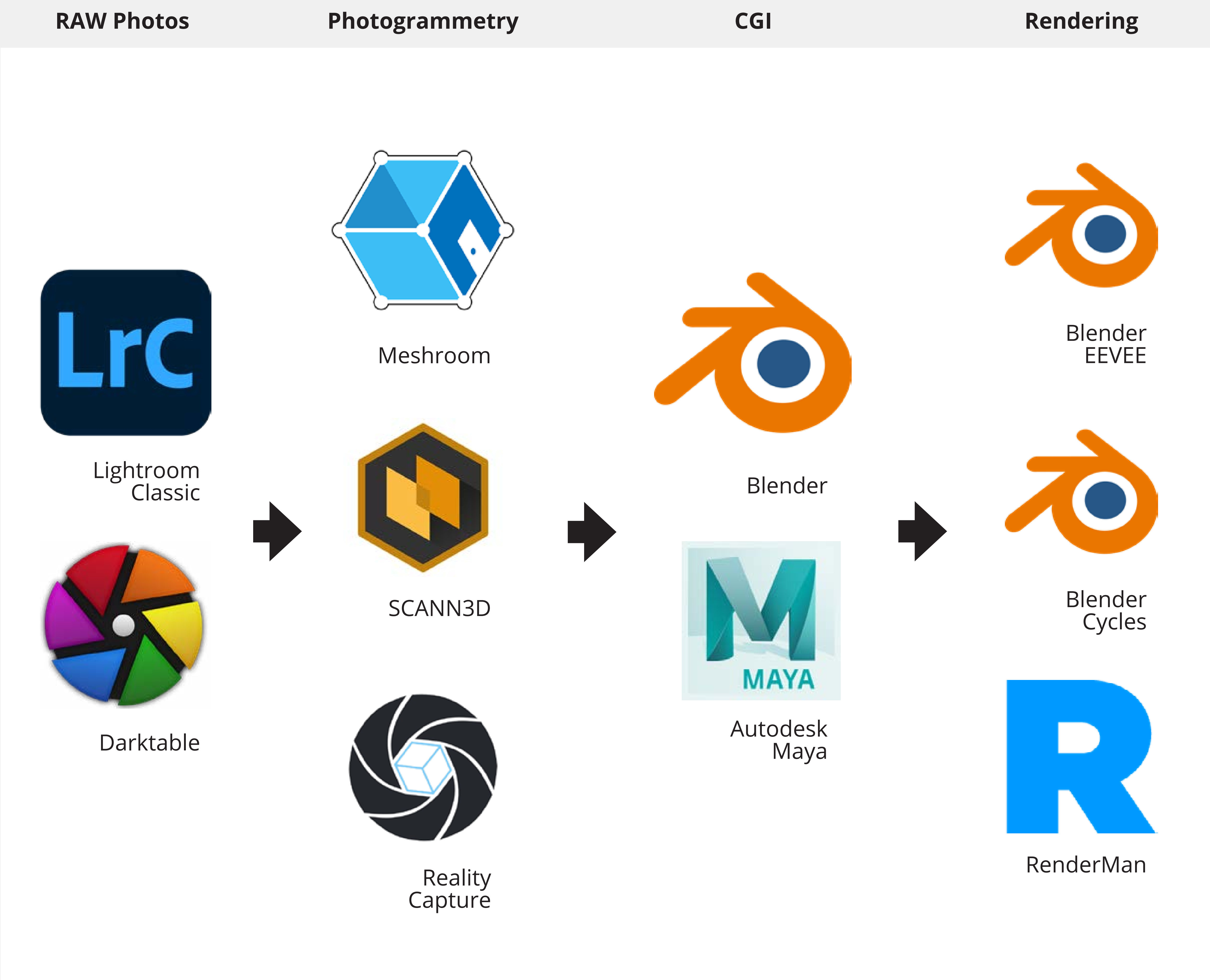


RAW Photos

Photogrammetry

CGI

Rendering

Lightroom Classic

Darktable

Meshroom

SCANN3D

Reality Capture

Blender

Autodesk Maya

Blender EEVEE

Blender Cycles

RenderMan

Assignment 1

Software and Process Overview

In order to make a successful photogrammetry object, I needed a variety of programs.

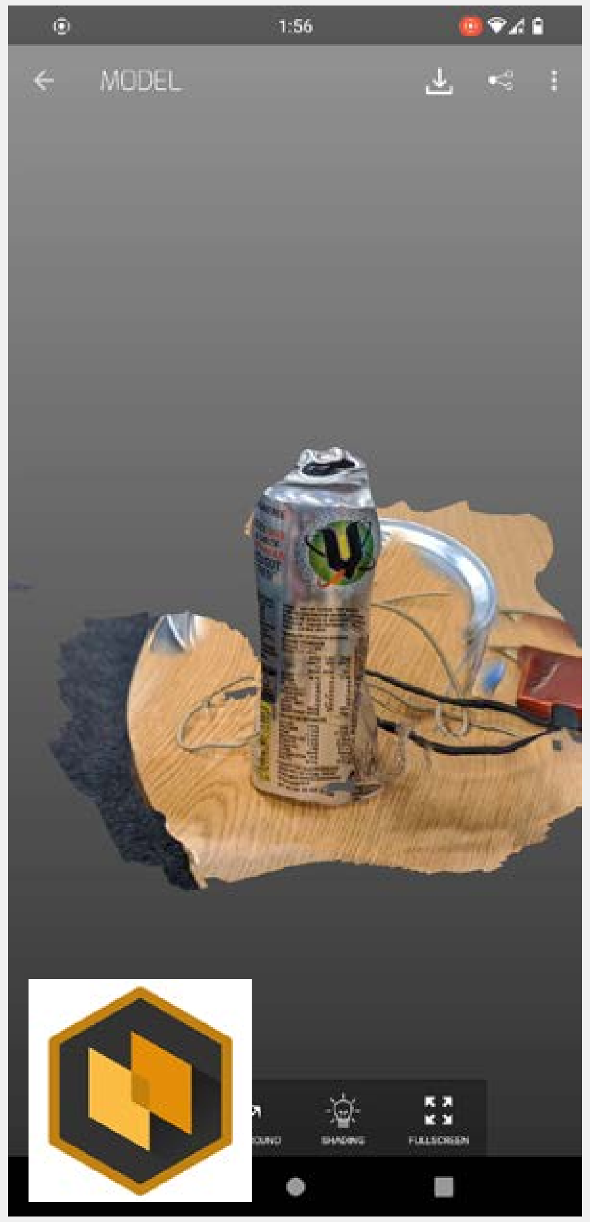
The process starts with using a DSLR camera to capture RAW photos with consistent exposures. These are brought into a photo developer application such as Adobe Lightroom or the free open-source Darktable. These are adjusted to better show detail, before being exported to a more appropriate format, such as JPG.

The developed photos are imported into a photogrammetry program, such as RealityCapture, which creates a point cloud from the batch of images. This cloud is then used to create the object's geometry and textures.

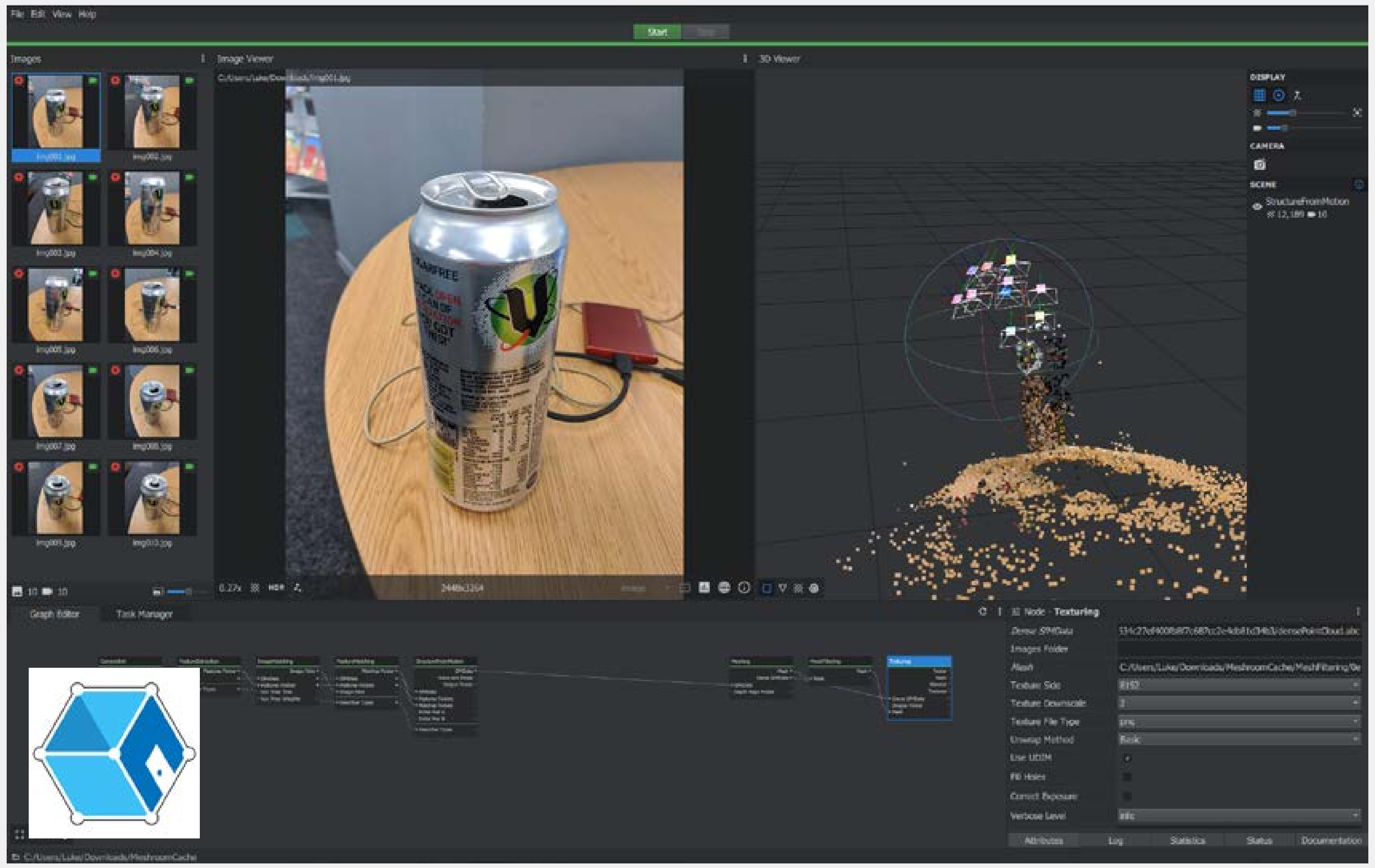
Once done, I exported the OBJ geometry and PNG texture files. My justification for these specific formats is that OBJ is a relatively minimal option for keeping the geometry, UVs and not much else. PNG is a versatile format that remains fairly small without losing quality.

