Final Project Proposal

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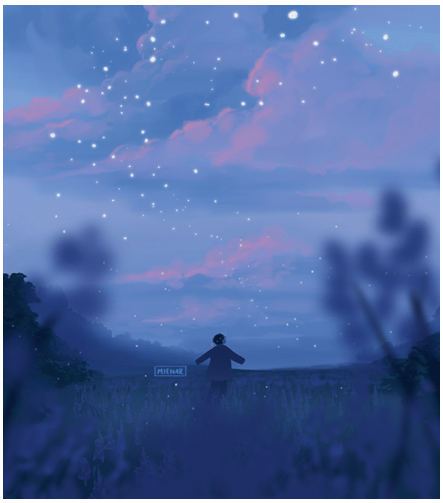
1 Overview

We wish to model a twilight/nighttime environment scene where the center of focus is the emissive effect caused by the glowing moon. Since the moon here will act as a physical light source that both glows and casts light into the scene below, we will want to capture these properties in the shape of the clouds and reflectance of the water below. We take inspiration from various artistically-rendered images rather than pure photography in hopes to render our final product as close to realism as possible while still having surrealistic effects as seen in the references images below. Through volumetric particle rendering we can simulate the clouds and fog, and will also observe how to procedurally model the stars.



2 Part 1: Modeling

Most of the modeling will be completed in Blender. It will consist of a sphere as the acting moon, landmasses surrounding the body of water, and a scattering of trees around the scene. For the mountains, normally this would be procedurally modeled in Blender and rendered using their Cycles engine, but we may opt to

procedrally model them in PBRT. Same would go for the blades of grass. Fog and clouds would be rendered using volumetric particles.

3 Part 2: Rendering

Our rendering algorithms will focus on three primary effects: emission, fog/clouds, and reflection.

Emission
The moon and stars in our reference image will be modeled as objects; however, because the moon is also going to be the primary light source in our render, we will need to implement an algorithm that allows for emissive effects. We found 2 excellent papers to build the foundation our programming and design: :A Physically Plausible Model for Light Emission from Glowing Solid Objects" [4] and "Multiple Importance Sampling for Emissive Effects" [3]. The former is particularly useful as it outlines a *lighting model* for emissive objects in three degrees of complexity; as we develop our algorithm, it will likely make sense to incrementally achieve lighting effects that become more complex. The latter paper describes how we could then *importance sample* the emissive light source to render a semi-realistic "glowing" effect.

Fog/Clouds
To achieve the hazy effects of nighttime fog and clouds, we need to develop a rendering algorithm to achieve a Monte-Carlo scattering ray tracing algorithm. The paper we found that seemed most useful and relevant was "A Rendering Algorithm for Discrete Volume Density Objects" [1], which describes an algorithm that actually modifies the direction of the ray, looping over voxels and pixels in two separate passes.

Reflection
Finally, we'd like to achieve the effect of a moon reflecting from a glassy base of water. "Real-time water rendering" [2] provided a thorough presentation of the physics of rendering water. In particular, section 3.4.6 mentioned that for local reflection, we should treat the surface as a mirror. The entirety of the paper demonstrates a useful series of steps for a realistic, reflective render for a body of water.

References

[1] Philippe Blasi, Bertrand Saec, and Christophe Schlick. A rendering algorithm for discrete volume density objects. *Computer Graphics Forum*, 12(3):201–210, 1993.

[2] Claes Johanson. Real-time water rendering. *Lund University*, Mar 2004.

[3] Ryusuke Villemin and Christophe Hery. Multiple importance sampling for emissive effects. *Pixar Technical Memo*, 13(02), Jan 2013.

[4] A. Wilkie and A. Weidlich. A physically plausible model for light emission from glowing solid objects. *Computer Graphics Forum*, 30(4):1269–1276, 2011.