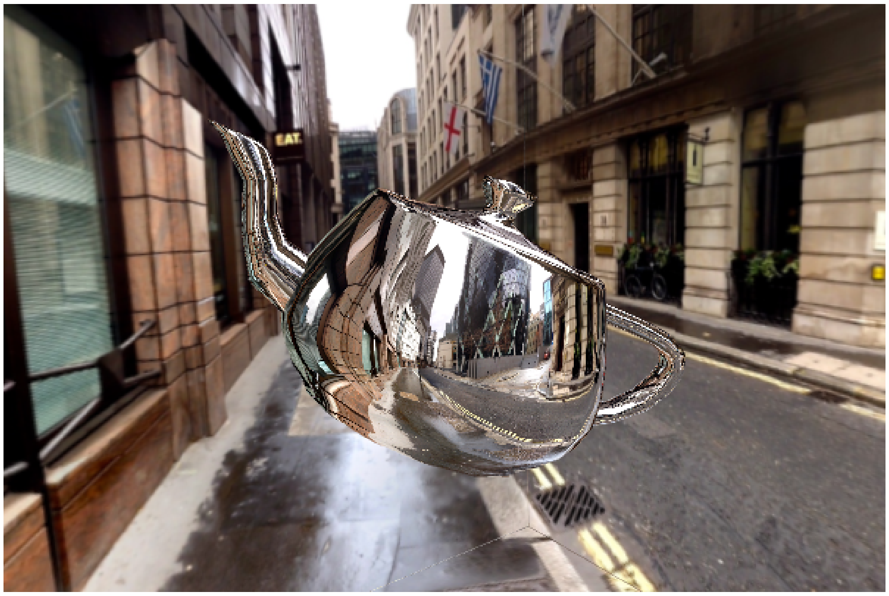
# MP3: Environment Mapping

## Due: November 29 at 11:55pm



Load the Utah teapot from the attached triangle mesh file and render it using environment mapping. Use the following techniques:

- Perspective
- Hidden surface removal
- Phong or Blinn-Phong Reflectance Model
- Environment Mapping
- Skyboxing

**Hints:** It is strongly suggested you implement the MP in pieces and test as you go.

1. Implement the skybox first and test it
2. Impement the ability to change the view. Test it.
3. Implement the capability to parse an obj file and load vertex and element arrays. Test it.
4. Write the code to calculate normals and render the teapot with the Blinn-Phong lighting. Test it.
5. Render the teapot using a cube map.
6. Add the ability to rotate the teapot. Test that the reflected environment changes correctly

### Running a Local Server:

To get around the issue of reading files from the local filesystem, it is best to test by running a local webserver. There are two relatively easy ways to do this:

- If you use the Brackets editor, the live preview function will start up server (and browser) to test your code. Just have chrome open, and the open your html file in Brackets. Click the lightning bolt icon in the top right of the Brackets window
- Alternatively, you can install node.js Then install and run httpserver to serve the directory that it is run from.

### Skyboxing:

Create and draw an environment using skyboxing...render a large cube surrrounding the viewer...this is the skybox. Use the cube map images to texture map the inside of the skybox. You should use the same set ofsix images that you will use for environment map.

**Background Reading and Resources:**

- A good tutorial on generating cube maps is here. A set of 6 image files forming the cubmap used in that are available in this zip file.

### Teapot Loading:

Utah Teapot OBJ file: Teapot

**Background Reading and Resources:**

- The OBJ file format is documented in this wikipedia article.
- Parsing a text file in JavaScript. You will need to get the OBJ file from the server, and then parse it to generate the vertex and face arrays. If you know how to use AJAX or jquery you can use those to get the file.
  If you don't know how to use those, you can use the function given in readText.js to get a file and send it to the function you will write to parse the file.

Use the above linked teapot model, which consists only of vertices and triangular faces. Load the vertices into a vertex position array, and the triangle faces into a face array whose elements are triples of vertex indices. You will need to create per-vertex normals, which you can create by setting a per-face normal, and then setting the vertex normal to be the sum of its adjacent face normals, normalized (so the resulting vertex normal is unit length). You can create a normal accumulator entry for every vertex and initialize it to zero. Then loop through every face and add its normal to the normal accumulator of each of its three vertices. Then for each vertex, normalize (make unit length) its accumulated normal vector

## Environment Mapping:

For environment mapping you will use a cube map. You can use the London cube map in this example. Alterrnatively you can try to use one from this collection.

### Background Reading and Resources:

The wikipedia article on cube mapping is good.

## User Interface:

Your user interface should allow two methods of interacting with the scene:

1. Be able to rotate the teapot (even just around it's y-axis is fine).
2. Allow to the users view to orbit the tepot (again, just letting the view circle the teapot by rotating aorund the y-axis is fine).

Note that the first can be achieved by a modeling transformation applied to the tepot.
The second effect can be achieved by rotating the world (teapot and enclosing environment box) assuming the teapot is at the origin.

## Lighting:

Similar to the previous MP, use a light source to light the model from the obj file. Use the Phong or Blinn-Phong reflectance model.

## 4 Credit Option Extra Feature:

Use a normal map to generate a bumpy apearance on the teapot. Be able to turn this effect on and off through an interface on the webpage.

## Submission:

You will upload your files to compass in a zipped folder with name **${NetID}_MP3.zip**. Include all of the files necessary for your application to run locally. Name your webpage *Teapot.html*

## Rubric:

| Points | Description |
|---|---|
| 2pts | Load teapot geometry correctly |
| 1pts | User can rotate the teapot |
| 2pts | User can change view in an orbit around the teapot |
| 2pts | Teapot surface is shaded correctly using one or more light sources |
| 3pts | Environment is rendered on a box enclosing the viewer |
| 3pts | The teapot surface reflects the environment correctly |
| 2pt | Your code should be commented and user interface on the webpage should be clear |
| 4 CREDIT: 5pts | Apply a normal map to the teapot surface. Be able to turn this effect on and off through an interface on the webpage. |