Texturing, Lighting and Rendering

Character and Set Design
Interior Reconstruction (Stage 2)

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1 Introduction

This report details the lighting and shading stage of my virtual recreation of the upstairs seating area in Bakesmiths, a café and bakery located on Whiteladies Road, Bristol.

2 Challenges and Highlights

While lighting and texturing my diffuse grey scene, I encountered and overcame a number of obstacles. In this section, I will discuss both these obstacles, and the highlights of my scene.

2.1 Hanging light illumination

A collection of hanging lights form the foreground of my scene. These hanging lights consist of a black reflective shade paired with a bright exposed light bulb. Accurately recreating the visible bulb required a lot of experimentation – the list below summarises the different approaches that I tried:

- Replacing the bulb with a point light (This did not work as – without environment fog – point lights are not visible to the camera)
- Extracting the bulb geometry from the revolved light unit and subsequently creating an Arnold mesh light (This worked, however there was heavy aliasing due to the high contrast between the over exposed bulb and the comparatively darker background. See figure 1b)
- Creating the mesh light as above, then retaining the bulb geometry and assigning an emissive surface shader (This worked very well. See figure 1c)

(a) Original photo

(b) Creating mesh light from bulb

(c) Adding emissive surface shader

Figure 1: Recreating the hanging lights (photo is from a different angle)

2.2 Suppressing harsh mirror and window reflections

To illuminate the interior, I imitated sunlight using Arnold area lights placed outside each window. These lights are not normalised so the intensity is therefore related to the size of window. Within my scene, there is a mirror nearby and adjacent to the back window. As a result, this mirror very strongly reflects the area light resulting in a bright, solid white reflection (as seen in figure 2a). This effect is also seen in the window on the opposing wall (figure 2c).

(a) Over exposed mirror (b) Fixed mirror (c) Over exposed window (d) Fixed window

Figure 2: Mirror and window reflection correction

Fixing this lighting artefact was not easy; after lots of searching, I found that lights could be unlinked from specific objects in the scene. I proceeded to unlink the mirror and window panes from the back window area light, then created a new lower intensity area light linked only to these objects. The resulting mirror and window reflections are shown in figures 2b and 2d respectively.

2.3 Texturing the floor

The floor takes up a large portion of the scene; as a result, this was the texture that I worked on first. I had planned to use a photo of the floor as my texture, however the lighting conditions in this photo were not uniform. Instead, I found a wood texture online (figure 3a). I saved this texture, then modified the colour in Adobe Photoshop to better fit the original flooring (figure 3b). Since the floor is a rectangular plane, it was easy to apply the texture with replication in both U and V to maintain the texture aspect ratio.

(a) Online wood texture [1] (b) Colour changed in Photoshop (c) Displacement map

Figure 3: Flooring texture files

Figures 4a and 4b show the floor before and after texturing respectively. While this texture looked good, in reality the light casts very slight shadows between the planks. To recreate this effect, I made a

displacement map in Adobe Photoshop which perfectly matches the dimensions of the flooring texture (figure 3c). This displacement map is designed to be tileable (top and bottom lines have single pixel width, intermediate lines span two pixels), and has troughs where the floorboards meet. Figure 4c shows the final flooring arrangement, with both texture and displacement applied – I am very pleased with this shader.

(a) Floor shader without texture (b) Floor shader with texture (c) Displacement map applied

Figure 4: Applying the floor texturing and displacement

2.4 Decorating the blackboard panels

To texture the left wall blackboards, I first used Adobe Photoshop to perspective-correct front on photos, producing decals. I then collated these decals side by side; this allowed me to use the same shader for each board. In the Maya UV editor, I positioned each board projection over the corresponding decal, ensuring I was snapping to boundary pixels. Figure 5 demonstrates this with the UV positioning of the leftmost blackboard.

