

Into the Graphics-verse: developing an OpenGL rendering engine and short in the style of ‘Into the Spider-verse’ in a ten week period

Kolton Yager, Douglas McGirr, Elleis Souza, Matthew Key, Camden Stocker, Jack Pietrock, Jillian Empey, Kelsey McDonough, James Asbury, Jacob Loh, Zoë J. Wood
California Polytechnic State University (Cal Poly)
San Luis Obispo, CA
zwood@calpoly.edu

ABSTRACT

As part of a project based graduate course, we developed a computer graphics rendering system and original CG animated short in the style of ‘Spiderman:Into the Spider-verse’. We present the rendering system we developed using OpenGL to support producing the original CG animated short with numerous rendering effects, including color bleeding using an approximate many lights implementation and numerous cartoon rendering styles. The short was produced by students creating original models and animations in Blender, then exported in the gltf format and rendered using our OpenGL system.

KEYWORDS

computer graphics engine development, production pipeline in a technical course, cartoon rendering effects

ACM Reference Format:

Kolton Yager, Douglas McGirr, Elleis Souza, Matthew Key, Camden Stocker, Jack Pietrock, Jillian Empey, Kelsey McDonough, James Asbury, Jacob Loh, Zoë J. Wood. 2020. Into the Graphics-verse: developing an OpenGL rendering engine and short in the style of ‘Into the Spider-verse’ in a ten week period. In *Proceedings of ACM Conference (Conference’17)*. ACM, New York, NY, USA, 2 pages. <https://doi.org/10.1145/nnnnnnnn.nnnnnnnn>

1 INTRODUCTION & BACKGROUND

Creating authentic production style learning experience for students in computer graphics courses can be a challenge. In the fall of 2019, an experimental project based graduate level computer science course focused on providing students with the opportunity to be creative and develop their technical computer graphics skills while producing an animated short.

During this ten week course, we wrote and developed the script, assets and software for an original animated computer graphics short in the style of ‘Spiderman:Into the Spider-verse’. The short is titled ‘Into the Graphics-verse’ and depicted a brief imagined story of what might have happened to the spider after it bit the main human protagonist, Miles. The short includes spiders from various other multi-verses, similar to the original movie each of these hero spiders (Miles, Noir, Gwen and spider-pig) have their own rendering style.

Conference’17, July 2017, Washington, DC, USA

© 2020 Association for Computing Machinery.

This is the author’s version of the work. It is posted here for your personal use. Not for redistribution. The definitive Version of Record was published in *Proceedings of ACM Conference (Conference’17)*, <https://doi.org/10.1145/nnnnnnnn.nnnnnnnn>.

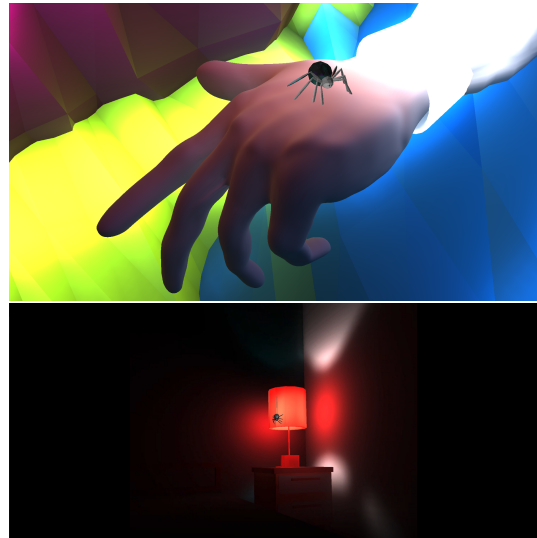


Figure 1: Many lights OpenGL implementation rendering of two scenes, one when our hero spider starts its life like a normal spider in a room (descending on lamp) and later when it bites a human.

The specific rendering technologies developed using OpenGL, include:

- Global illumination: The global illumination system used in several scenes of Into the Graphics-verse is based on the concepts illustrated in Many Lights [1]. It uses a multi-pass algorithm to place virtual point lights (VPLs) in the scene and renders the scene using a deferred shading [3] approach (Figure 1). After the render pass, objects with custom shaders are processed and the images produced during the render pass and the custom shader pass are composited together. During the deferred shading geometry pass, the locations of globally-illuminated objects and objects with custom shaders are recorded so that they can be placed appropriately during the composite pass, so as to preserve the correct depth in the scene.
- Animated Comic Panels: The comic panels implementation operates primarily by using various alpha map textures to “mask” portions of the scene which should only be shown through one specific panel, which change over time.

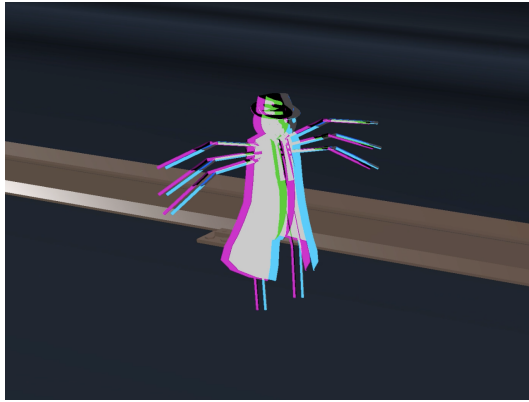


Figure 3: One of the rendering effects created for the short includes chromatic aberration for when the multi-verse 'glitches'. Shown on a close up of the 'noir' spider.



Figure 4: Another rendering effect for the short includes graphics panels, created using alpha maps



Figure 5: For the 'spider-pig', we developed our own post-production pipeline for adding a stippled cartoon render effect.

- Various shaders: including bloom, toon shading, chromatic aberration [4] and an original post-processing pipeline for adding polka dots to the spider pig. This specialized polka dot rendering pipeline allowed students developers to simply apply green to sections of the spider pig and then in post-processing replace those green sections with a provided pattern. This technology worked similarly to using a green screen [2] and was developed using OpenCV. The pipeline was then automated using Bash and Python scripts.

2 RESULTS

We were able to produce not only an OpenGL rendering engine to incorporate all of the various technologies needed for our original short, but we also produced the short itself all in a ten week academic quarter. The short can be seen at: <https://youtu.be/7SmURgZGSmc> and here we demonstrate frames highlighting the various rendering techniques.

The color bleeding from the many-lights implementation can be seen in Figures 1 and 2. A still of the comic panels showing multiple-characters in various scenes and jointly, can be seen in Figure 4. Chromatic aberration rendering can be seen on one of the original characters, the 'noir' spider, in Figure 3. And polka-dot cartoon shading is shown on the spider-pig in Figure 5.

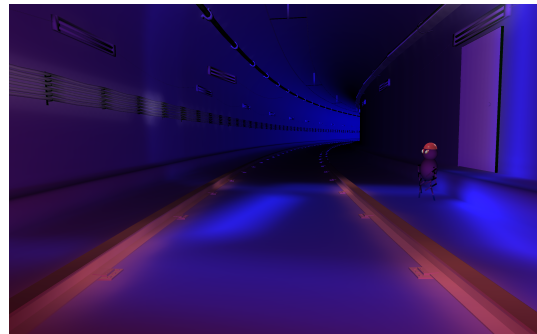


Figure 2: Many lights OpenGL implementation rendering of the transformed Miles Morales spider dancing in the subway

We learned a great deal from this quarter long production focused computer graphics class, specifically that production is hard, but fun and would love to present our work and learning via this poster.

REFERENCES

- [1] Miloš Hašan Adam Arbree Bruce Walter Jan Novák Carsten Dachsbacher, Jaroslav Krivánek. 2013. Scalable Realistic Rendering with Many-Light Methods. EUROGRAPHICS.
- [2] Eهران Edwards. [n. d.]. Green Screen Basis. <https://ehranjade.wordpress.com/2013/07/08/green-screen-basics/>
- [3] learnopengl. 2014. Deferred Shading. <https://learnopengl.com>.
- [4] @NickWest. 2013. Chromatic Abberation. <https://www.shadertoy.com/view/Mds3zn>