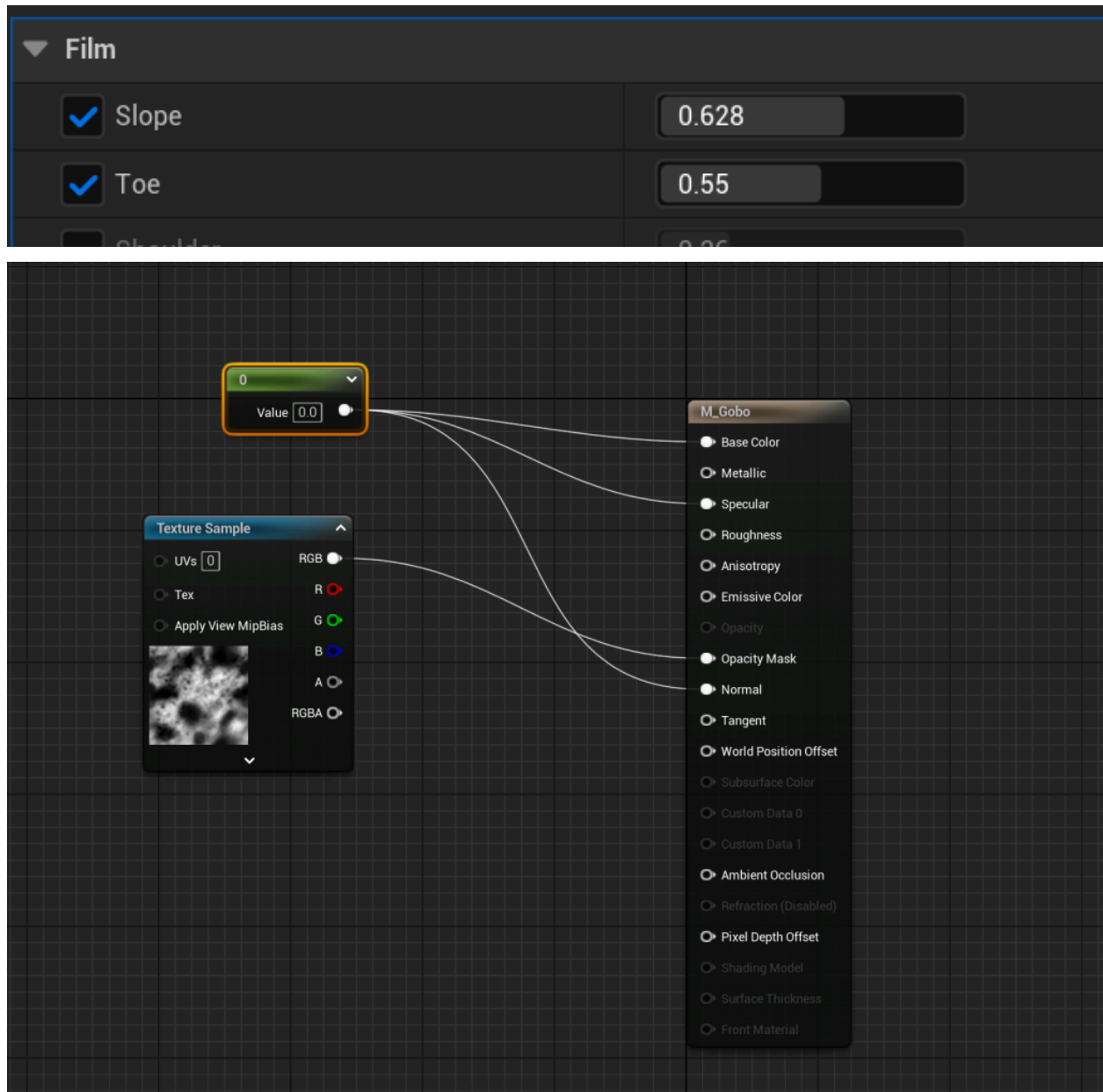
Exponential Height Fog

I then ticked volumetric fog inside of ExponentialHeightFog and then increased the fog value to make it more atmospheric and then I increased the volumetric scattering density to make the fog look thicker and also double checked that ray traced shadows were disabled.

Slope and Toe

Next I went into the post process volume and adjusted the slope and toe values to change the mid-tone and shadow contrast in the scene. From default, I decreased the slope slightly to 0.6 make the mid tones darker to simulate night time better. For Toe, I kept the default value of

0.55 as after adjusting the slope it is doing a good job at simulating night time, and adjusting anymore will make the contrast too dark.



Adding the gobo into the scene made the god rays of the volumetric fog much more pronounced by breaking up the light rays and allowed me to play around with the position and intensity of these rays in the scene.

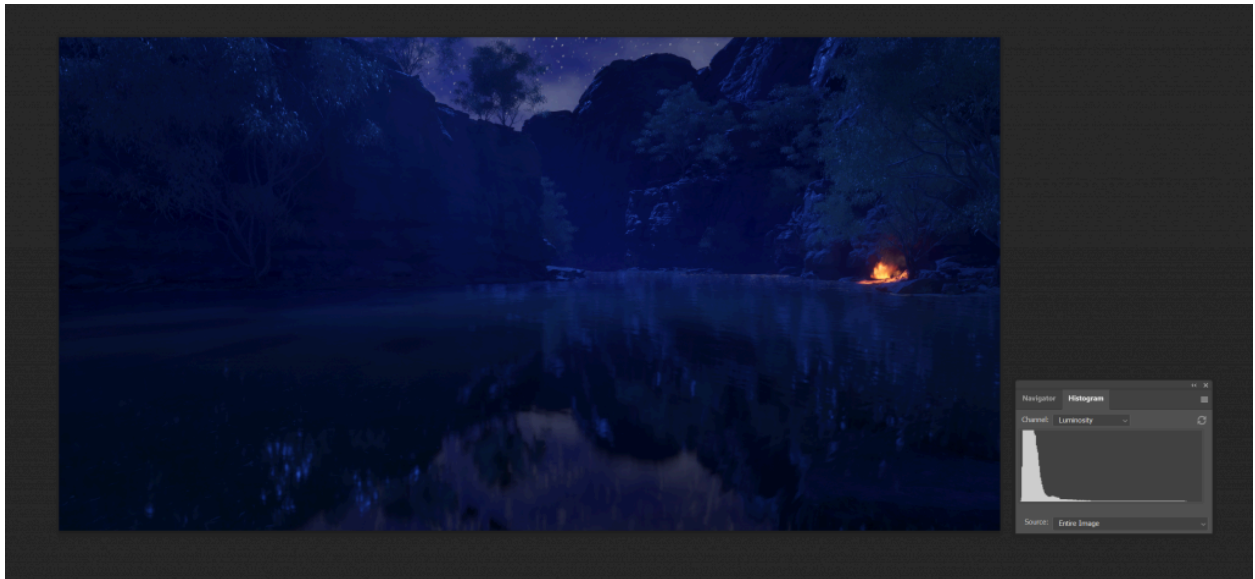
Without Gobo



With Gobo



Render Attempt #1 & Histogram



For this first attempt, I think I was able to create a night scene successfully using the techniques shown in class with the gobo and Purkinje effect. However, I want to make some adjustments to the shot, mainly the fact that it is underexposed, which although night scenes are expected to lean towards the left side of the histogram, I think some detail is missing and the shot is a bit too dark to

successfully convey the environment. I also think the stars are a bit too much, I had them set to 1.0 after some adjusting and I think I want to set it at 0.5 as they are unrealistically bright and I want the focal point to be the contrasting campfire.

Render Adjustments

I went back and reduced the stars' brightness as I think they were a bit too notable and since they're bright white, at the current brightness they contrasted against the scene heavily meaning your eyes are drawn to them too much. I think lowering the brightness intensity and making them more subtle allows for the fire to be the focal point of the shot and stops the scene from looking too busy. I also increased the lux by 3 and decreased the fog density slightly as despite being a night scene, I think it was too dark, and some details of the environment were being missed out on. This is important as if this was an environment modelled by scratch, you would want to showcase intricate details of what you have created, even if you choose to create renders for it in the nighttime. I finally went back and decreased the slope from 0.7 to 0.6 to make the mid tones lighter, as I think it makes the shot look less dark too. I also adjusted the gobo placement slightly to make the rays more noticeable. I finally increased the exposure compensation to help with these issues.

Final Night Renders:





Final Reflection

Overall, I think my final shot looks much more balanced and less dark due to the adjustments. There is more detail able to be seen in the environment while also maintaining realistic darkness. The rays are more noticeable with the gobo readjustment and altering the slope helps to make the shot look lighter. To improve, I think the scene is potentially too bright and could have been made slightly darker to add more realism, however, I wanted to make sure that I'm successfully showing the environment and I think if the

renders are too dark, you gain some realism but also make it too dark to see anything.

