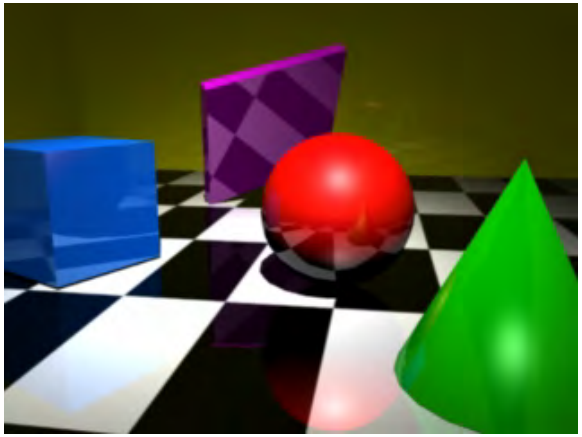
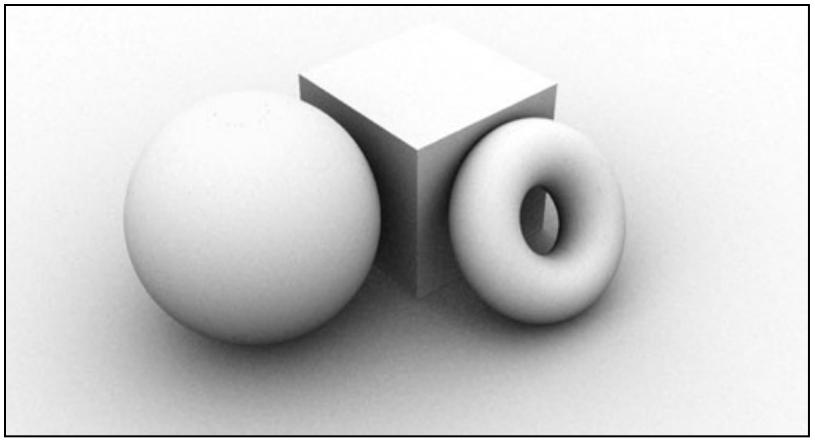
Rendering, Shaders, & Textures in Maya





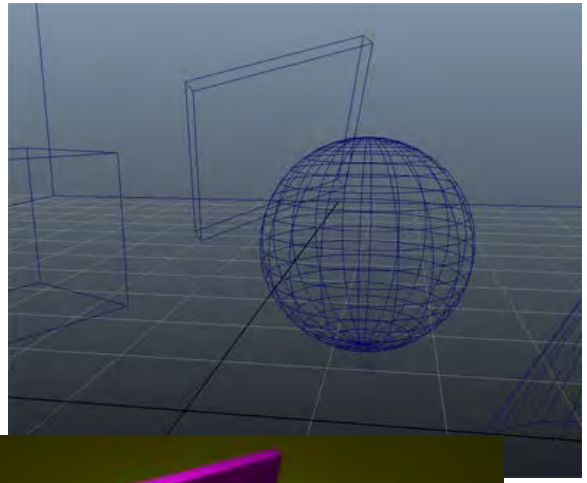
Main Components

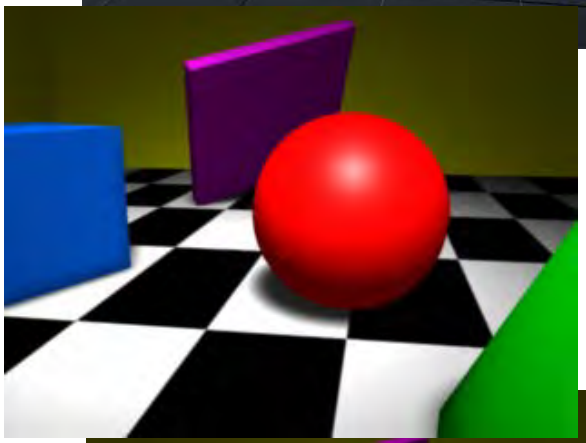
- **Renderers**
  - Panels, Maya software, Mental ray, etc
- **Shaders (Materials)** – surface properties
  - Lambert, Blinn, etc
- **Texture Maps & UV Coordinates**
  - Images or procedurally generated
- **Lights**
  - Point, Directional, Spot
- **Quality**
  - Anti-aliasing

