



This picture is from the previous lab but it was fitting for the title.

World 404

A CSC 155 LAB A4 Report by Kenneth Munk

CSC 155 Section 2

Tested On Wolfenstein in RVR 5029

Disclaimer:

This scene is very hardware intense and will not run well on personal laptops. It is strongly advised to check this assignment on the computers in Riverside 5029 as it sees slightly better performance there. This is due to a few of the shaders utilizing 12 texture units which is higher than what most laptops can provide.

A scene of a few floating islands with an workshop missing a world.

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Features Implemented in This Lab

The following features were implemented in this application:

- Five of Eight Required Features
 - Transparency & Fog
 - Bump/Normal Mapping via Textures
 - Environment Mapping
 - 3D Textures and Noise Textures
 - Stereoscopy
- Shadow Mapping (Partial)
- Skybox
- Additional Features
 - Color Filtering
 - Color Transformations
 - Channel Based Texturing

Shadow Mapping (Partially Successful)



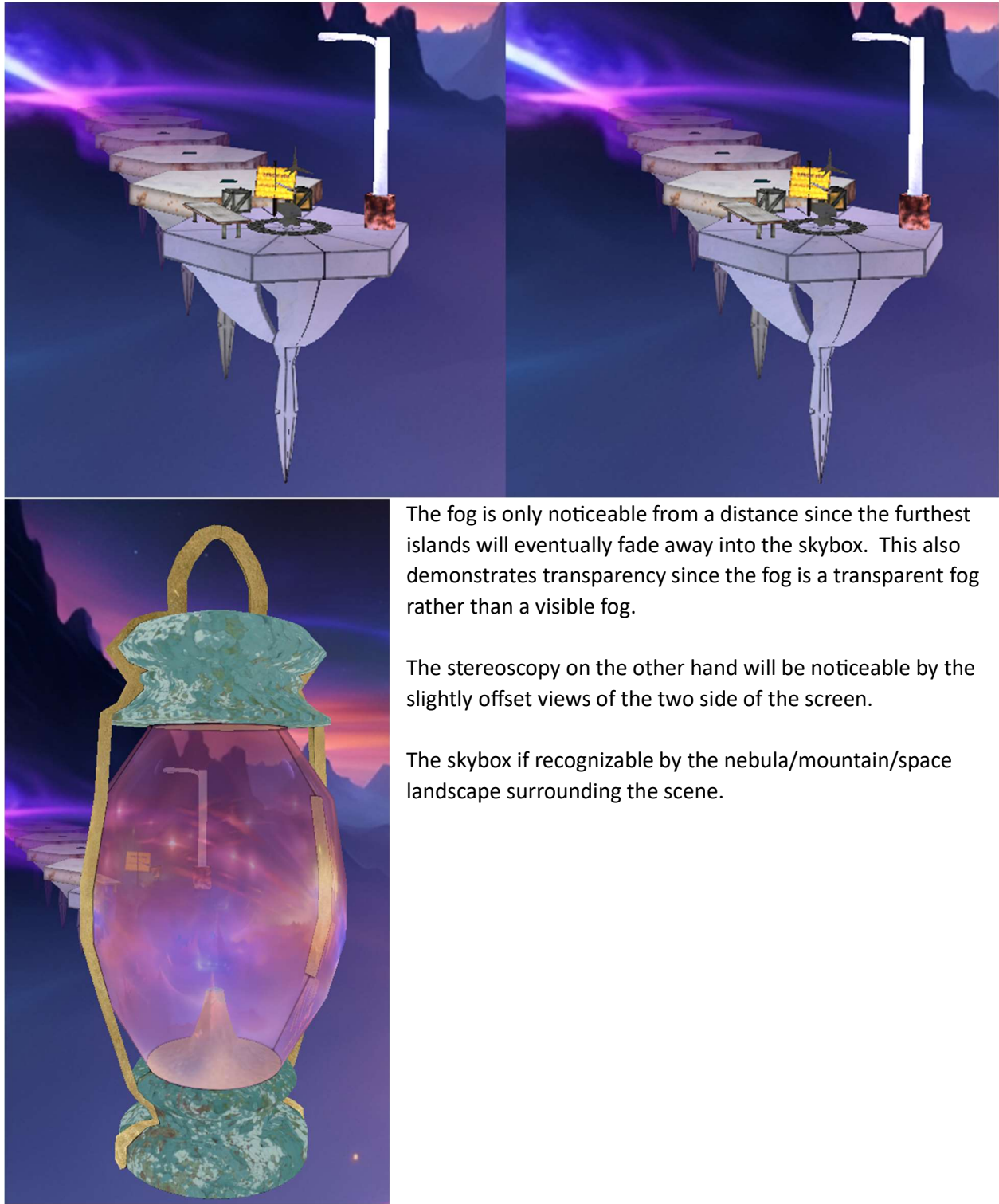
Objects that can receive shadows:

- Simple_Street_Light--High_Poly.obj
- TimberCrate--Complete--Default.obj
- Sign_on_wood_post.obj
- Hex-Tile-Room -- Floor -- V-UV-03.obj
- Gladius_Single.obj

Objects that cast shadows:

- Everything

Figure 1 - (Skybox, Fog, Transparency, and Stereoscopy)

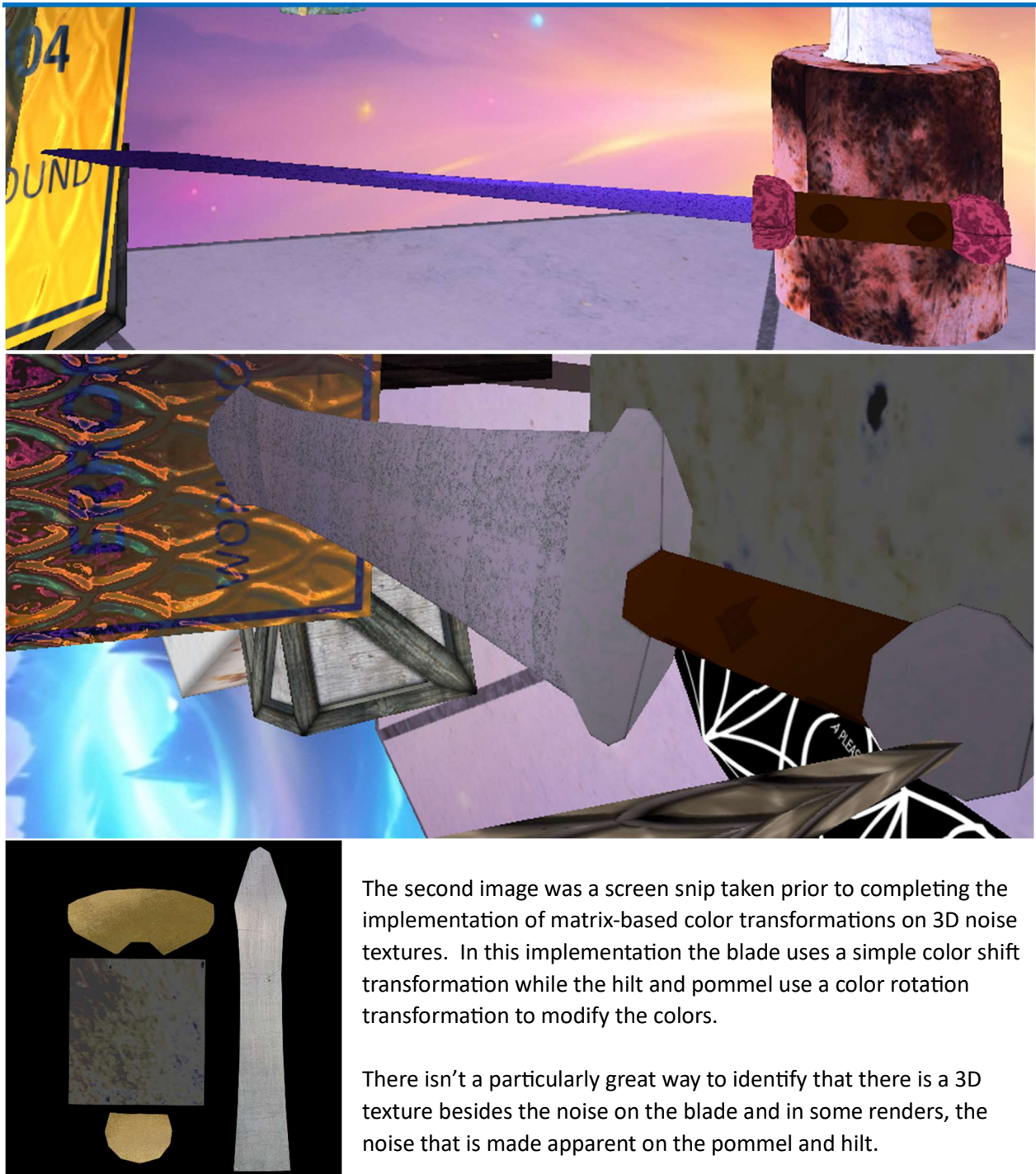


The fog is only noticeable from a distance since the furthest islands will eventually fade away into the skybox. This also demonstrates transparency since the fog is a transparent fog rather than a visible fog.

