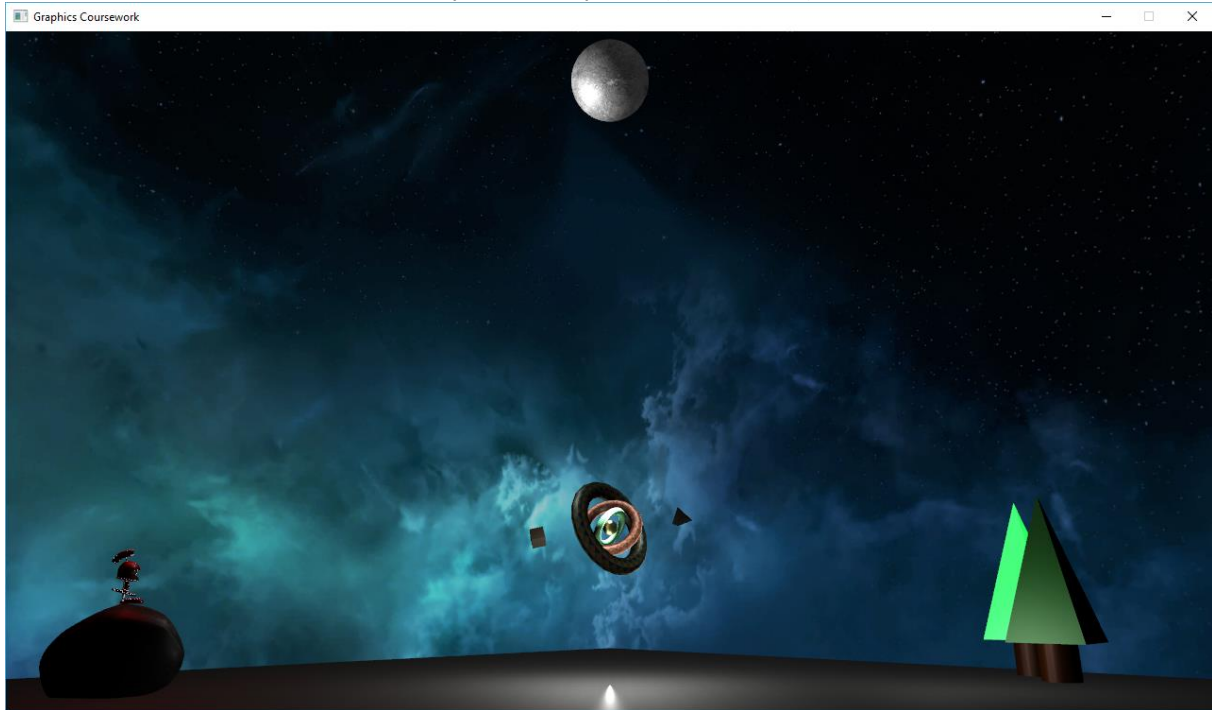# Minimalism

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Figure (a)

Abstract

The purpose of this project was to display what I have learned throughout the model so far by way of creating a 3D scene using C++ and OpenGL, implementing the following techniques; multiple lights, multiple cameras, geometric transformations/transform hierarchy, texturing (with an instance of normal mapping), shading and shadowing. My project is interesting as it uses all of the above methods (excluding shadowing) but manages to retain its simplicity despite all of its complexity and captures the viewer whilst simultaneously pleasing them aesthetically.

Keywords: *multiple lights, texturing, normal-mapping, transform hierarchy, shading.*

Introduction

- Multi-lighting (spot / point), see figure (b)
- Transform hierarchy / multiple transforms, see figure (c)
- Texturing, see any figure
- Normal-mapping, see figure (d)
- Multiple cameras, see any figure
- Skybox, see figure (e)

My own personal goal was to create a unique and somewhat realistic 3D environment whilst also keeping with the assessment criteria. The initial concept was to have a fantasy forest, if

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you will, with a mystical artefact that was kept in place by a stone dais in the centre of the scene. With high ambitions, I also aimed to have terrain, procedurally generated trees and perhaps even a small stream. The initial goal has not changed and I, of course, aim to attempt all of the above for my final 3D scene whilst also staying true to the original scene showcased here. The difficulty in this project was combining all of the different workbook lessons together in a way that worked seamlessly and well, as sometimes (most of the time) one thing or another did not want to play nice. Limitations came only in the form of doing some things I had never even attempted before and more so in my own self-doubt.