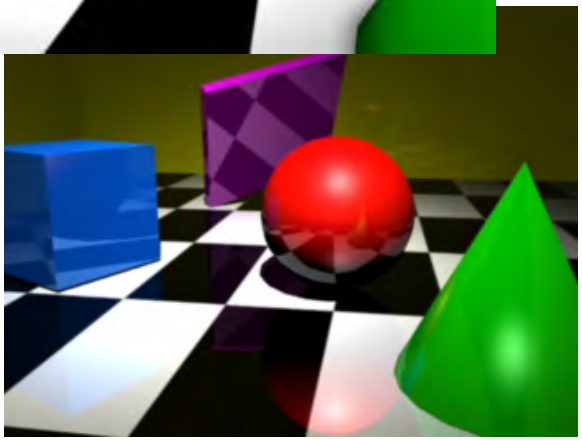
Renderers

A renderer is the *computational engine*: It takes the entirety of the parameters (modeling, lighting, animation, …) and generates the 2D image.

- **Maya Panels**: low quality, very fast, intended for interaction with user.
  - Options: wireframe, shaded, etc
- **Maya Software**: high quality
  - Scanline (no reflections or refractions)
  - Can turn on Ray Tracing (for reflections and refractions)

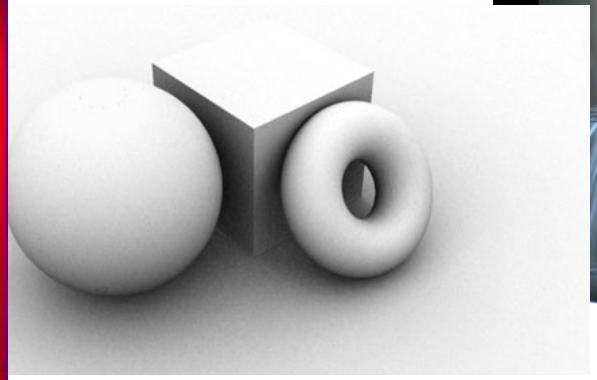


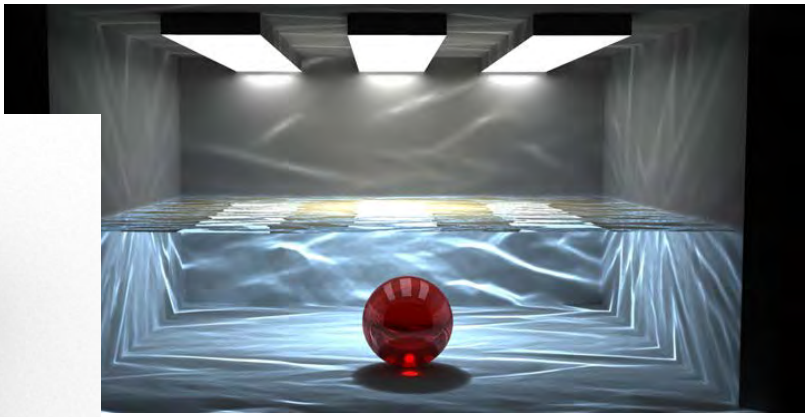




Renderers (cont)

- **Mental Ray**: professional quality, very slow!
  - Uses both Scanline and Ray Tracing
  - **Indirect Lighting**:
    - **Global Illumination (GI)** for capturing indirect lighting.
    - **Final Gathering (FG)** – more subtle indirect lighting effects.
  - **Caustics**
  - **Ambient Occlusion (AO)** (requires special mental ray shaders and settings)

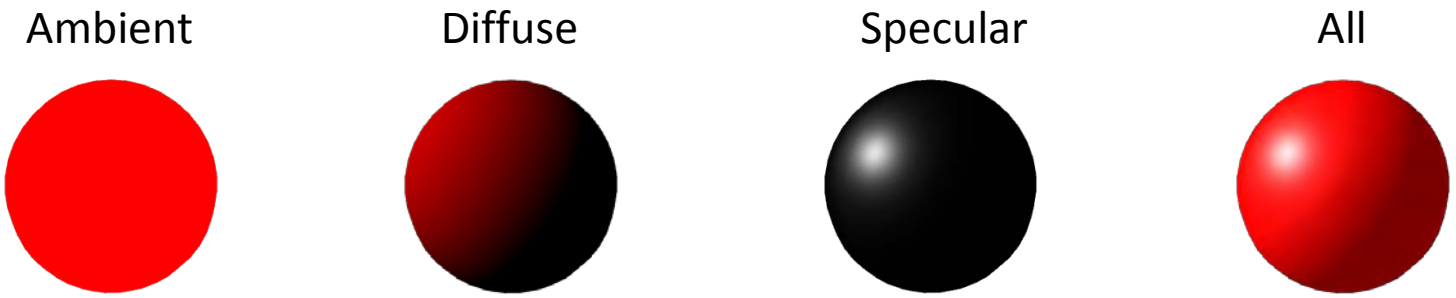




Shaders (Materials)