Assignment 1

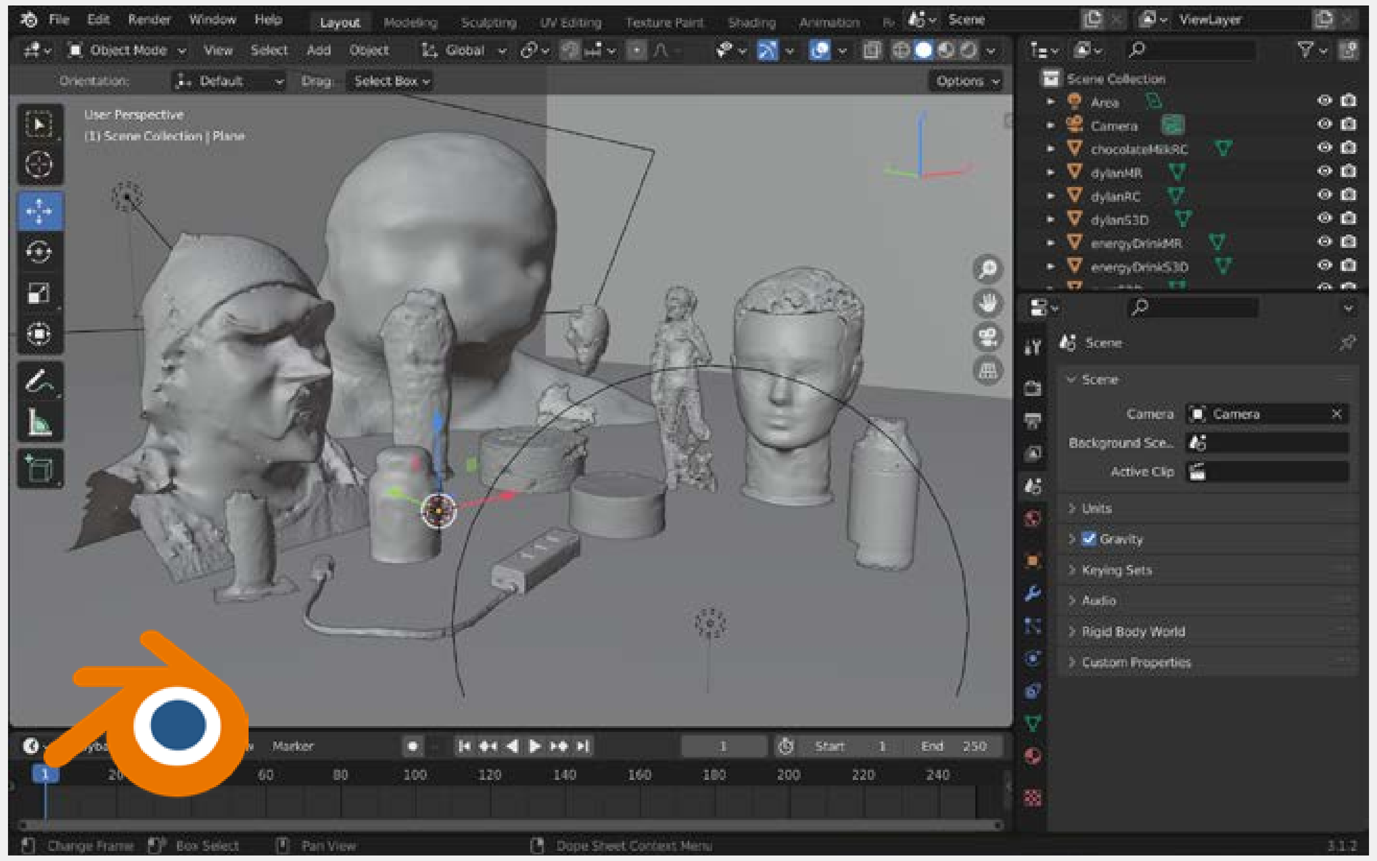
Software Screenshots



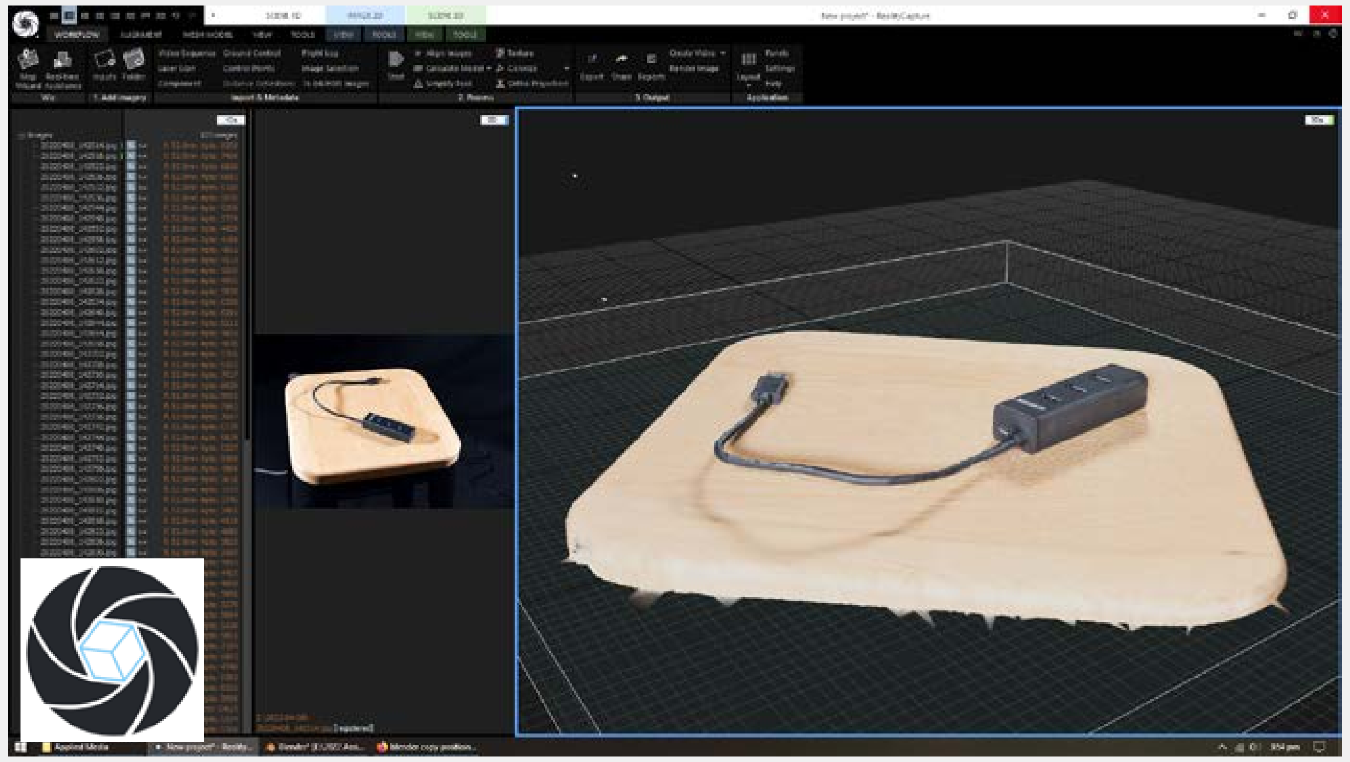
SCANN3D user interface



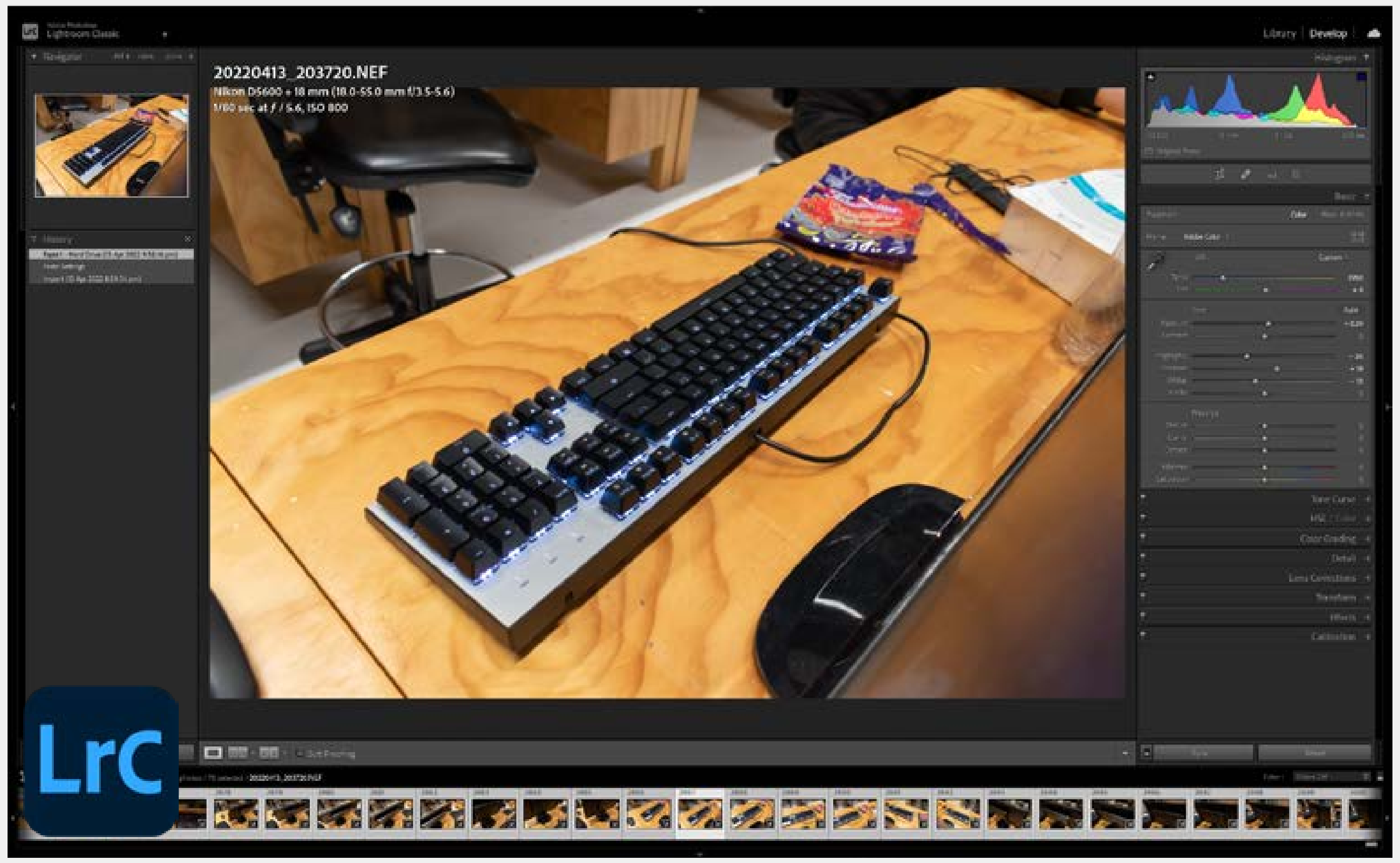
Meshroom user interface



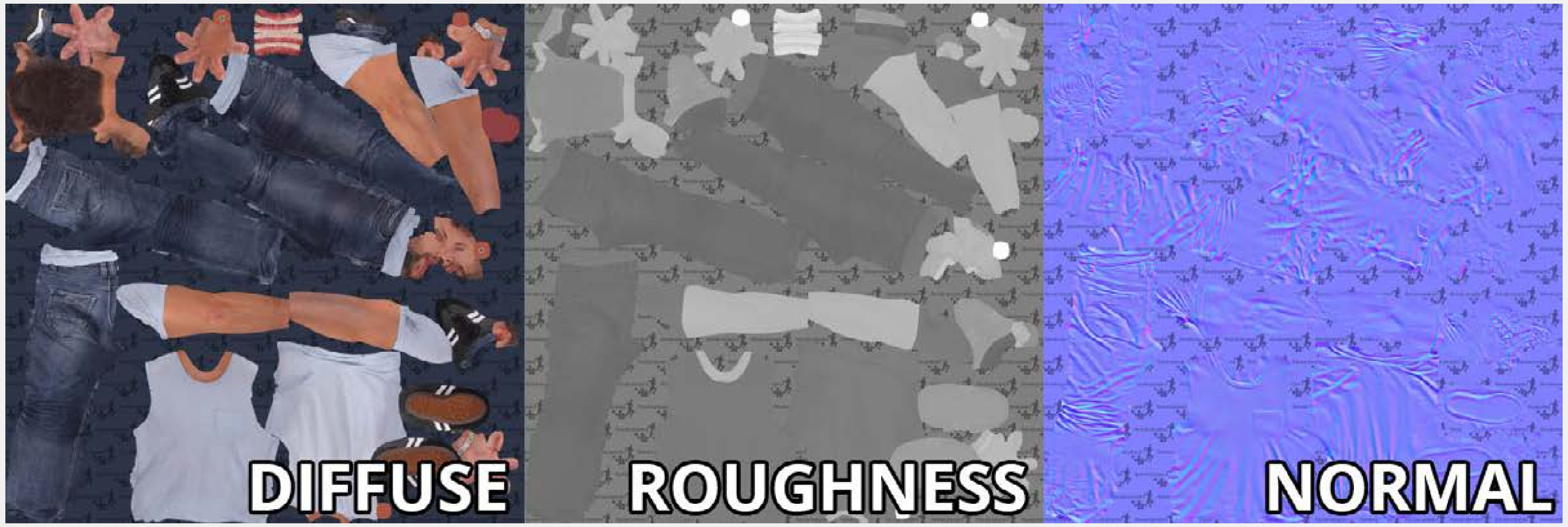
Blender user interface



RealityCapture user interface



Adobe Lightroom user interface



Textures sourced from: https://free3d.com/3d-model/nathan-animated-003-walking-644277.html

Assignment 1

Texture Maps

Diffuse:
Standard color map with shadows. This is most likely what you'll get from photogrammetry software.

