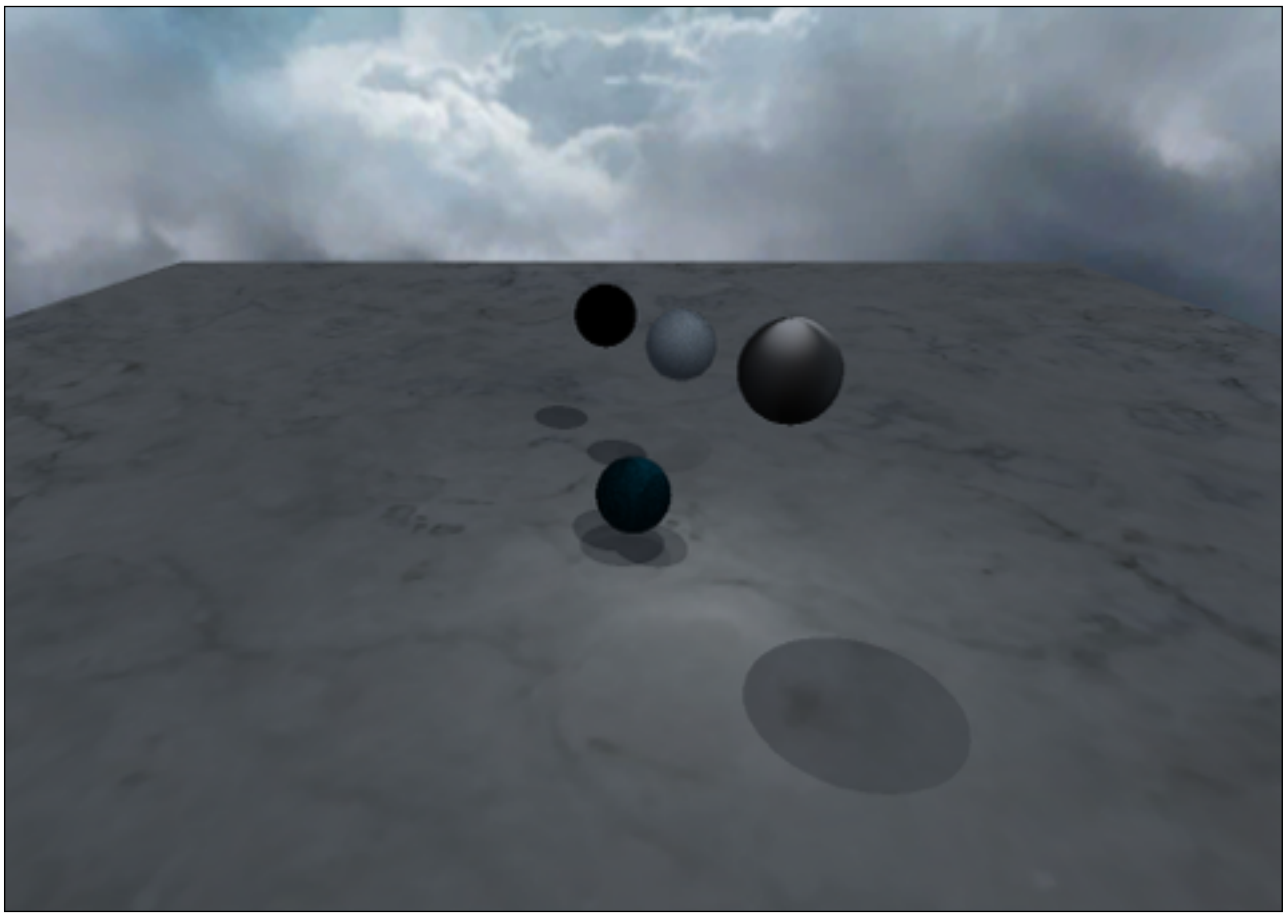
Ray Tracing

Implementing Ray Tracing in Unity

Jack Prior - 30 May 2016



Ray Tracing

The purpose of this Ray Tracing project is to render a 2D texture in front of the camera mirroring the game scene using ray tracing principles. I achieved this by writing a script that loops through every pixel on the camera; detecting it's colour and rendering it to it's corresponding position on the 2D texture.

Generate Colliders

To ensure that the game objects all contained consistent attributes I began by looping through every game object in the scene and appended a clone containing the a converted Mesh Collider; the clones were all added to layer 31.