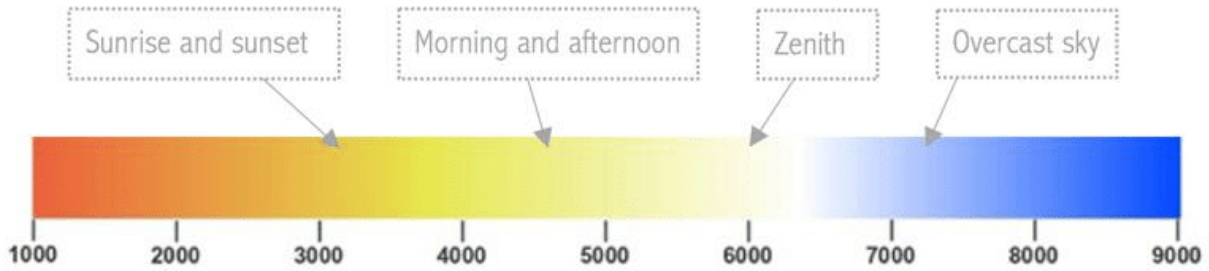
May 15, 2024 – Lighting Exterior Scene: Day

Setting up the Project

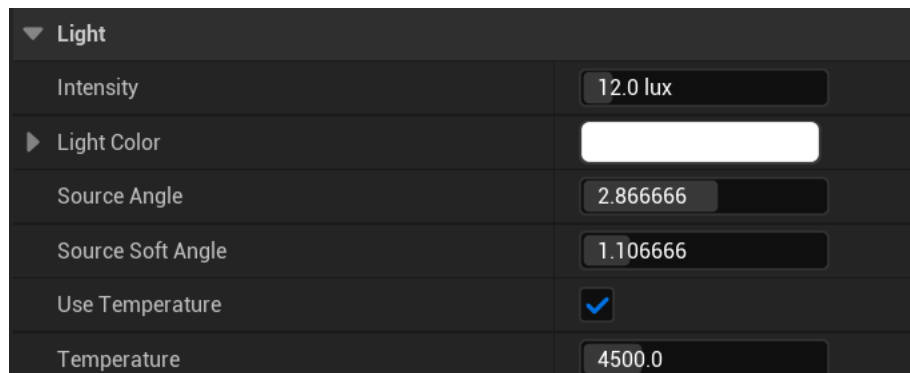
Firstly, I removed all of the preexisting lights and post process volume and added the directional light, skylight, sky atmosphere, volumetric cloud and exponential height fog back in with their base values giving me this appearance.



Now that all the values are set at the base level, I can now go in and tweak them. The first thing I did was set the directional light to 12 intensity to increase the brightness of the scene as I'm going for a hot midday sun sort of look. I then changed the temperature to match the Kelvin temperature value to 4500.



Adjusting Directional Light and Fog



I set the indirect lighting intensity to 1.5, just so the lighting bounces more and makes the scene look slightly brighter. I then increased the fog density to give a hazy effect which helps get the humid summer day vibe I'm going for. I haven't really played with this option before, but I found increasing the extinction scale value makes the fog denser and makes the scene, especially the rocks, look more muted and washed out which to a small degree gives it a hazier feel. From there I tweaked the light shaft bloom to get some more pronounced god rays into the scene, so the sun is a more prominent feature.

Before



After



Source Angle and Cubemap

I then went and altered the source angle. I didn't see too much difference in the shadows in my scene but the increased angle gave me a reflection of the sun in the water so I increased the value to get that effect for realism. The final thing I added was the cubemap under the skylight. I found that a lot of them made the scene much brighter than real time capture but I found the desert cubemap didn't have this issue and gave some of the rocks a warmer, orange look than real time capture which I thought worked well for the scene of a blazing, humid day so I went for this one.

Desert Cubemap (Top) vs Real Time Capture (Bottom)





Final Adjustments

Before making my final render, I turned the directional light to 20. Although I thought this would be too bright, I think that since I'm going for a summer midday environment with no shade, leaning towards a slightly overexposed look works as it emphasizes the sun and its impact on the environment.

Final Renders and Histogram





When looking at the histogram, I realise that I made the correct decision to increase the intensity to 20, as not only has this made the scene much more summery and bright, it also hasn't fallen into overexposure and is actually more in the exposed to the right range which is considered the ideal histogram. I think before it looked more like afternoon but pushing the intensity by 5 has made it look much more like midday. I think the top render shows what I was going for with the fog extinction scale as the rock looks slightly washed out but that gives off the impression of haziness and humidity.

Reflection

Overall, these two tasks were very helpful, and I learned a lot from them. I didn't know what a gobo was before and now I have a good understanding of it and am able to utilize it in my work. I was also able to experiment with some options I haven't really touched or didn't have a great grasp of how they worked before like the bloom shaft, BP_Night_Sky (didn't know it existed before and is probably the best way I've seen to create a good night sky with its customization) fog extinction, source angle, cubemaps. It has furthered my understanding of exterior lighting, and I think they both turned out well.

May 23, 2024 – GPU Lightmass Exterior Lighting Study

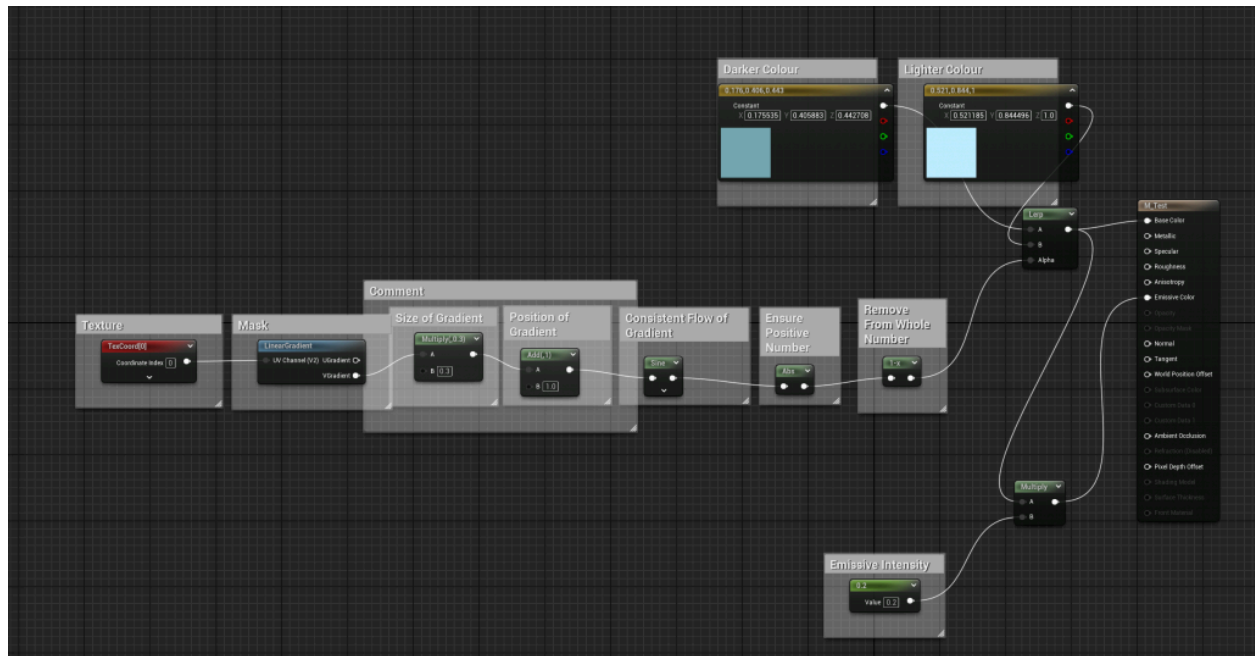
Draw Calls

A draw call is the number of times the CPU asks the GPU to draw graphics on the screen. Having too many draw calls can slow down Unreal. To optimize the performance of Unreal, it is important to get rid of any unneeded draw calls. This can be things like minimizing the colours and textures used as that can be costly, as they take up a lot of video memory. You can also use instances to limit the number of draw calls. For example, multiple trees can be combined into one batch rather than having separate calls for each individual tree.

Creating A Gradient Shader

This is the gradient shader I created in Unreal. It is used to give flat coloured materials more variety without needing to use textures. As explained before, textures are quite costly, so this can help reduce the number of draw calls while still getting a shaded effect. Emission can also be added to simulate light. As seen below, I made the shader two blue colours and then added emission and then applied it to the windows, giving

a daylight effect.