Albedo:
Also a color map but with no lighting or shadows. The result is a very flat looking texture.

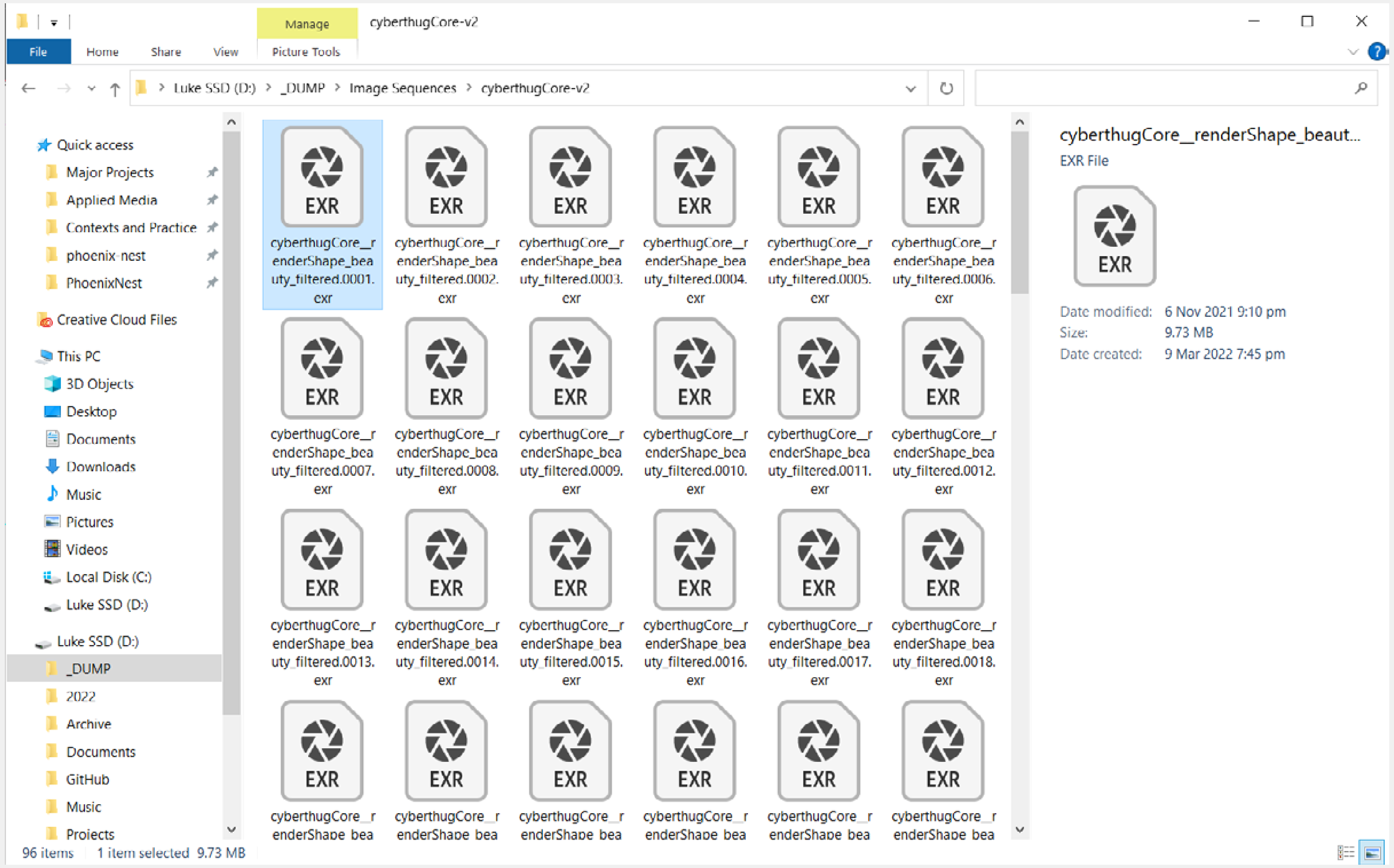
Ambient occlusion:
Typically a greyscale texture that identifies lighting and shadows. This placed over an albedo map equals a diffuse map.

Bump/normal:
Used to fake detail without changing the geometry itself. Bump maps are greyscale, while normal maps are generally blueish.

Displacement:
Changes the geometry of the model. More "expensive" than bump/normal maps but produces more realistic results.

Roughness:
Typically greyscale. Controls the roughness/glossiness of the material.

UV layout:
Not a texture per se, but more of a guide for how texture maps translate to the mesh.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Applied Media
Contexts and Practice
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This PC
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EXR File
96 items
1 item selected 9.73 MB

Date modified: 6 Nov 2021 9:10 pm
Size: 9.73 MB
Date created: 9 Mar 2022 7:45 pm

A folder of rendered image sequences saved in the EXR file format

Assignment 1
Best Practices

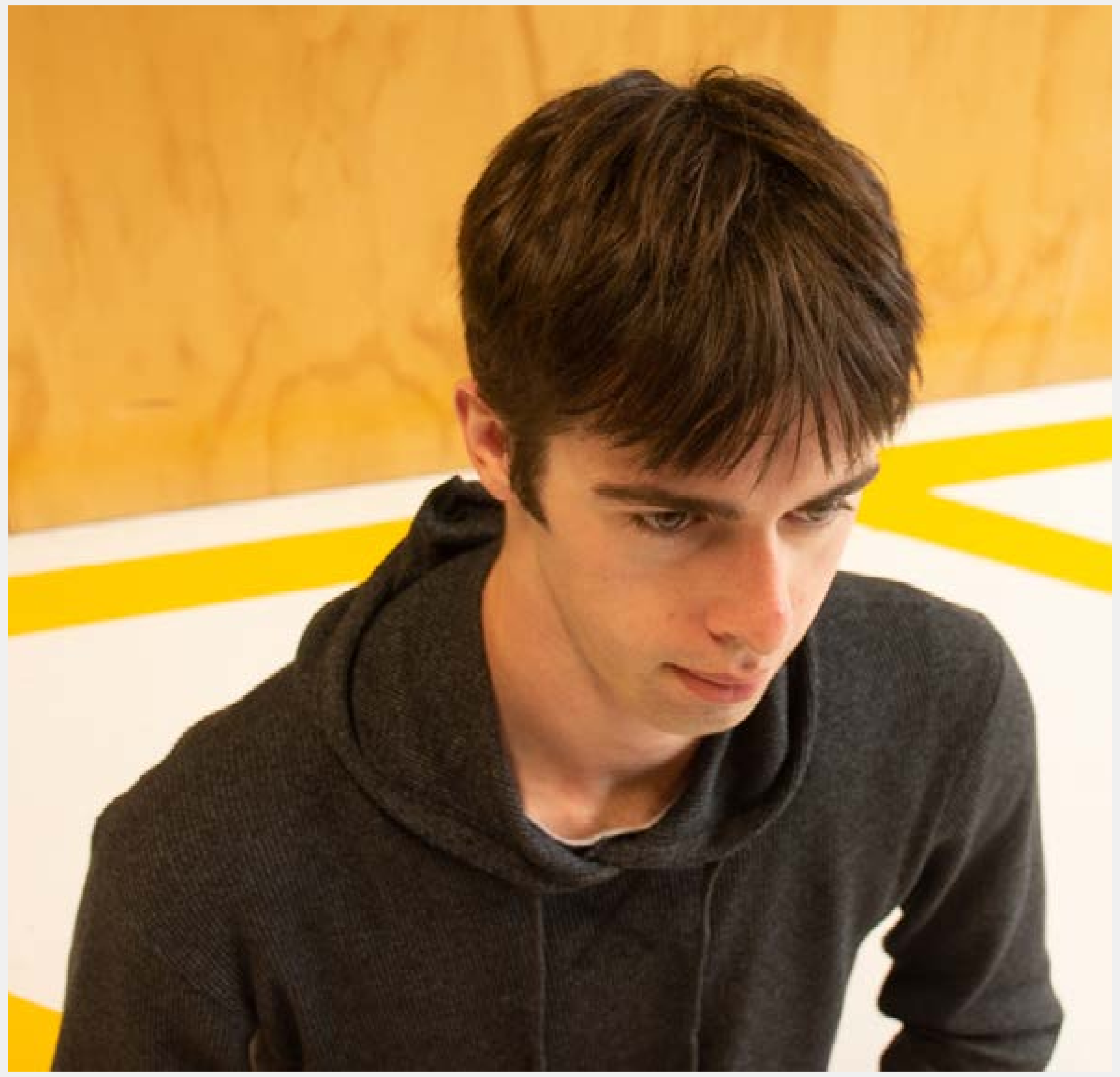
When it comes to digital media, I believe it's useful to have a good grasp on the various formats and standards.