The stereoscopy on the other hand will be noticeable by the slightly offset views of the two side of the screen.

The skybox is recognizable by the nebula/mountain/space landscape surrounding the scene.

Figure 2 – (3D Textures, Channelized Textures, Color Transforms)



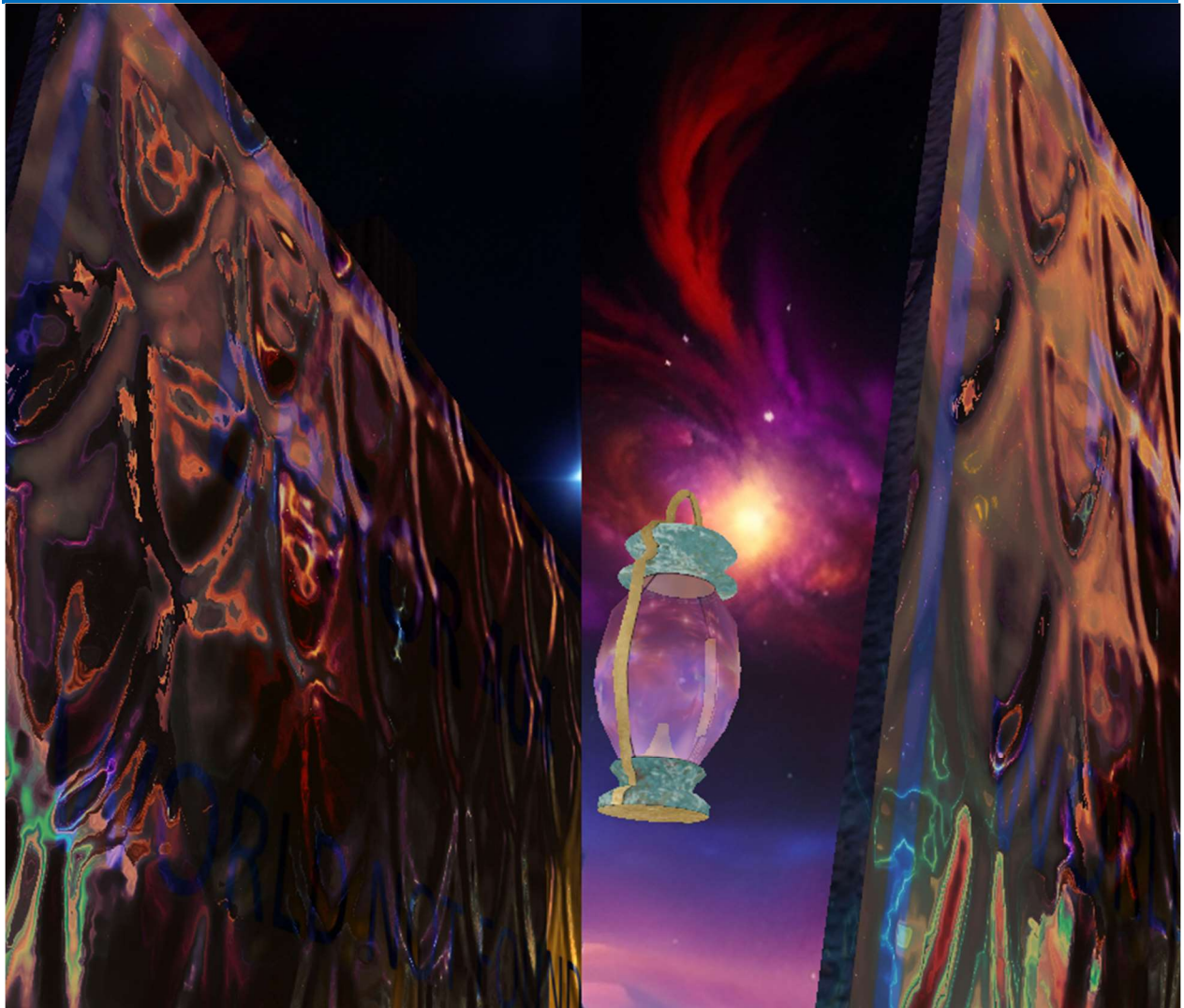
The second image was a screen snip taken prior to completing the implementation of matrix-based color transformations on 3D noise textures. In this implementation the blade uses a simple color shift transformation while the hilt and pommel use a color rotation transformation to modify the colors.

