

Shadow Rendering Techniques

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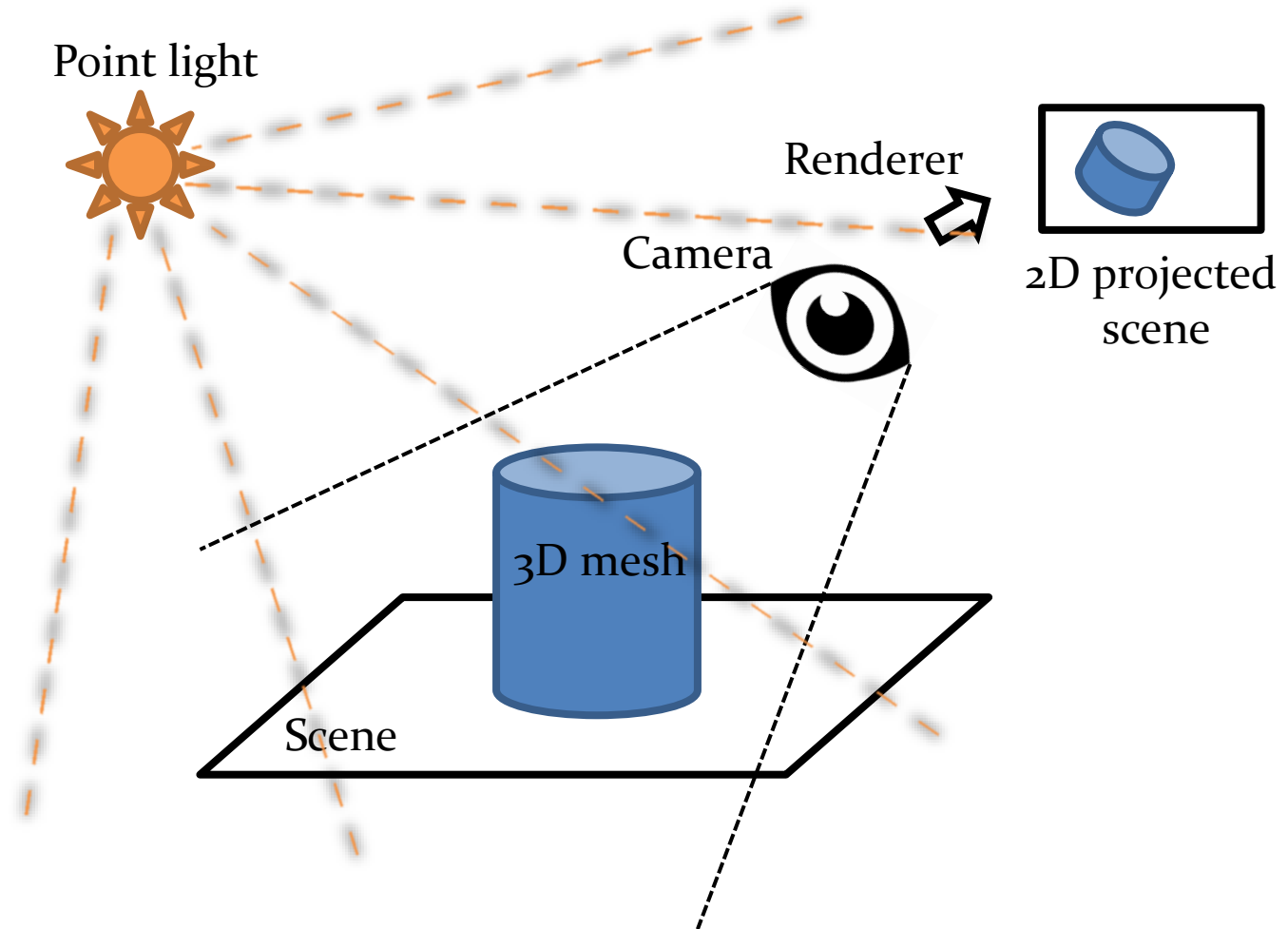
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Two Major Types of Shadowing Techniques