Default

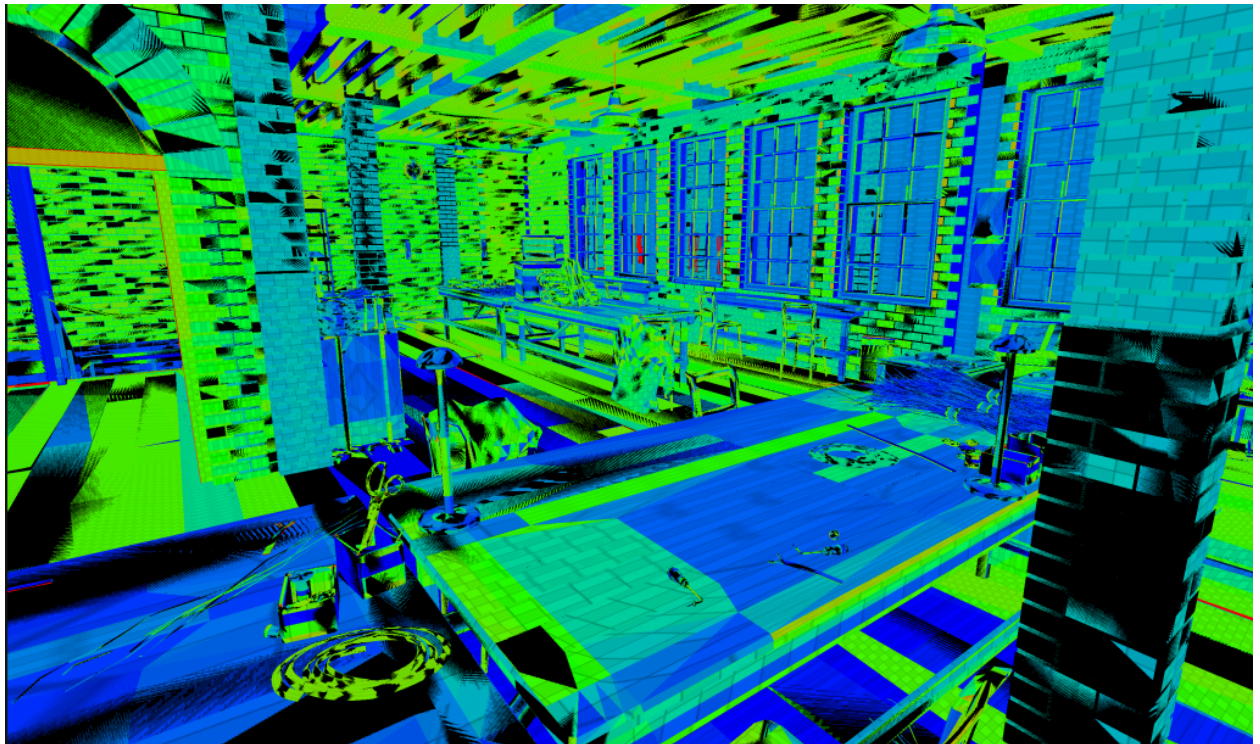
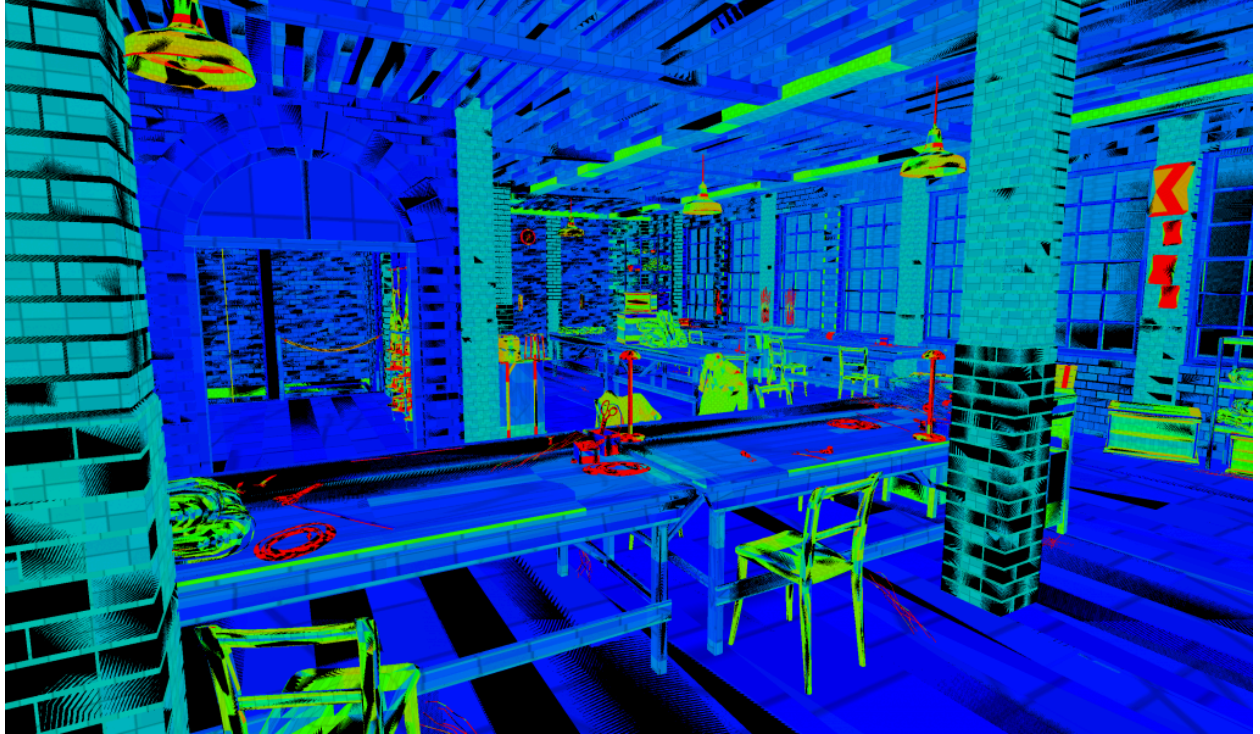


Using Emissive Material



Lightmap Optimization

To optimize my scene, I mainly focused on bringing the resolution down of the smaller props, especially because a lot of them were showing up as red. I brought the bigger parts of the scene up from blue to green, as their detail is more noticeable. When following tutorials for GPULM, the videos I looked at said to keep the colours between green and blue and that turquoise is ideal.



Day Scene

This is the day scene I lit for this task. For this, I focused on lighting the scene through the windows by adding rect lights on each window. I added a low intensity white coloured light to the lamps just to brighten the scene a bit more without making it overexposed. I used white as it gives it a brighter feel than a colour like orange and harmonises better with the white/blue colour of the daylight, but the focus was on the windows, also because I wanted to demonstrate how the material works within a scene.

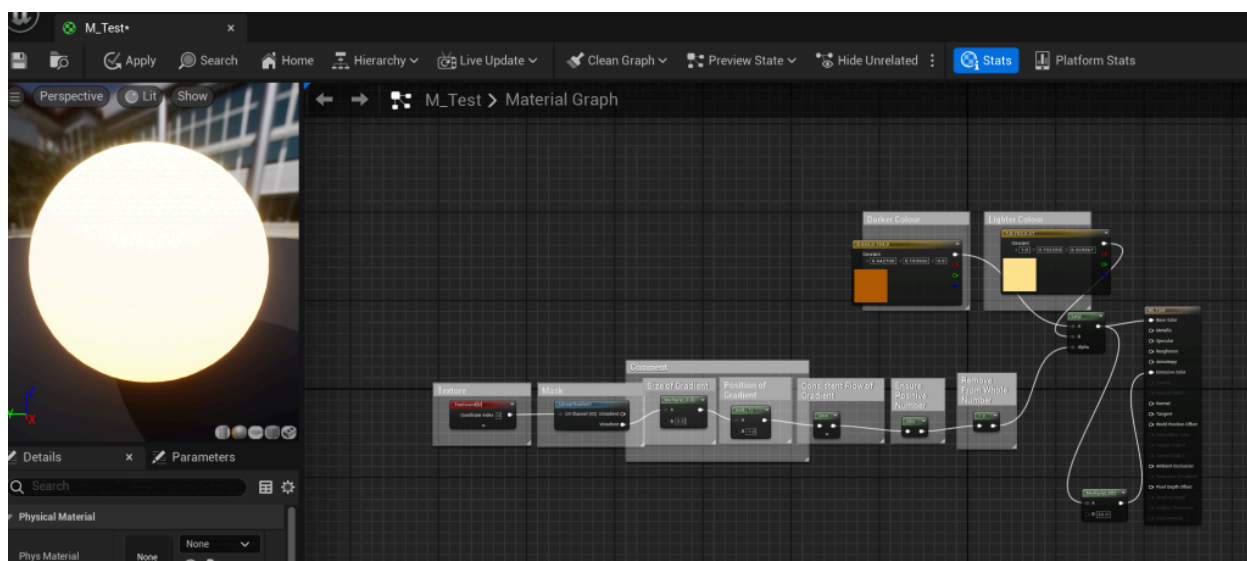




Night Scene

This is the lighting setup I made for a scene at night where I wanted to go for a cozy sort of feel for this render. I focused the lighting on the lamps for this render as I put a lot of focus on the windows for my day scene. I couldn't get an effective looking nighttime look for the windows using the material from the lecture, so I made the outside visible and added the BP_Sky_Sphere and set it up to be a night sky. I then made the lamps orange, as orange is often more seen in natural nighttime lights (e.g. candlelight, fireplaces), which gives the scene a more natural feel. In colour theory, orange symbolises comfort and warmth as opposed to cool tones like blue. I realised that the lamps don't have any sort of bulb and it looked strange that the room was illuminated with no visible light source, so I made my own by altering the material from the lecture to an orange/yellow, then creating a sphere and applying the material to it and then moving the sphere in place to act as a bulb.

