



---

# Global Illumination

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen



---

## Local vs. Global Illumination

### Local

- **Direct illumination of surfaces by light sources**
- **e.g. Phong and Cook/Torrence illumination**

### Global

- **all light/surface interactions for entire environment**
- **Recursive ray tracing and radiosity compute this partially...**

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen



## Rendering Equation

---

**I**: illumination at first point from second  
**g**: geometry term for visibility and distance  
 **$\epsilon$** : emitted light from second point to first  
 **$\rho$** : reflectivity of light from  $x''$  to  $x$  via  $x'$   
**Note that the equation is recursive**

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen



## Ray Tracing

---

**Modifies reflectivity term**

- **Computes specular interreflections among surfaces**
- **Computes diffuse and specular reflections between light sources and surfaces**

**Typically integrates using point sampling of direction space**

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen



## Radiosity

---

**Also modifies reflectivity term**

- **Computes diffuse interreflections among surfaces (light sources not distinguished)**

**Integrates by quantizing surface points and summing**

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen



## Path Tracing

---

**Similar to distribution ray tracing**

**Applies Monte Carlo sampling to estimate integral**

**Traces a single path for each eye ray (only a single ray spawned at each surface intersection)**

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen



## **Two-Pass Radiosity/Ray Tracing**

---

### **First pass: radiosity**

- **Compute extended form factors and diffuse illumination**

### **Second pass: ray tracing**

- **Perform standard ray tracing**
- **Diffuse component of illumination radiosity solution rather than just local illumination**

**Note: still doesn't handle light reflected specularly and later diffusely**

---

Johns Hopkins Department of Computer Science  
Course 600.456: Rendering Techniques, Professor: Jonathan Cohen