There isn't a particularly great way to identify that there is a 3D texture besides the noise on the blade and in some renders, the noise that is made apparent on the pommel and hilt.

The color transformations on the other hand will be noticeable when you compare the two images against what is seen in the scene since the color transformations alter the colors in shader meaning that if the colors of the input 3D texture vary per instance, the colors of the sword will also reflect that with the transformations.

As for the channelized texture feature, that can only really be identified by comparing the textures in the files of the project since the default texture if there are no channels detected is completely different from the noise textures used.

Figure 3 - (Environment Mapping, Shadow Mapping, and Normal Mapping)





The environment mapping can be recognized by the shimmering reflections seen on all PBR objects with either a surface with a high level of shininess or in heavy darkness.

The sign with the castle roof normal map will expose this especially so since there is a mix of shadow, light, and reflection happening all at once on that surface.

Unfortunately, shadow mapping only partially works so it can only be identified by the sliver of shadow that flexes on the ground and on the sign.

User Controls

Movement Controls

There are two sets of movement controls, translational controls and rotational controls all based off local transforms and unbound to any axis.

Translational:

| | |
|---|----------|
| W | Forward |
| S | Backward |
| Q | Up |
| E | Down |
| A | Left |
| D | Right |

Rotational:

| | |
|---|------------|
| ← | Yaw Left |
| → | Yaw Right |
| ↓ | Pitch Down |
| ↑ | Pitch Up |

Note: Since the rotations are unbounded to any given axis, it is better to treat the rotation controls like flight controls.

Lighting Controls

Scroll Wheel Up (PC)

Move the light position further away from the camera.

| | |
|------------------------|---|
| Scroll Wheel Down (PC) | Move the light position closer to the camera. |
| Click and drag (PC) | Drags the light position to the screen space position in the camera view. |

Light positions are computed based off of the camera position and window location not render viewport position. This will mean that due to the offset nature of the stereoscopic camera the lantern will move slightly different in each viewport.

Toggles

| | |
|-----|---|
| ESC | Exit Application (Spam esc to quickly abort application) |
| P | Pause renderer (caltrop animation doesn't stop unfortunately) |
| L | Toggle the shadow mapping |
| M | Expose shadow mapping fragment shader results |

The L and M keys were set up to better show that the shadow mapping is indeed operating but unfortunately something about the matrices used is encountering an error that prevents objects from moving in the view of shadows.

The P key was prepared to combat issues with computer-wide latency caused by the application. Pressing this key will halt the heavy renderer and give your machine enough breathing space to take screen captures or use other applications.

The ESC key was meant for its namesake, quickly closing the application without having to click into the console. This was more of a personal quality of life improvement.