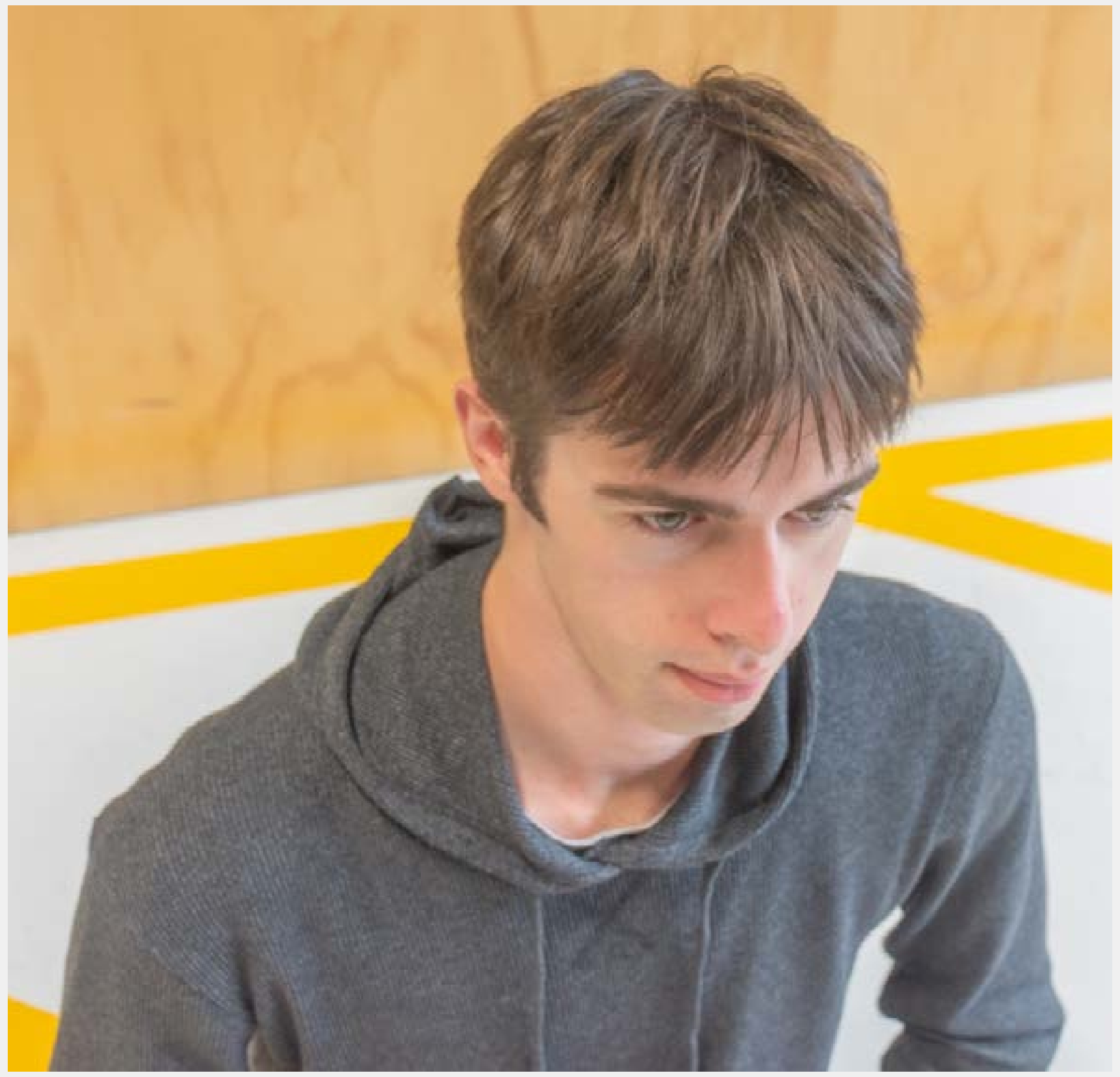
Source images:
The photos taken with my DSLR are shot in RAW with consistent exposure settings. Once I take these into Lightroom, I remove the natural lens distortion and vignetting and export the photos as JPGs.

Texture maps:
As good practice, I keep my textures saved as PNGs, ensuring they won't degrade in quality after each save (as is the case with JPGs) and with a bit depth of 16 per channel, to reduce the risk of color banding.

Objects:
For cross-compatibility between Maya, Blender and other 3D programs, I decide to save my objects as OBJ files. This small and versatile format contains geometry data, UVs and not much else.

Rendered images:
When rendering from Maya/Blender, I make sure to use the 16-bit EXR format to preserve information in case colour correction is needed. Think of this as the CGI equivalent to RAW photos from a DSLR.

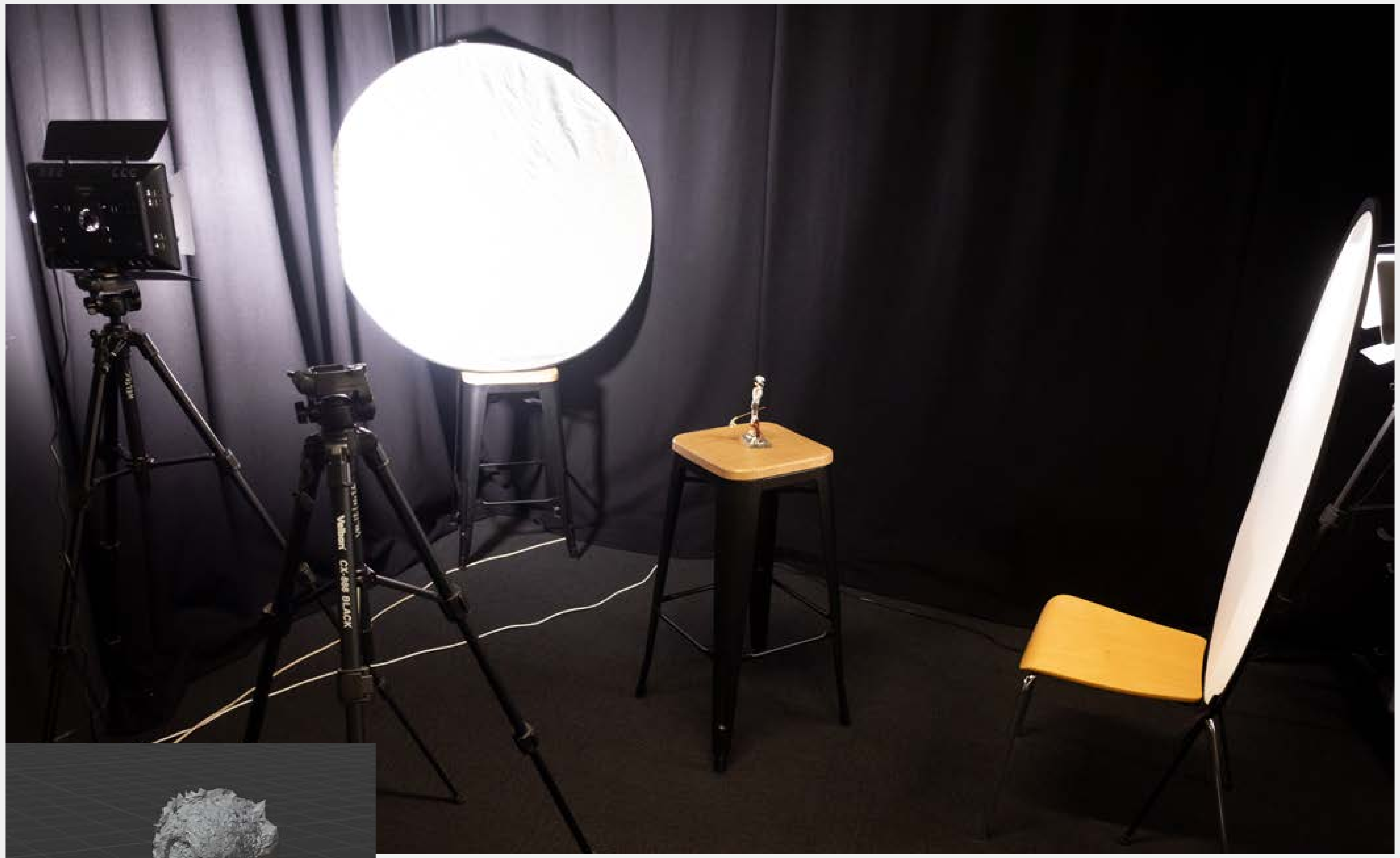


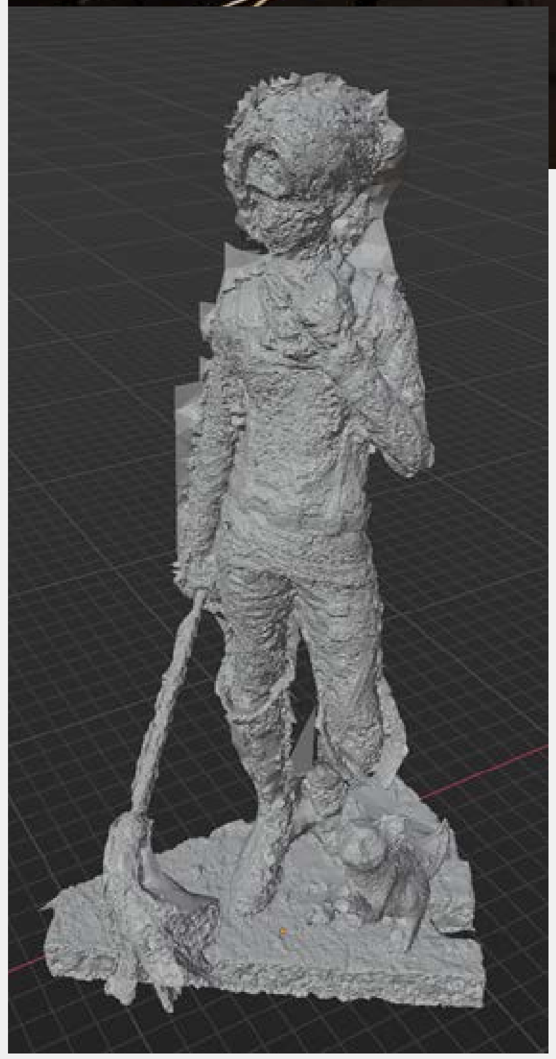


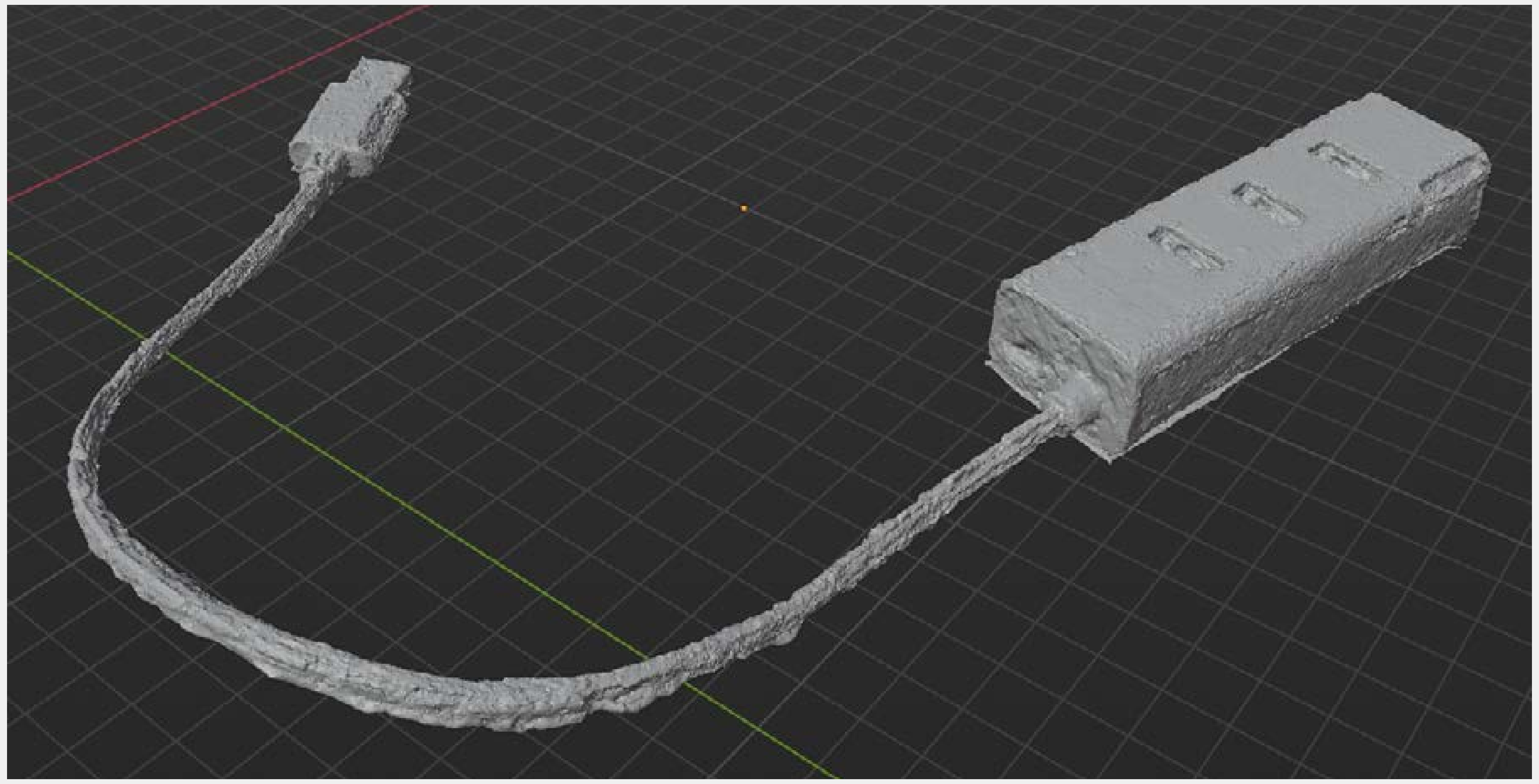
Assignment 1

Lightroom Tricks

On the day the assignment was due, I figured it made sense to try compressing the highlights and shadows of the source images in Lightroom, both to retain the detail in the extremes when exporting the JPGs, and to minimize the effects of the lighting as much as possible. Unfortunately, this particular set of images shown to the left didn't work at all.