Related Work

The inspiration for my initial concept came from a combination of settings and scenes from *The Elder Scrolls* series. My environment coming from *Valenwood*, an area within *The Elder Scrolls: Online* (see figure (f)) and the contents of my scene (the mystical artefact) was inspired by the Lexicon puzzles in *TESV: Skyrim* (see figure (g)).
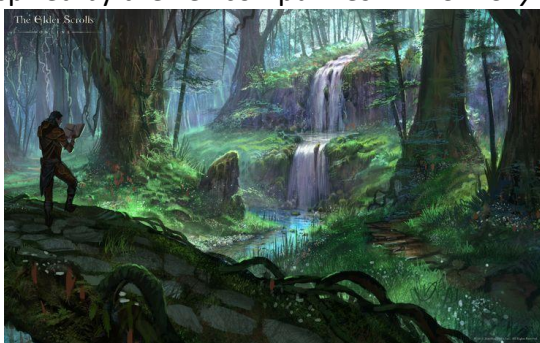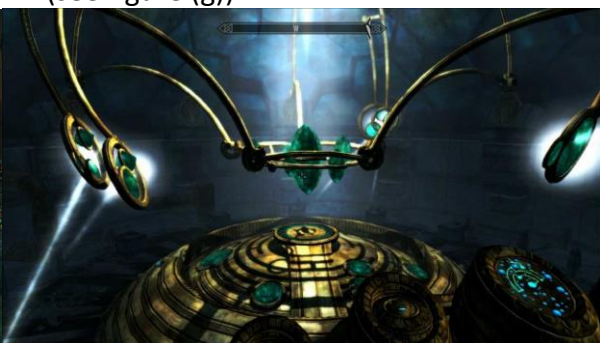

Figure (f)   Figure(g)

Implementation

Skybox

Without a Skybox, the scene felt crude and empty. In creating a cube and mapping a texture per each inside face allowed for a seamless setting for the project. During the rendering process of said Skybox the depth-buffer had to be disabled temporarily to ensure that the Skybox gives off the illusion that it appears to be in the distance.

Figure (e)

Normal-mapping

This is the technique of layering a Normal texture under the object's surface texture to give it the appearance of a more defined and realistic 3D surface representation. As there was already a moon in the scene, it was decided that because of its craggy surface in the real world that this would be the mesh that was to be normal-mapped.

```
glUniformMatrix3fv(moon_eff.get_uniform_location("N"),
                   1,
                   GL_FALSE,
       value_ptr(moon.get_transform().get_normal_matrix()));
```
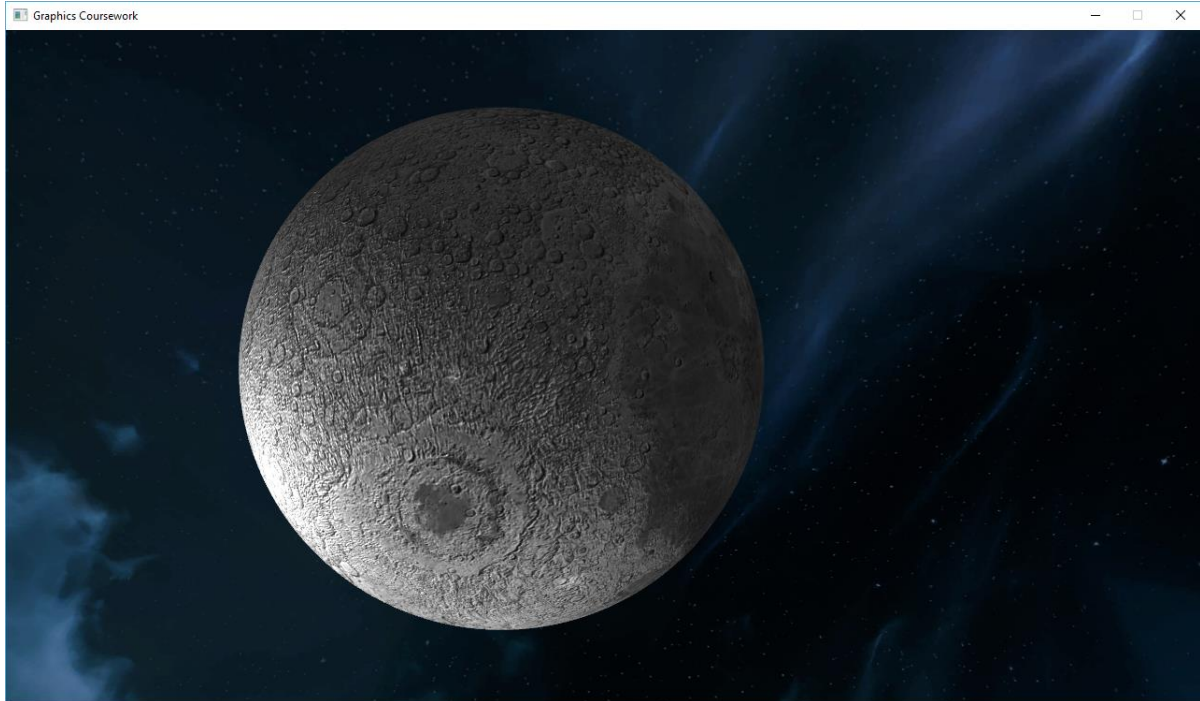

