Shading

• Why is shading important ?

- Images containing uniformly bright objects do not demonstrate 3D appearance

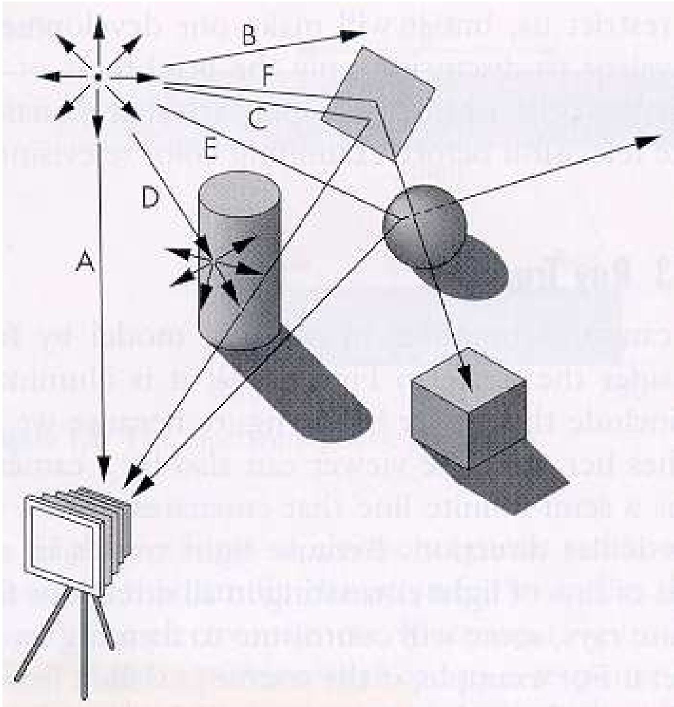
- Simulate the way light interacts with the surfaces of the objects in the scene

• To obtain realistic lighting effects, we must define:

- Normal vectors for each vertex of each object

- Material properties for each object

- The position and other properties of the light sources



• Lighting or shading models

- They allow us to compute the shade to assign to a point on a surface

- *Local* lighting models

- *Global* lighting models

• **Local lighting models**

- They do not take into consideration other surfaces in the scene

- Calculations depend on:

    * Material properties (rough, smooth etc.)

    * Local orientation of the surface (normals need to be computed)

    * Locations and properties of light sources

- Commonly used methods: **Phong** and **Gouraud**

• **Global lighting models**

- They take into consideration other surfaces in the scene

- More realistic images (shadows can be modeled !!) but at the cost of more computations

- Commonly used methods: **ray tracing** and *radiocity*

• **Steps in building a local lighting model**

- Model the light sources in the scene

- Build a reflection model which deals with interactions between materials and light

• **Types of light sources**

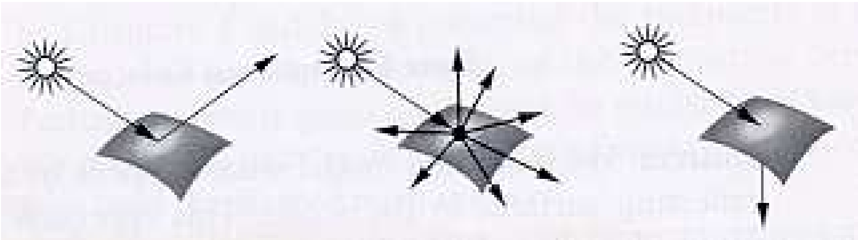
- Ambient light

- Point sources

- Spotlights

- Distant light

Interactions between materials and light



- <u>Specular surfaces</u>

    * Appear shiny

    * Reflected light is scattered in a narrow range of angles close to the angle of reflection

    * Mirrors are perfectly specular surfaces

- <u>Diffuse surfaces</u>

    * Appear the same from different viewing directions

    * Reflected light is scattered in all directions

    * Wall painted with matte paint is a diffuse reflector

- <u>Translucent surfaces</u>

    - Appear transparent

    - Some light penetrates the surface and emerges from another location on the object (*refraction*)

    - Water and glass are characterized by refraction