Assets In Project Folder

3D Models

| Model File | Used In Application | Source Link | Perm Source |
|---|---------------------|---|-------------|
| Anvil--01.obj | No | https://github.com/KenMunk/Project_Asset_Library | Self |
| Anvil--02--Triangulated.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| Axis.obj | No | https://github.com/KenMunk/Project_Asset_Library | Self |
| CaltropStar.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| Gladius_Single.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| GroundRing.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| Hex-Tile-Room -- Floor -- V-UV-03.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| LongTable--Simple--SquareLegs.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| MultiCube.obj | No | https://github.com/KenMunk/Project_Asset_Library | Self |
| Sign_on_wood_post.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| Simple_Lantern--With_Internal_Faces.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| Simple_Lantern.obj | No | https://github.com/KenMunk/Project_Asset_Library | Self |
| Simple_Street_Light--High_Poly.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |
| TimberCrate--Complete--Default.obj | Yes | https://github.com/KenMunk/Project_Asset_Library | Self |

Textures/Images

| Texture/Image Path | Where In Scene? | Source Link | Permission Link | Compliance |
|-----------------------------------|-----------------------|---|---|---|
| castleroof.jpg | Caltrop Star Texture | Textbook Files | | Used in classroom project for authors class |
| castleroofNORMAL.jpg | Error 404 Sign Normal | Textbook Files | | Used in classroom project for authors class |
| digital_painting_sea_of_stars.jpg | Skybox Textures | https://skybox.blockadelabs.com/ | None found, contacting Blockade Labs https://www.blockadelabs.com | Unclear due to AI |
| dreamlike_nebula.jpg | Skybox Textures | https://skybox.blockadelabs.com/ | None found, contacting Blockade Labs https://www.blockadelabs.com | Unclear due to AI |

| | | | | |
|----------------------------|---|---|---|--|
| metal_bare_0012_01_s.jpg | Lantern composite texture | texturelib.com http://texturelib.com/texture/?path=/Textures/metal/bare/metal_bare_0012 | http://texturelib.com/license/ | In compliance with the license since the assignment isn't considered as a third party texture pack. No other restrictions on usage indicated in license. |
| Texturelabs_Metal_189M.jpg | Street lamp composite texture Long table composite texture Hex Tile composite texture | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures that were used in some models |
| Texturelabs_Metal_242L.jpg | Glaious composite texture Street lamp composite texture Hex tile composite texture | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures that were used in some models |

| | | | | |
|----------------------------|---|---|---|--|
| Texturelabs_Metal_245M.jpg | Lantern composite texture Glaious composite texture Gold Panel Timber Box Texture | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures that were used in some models |
| Texturelabs_Stone_132M.jpg | Hex tile composite texture | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures that were used in some models |
| Texturelabs_Stone_159M.jpg | Hex tile composite textures | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures that were used in some models |
| Texturelabs_Wood_133L.jpg | Long table texture Timber box textures | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures that were used in some models |
| Texturelabs_Wood_167L.jpg | Long table texture | https://texturelabs.org | https://texturelabs.org/terms/ | Textures were incorporated into composite textures |

| | | | | |
|------------------|---------------------|---|---|--|
| | Timber box textures | | | that were used in some models |
| NebulaSky\xn.jpg | Skybox | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| NebulaSky\xp.jpg | Skybox | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| NebulaSky\yn.jpg | Skybox | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| NebulaSky\yp.jpg | Skybox | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| NebulaSky\zn.jpg | Skybox | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |

| | | | | |
|-------------------------------------|---------------------|---|---|--|
| NebulaSky\zp.jpg | Skybox | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| Anvil_Laptop_Sleeve.png | Anvil Model | Made for this project | Made for this project | Made for this project |
| Axis.png | Not used | Made for this project | Made for this project | Made for this project |
| Glaious_Single_Type0--Ambient.png | Glaious Sword Model | Made for this project | Made for this project | Made for this project |
| Glaious_Single_Type0--Channels.png | Glaious Sword Model | Made for this project | Made for this project | Made for this project |
| Glaious_Single_Type0--Default.png | Glaious Sword Model | Made for this project | Made for this project | Made for this project |
| Glaious_Single_Type0--Diffuse.png | Glaious Sword Model | Made for this project | Made for this project | Made for this project |
| Glaious_Single_Type0--Shininess.png | Glaious Sword Model | Made for this project | Made for this project | Made for this project |

