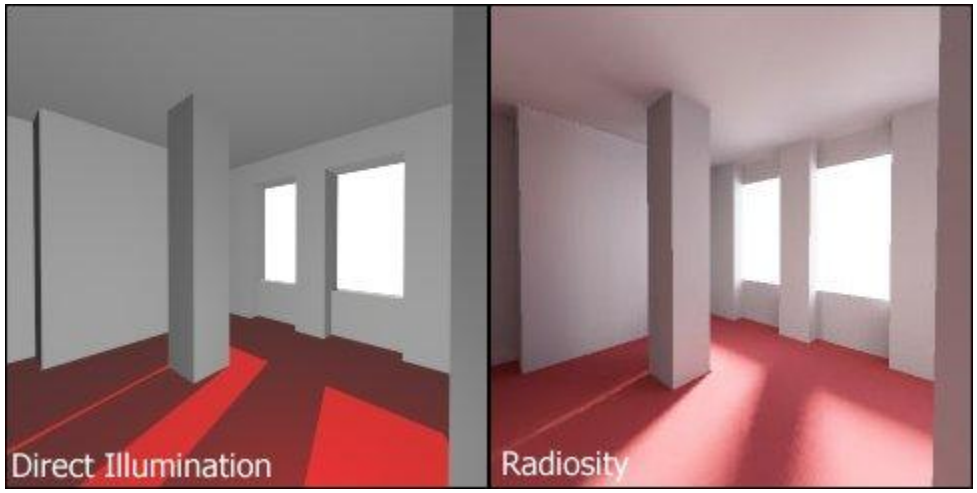
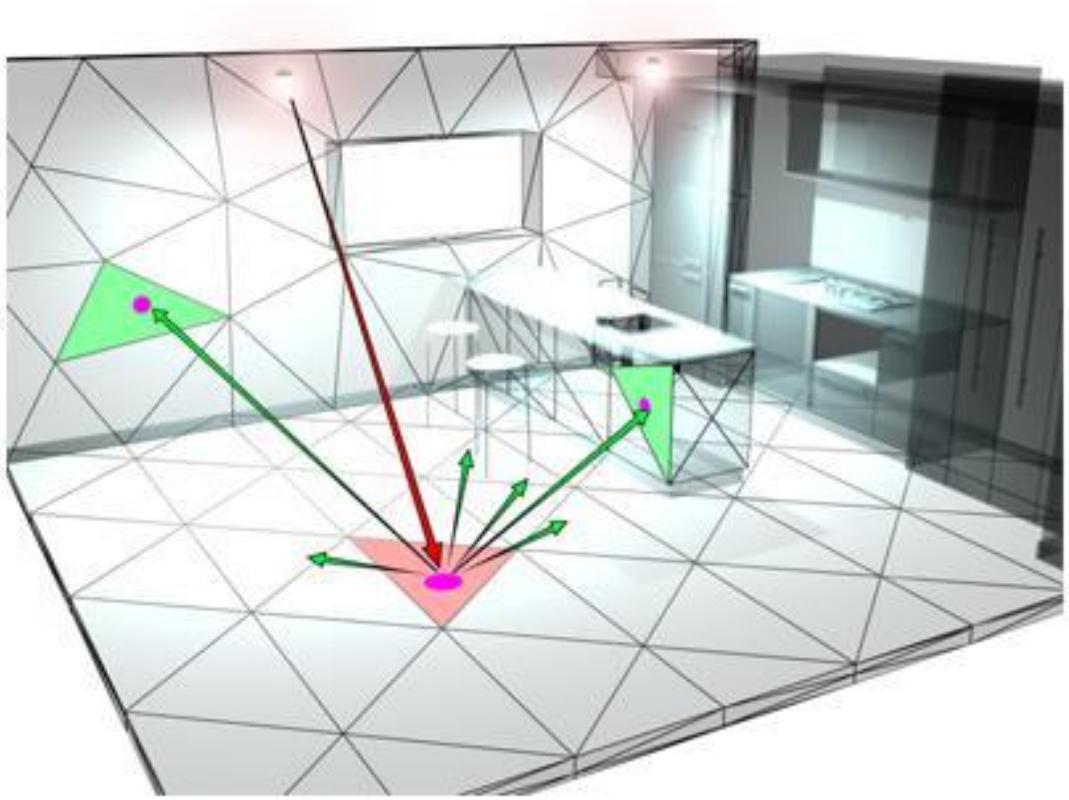
90’s: Radiosity

- Ray-tracing generates perfect reflections that look “artificial” because surfaces of most real world objects are not mirror-like smooth.
- A ray is usually scattered from a surface in many directions. Radiosity is one of the methods to model this property.



- Radiosity methods were first developed in about 1950 in the engineering field of heat transfer. They were first applied to the problem of rendering computer graphics in later 80’s by researchers at Cornell University led by Dr. Donald Greenberg, a professor in architecture.

- The rapid development of techniques for radiosity happened in 90’s.
- Radiosity utilizes the finite element method to solving the rendering equation for scenes with purely diffuse surfaces.