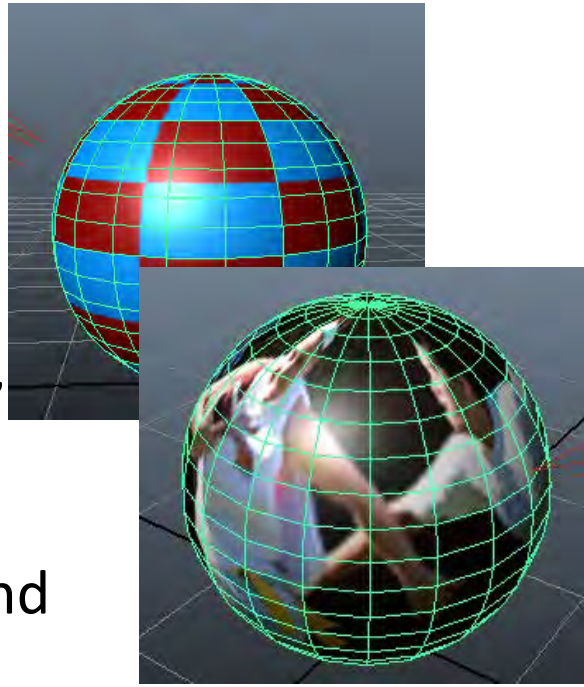
Defines surface properties. Determines color and light & surfaces interactions.

- Types: Blinn, Lambert, Phong, mia_material, etc
- Material properties (diffuse, ambient, transparency, etc)
- Properties can be constant or map to a texture.

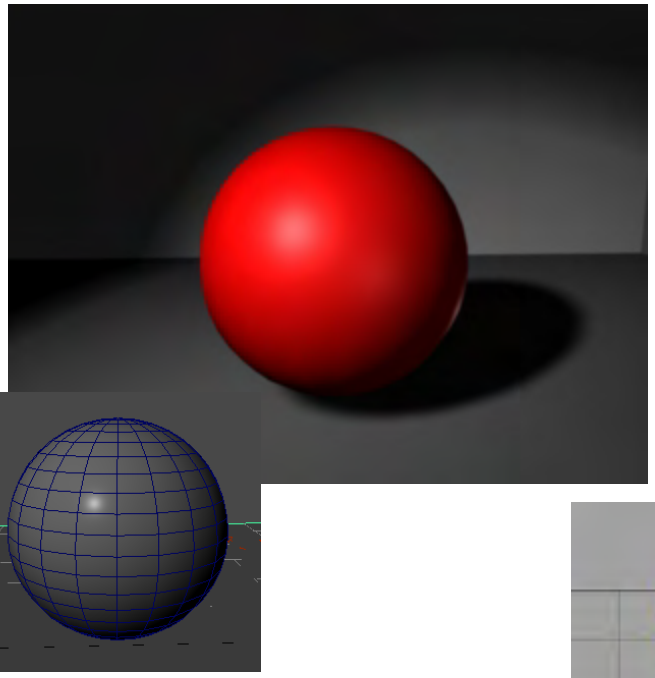


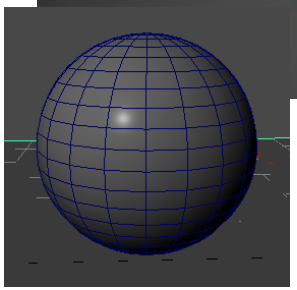
Texture Maps and UV Coordinates

- Default surface properties (diffuse, transparency, bump, etc) are constant for all points on a given surface.
- Textures make it possible for properties to vary across a given surface.
- Textures are
  - 2D images, e.g. jpg, photoshop files
  - 2D or 3D procedural textures, e.g. fractal, wood, marble
- Mapping
  - Textures are “wrapped” or mapped around surface.
  - UV coordinates determine how textures are mapped.

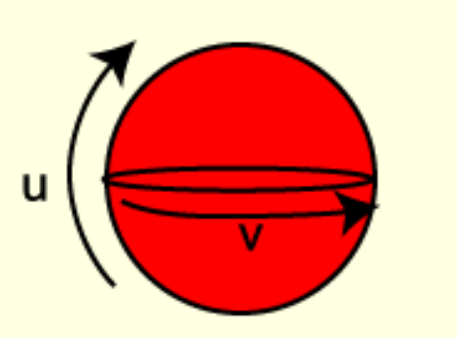


2D Texture Mapped to Sphere

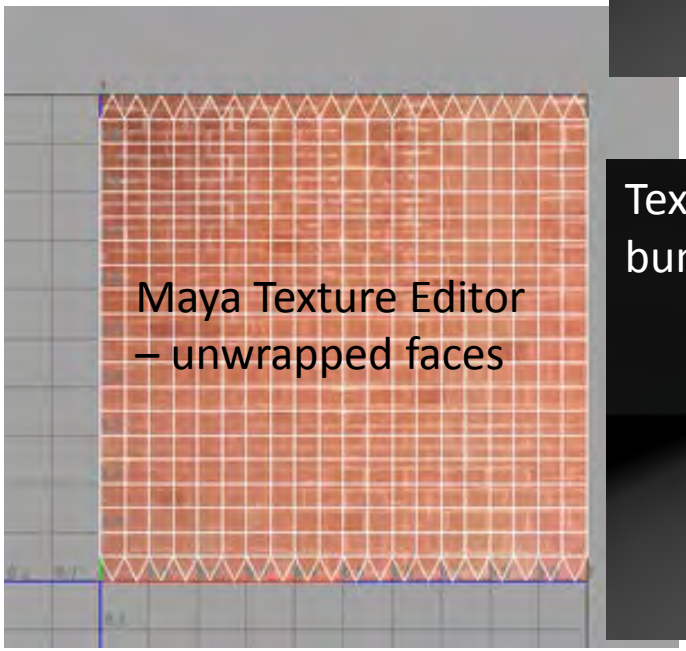




uv coordinates



2D image texture



Anti-Aliasing

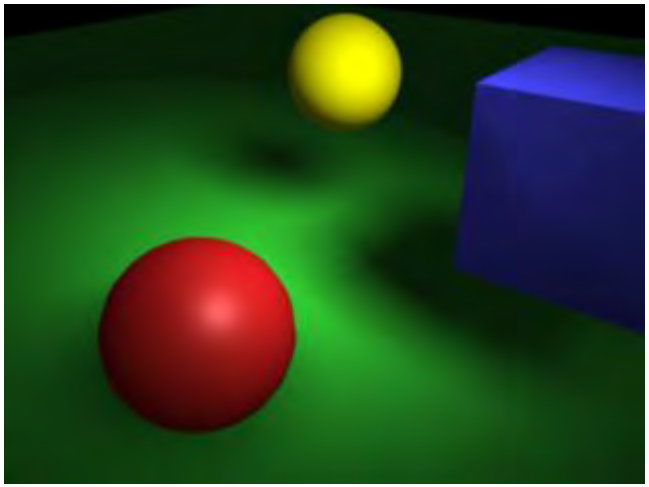
- Aliasing
  - “jaggies”caused by under sampling.
- Anti-aliasing techniques.
  - Pixel color is sampled at multiple points and then averaged
- In Maya Software Renderer, “Production Quality” applies anti-aliasing techniques to smooth out images.

Shadows

- Associated with a light.
- Depth-mapped
  - Faster, lower quality but often just fine.
  - May be easier to produce softer shadows
- Ray Traced
  - Slower, higher quality
  - Can be used with transparent or refractive surfaces

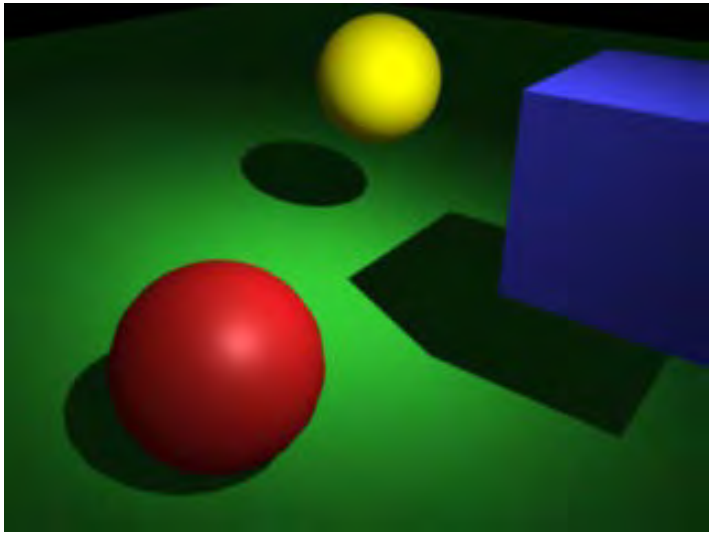
Depth Mapped Shadows

- Sharp: high resolution, small filter size
- Soft: lower resolution, larger filter size