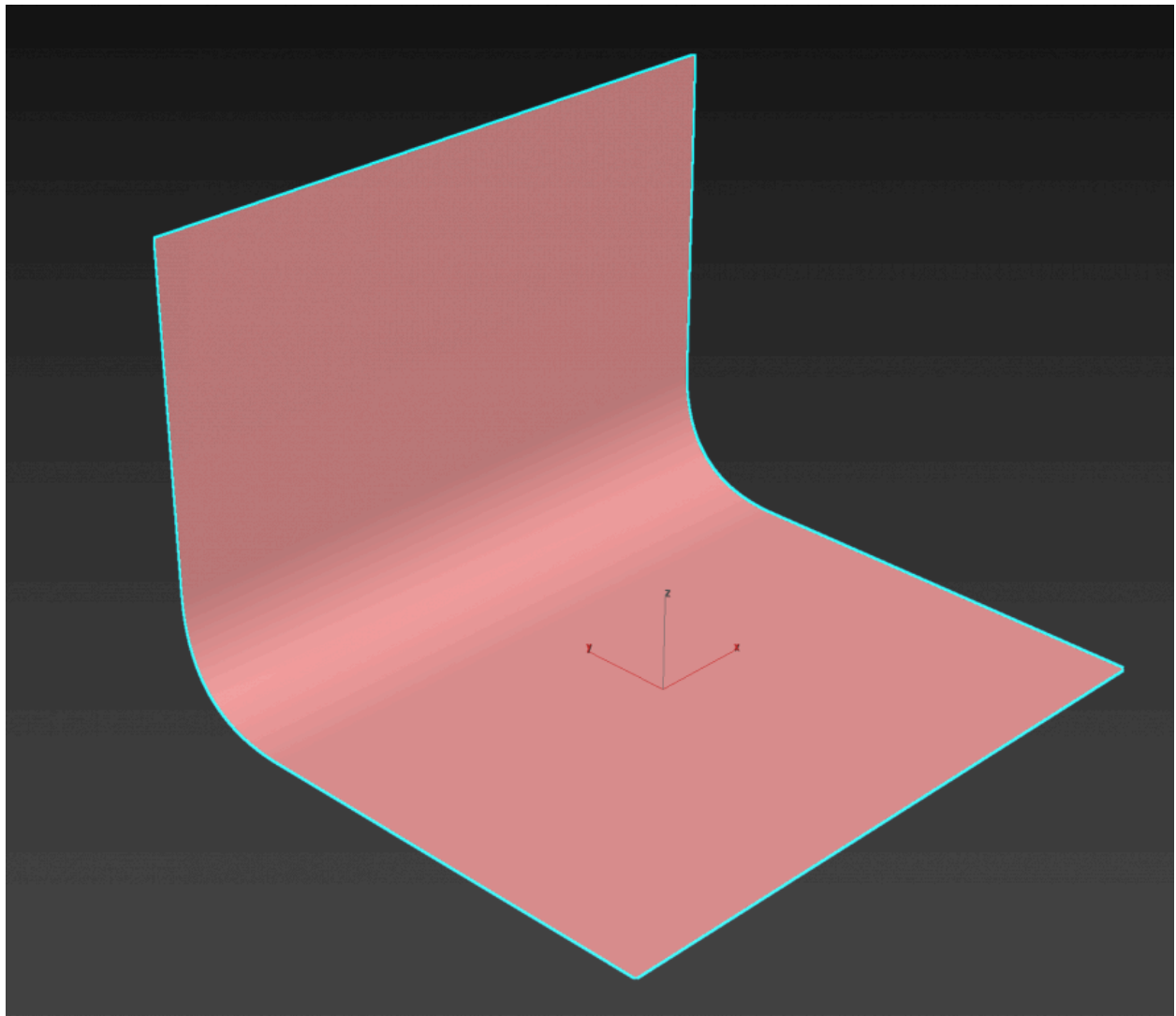




May 25, 2024 – Prop Studies - Boombox

Boombox Renders

The first thing I did was create a sloped backdrop to use as the background for my renders in 3DSMax and import it into Unreal.

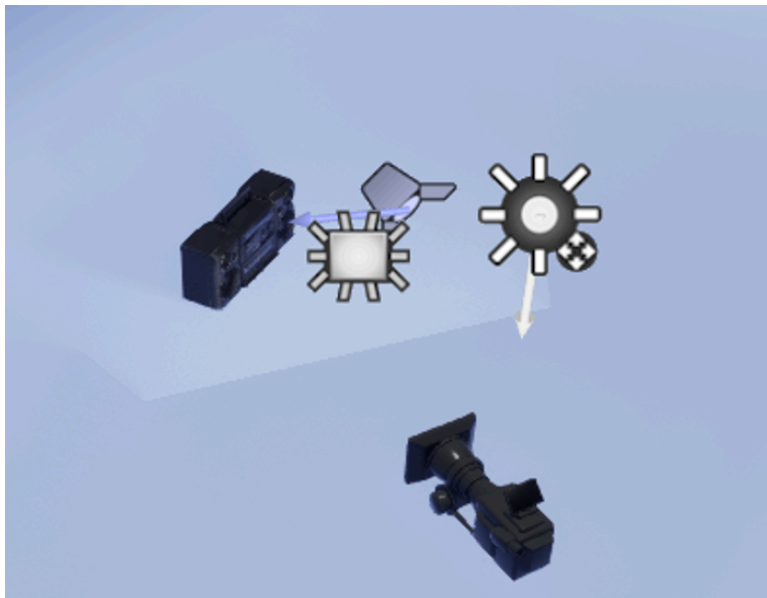


This is the first render I created. I used a simple three-point lighting setup using a directional light as the key light, a rect light as the kicker and a spotlight as the rim light. I made this render as a sort of 'professional' setup that focuses on illuminating the prop with a white

light, showing the shape then the blue as a highlight that also compliments the background colour.