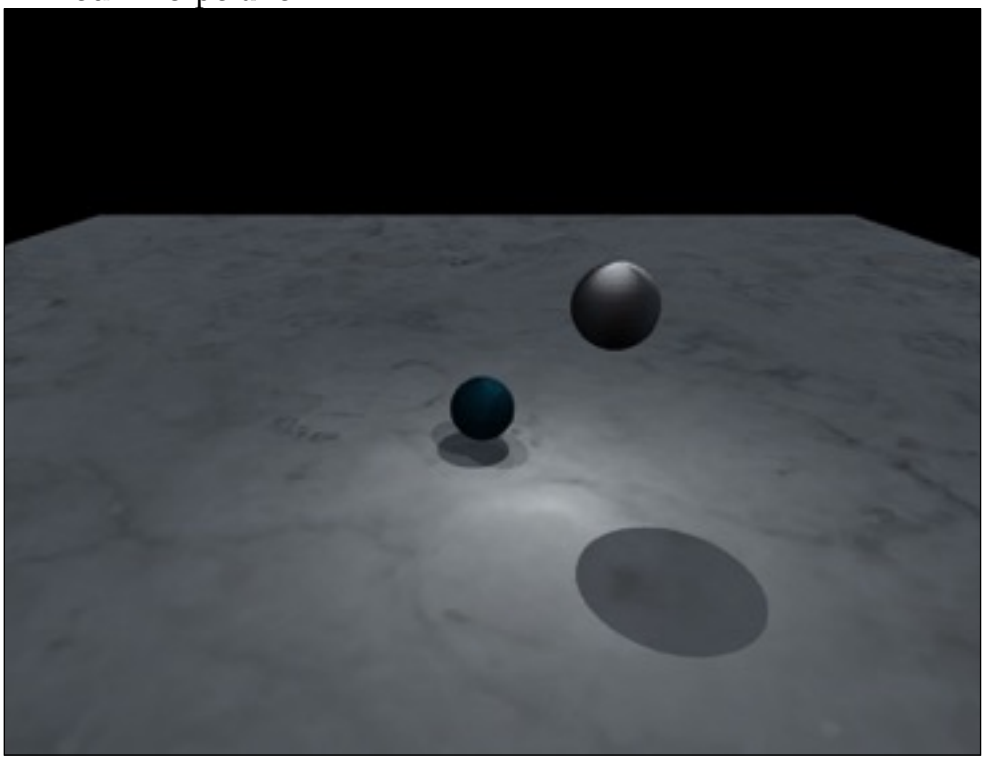
Trace Ray

The Ray Trace that I fired off for each pixel in the camera had a filter that looked for Game Objects only on layer 31. If the Ray Trace hit then a material is drawn for the corresponding Game Object. The GetPixelBilinear function enabled me to extract the relevant colour from the material using the Ray Trace hit texture co-ordinates.

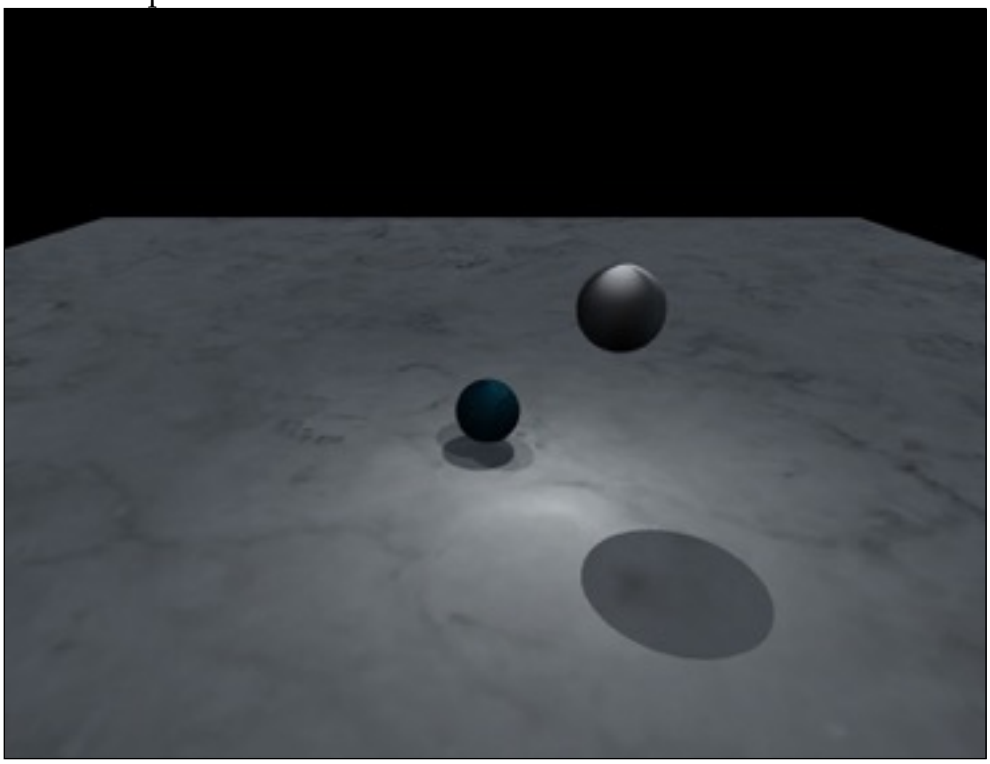
Normal Interpolation

The pixels rendered on the 2D texture were blocky so I interpolated between the normals in each triangle on the mesh to produce smooth looking surfaces.

Without interpolation:



With interpolation:



Light

The Light parsing function is split into 3 categories and takes into account the alpha of the material it hits.

- Directional light is calculated as a function of it's light intensity against the colour of the material the ray trace hits.
- The point light is similar to directional light except that it works out it's light intensity with regard to the distance of the material from the light source.
- Spot light is again similar to point light and adds another layer of complexity incorporating not only the distance from the light source to the material but also the angle from the centre of the direction the light is pointing out when it works out the light intensity.

Transparency Trace

All light sources take into account the transparency of the material it hit when working out how the light intensity should affect the colour.

Skybox

If the light source does not hit a Game Object in the scene then it looks at the Ray Trace direction vector and retrieves the appropriate skybox texture. It then uses the GetPixelBilinear to get the correct colour for the pixel it hits.

References

Benjamin Schaaf's tutorial on Ray Tracing:
https://github.com/BenjaminSchaaf/Unity-Raytracer/blob/master/Tutorial%20(Simple).md