Assignment 1

Controlled Environment Tests

I'm no expert in lighting, but I tried making 2 models with studio floodlights and a thick black curtain in the background. The setup was slightly different for each, with reflective sheets used for the janitor object.

USB Hub

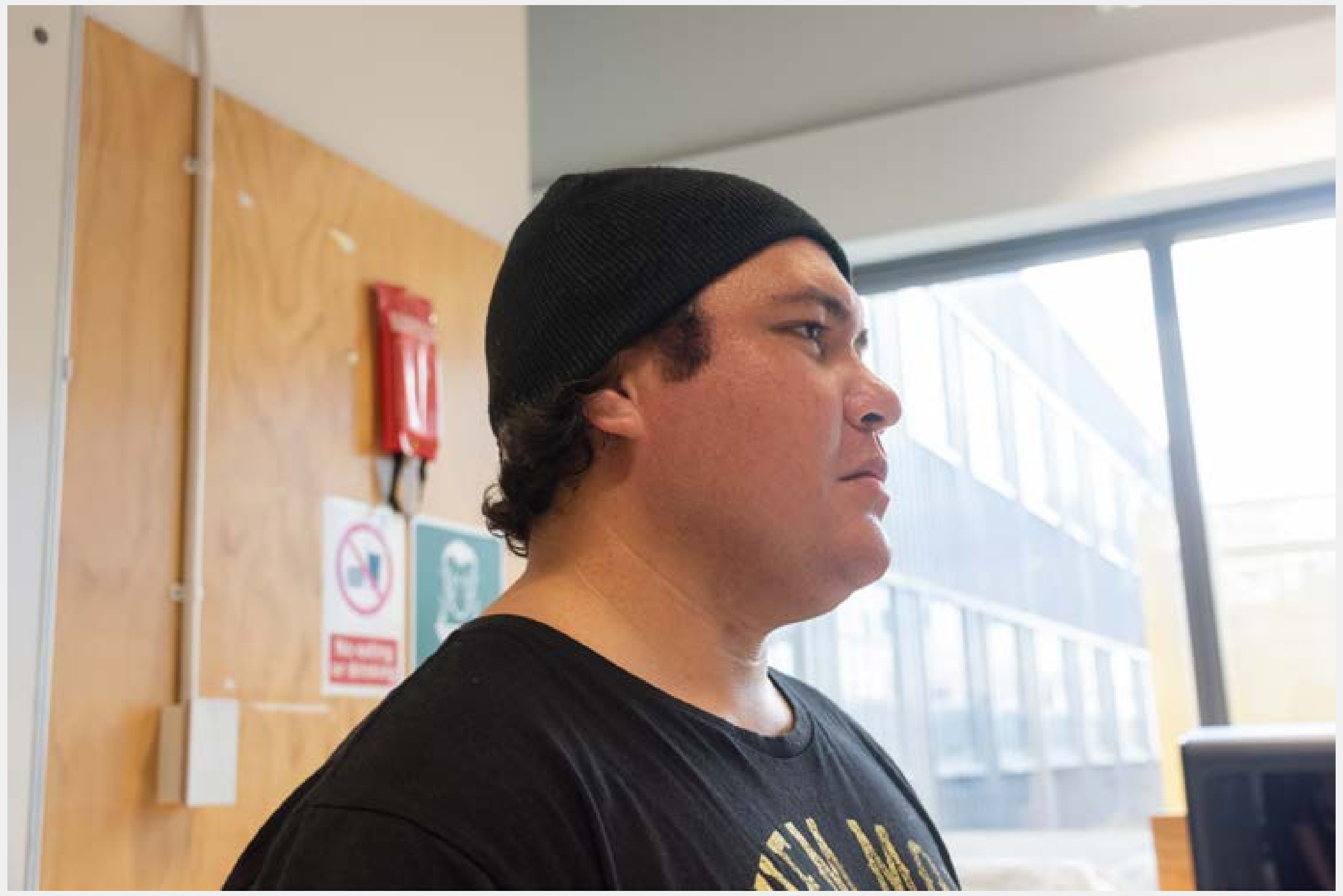
Camera:	**Nikon D5600**
Exposure:	**1/80s f/4.5 ISO 800**

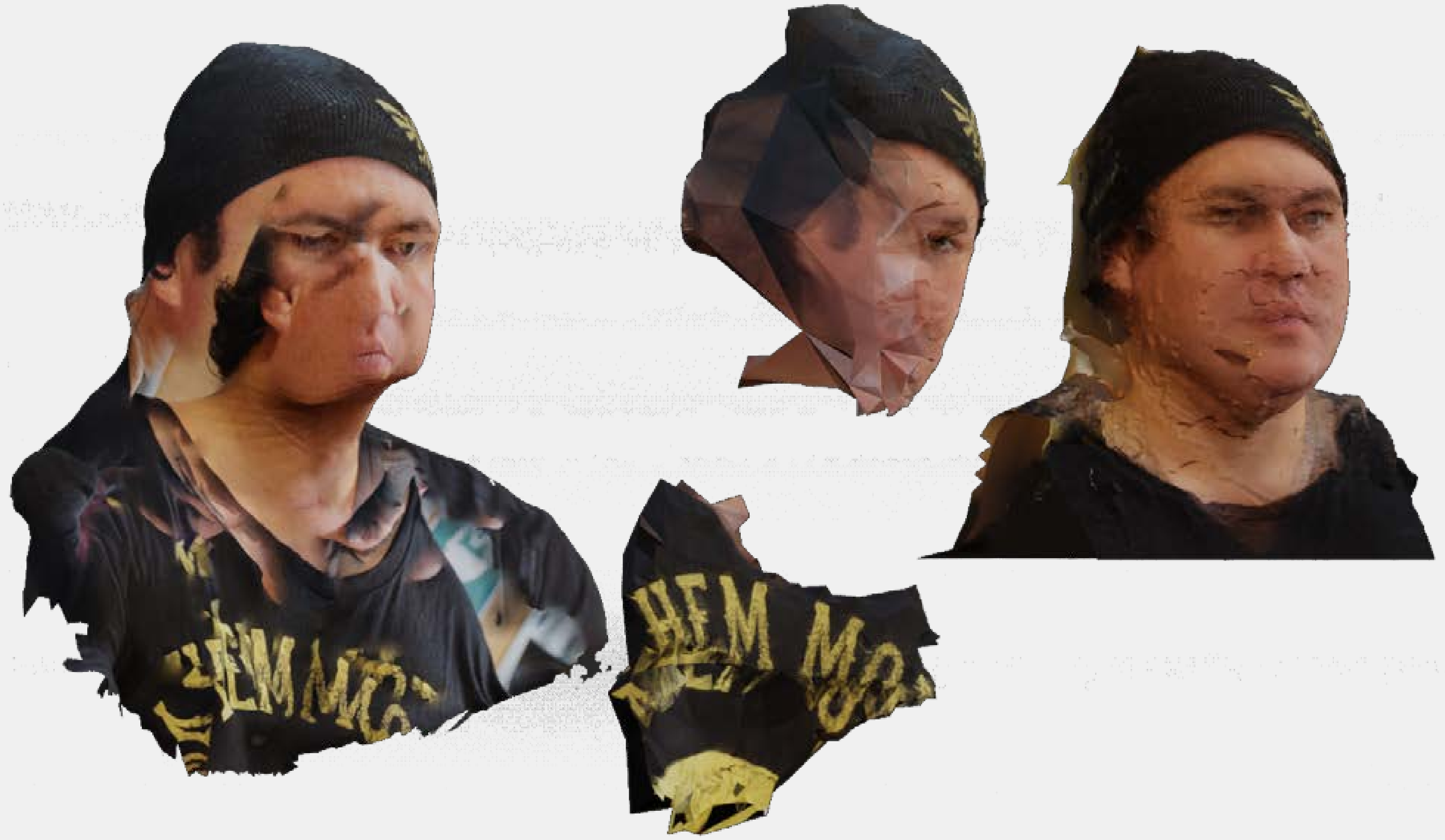
The lighting setup for this was similar to the photo shown, only without the reflective sheets or a tripod. Despite the object being fairly small, there were still hard shadows present. For the shots, I moved around the object in 3 rotations, with a few random close-ups for the sake of providing detail.

Janitor

Camera:	**Nikon D7200**
Exposure:	**1/50s f/5.3 ISO 1600**

For this test, the camera was mounted on a stationary tripod, with the object itself being rotated by another student on command. The tripod's height was adjusted after a full rotation.