Render 1 Setup

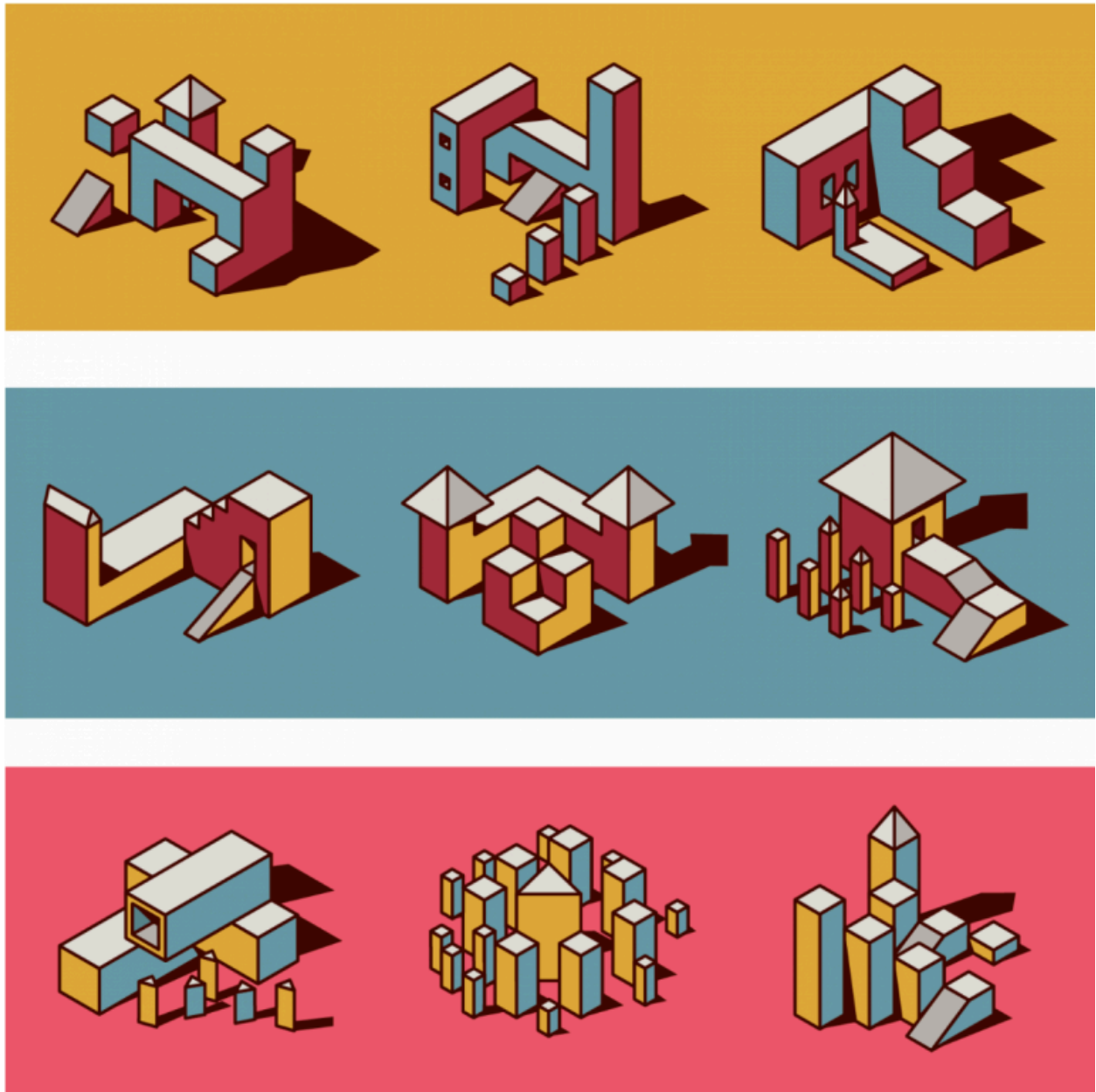


Boombox Render 2

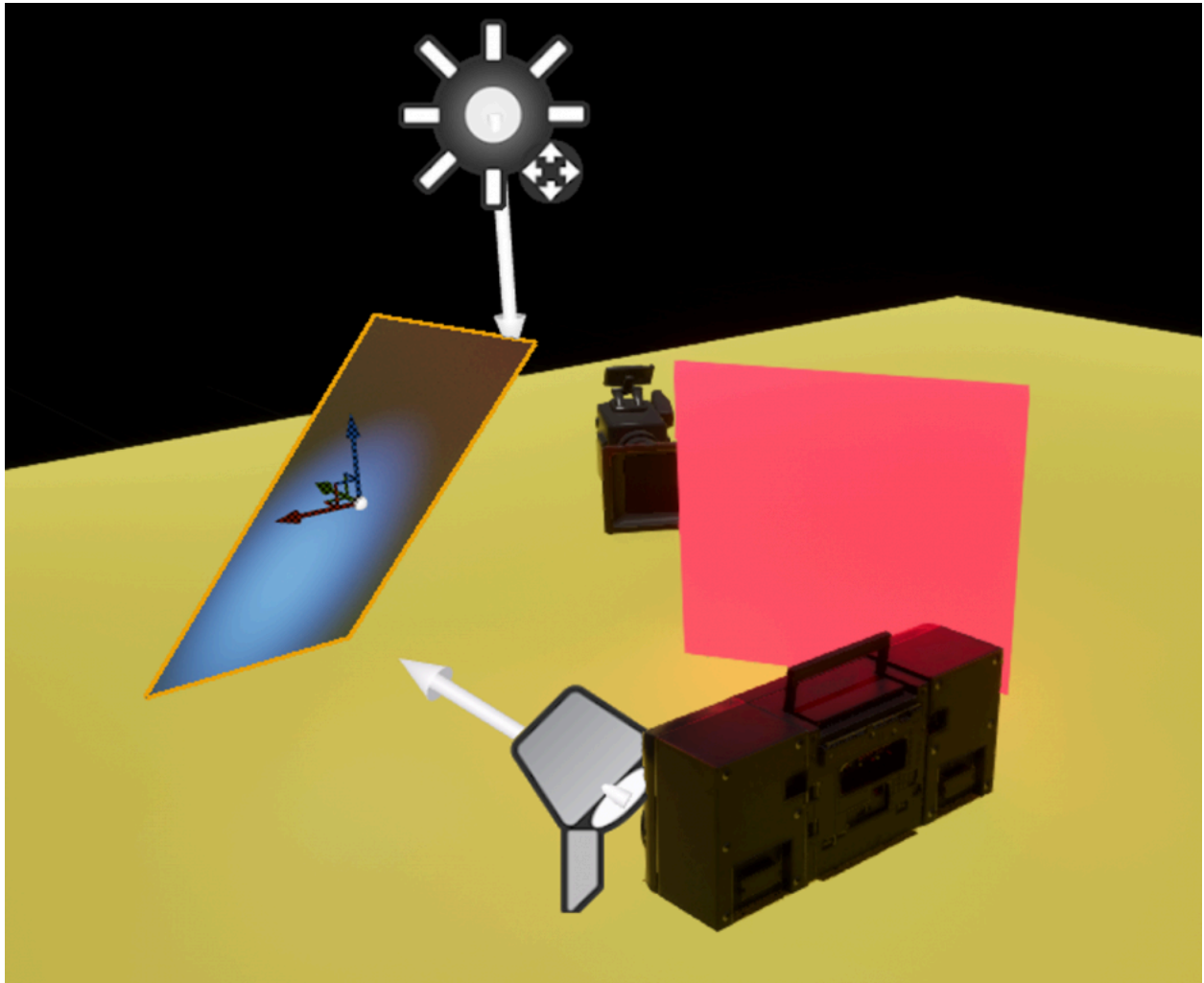


This is the second render I created. This time, I decided to go for something more experimental, on top of the directional light, I chose yellow as the backdrop, red as the primary light and blue as the highlight as they are triadic colours; StudioBinder states, 'Triadic colors stand out from one another and make for a vibrant, lively color palette regardless of which particular colors are used. Triadic color harmony refers to the pleasing appearance that triadic colors have when used together.' I read that triadic colours need to be used equally to keep a balance - one should be a main colour and the others should be accents or it becomes too overwhelming, so I made the red and the blue more subtle to make sure the render doesn't appear too busy.

Triadic Colour Usage



Render 2 Setup

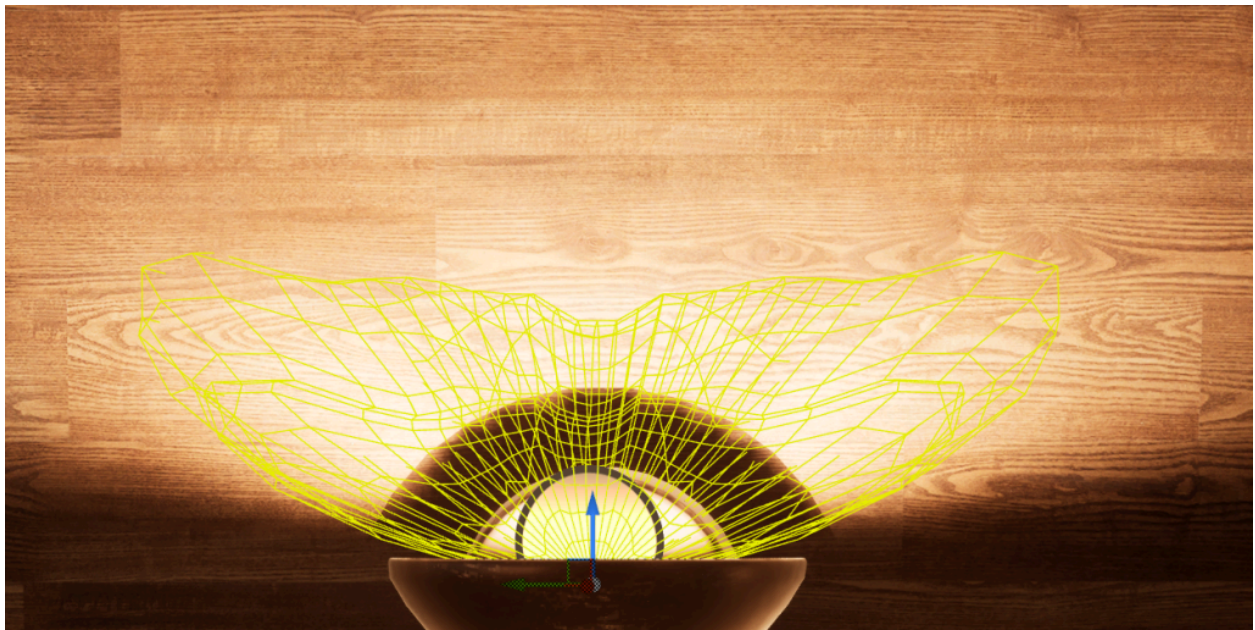


I used bounce lighting for the blue so I could have more control of where specifically the blue light was hitting, which I placed on the top far side to highlight the shape. I used an emissive material for the red as I wanted it to be the more prominent, brighter colour that covered more space than the blue, meaning it wasn't as necessary for it to hit a specific part of the boombox. I placed the highlights around the knobs and switches to draw attention to that area.

With and Without Highlight

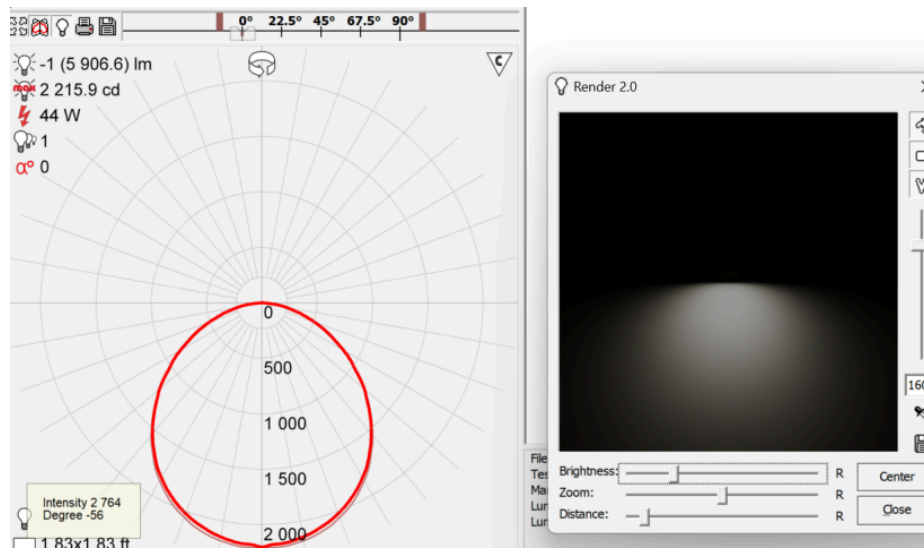


IES profiles are a way to get dynamic and realistic lighting within a scene. They contain data that realistically simulates light as it would appear in real life. The data it contains includes colour, intensity, falloff and shape information. They give detailed information about the distribution of light to provide realistic lighting for a scene and can be useful for specific lighting setups, for example, a pattern of light cast by a certain type of lamp. This was seen in the GPULM Week 2 task, where the lights used an IES profile to get more realistic lighting in the scene.

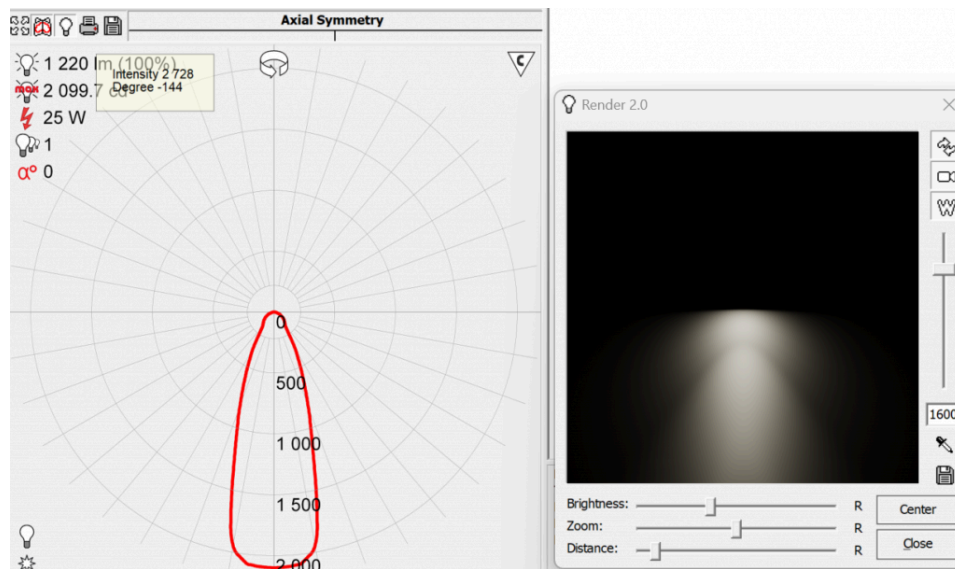


The first thing I did was download the IESViewer. This app allows you to preview and render IES profile shapes before bringing them into Unreal. I picked one from the Phillips link and one from the Lithonia Lighting link and then loaded them into the app.