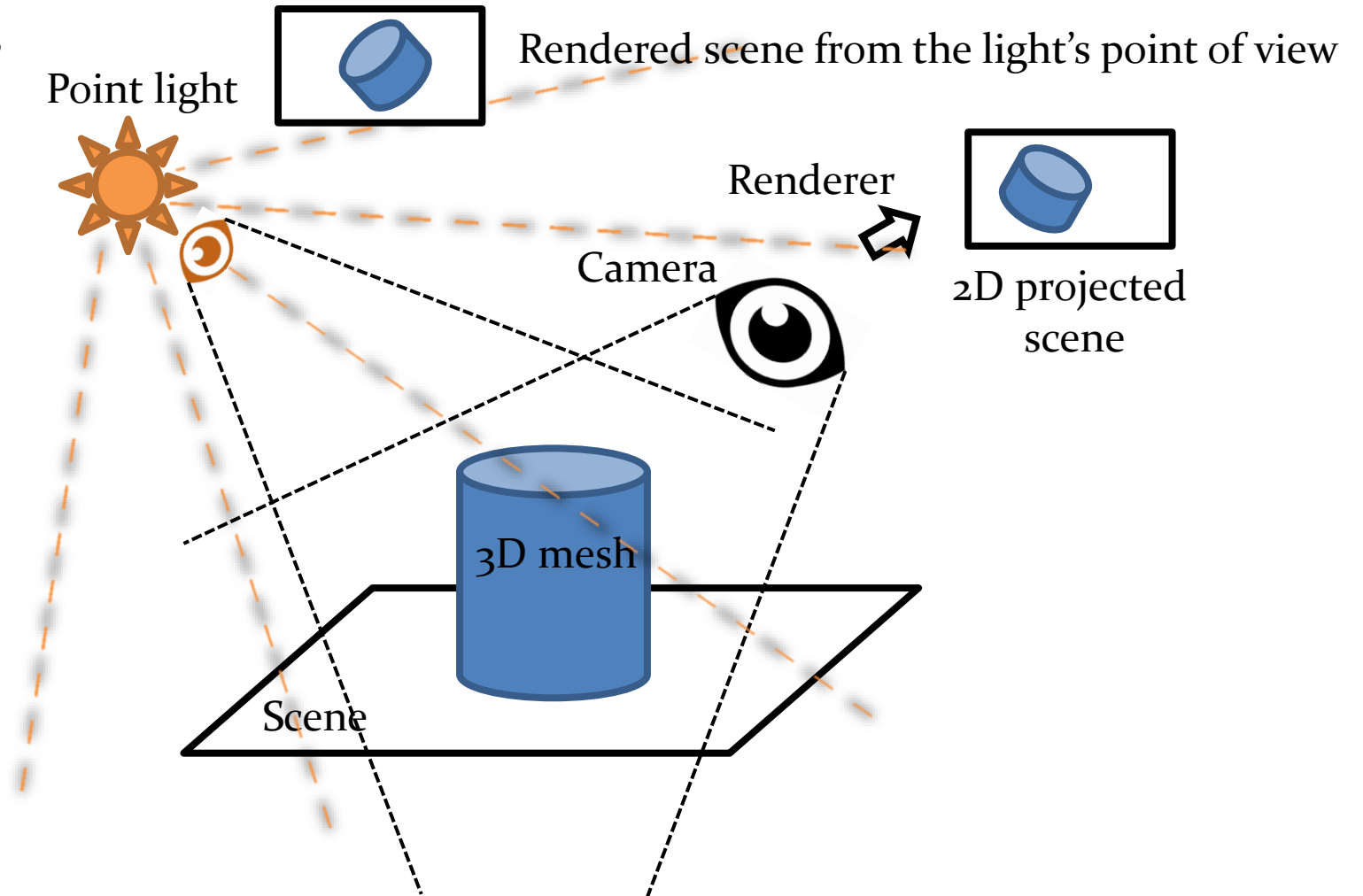
- Shadow mapping
- Global illumination

Shadow Mapping – Basic Components



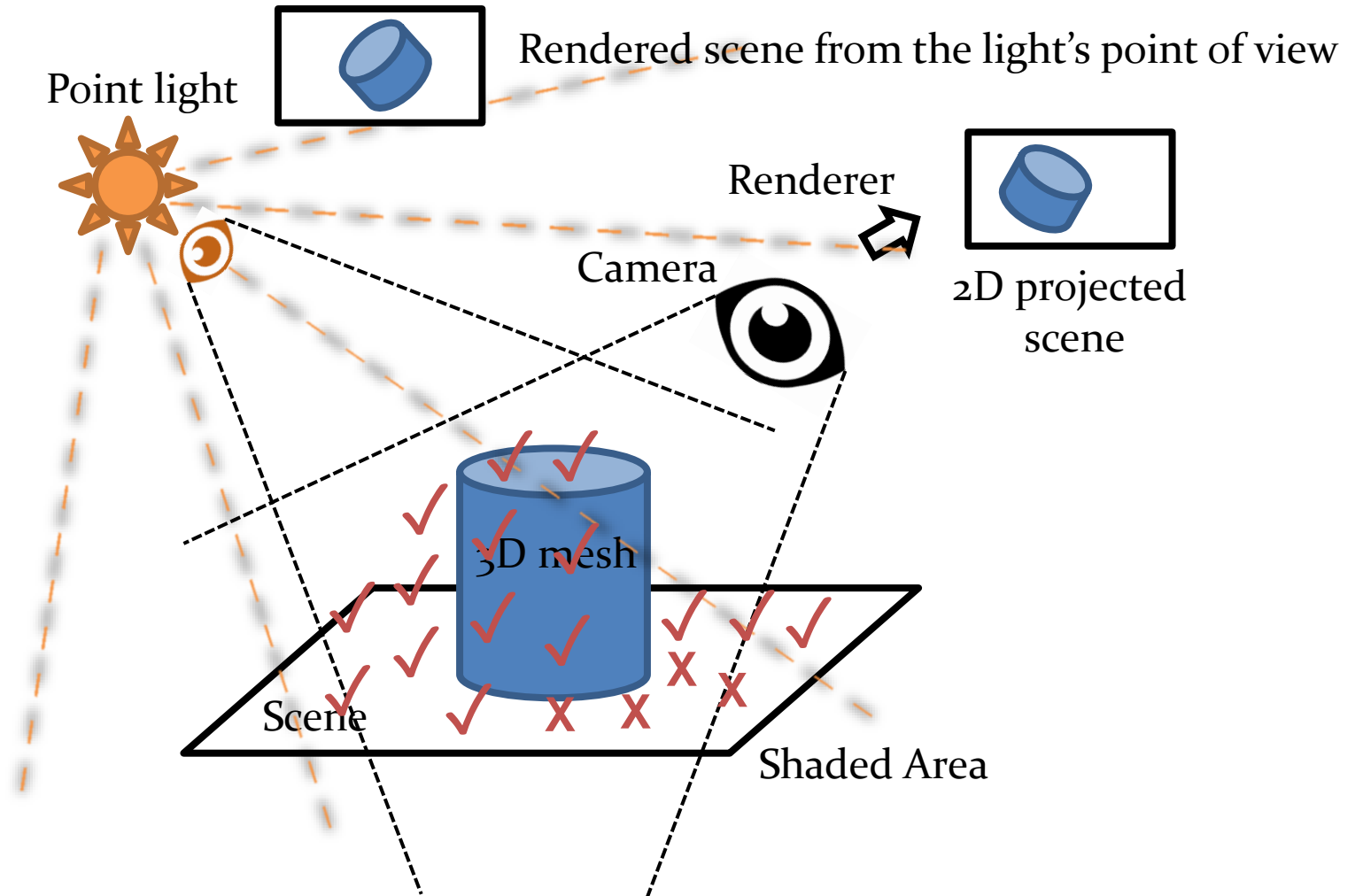
Shadow Mapping Step 1 - Rendering from the Light's Point of View

- Attaching a “virtual” camera on the light
- Everything seen by such a camera should be lit
- Everything not seen should be shadow