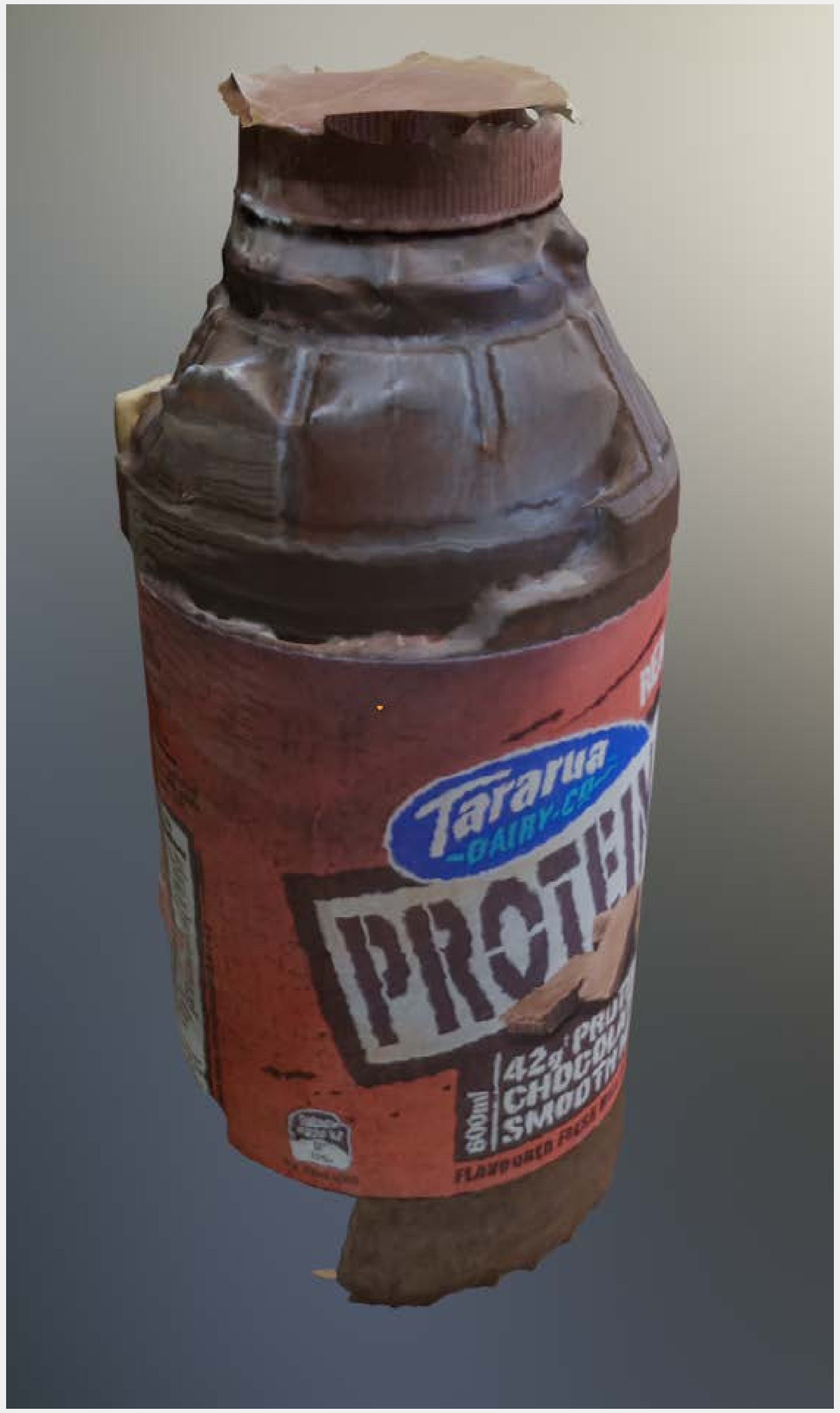
Dylan objectified by SCANN3D, Meshroom and RealityCapture

Assignment 1

Natural Lighting Tests

Camera:	**Nikon D5600**		
Exposure:	**1/100s**	**f/5.0**	**ISO 800**

This test of Dylan was deliberately taken in an unevenly-lit environment. This was the only object to be created in all 3 photogrammetry programs (SCANN3D, Meshroom and RealityCapture). RealityCapture managed to recreate most of his face, but Meshroom struggled with the side shown, which I assume was due to the overexposed background.

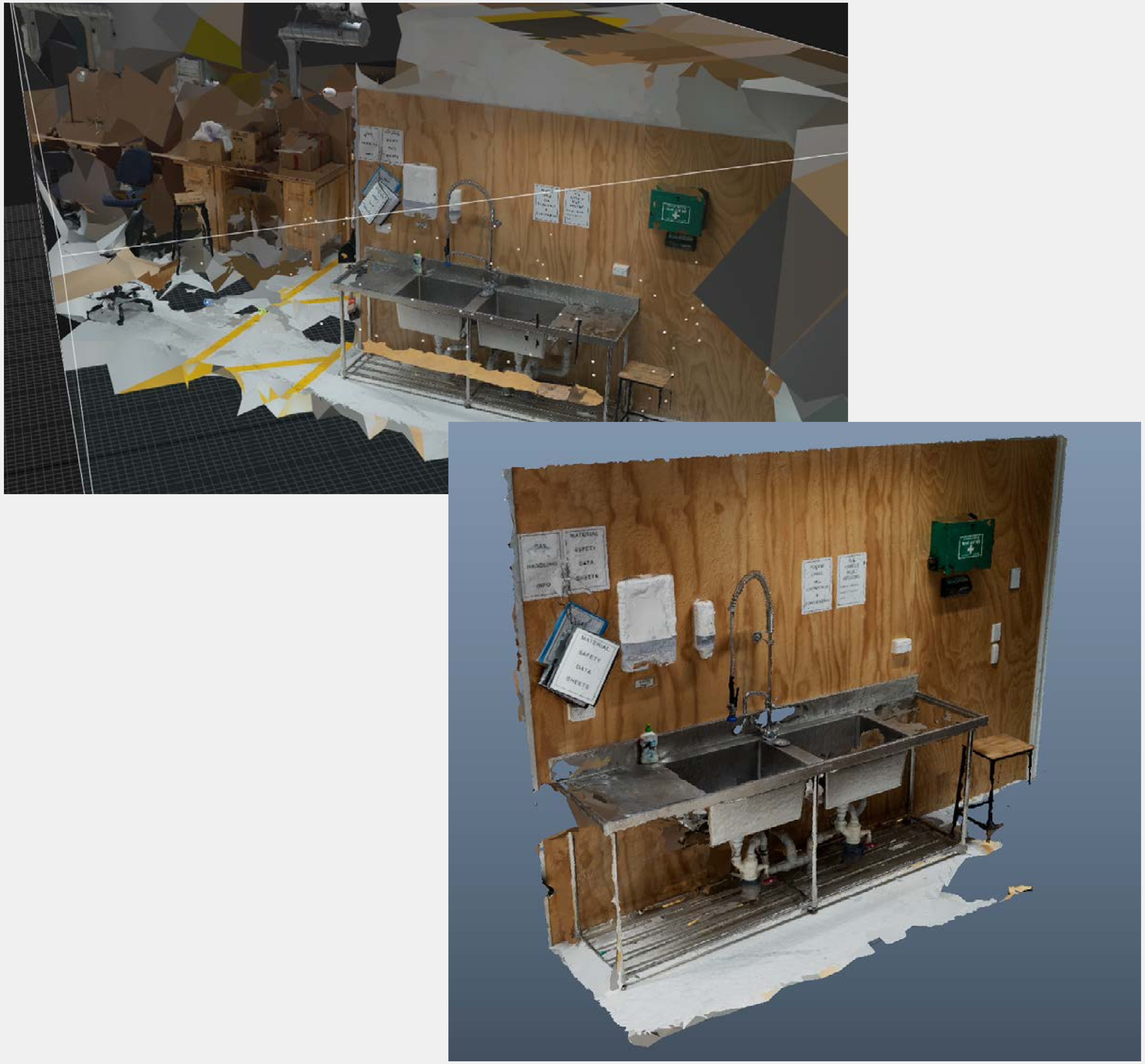


Assignment 1

Phone Camera Test

Camera: **Google Pixel 4**
Exposure: **Inconsistent**

I did a quick test of a chocolate milk bottle using my phone camera, which had the added convenience of faster autofocus amongst other things.



Assignment 1

Environment Test

Camera: **Nikon D5600**
Exposure: **1/80s f/5.6 ISO 800**

I took some photos from a section of the classroom. Although it was evening, the lighting was good, and I just clicked away from random angles.

The resulting object (made in RealityCapture), was tens of millions of polygons. Even the computers at school equipped with 32GB of RAM only just managed to import it.

I decimated the model (as shown before), then deleted all faces except for what's shown to the left.

I figured this would be a good background to use for stuff.

This particular test also made me realise how convenient photogrammetry could be for properly remodelling a real-life scene. It elimates the need for tape measures and getting proportions right. The basin shown for instance could be optimised with simple planes using what's already there as reference.

Assignment 1

DSLR Exposure Settings

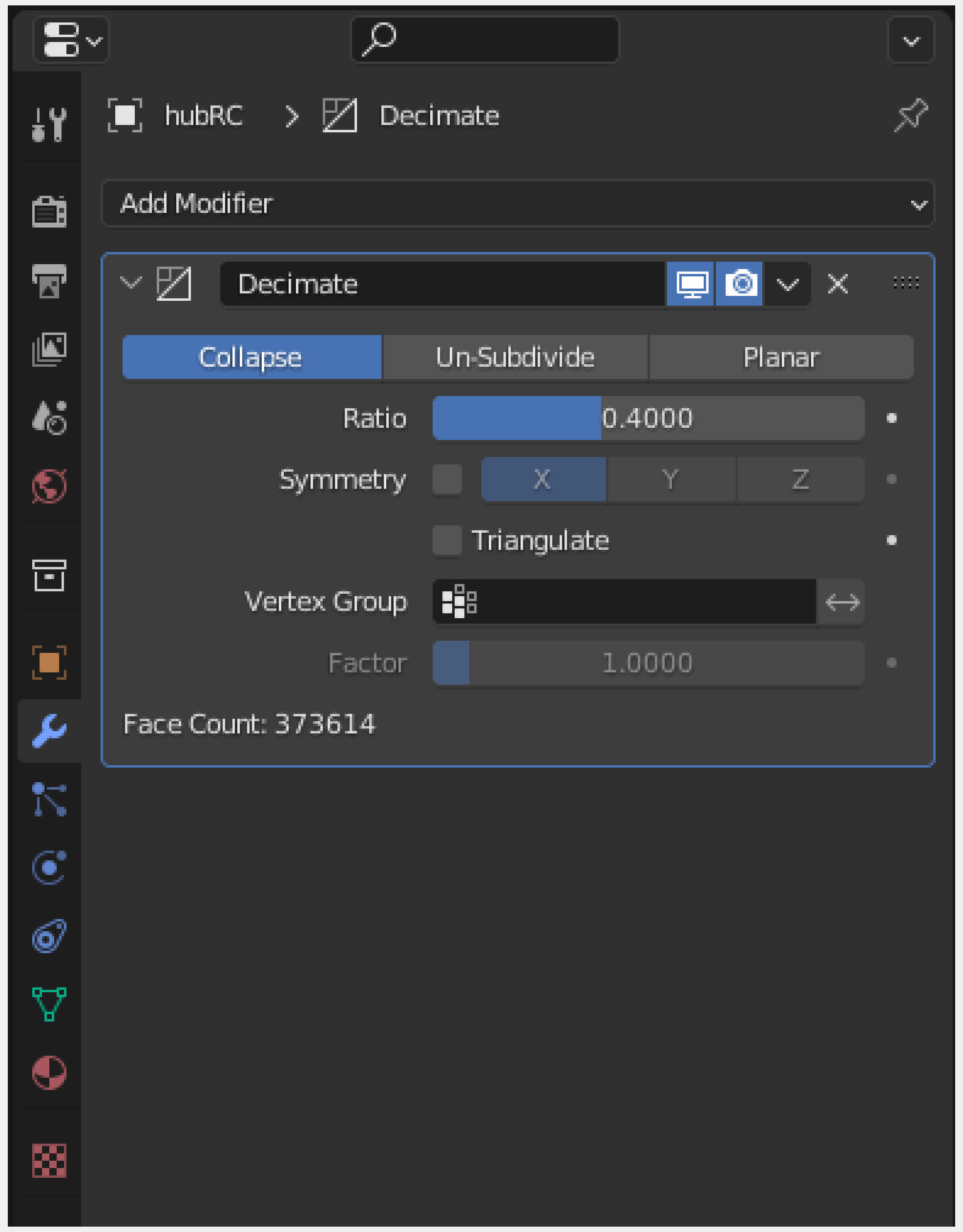
Stuff that feels like commonsense to a long-time photographer like me. Fast shutter speeds when holding the camera result in sharper shots, which are important for the software to pick up details. Depending on various things like wind and caffeine jitters, I found 1/80s to be the slowest ideal choice.

ISO could go up to around 800 before noise crept in. Not a huge deal as Lightroom’s denoiser works well.

For the aperture, I tried to leave it between f/5.6-9.0 where possible, to get enough depth in focus without crossing the line into lens diffraction at higher f-stops.