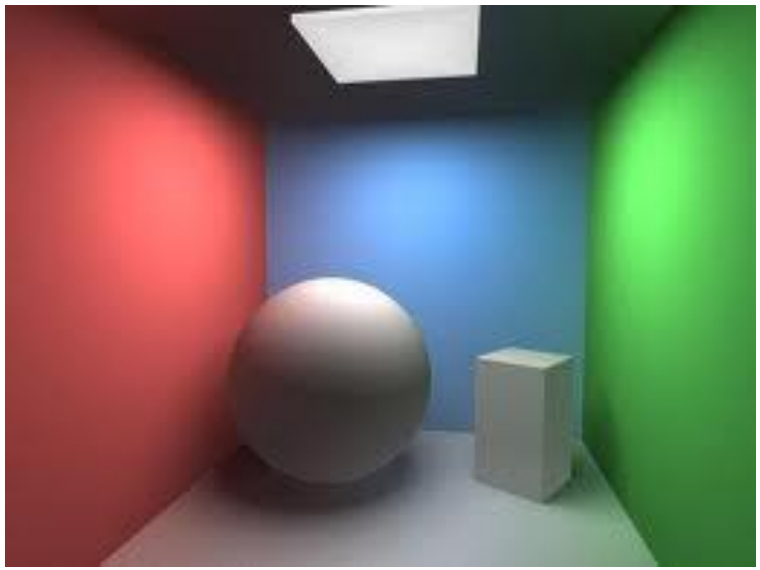


Brief idea of progressive algorithm:

1. Rays are emitted from a light source to all surface patches that are visible directly from the light source;
2. At each patch that receives a ray from the light source, reflection rays are calculated for each surface patch in the environment that is visible from the current patch;
3. At each patch, all rays (either direct from light, or reflected from other patches) are added together, and then reflected to all visible patches in the environment;
4. Repeated the above step until the value at each patch becomes stable.

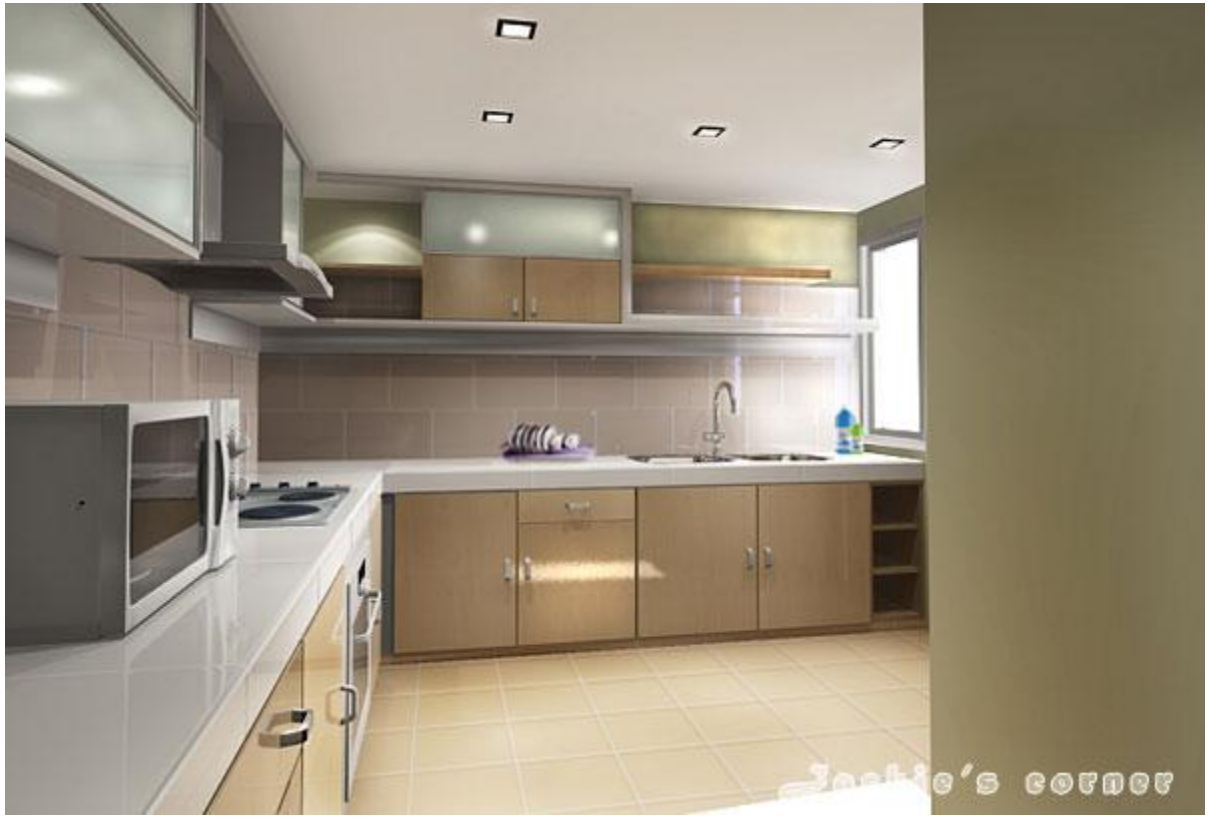
- The shading value for each patch is obtained in the above iterative algorithm.
- We can then render images from any view point, using either polygon scan conversion or ray-tracing technique to render images.

- Interpolation techniques can be used to interpolate the shading across each patch, resulting in more smooth variation:



Example 1:

Example 2:



Example 3:

Example 4: