A5 Project Proposal
Title:
Name: Jacob Bush
Student ID: 20558637
User ID: jbush

Final Project:

Purpose :

To create an image that can simulate glass in a near-photorealistic manner.

Statement :

For Ray Tracers: Paragraph describing interesting scene to be rendered and what features are needed to achieve this scene.

Paragraph: What it's about.

Paragraph: What to do.

Paragraph: Why it is interesting and challenging.

Paragraph: What I will learn

Technical Outline :

For new primitives, I will implement cylinders and toruses. I will use the equations provided in class, and also by referencing Watt & Watt [1] and Wolfram Mathworld [2]. This will require the creation of two new commands to the input language. The command `gr.cylinder` will create a cylinder, and the command `gr.torus` will create a torus. Non-hierarchal versions of these commands (`gr.nh_cylinder`, `gr.nh_torus`) may also be added for convenience.

For both texture and bump mapping, I will rely heavily on Watt & Watt [3], as well as referencing Blinn & Newell's 1976 paper [4] and Catmull's original dissertation on the topic [5]. Two new commands will be added to the input language to implement texture mapping. The command `gr.texturemap` will return a TextureMap object (by, for instance, reading an image file into a matrix of size equal to the image resolution). The object method `geonode:set_texturemap` will apply the given texture map to the GeometryNode. We will similarily define two new commands for bump mapping: `gr.bumpmap` to create a BumpMap object, and `geonode:set_bumpmap` to apply the bump map to a the GeometryNode.

Reflection.

Refraction.

Caustics.

Acceleration will be acieved through the use of octtrees. The space will be divided into octants, (eight regions) with each octant containing 0 or more objects. Octants with more than a certain threshold of objects in them will be further subdivided. Instead of testing a ray's intersection against all objects in the scene, we test it against only the objects in the regions that the ray will pass through, reducting computational overhead [6].

Antialiasing will be achieved via the jittering method described in class. That is: subdivide each pixel in the scene into an $N \times N$ grid, for some fixed N. For each region in the subdivided grid, randomly select a point in that region, and trace a ray through that point. The resulting color of the pixel is the average of the colors returned by the N^2 rays.

Depth of field.

Final Scene.

Bibliography :

[1] Watt, Alan H.& Watt, Mark (1992). Instersections: ray/quadratics. In Advanced Animation and Rendering Techniques: Theory and Practice. Addison-Wesley Professional. pp. 226-227.

[2] Weisstein, Eric W. "Torus." From MathWorld–A Wolfram Web Resource. `http://mathworld.wolfram.com/Torus.html`

[3] Watt, Alan H.& Watt, Mark (1992). Mapping techniques: texture and environment mapping. In Advanced Animation and Rendering Techniques: Theory and Practice. Addison-Wesley Professional. pp. 178-201.

[4] Blinn, J. F., & Newell, M. E. (1976). Texture and reflection in computer generated images. Communications of the ACM, 19(10), 542-547. https://doi.org/10.1145/360349.360353

[5] Catmull, E. (1974). A subdivision algorithm for computer display of curved surfaces (PhD thesis). University of Utah.

[6] Watt, Alan H.& Watt, Mark (1992). Spatial coherence. In Advanced Animation and Rendering Techniques: Theory and Practice. Addison-Wesley Professional. pp. 241-248.

Objectives:

Full UserID: **jbush** **Student ID:** **20558637**

1. Primitives
2. Texture Mapping
3. Bump Mapping
4. Reflection
5. Refraction
6. Caustics via ...
7. Acceleration via Oct-tree
8. Antialiasing
9. Depth of Field
10. Final Scene

A4 extra objective: I did antialiasing as my extra objective for A4. **However**, I do not expect to receive the mark for it. If I *do* recieve credit for this objective in A4, I will choose a new objective for the projcet.