Photos were shot in RAW as always, but after developing were exported as JPGs because that’s all that was needed.

DSLRs are generally a better choice over phone cameras, although I found the focus-locking on my Pixel 4 useful when shooting the chocolate milk.


hubRC > Decimate

Add Modifier

Decimate

Collapse | Un-Subdivide | Planar

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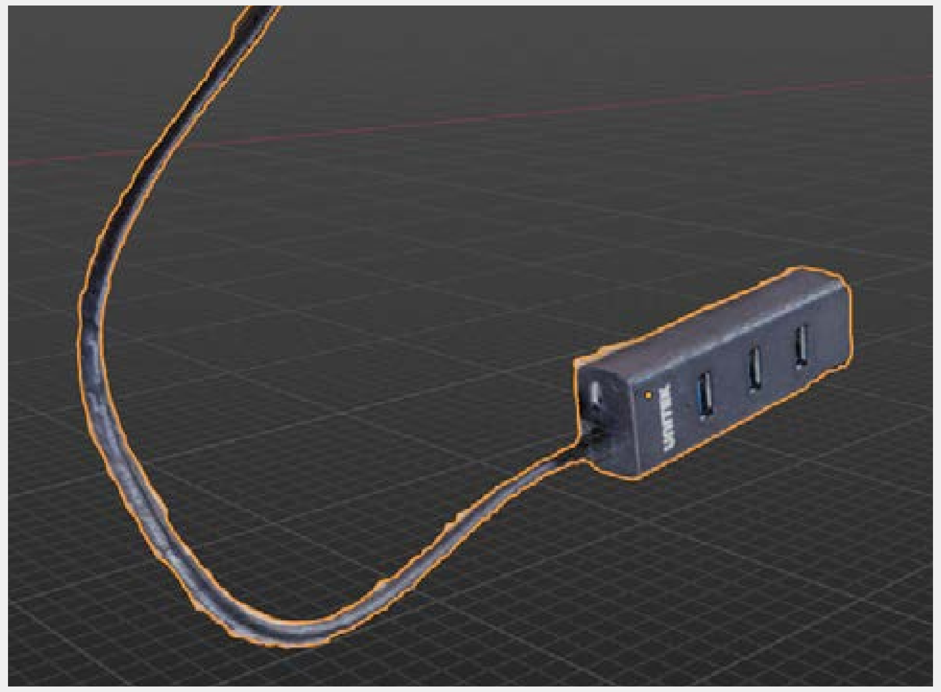
Symmetry □ X Y Z

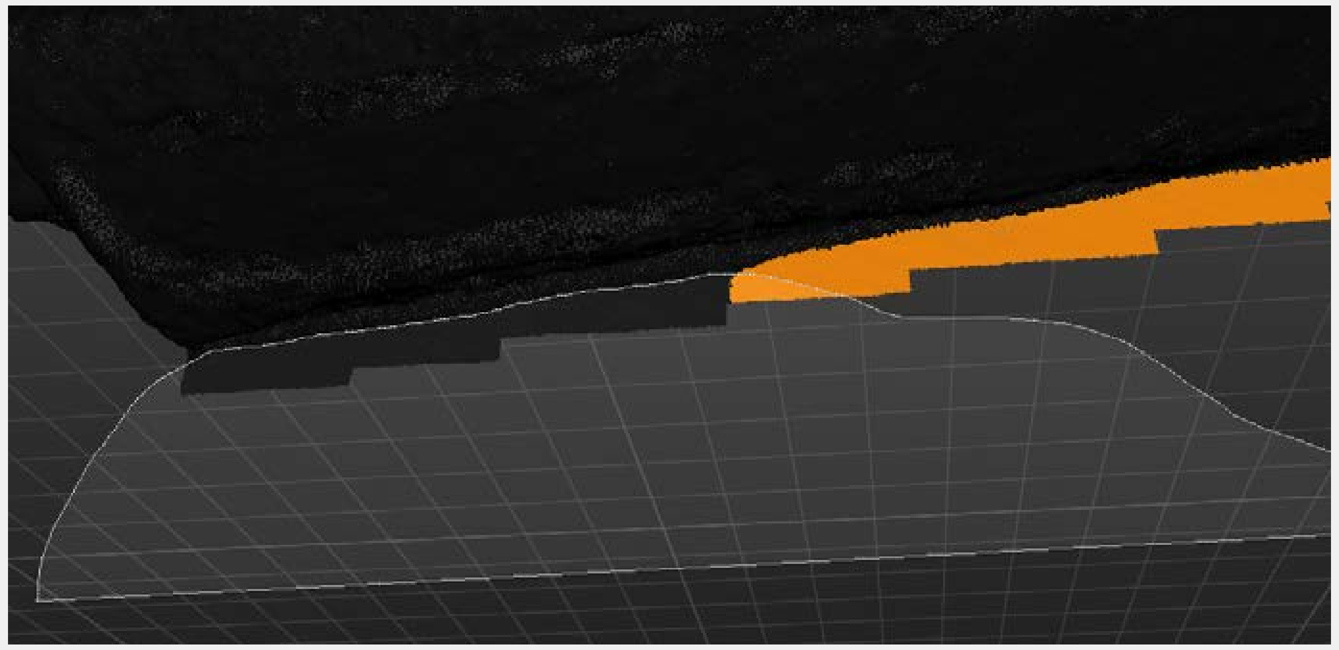
□ Triangulate

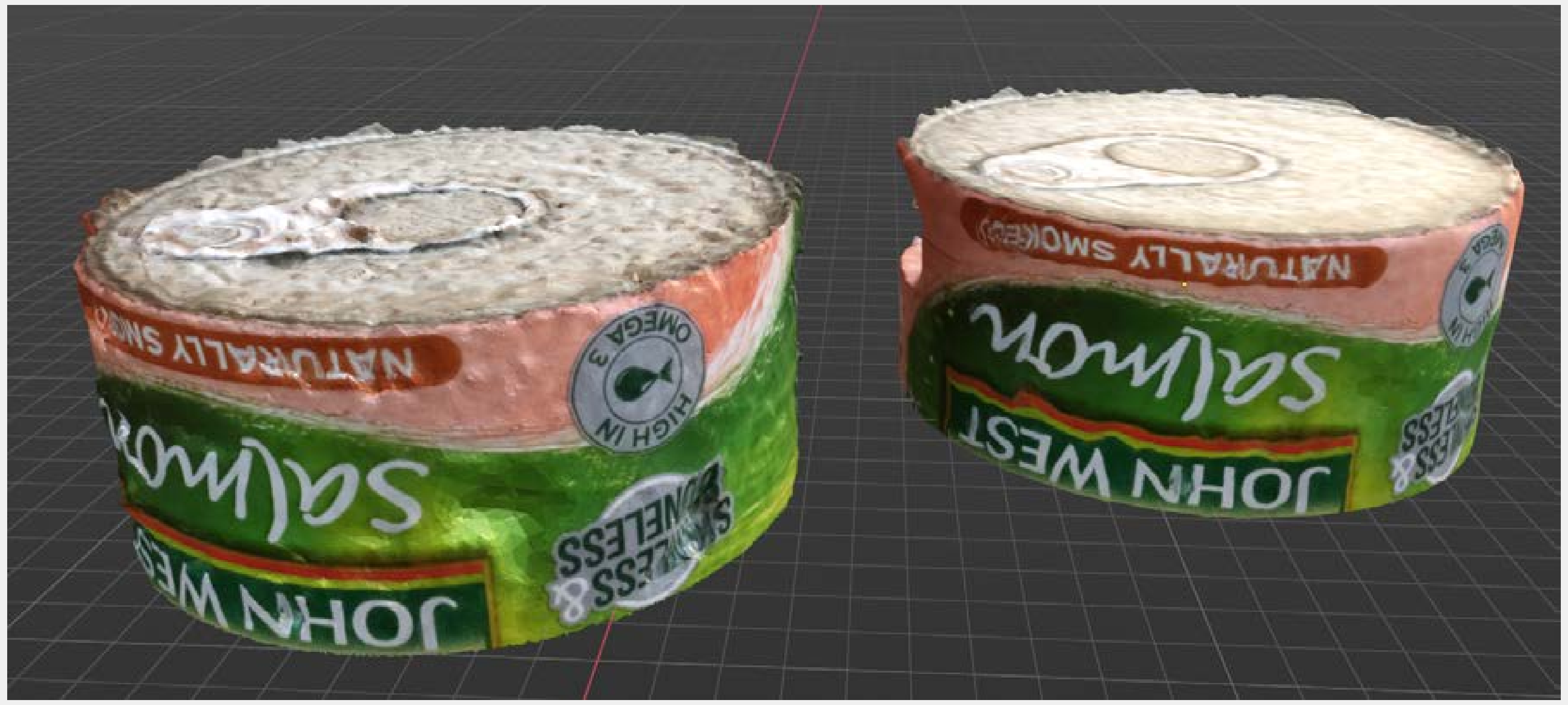
Vertex Group

Factor 1.0000

Face Count: 373614







Assignment 1

Blender Cleanup

Decimate

The first step after bringing the objects into Blender was to reduce the polycount. Some of the objects were very dense, namely Dylan's head, which had 12 million faces. This tool kept the overall shape without affecting the textures. The slider of interest, labelled Ratio, considers a value of 1 to be the original density, ergo I found a value of 0.3 to be adequate for most models.

Polygon deletion

The photogrammetry software would often consider bits of the background to be part of the object, and would include them in the model. To fix this, I simply switched to Edit Mode and deleted the unnecessary faces from around the subject.

Reshaping/Smoothing

By using Blender's sculpting tools, I was able to smooth the surface of the models to reduce the bumpy bits. This in combination with the Smooth Shading feature resulted in a cleaner model.

Assignment 1

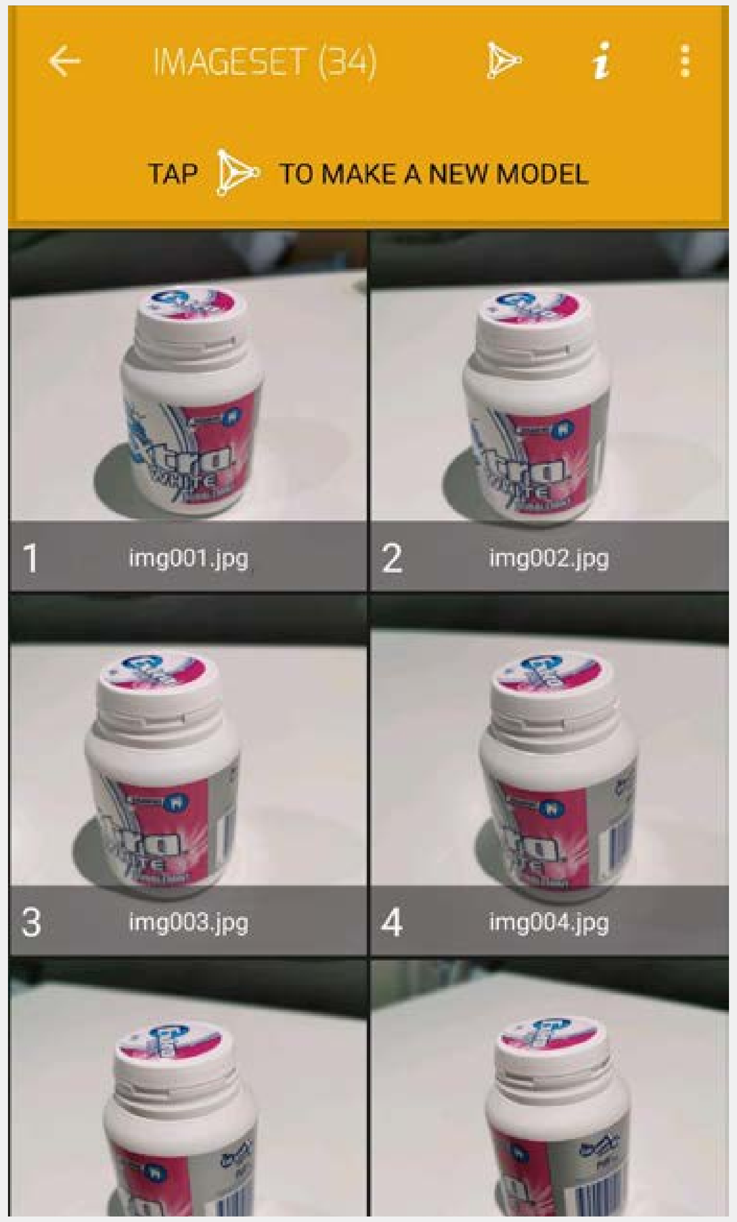
2017 and 2019 Tests

Turns out I did photogrammetry twice before, once in 2017 when I didn’t even know what it was called, then again in 2019 for an assignment.