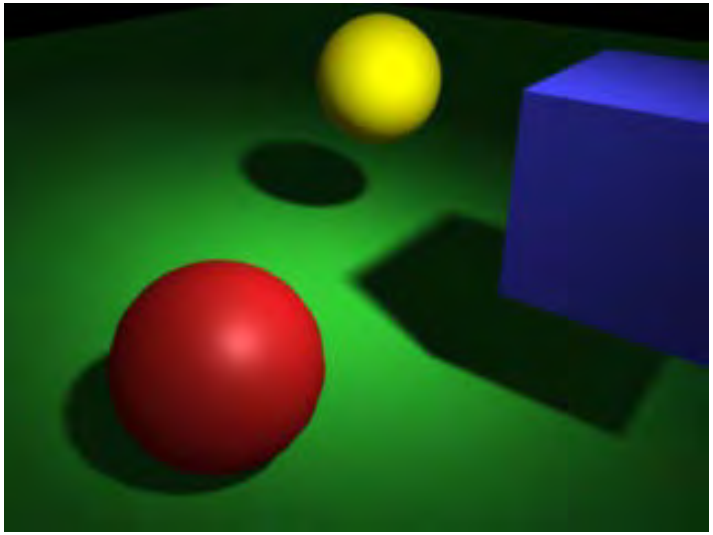


Ray Traced Shadows

- Must turn on Ray-Tracing in Render Settings as well as in the light settings.
- Sharp: 0 Light Radius, 1 shadow ray
- Soft: non-zero Light Radius, many shadow rays



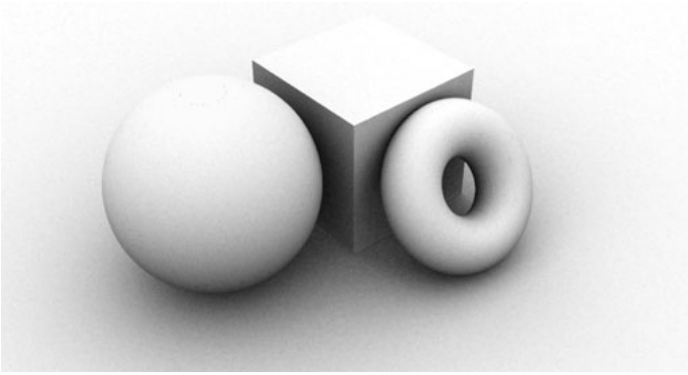
Light Radius = 0, Shadow Rays = 1

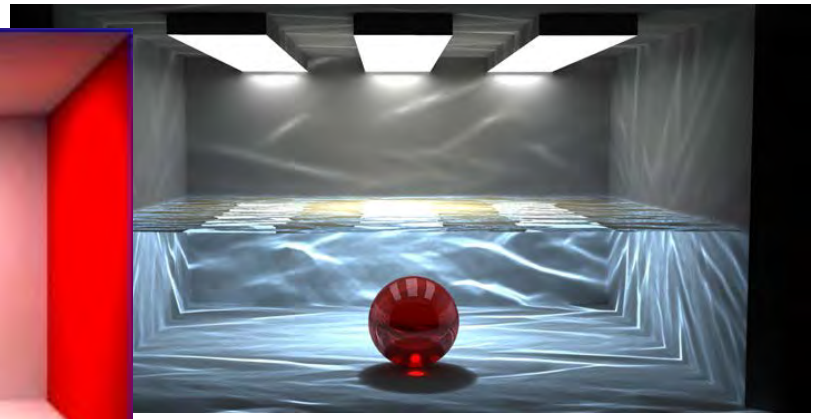


Light Radius = 1, Shadow Rays = 40

Mental Ray Renderer

- Direct Lighting: Scanline and/or Ray Tracing
- Indirect lighting:
  - Global Illumination (GI)
  - Final Gathering (FG)
- Ambient occlusion (AO)
- Caustics





Mental Ray – Global Illumination

Multi-step process:

- Photon Map: Simulate photons bouncing off geometry to create a “photon map”
- Illumination of a surface is based on number and intensity of photons on that surface and value of diffuse coefficient.
- Rendering – “Energy” values are averaged and interpolated.