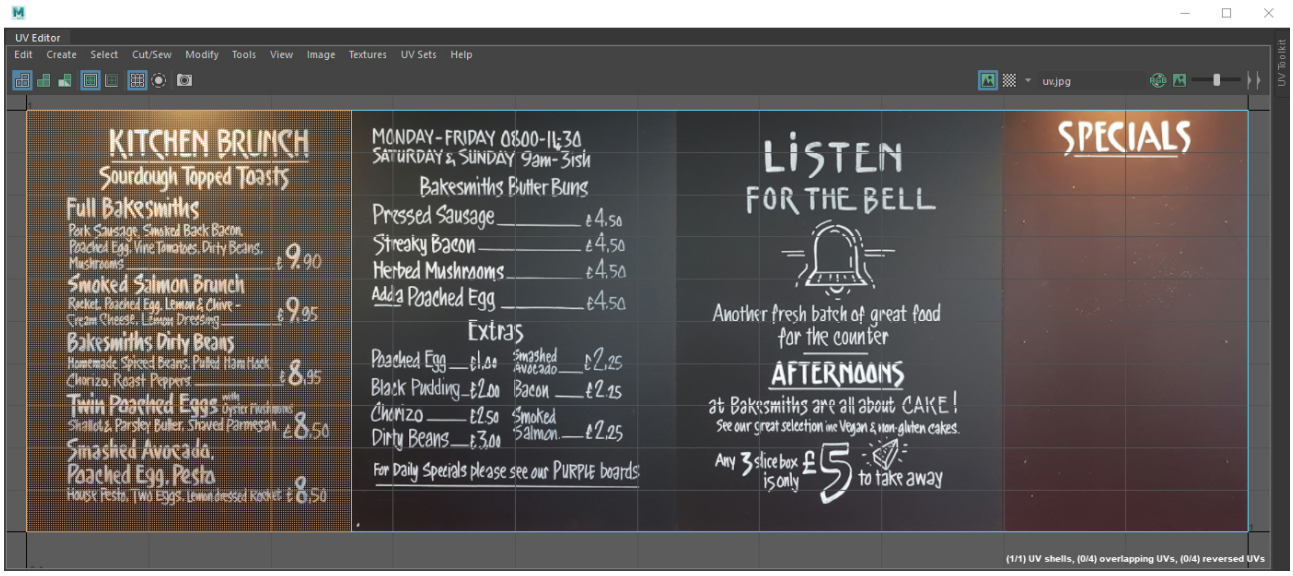


Figure 5: Positioning the planar projection of the leftmost board in the UV editor

2.5 Texturing the chairs

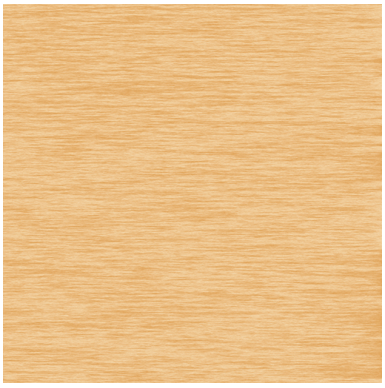
As there are many chairs in my scene, each at different angles, recreating them accurately was important. The chairs have textured laminated wooden supports alongside copper pipe legs, as shown in figure 6a.

(a) A reference photo of a chair and table

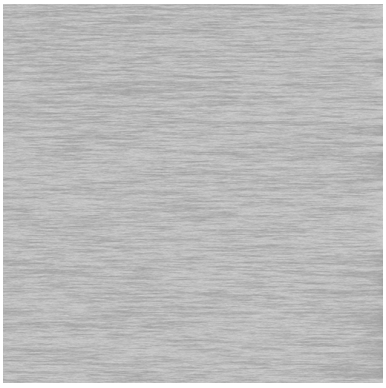
(b) An isolated render of a chair

Figure 6: Chair comparison

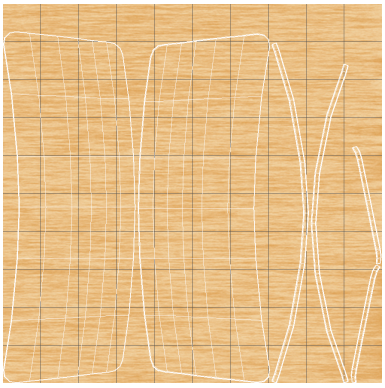
I first created a separate shader for the legs and supports. The leg shader is a simple adaption on the $aiStandardSurface$ copper preset, and the support shader has a mostly matte finish with a thin coat to simulate lamination. With the leg shader complete, I then applied a fine grain wood texture which I found online to the base and back of the chair (figure 7a). I used the Maya automatic UV explosion feature to correctly map this texture to the surfaces; since some chairs were rotated to arbitrary angles, a planar projection would not be suitable. Figure 7c shows the UV space for the chair back overlaid on the wood texture.



(a) Original chair texture [2]



(b) Chair displacement map



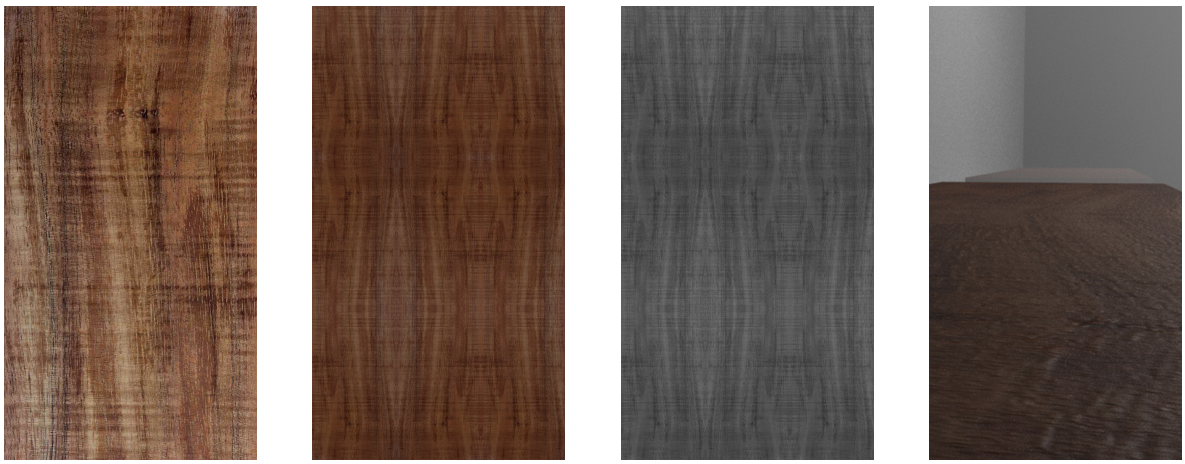
(c) Chair back UV map

Figure 7: Textures applied to the chair supports

To improve the chair further, I applied a subtle displacement map to the supports. This displacement map, shown in figure 7b, is a greyscale version of the original chair texture. Subsequently, the displacement aligns perfectly with the grains. This displacement map gives a slight ribbed texture to specular highlights on the chair when rendered, adding to the realism of the scene.

2.6 Texturing the rectangular table

I textured the rectangular table in the same way that I textured the chairs. I first found an online wood texture, then I modified it in Photoshop, simultaneously producing a greyscale counterpart. I then applied both the texture and displacement to the automatic UV explosion.



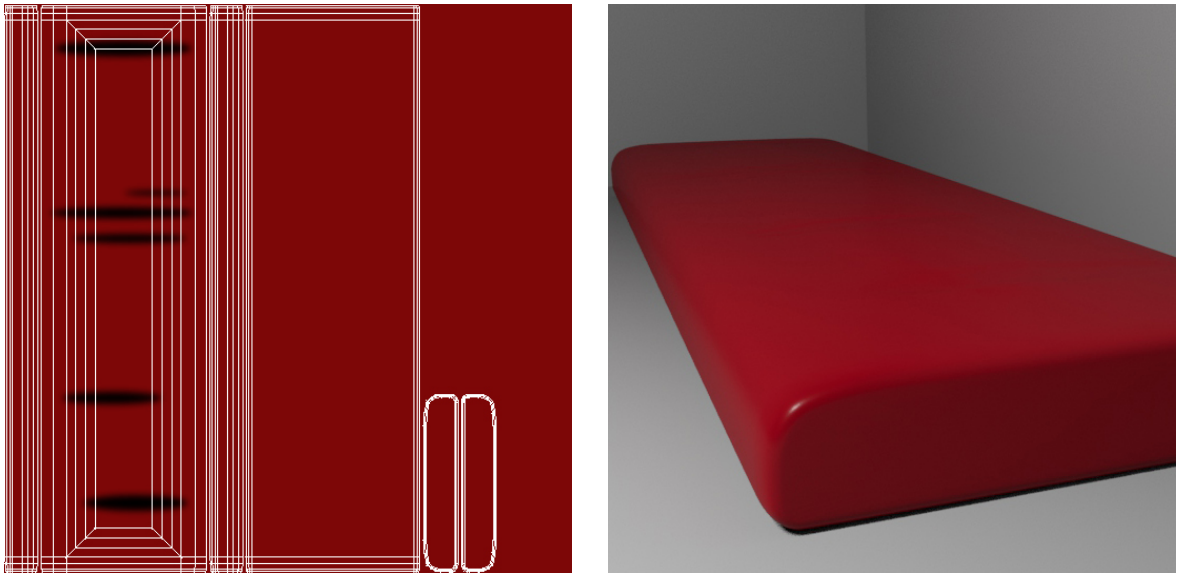
(a) Online texture [3] (b) Photoshop changes (c) Displacement map (d) Isolated render

Figure 8: Texturing the large rectangular table

As this table is quite distant from the camera, I did not put further work into improving it as changes would only be represented in a very small region of the final render.

2.7 Texturing the bench

The red leather bench proved hard to texture. While it looked good with a simple surface shader applied, the cushions were too perfect and did not reflect the same wear as seen in person.



(a) Creating the displacement map for the cushion (b) Displacement map applied to cushion

Figure 9: Adding surface imperfections to the bench cushions

The bench in Bakesmiths has thin depressions where customers frequently sit. To recreate these, I made a displacement map from scratch:

1. I exploded the UV space using the Arnold automatic UV function, exporting the result to Photoshop
2. I added black ellipses to areas where dips are seen in the cushion
3. I applied a gaussian blur to the ellipses to soften the edges of the resulting depressions
4. Finally, I applied the displacement map to the cushion using the node editor in Hypershade and rendered the result (figure 9b)

Though the effect of this displacement map is subtle, it achieves my goal of introducing surface imperfections and I am very pleased with the result.

I also experimented with the application of the built in Maya procedural leather texture. Due to the very small scale of the texture in comparison to the distance from the camera, the result was noisy. Furthermore, the repetitive nature of this texture was prominent in the render. Upon studying photographs of the physical bench, I realised this texture was not visible from a distance and subsequently decided to remove texturing from the bench altogether.

2.8 Realistic lighting

As my scene has lots of light sources, perfecting the lighting took a lot of trial and error. To learn more about lights, I watched a Solid Angle tutorial[5]. When working on a light, I would isolate it in the light editor so that only it illuminates the scene. This technique allowed me to fine tune each individual light such that the resulting scene looked realistic. I experimented with all available light types until I was happy with my scene. The final scene contains:

- Point lights
  - Ceiling mounted cylinder lights
- Area lights
  - Sunlight through windows
  - Single central florescent light
- Mesh lights
  - Hanging spiral lights
  - Blackboard illuminating lights
- Directional lights
  - Additional subtle sunlight beam at an angle through side window

2.9 Background image and out-of-shot textures

As a large portion of my scene is occupied by front facing windows, I had to place something behind them – leaving them as blank white regions looked very artificial. I placed a plane outside the windows and used a photo which I took with my camera pressed against the glass as this backdrop. I assigned this photo as a texture to an *aiUtility* shader, changing some attributes to prevent this plane from being affected by lights (I learnt this technique from Yone Santana's tutorial[4]).

A challenge was to align the plane correctly to produce the right perspective view. Since the shot camera in the scene is placed in an unreachable location in the café, I could not take a reference photo. Instead, I inferred the position from a series of perspective photos taken around the café.

The front wall of the café has two mirrors in real life. As this wall is out of shot of the camera, only the reflections are relevant. To recreate these reflections, I gave the whole wall a mirror texture, setting it to transparent from one side such that the camera can see through it.

2.10 Camera settings

To make the render look more like a photo, I applied a depth of field effect. As this is not a closeup image, I used a very small aperture value and set the focal point to the central table. While this change is subtle, it helps bring realism to the scene.

2.11 Render settings

As my scene contains no environment fog, I set the volumetric sampling to 0 to improve render times. My final scene was rendered with the settings shown in table 1 and took approximately 11h 30m to render on my laptop. To learn more about render settings, I watched a Solid Angle tutorial[6].

Sample type	Number of samples
Camera (AA)	8
Diffuse	5
Specular	4
Transmission	2
SSS	2
Volume Indirect	0

Table 1: Final render settings

3 Conclusion

Figure 10 shows the final render of my scene – I am very pleased with how it turned out. The progression of the shading process is shown in figure 11.