Lithonia IES Profile



Phillips IES Profile



To compare the two, the first one is wider, diffused light with a larger radius and a circular shape. The Phillips IES profile is more of an intense beam, with the intensity increasing through the middle. To practice lighting a prop, I think from purely looking at their shape, the Lithonia one would be better to light a prop as it would be able to illuminate a prop more effectively with its' larger radius and diffused light distribution, and this is important within

the context of showing off a prop that has been personally modelled - the texture, form and silhouette will want to be properly showcased and not missing any detail. The more narrow beam would work better for accent lighting rather than a broader lighting use. I plan to combine them into one render as they seem to compliment each other well; the Lithonia IES profile will be the main light and the Phillips IES profile will act as a highlight/accent.

Setting up the IES Profiles

The first thing I did was find a prop to render as I wanted to practice with another prop instead of reusing the boombox. I found a typewriter on SketchFab to use. (credit:

<https://sketchfab.com/3d-models/victorian-typewriter-cbfc0e1d8c74f02bde4cfa7b92115f>)

To set up the IES profile, I imported both it into my unreal project and then searched for 'IES profile' under a spotlight to make them in use for the light. I made a spotlight for each and placed them into their positions. I set the primary light, the Lithonia IES profile at 5 intensity as that gave the prop good coverage without it being too bright. For the accent light, the Phillips IES profile, I set that at 3 intensity so it isn't as overpowering as the primary light but is still noticeable and can bring attention to the area of the prop where it is placed to. I saw that the typewriter wasn't getting a lot of light in the middle, so I used the accent light to cover that area while also making the prop pop with a small amount of blue. I went for a grey backdrop as I think it works well with a typewriter since in colour theory, grey symbolizes seriousness and sophistication.



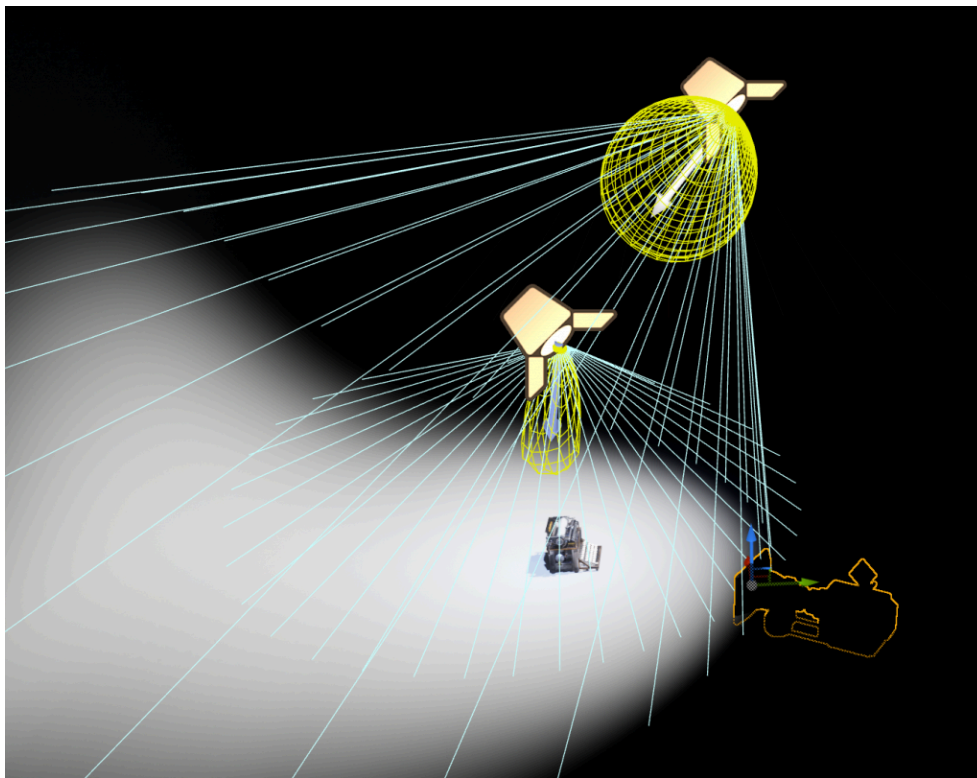
Typewriter Render #1



Overall, I'm happy with how the render turned out. I managed to illuminate the prop with the IES profile lights and effectively show the detail of the prop. The main issue I see with the render is that

originally I made the backdrop a dark grey, however, with the primary white light source shining onto the prop, it made the backdrop appear a more white colour which I think makes the white typewriter keys blend in too much with the backdrop which makes the silhouette in that area less clear. Changing the backdrop to a colour that stands out more like purple, red or orange, or changing the colour of the primary light source would have fixed this issue and something I will keep in mind for the future.

Typewriter Render Setup



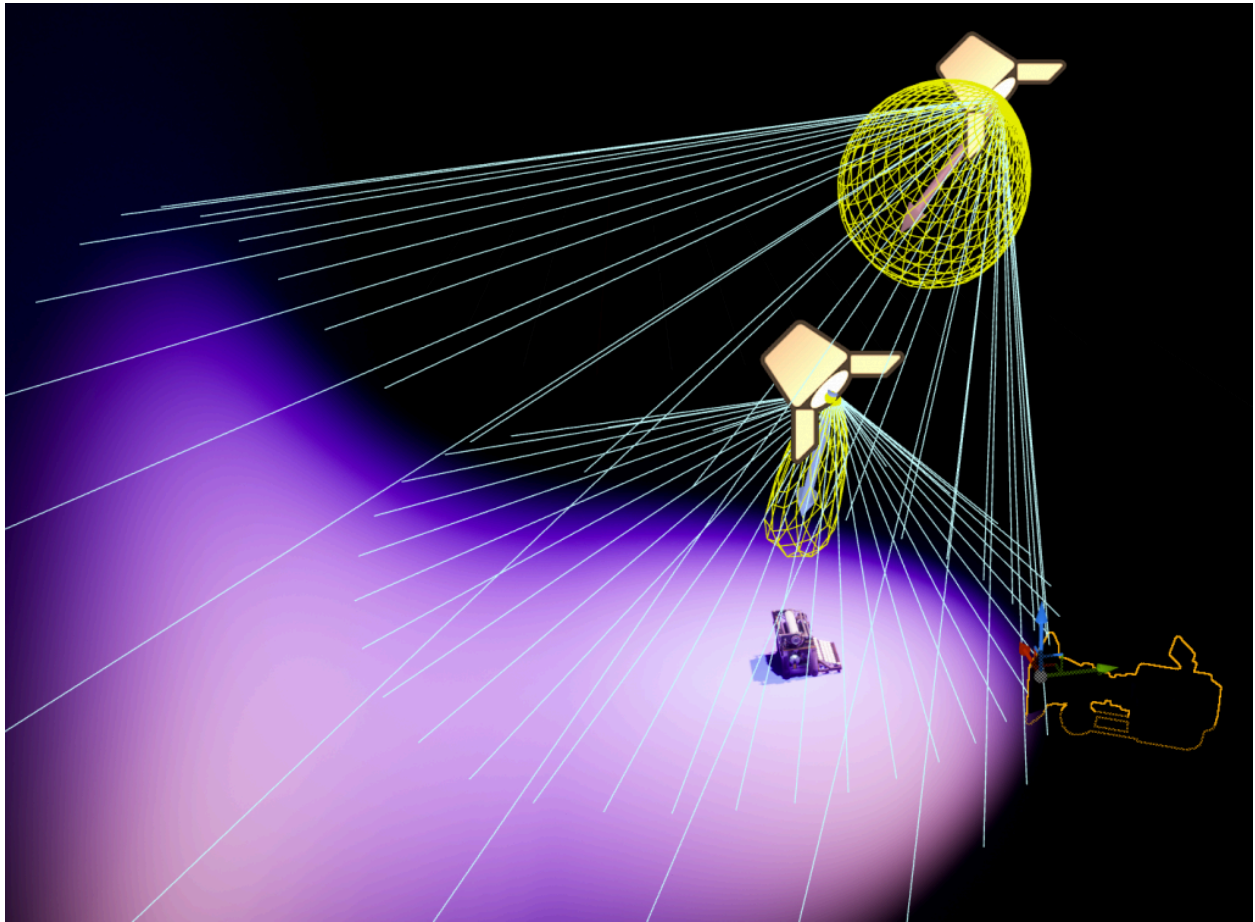
Typewriter Render #2

I thought that my first render had some issues with capturing the silhouette properly, so I had another attempt, this time using some more eye-catching colours. I rectified this by changing the backdrop to

purple, making the primary light source pink and keeping the highlight blue. I think this turned out well and gives the typewriter a more prominent looking silhouette and shows off its' form better, and because purple, blue and pink are analogous colours, meaning they harmonize well together as they have similar colour components.