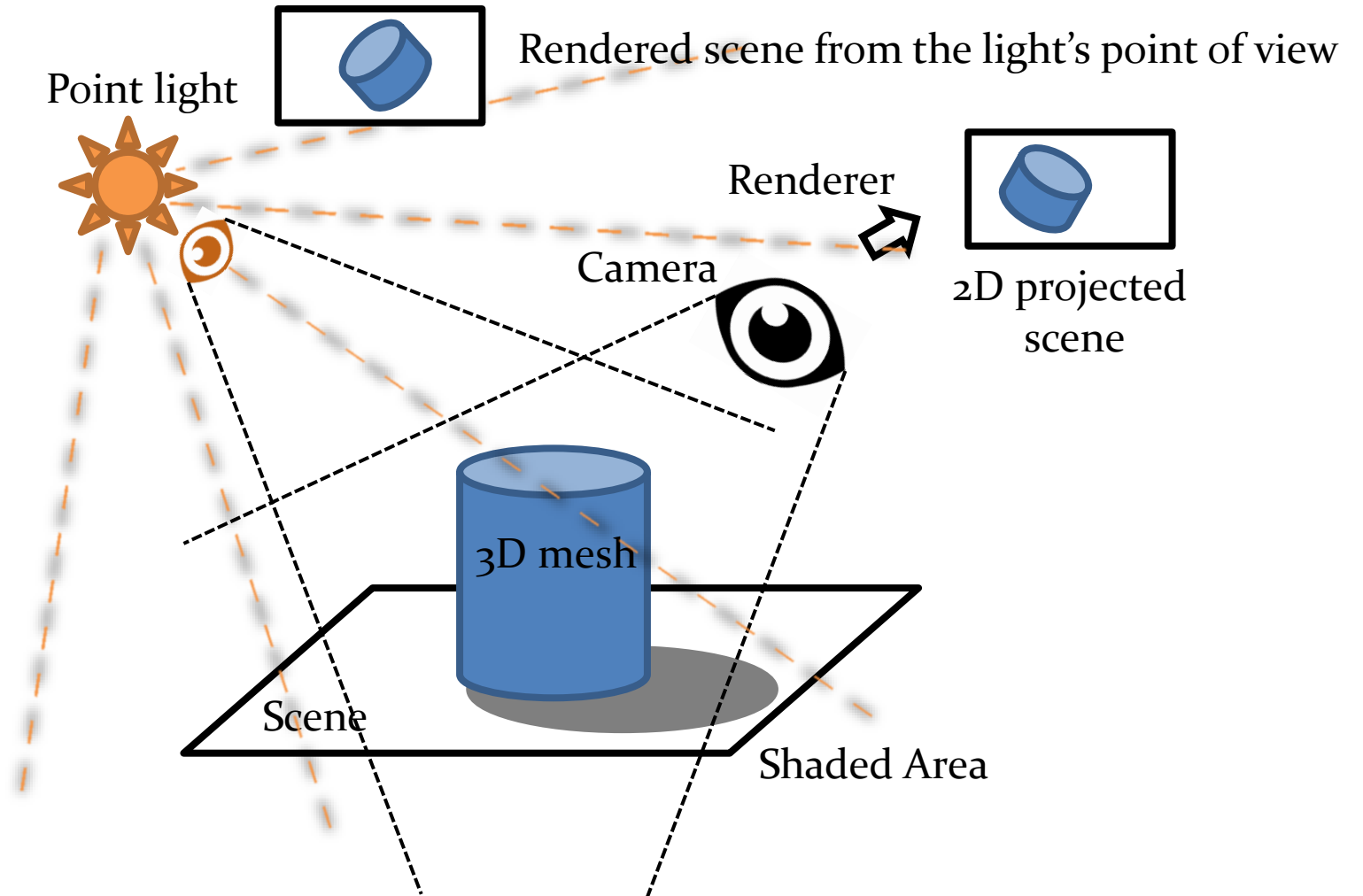
Shadow Mapping Step 2 - Converting Light View Images into the 3D Space

- Numerical calculations for projecting the light view images back into the 3D space