Figure 10: The final render of the scene

Given more time, I would have liked to improve this render further. I would have added fine procedural noise texture and bump maps to objects such as the banister, light shades and walls. Also, I would have liked to experiment with modelling the scene at a different time of day, perhaps introducing god rays.

If I were to recreate another interior, I would use my new knowledge of shading to my advantage when modelling the geometry. While I did not have to modify much geometry when shading, there were a few times when I had to extract faces from an object. This step could have been avoided had I modelled some objects with shading in mind.

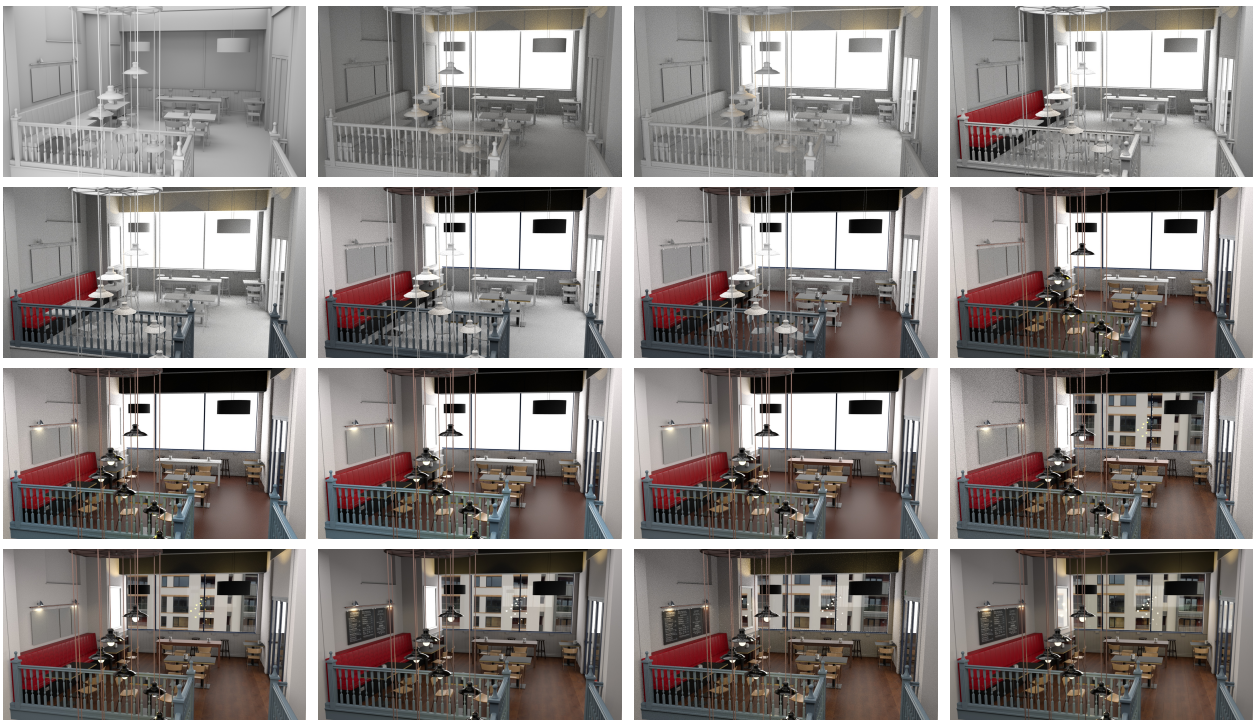


Figure 11: Renders showing progression of shading

References

[1] Floor texture,
https://www.karndean.com/a/media/images/products/swatches/product-listing-images/product-overheads/korlok/rkp8110antiquefrenchoakoverhead.ashx

[2] Light wood texture,
http://www.photosinbox.com/download/light-wood-texture.jpg

[3] Dark wood texture,
http://i0.wp.com/stringsmagazine.com/wp-content/uploads/2016/11/YIOpener.jpg

[4] Yone Santana - Interior Lighting with Arnold,
https://www.youtube.com/watch?v=mTGHba6yIr4

[5] Ben Greasley - Arnold for Maya Tutorial - Lights,
https://www.youtube.com/watch?v=oj6Rnmos5oE

[6] Ben Greasley - Arnold for Maya Tutorial - Render Settings,
https://www.youtube.com/watch?v=Glij5HdW630