Typewriter Render #2 Setup



Since the main issue I had with the first render was the colours, I didn't have to adjust the actual setup much apart from changing the colours.

May 28, 2024 – Vehicle Studies - Cars

Directional Lighting

Using Directional Lighting does a good job of illuminating the whole car. However, lighting purely with directional light is not ideal for precise control over how light is travelling within the scene if reflectors or bounce light objects are in use. Using spotlights is much more flexible as you can control the direction of light more precisely and where specifically you want light to hit. Spotlights allow for more control over which parts of the car you want to highlight and bring attention to. - with this being a sports car, highlighting areas like the curvature of the car, the bonnet and the aerodynamics of the bodywork and the details that make it look sleek, powerful and expensive like the sporty curvature, carbon fiber material, grills, vents, front grill, large exhaust.



Fluorescent Tubes Lighting

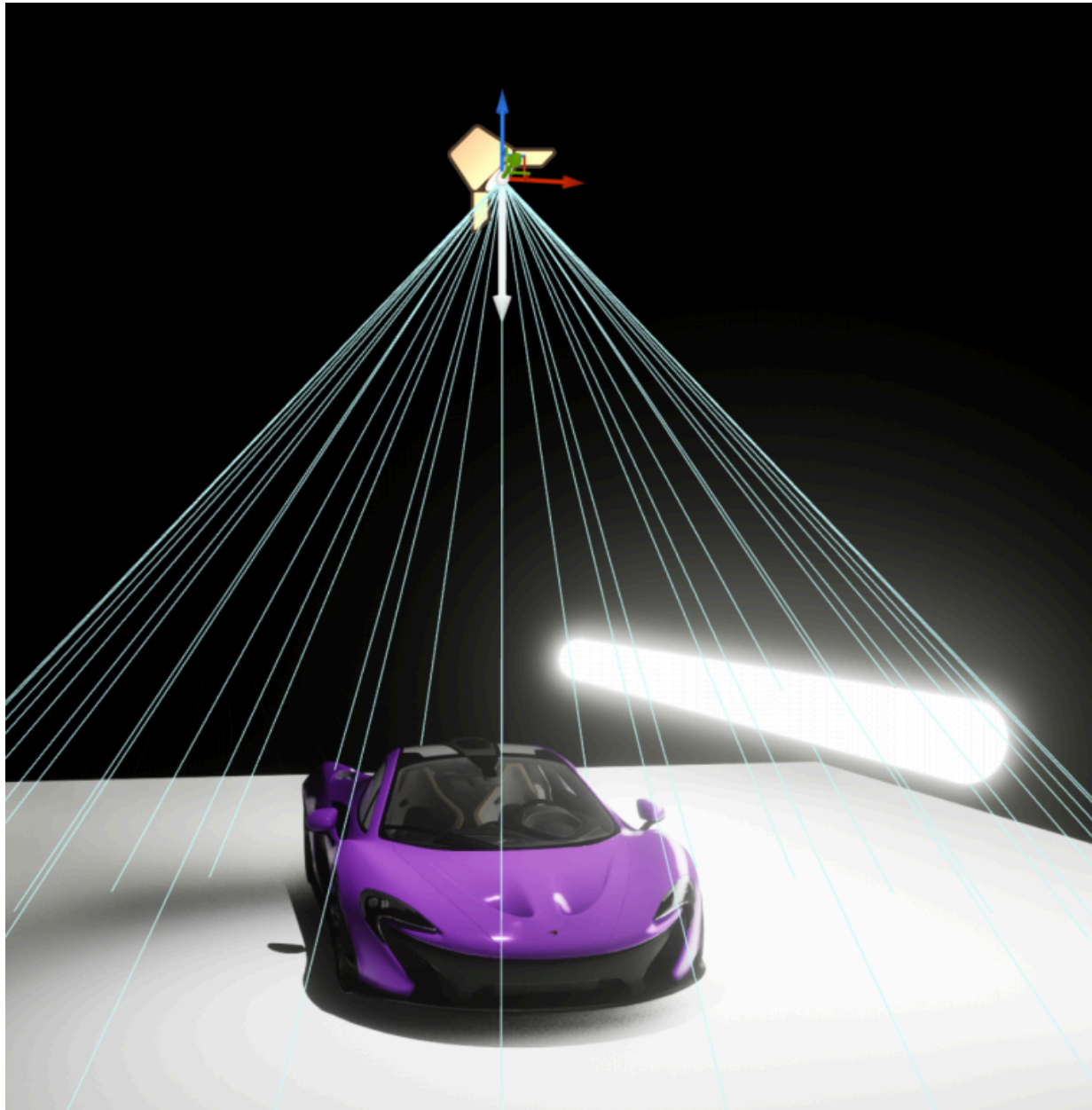
Flourescent tubes can illuminate cars well across a large area. They can be replicated in Unreal Engine using emissive material. One of the negatives of using fluorescent tubes is that they have a short range. I found that fluorescent tubes were good for creating thinner highlights that follow the shape of the vehicle. I found this image of a Lamborghini render. I think to make my own example better, I could have tried to get the line pointing upwards towards the end, as it gives it a sleeker look. I also added a spotlight to the far-left side of the car just to match the reference better.



Fluorescent Tubes Example/Reference



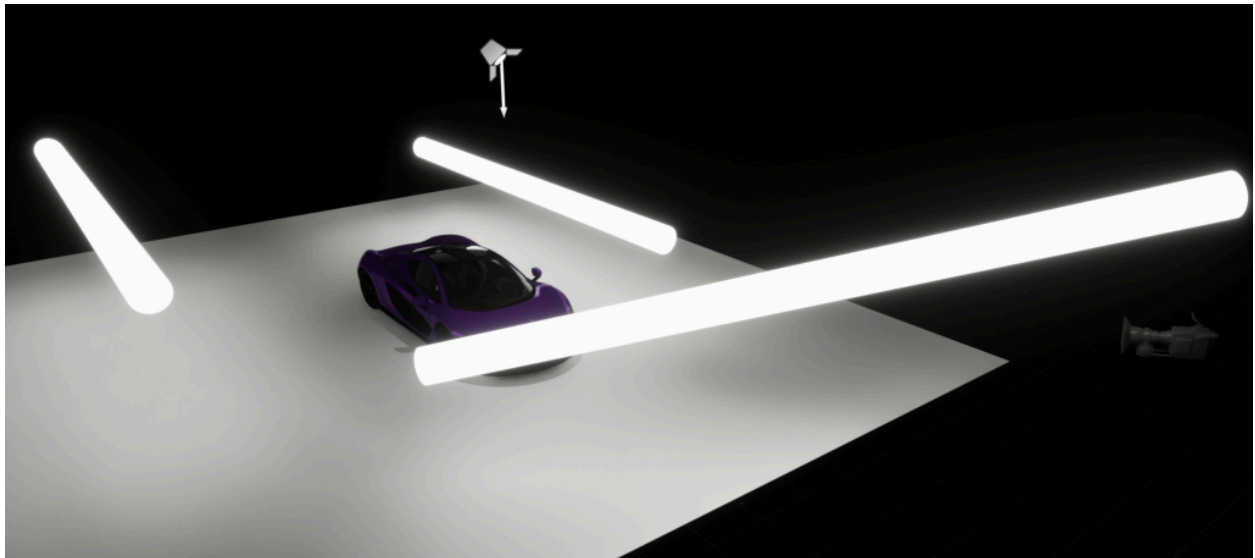
Flourescent Tubes Setup



This setup was very simple; I placed a cylinder down the side of the car and applied an emissive material to it.

Fluorescent Tubes Render 2

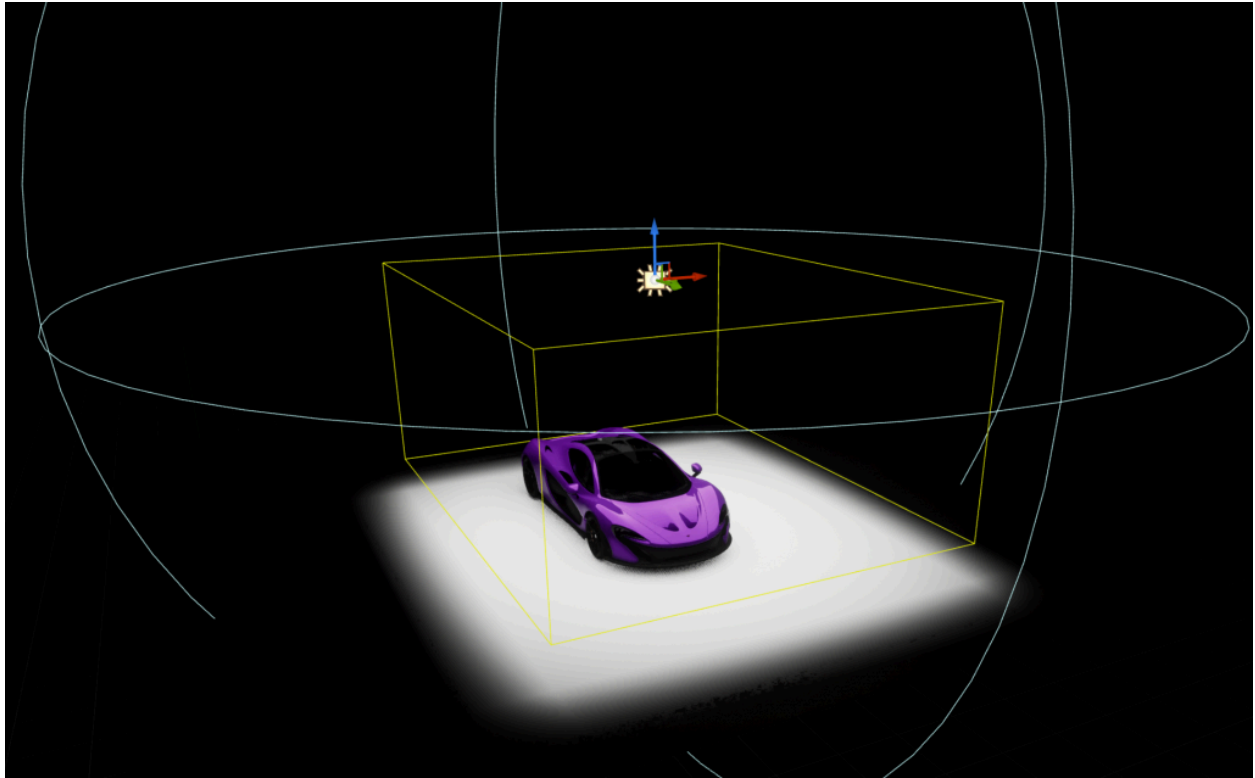
I then added two more just to play around with using fluorescent lights. I added one to the left to add a highlight going across the window screen, and then another one at the front of the car to accentuate the bonnet.