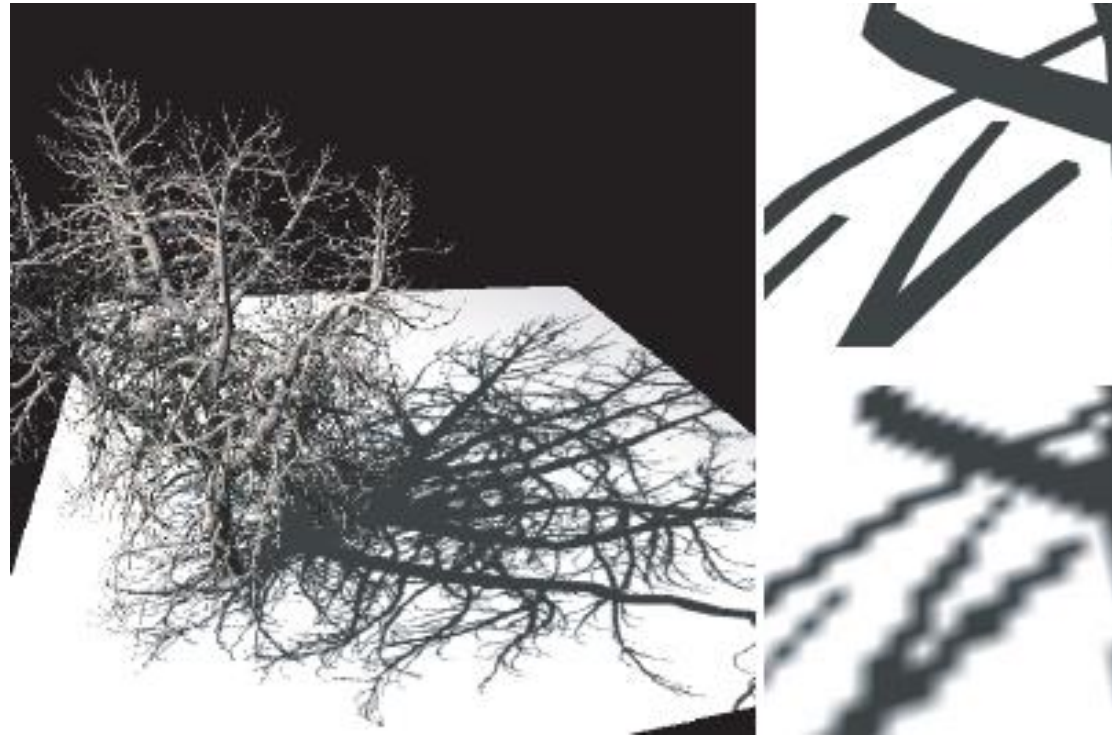
Shadow Mapping Step 3 - Shading the 3D Scene