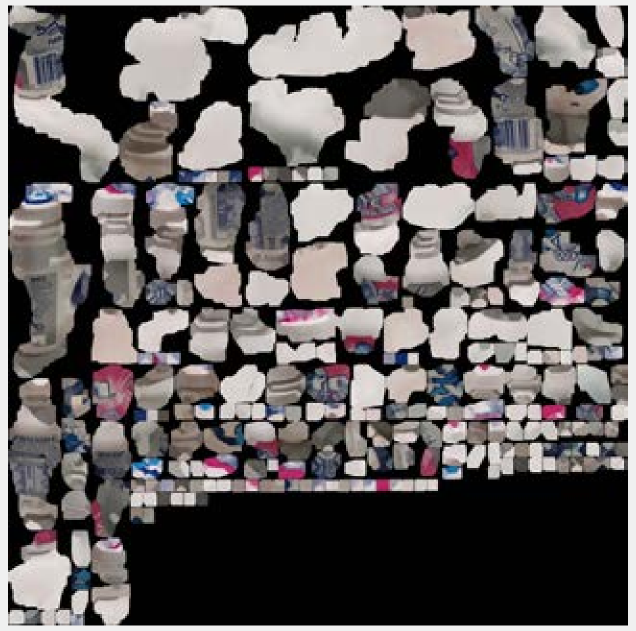
All I have of the former is a rendered video, but from what I remember this only used 5 shots from my phone’s selfie camera, which would explain the quality. I had brought this into Maya and done a simple gravity simulation.

The gum was made using SCANN3D, which would then be brought into a simple Unity model viewer of my own making and exported for the WebGL platform.

Photogrammetry test back in 2017

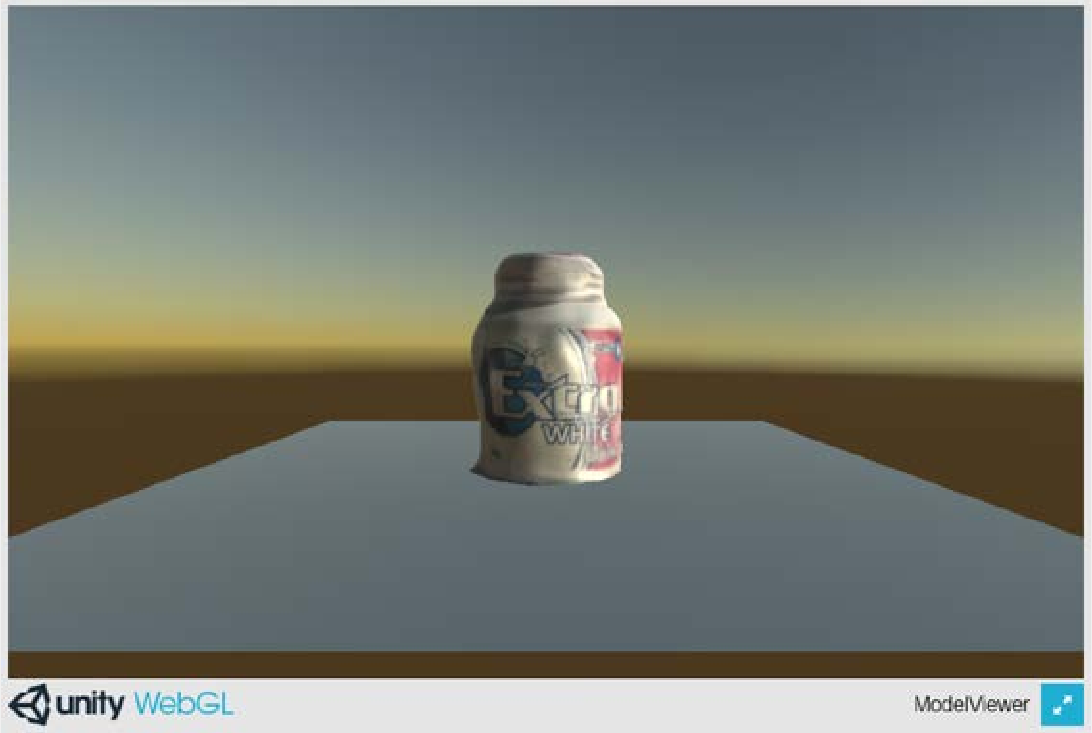


Source images



Gum texture

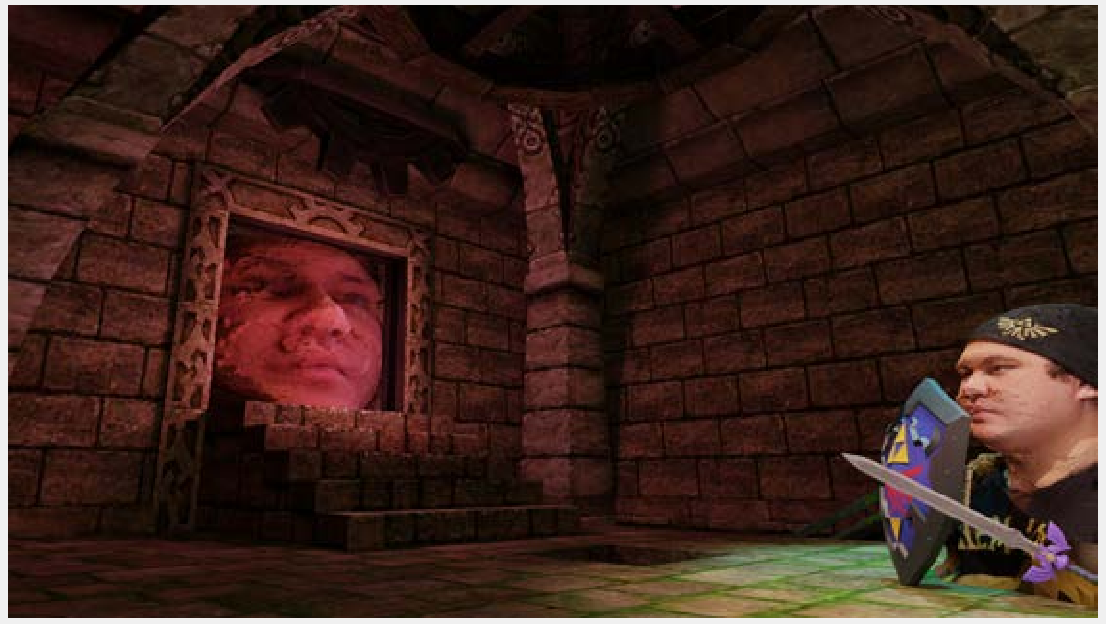
Gum preview

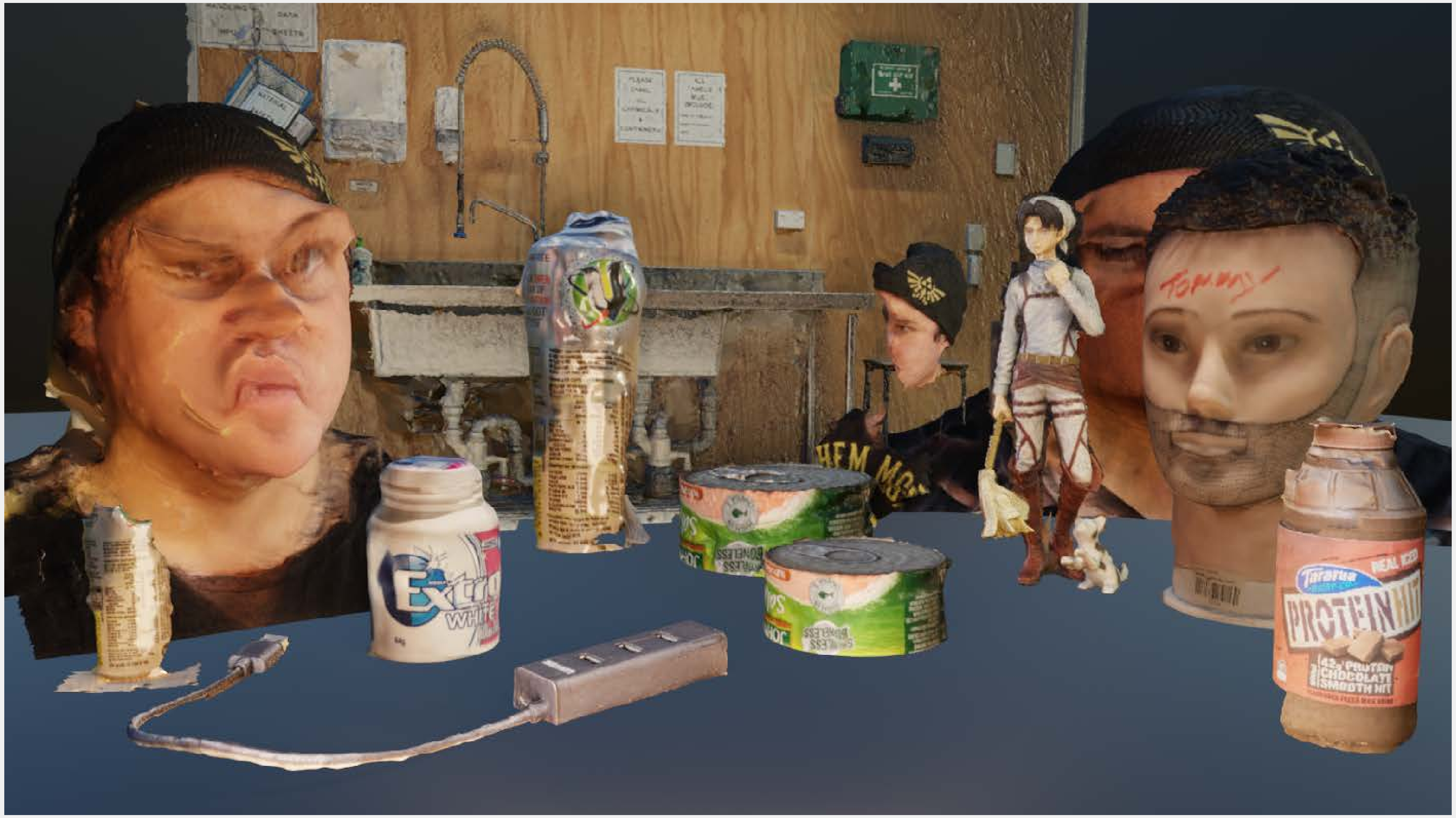


Gum shown in the Unity WebGL player

Assignment 1

Final Renders

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