| | | | | |
|--|---------------------|-----------------------|-----------------------|-----------------------|
| Glaious_Single_Type0--Specular.png | Glaious Sword Model | Made for this project | Made for this project | Made for this project |
| Hex-Tile-Room -- Floor -- V-UV-03--Marbel_Top--pbr--ambient.png | Hex Island Model | Made for this project | Made for this project | Made for this project |
| Hex-Tile-Room -- Floor -- V-UV-03--Marbel_Top--pbr--diffuse.png | Hex Island Model | Made for this project | Made for this project | Made for this project |
| Hex-Tile-Room -- Floor -- V-UV-03--Marbel_Top--pbr--MarbleLime.png | Hex Island Model | Made for this project | Made for this project | Made for this project |
| Hex-Tile-Room -- Floor -- V-UV-03--Marbel_Top--pbr--shininess.png | Hex Island Model | Made for this project | Made for this project | Made for this project |
| Hex-Tile-Room -- Floor -- V-UV-03--Marbel_Top--pbr--specular.png | Hex Island Model | Made for this project | Made for this project | Made for this project |
| Hex-Tile-Room -- Floor -- V-UV-03--Marbel_Top.png | Hex Island Model | Made for this project | Made for this project | Made for this project |
| LongTable--Simple--SquareLegs--Weathered.png | Long Table Model | Made for this project | Made for this project | Made for this project |

| | | | | |
|---|---|-----------------------|-----------------------|-----------------------|
| NormalDefault.png | All PBR Shader models not using the castle normal map | Made for this project | Made for this project | Made for this project |
| RunicRingSegment.png | The runic ring on the ground | Made for this project | Made for this project | Made for this project |
| Sign_on_wood_post--World404--Ambient.png | Error 404 Sign | Made for this project | Made for this project | Made for this project |
| Sign_on_wood_post--World404--Base.png | Error 404 Sign | Made for this project | Made for this project | Made for this project |
| Sign_on_wood_post--World404--Diffuse.png | Error 404 Sign | Made for this project | Made for this project | Made for this project |
| Sign_on_wood_post--World404--Shininess.png | Error 404 Sign | Made for this project | Made for this project | Made for this project |
| Sign_on_wood_post--World404--Specular.png | Error 404 Sign | Made for this project | Made for this project | Made for this project |
| Simple_Lantern--MagicLantern--Transparent.png | Lantern Model | Made for this project | Made for this project | Made for this project |

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|--|---------------------------------|-----------------------|-----------------------|-----------------------|
| Simple_Lantern-- MagicLantern.png | Lantern model | Made for this project | Made for this project | Made for this project |
| StreetLamp--High_Poly--basic-- test.png | Street lamp model | Made for this project | Made for this project | Made for this project |
| StreetLamp--High_Poly-- TextureLabsMetals--diffuse.png | Street lamp model | Made for this project | Made for this project | Made for this project |
| StreetLamp--High_Poly-- TextureLabsMetals-- shininessmap.png | Street lamp model | Made for this project | Made for this project | Made for this project |
| StreetLamp--High_Poly-- TextureLabsMetals-- specular.png | Street lamp model | Made for this project | Made for this project | Made for this project |
| StreetLamp--High_Poly-- TextureLabsMetals.png | Street lamp model | Made for this project | Made for this project | Made for this project |
| TimberBoxTexture--Lab3-- GoldPanel--Diffuse.png | One of the timber box models | Made for this project | Made for this project | Made for this project |
| TimberBoxTexture--Lab3-- GoldPanel--Shininess.png | One of the timber box models | Made for this project | Made for this project | Made for this project |

| | | | | |
|---|------------------------------|---|---|--|
| TimberBoxTexture--Lab3--GoldPanel--Specular.png | One of the timber box models | Made for this project | Made for this project | Made for this project |
| TimberBoxTexture--Lab3--GoldPanel--WoodTrim--Ambient.png | One of the timber box models | Made for this project | Made for this project | Made for this project |
| TimberBoxTexture--Lab3--GoldPanel--WoodTrim--Base.png | One of the timber box models | Made for this project | Made for this project | Made for this project |
| TimberBoxTexture--Lab3.png | One of the timber box models | Made for this project | Made for this project | Made for this project |
| World404Sign.png | One of the timber box models | Made for this project | Made for this project | Made for this project |
| SpaceSky\back.png | Not Used | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| SpaceSky\bottom.png | Not Used | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |

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| SpaceSky\right.png | Not Used | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |
| SpaceSky\top.png | Not Used | https://skybox-generator.vercel.app/ | https://github.com/jaxry/panorama-to-cubemap/blob/gh-pages/LICENSE | License is focused on the tool not the results of the tool |