- Shading everything not seen by the light view image



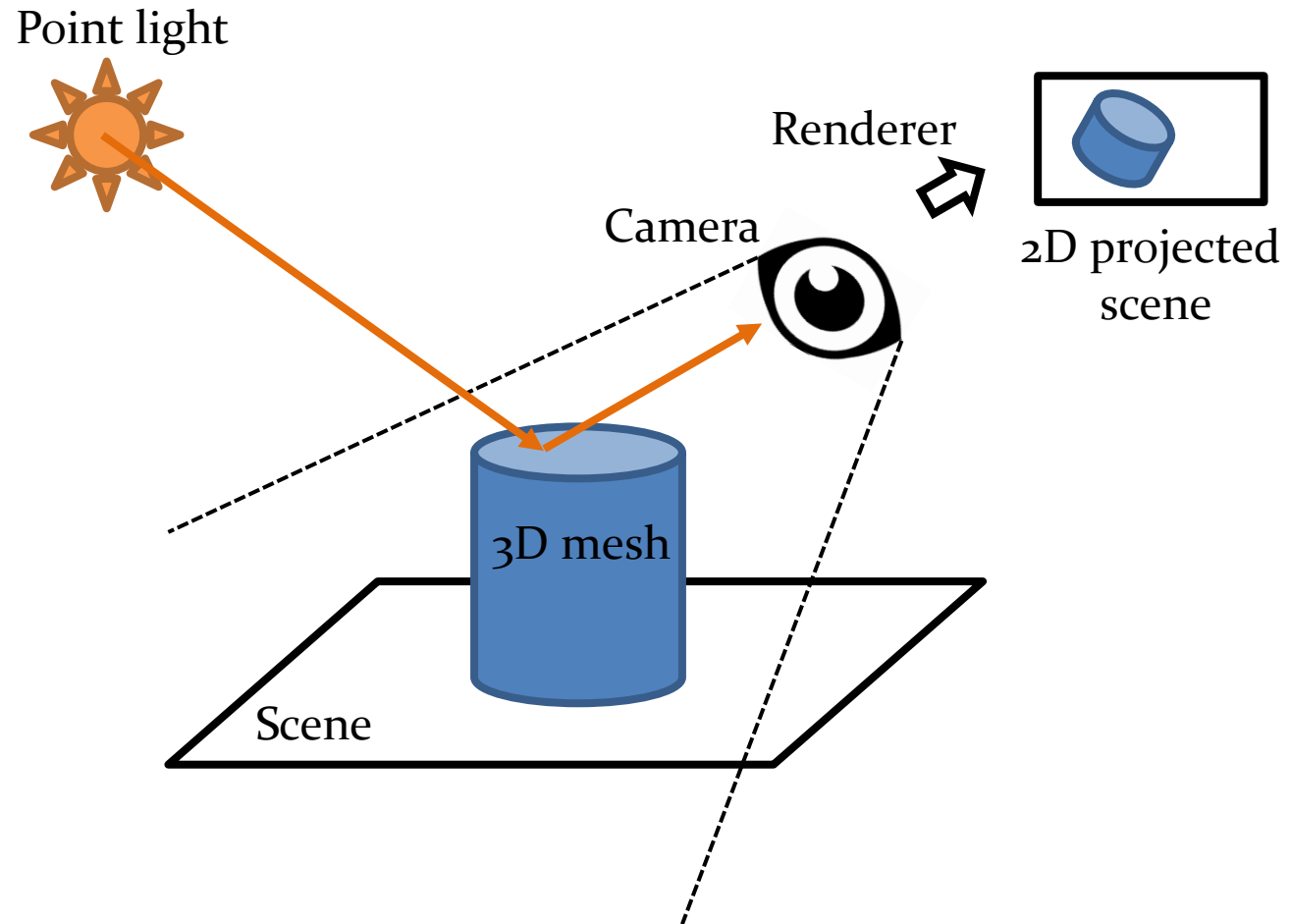
Shadow Mapping Consideration

- The resolution of the light view image
- Object casting shadows and object receiving shadows