Figure (d)

Future Work

If there was more time and my knowledge was greater I would like to make the addition of several things, the aforementioned terrain; procedurally generated trees; a stream/body of water, dynamic lighting (night/day) along with a few post processing techniques (greyscale/sepia, pixelation, etc.)

Conclusion

Getting to this point was both stressful and frustrating at times, but through sheer determination and perseverance I feel that I have created something beyond what I envisioned. My scene as it currently stands barely hints at my initial concept, however, overall, I am very happy with the result of my hard work (so far) and hope to extensively build upon, not only my scene, but also my knowledge of Computer Graphics. For the final version of this project I would like to implement some of the graphical features mentioned in *Future Work* as these would really flesh out my 3D scene and bring me one step closer to the above goal.
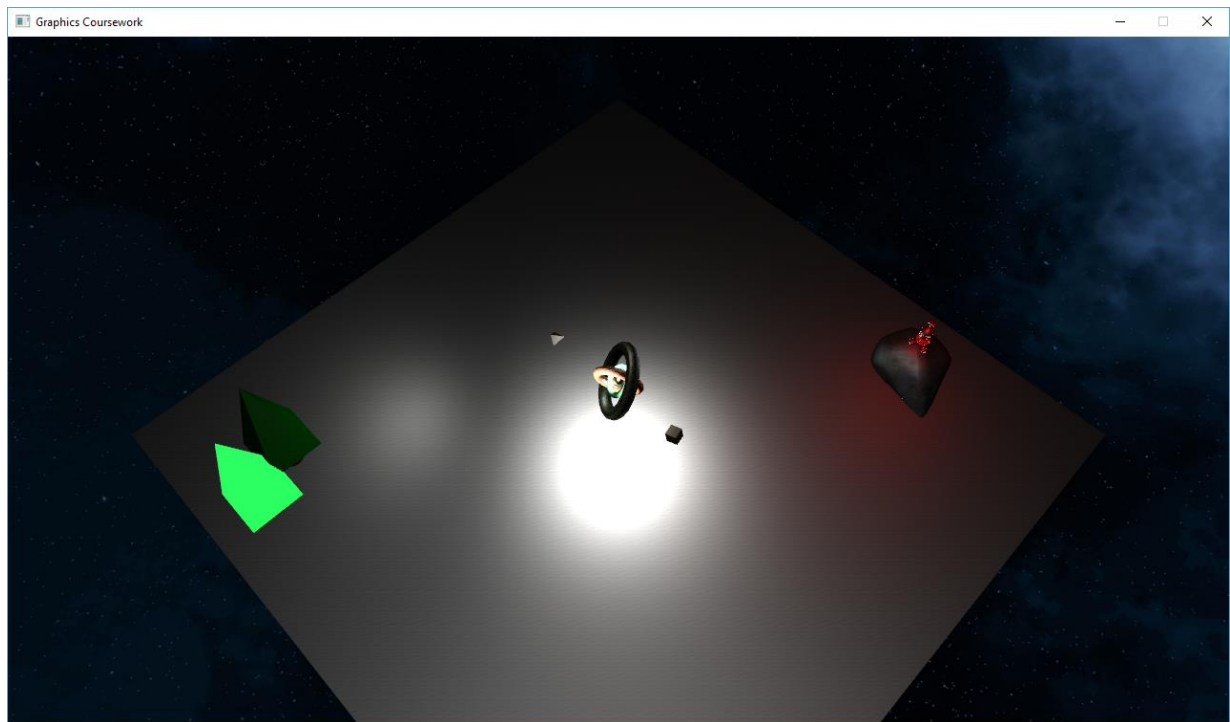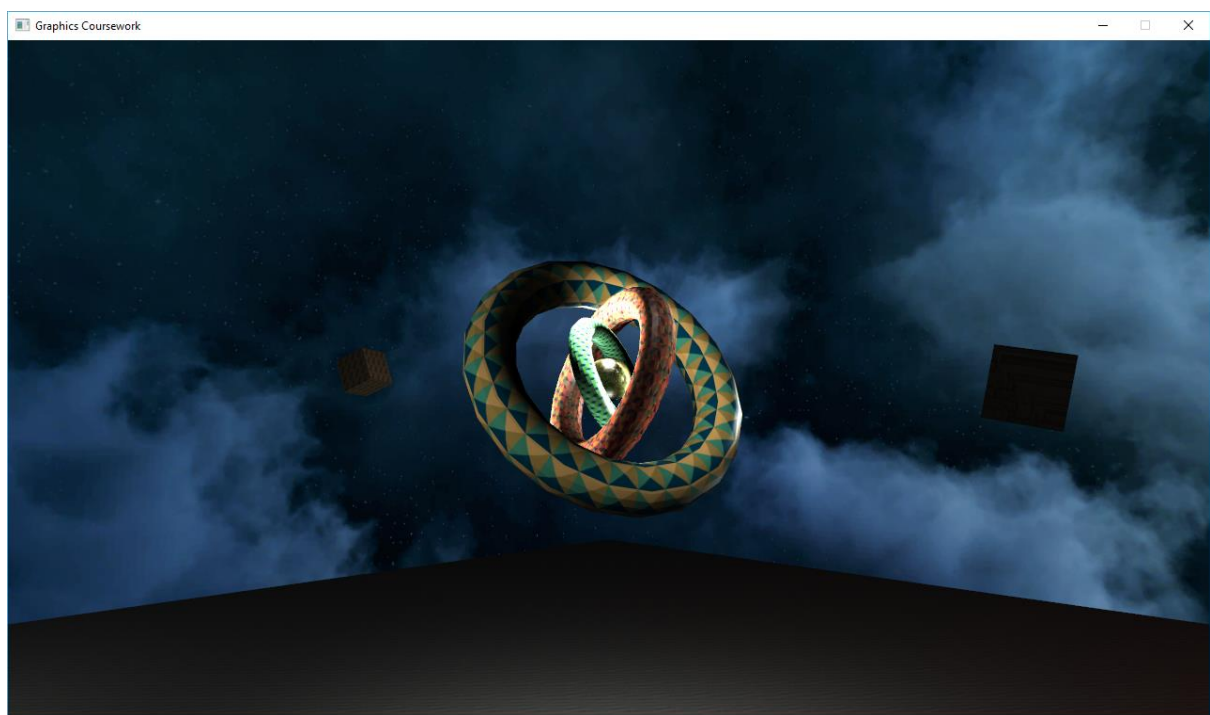
References

Computer Graphics Workbook

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Figure (b)

Figure (c)

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