CS488 Initial Project Proposal

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Final Project:

Purpose :

   To implement a number of advanced ray tracer features and model an attractive scene.

Statement :

   The scene I plan to render is that of the top of a marble bathroom sink. On the sink there will be a clear glass containing a thoothbrush, and sink stopper. The faucet will be running, and the sink will be full of water. The wall behind the sink will have a simple tile texture, and a mirror.

   The sink stopper is a cut off cone that will require a cone primitive and CSG to make. A torus will also be used as the metal loop at the top of the stopper. The glass and toothbrush will require refraction.

   The water in the sink will be rippled and require bump mapping. The sink and faucet will be constructed with CSG. The mirror and sink will both be reflective, and texture mapping will be used for the tiles, and running water.

Technical Outline :

   The additional primitives are very straight forward and will require additional intersection computations.

   Texture mapping will be done simply by mapping the pixel on the screen to a pixel on the polygon, and then onto the texture map to determine the right colour of the pixel.

   Bump mapping is done by perturbing the normals of a polygon according to a map. These changed normals will affect the lighting calculations and cause the desired effect.

   For CSG, we must store both member primitives under a boolean operation in our hierarchy. Intersection for the combined object can be done by doing ray intersect for both primitives, and performing the appropriate boolean operations on the resulting line segments.

   Glossy reflections are a simple extension to mirror reflections. Instead of casting a secondary ray in the mirror direction, we first perturb the ray slightly at random to get a glossy effect.

   Refraction can be done by changing the direction of the cast ray through a clear object. The direction change can be computed using snell's law.

   To get soft shadows, when we cast our shadow rays to the lights we can cast many rays to random points on an area light. Averaging these results will produce soft shadows.

   To get a marble texture for the sink, we can use a procedural generation of the 3D texture. Functions exist to generate marble texture with perlin noise.

   Bounding boxes can be used to decrease the number of intersection calculations that need to be performed. When we cast a ray, we check whether it intersects any bounding boxes intead of every polygon in the scene. This is much cheaper improves render speed.

Bibliography :

   1. Most information will come directly from the relevant chapters of the provided course notes.
   2. http://en.wikipedia.org/wiki/Procedural_texture
   3. people.scs.carleton.ca/ mould/courses/3501/procedural.pptx

Objectives:

Full UserID:_____   **Student ID:**_____

___ Additional primitives cylinder, cone, and torus are added.

___ Texture mapping is added.

___ Bump mapping is added.

___ Constructive solid geometry for primitives is added.

___ Glossy Reflections are added.

___ Refraction is added

___ Soft shadows from area light sources are added.

___ Procedural solid texture mapping for marble.

___ Bounding boxes are used for improved efficiency.

___ A final scene is modelled as described above.