Global Illumination by Ray Tracing

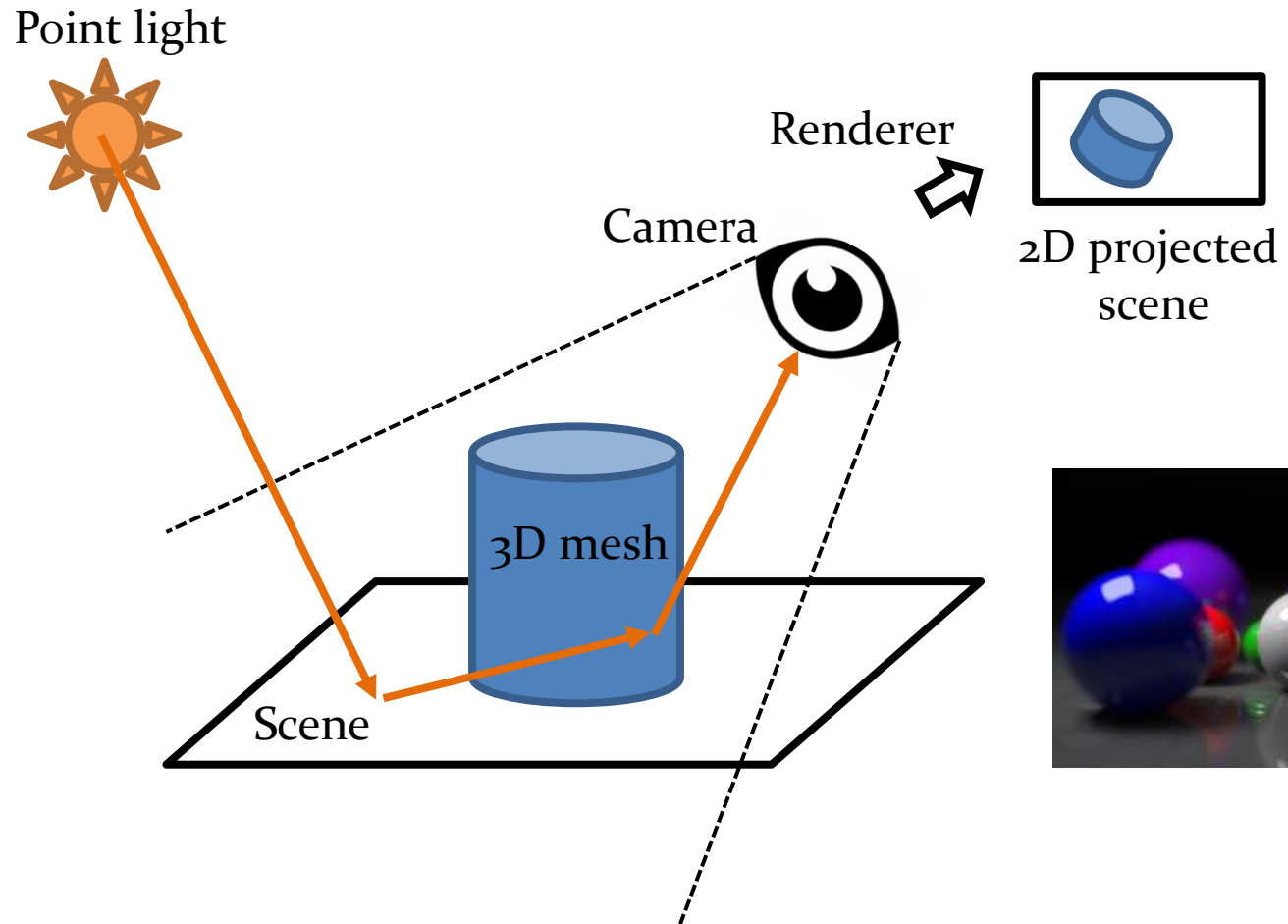
- Tracing each beam of light (i.e. ray) and find out which one got reflected to the camera
- Requiring thousands and thousands of ray
- Reflected rays forming lit pixels in the final render
 - More reflected rays to a pixel → A brighter pixel
 - Less reflected rays to a pixel → A darker pixel
 - i.e. Soft shadowing



Global Illumination by Ray Tracing

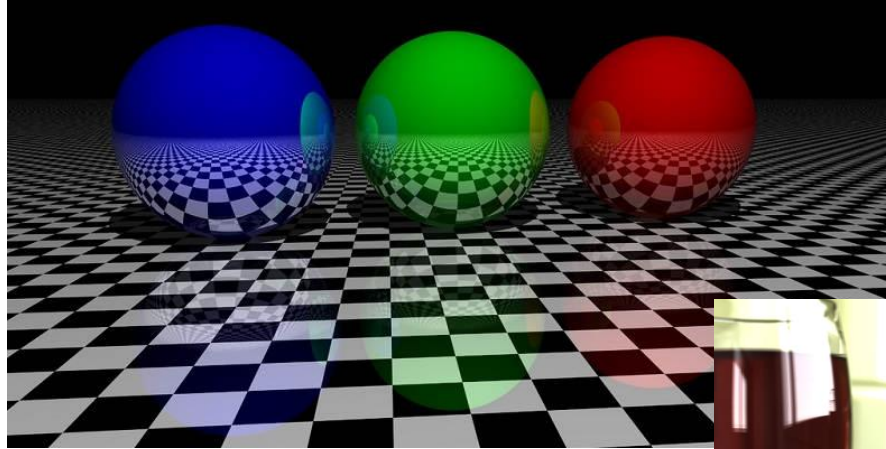
- Multiple Reflection

- Ray reflecting from objects to objects
- Each reflection reducing the intensity of light
 - Forming global illumination
 - i.e. soft shadows casted by object to another object