Overhead Soft Box Lighting

Softbox lighting is a soft source of light used to minimize harsh shadows. Soft boxes are useful if the light in the scene is darker and can fill in shadows when the light is harsh. Their consistent soft quality makes them useful for lighting many different objects or people. They are often used as the key or fill light. They work well to keep an image from falling flat as a fill light. For lighting portraits, they are useful for achieving rembrandt lighting setups.





For the overhead softbox setup, I showcased it as the key light. I used a rect light and increased the barn door length to give the boxed shape.

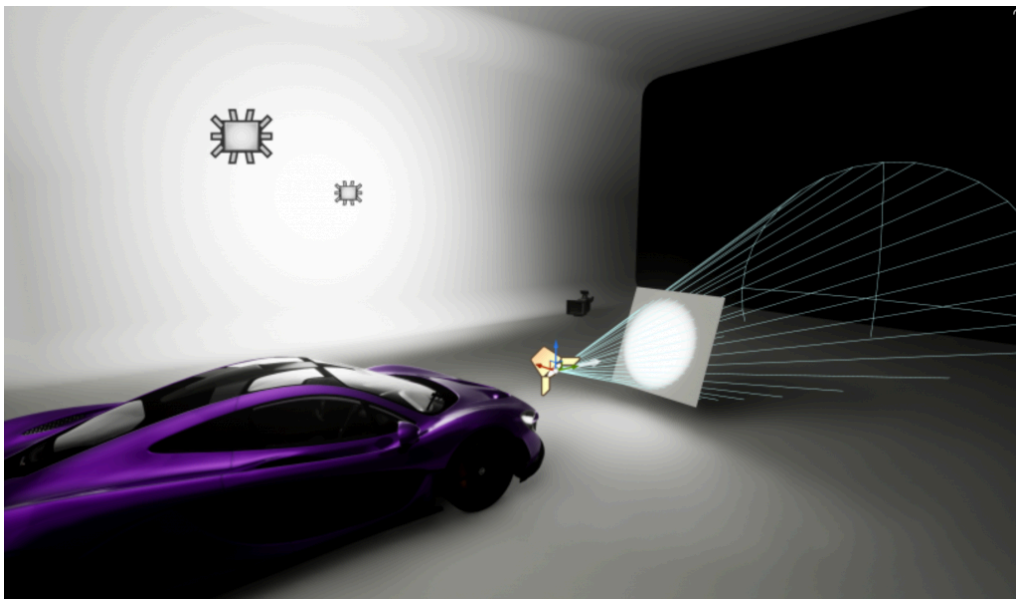
Indirect Lighting

Indirect lighting is when light is directed onto a surface and then reflects off of it. This reflection gives more natural light distribution. An example of indirect lighting is the moon, which reflects sunlight and gives off indirect lighting at night. One of the main positives of this type of lighting is that it has a more subtle effect - it creates a soothing atmosphere because of its non directness, and the fact that it evenly distributes light reduces eye strain.

Indirect Lighting Render



Indirect Lighting Setup



For this setup, I created a backdrop in unreal with three walls, a ceiling and floor as seen in the powerpoint. I placed two rect lights facing the ceiling and wall so that the light would bounce down onto the car. After doing this, I saw that the bonnet was not very well illuminated, so

I used a plane and a spotlight placed in front of the car and then bounced the light onto the bonnet.

Final Render

After replicating and experimenting with different ways to light a vehicle, I decided to do one final render. I picked a car image from the PowerPoint and tried to replicate a similar look.



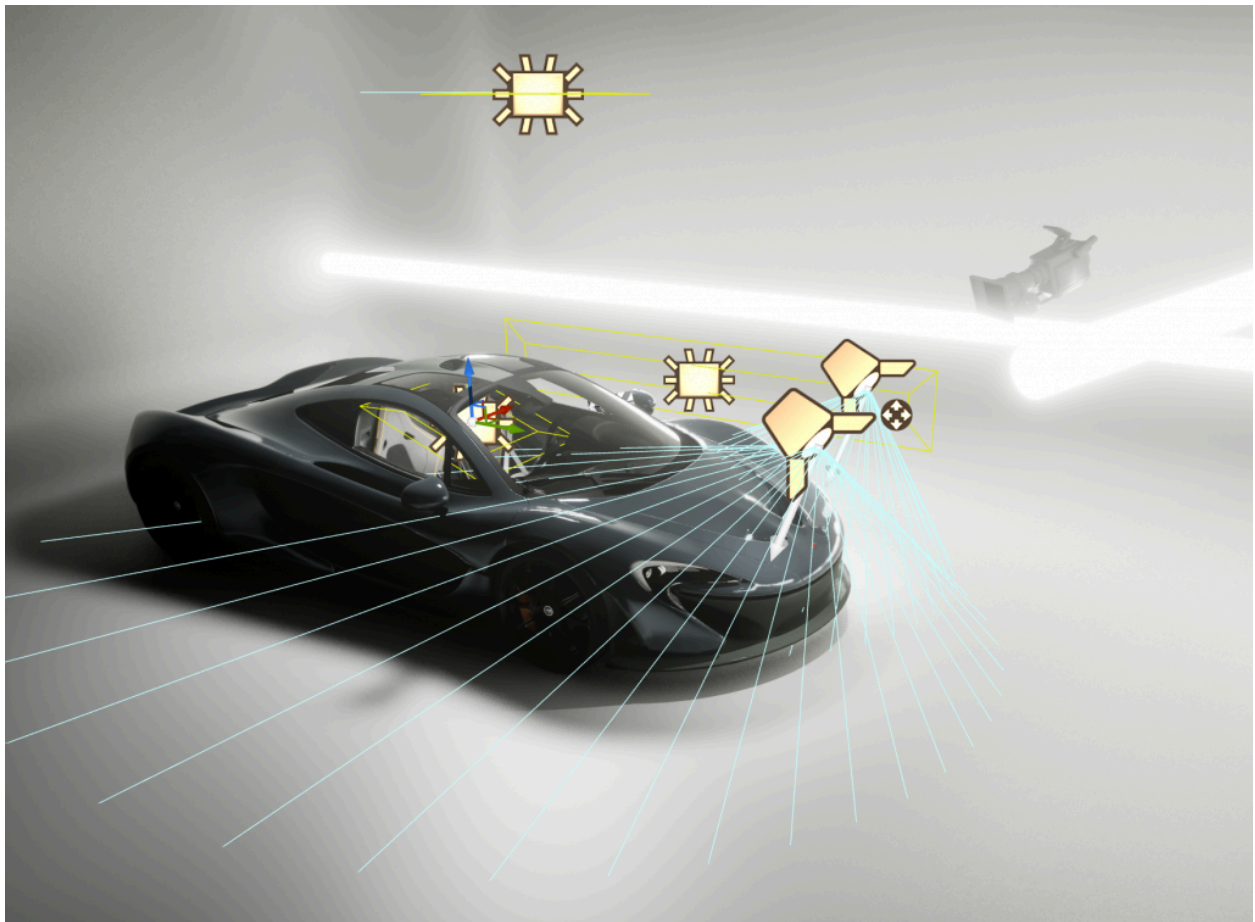


Final Render Setup

I used the top rect light as the key light, illuminating the vehicle and getting the general silhouette covered. I used the two spotlights as highlights as in the reference; both headlights are illuminated, bringing attention to them. I used the first fluorescent tubes to get the line of light through the side of the car as seen in the reference. I used the second to get the highlight on the bonnet of the car. Using a rect light as the primary light source gave less fall off, so they were able to illuminate the car well, However, I added another long rect light on a low intensity just to help illuminate it. In reference, the interior of the car is visible. Since it's being marketed, buyers will want to see what the inside looks like. My car's interior at that stage was quite dark, so I added in a final rect light to make the inside more visible.

To compare mine to the reference, I think I was able to replicate the mixture of dark and light areas and also the highlight on the side and

bonnet of the car. I think I should have toned down the light inside of the car as I think the intensity is a bit too high, compared to the reference where the seats can be seen, but there are also some shadows presents. I also think to make the car look more like the referenced car, the material colour is slightly off, and I could have increased the roughness of the material to make it look more like the car from the reference.



Sequencer Video

Since I am proficient in using Sequencer, I made a short clip showcasing the car from different angles, like what is seen in car advertisements.