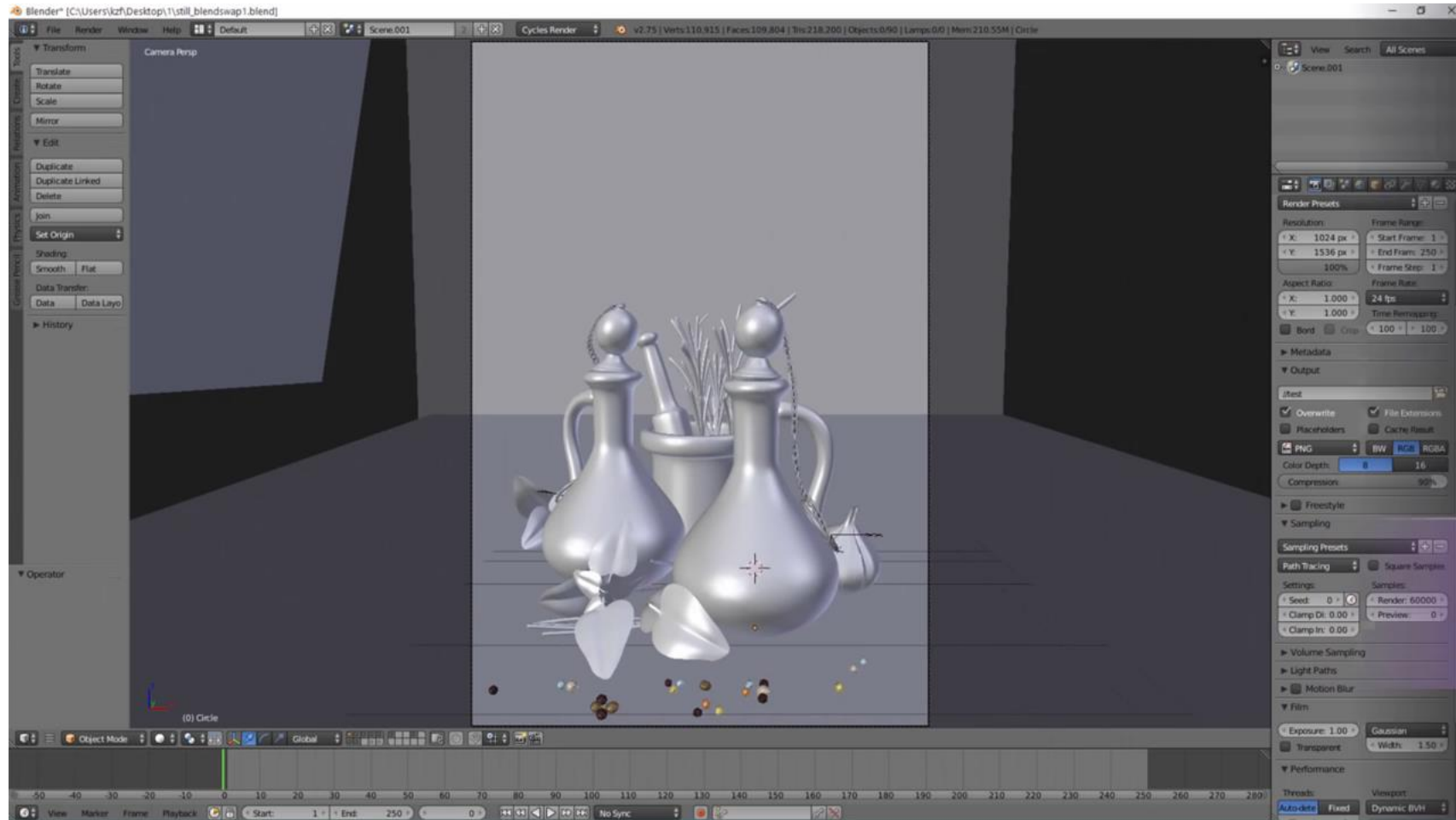


Ray Tracing for Highly Reflective or Transparent Materials

- Object to object reflection controlled by mesh materials
 - Highly reflective surfaces
 - Semi-transparent surfaces



Ray Tracing – An Active Research Area



Further Reading

- three.js Function List & Basic Tutorials
 - <https://threejs.org/docs/#manual/en/introduction/Creating-a-scene>
- Wikipedia
 - Shadow mapping:
https://en.wikipedia.org/wiki/Shadow_mapping
 - Ray tracing
[https://en.wikipedia.org/wiki/Ray_tracing_\(graphics\)](https://en.wikipedia.org/wiki/Ray_tracing_(graphics))
 - Three-point Lighting
https://en.wikipedia.org/wiki/Three-point_lighting

The End

Any Questions?