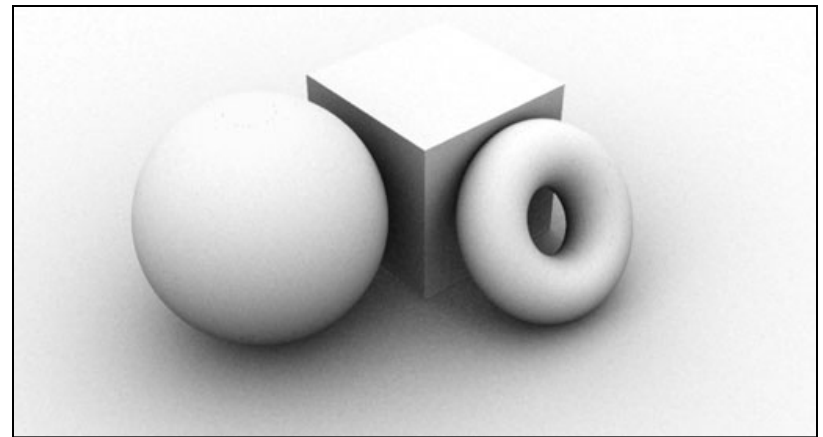
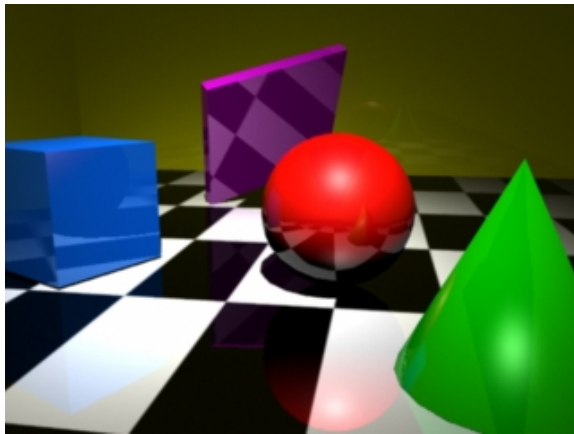


Rendering, Shaders, & Textures in Maya



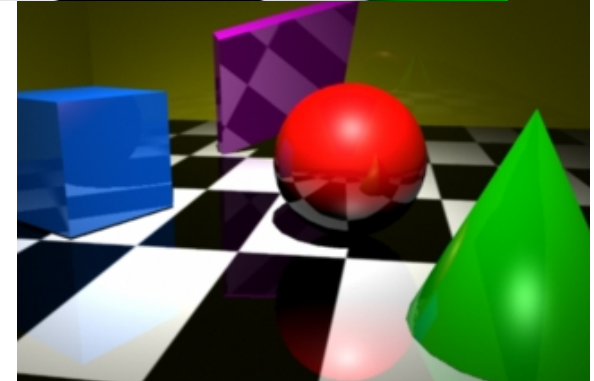
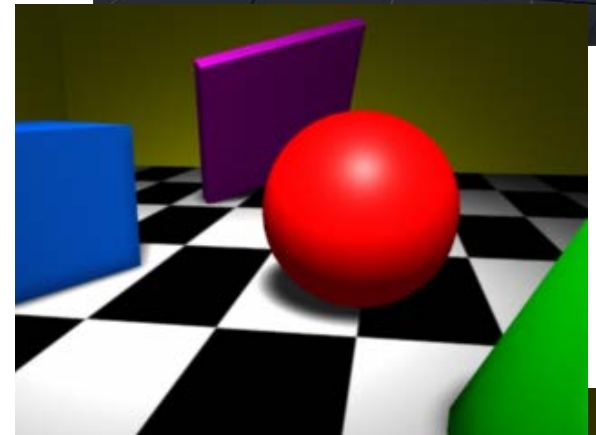
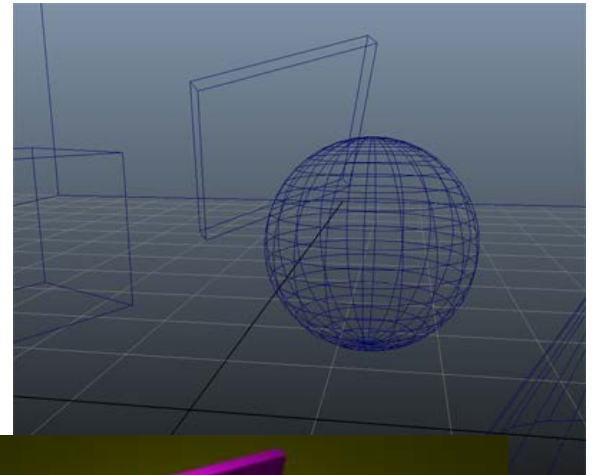
Main Components

- **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

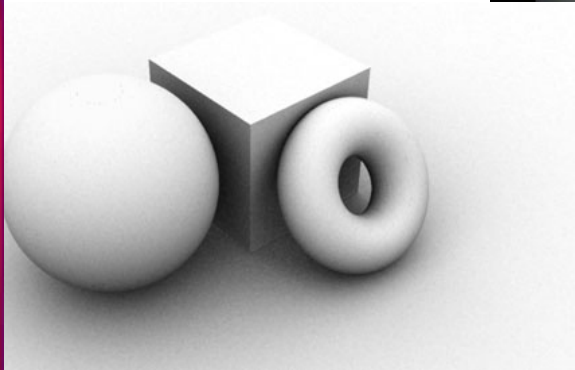
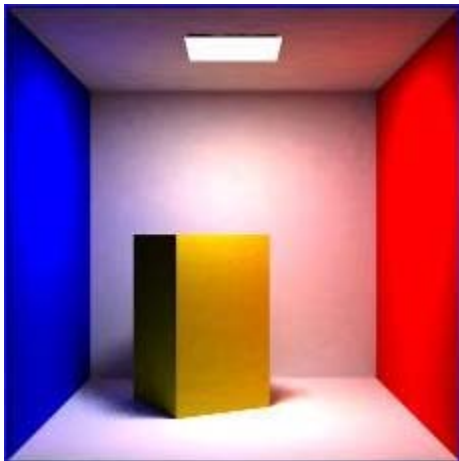
A renderer is the *computational engine*: It takes the entirety of the parameters (modeling, lighting, animation, ...) and generates the 2D image.

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



Renderers (cont)

- **Mental Ray:** professional quality, but 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)

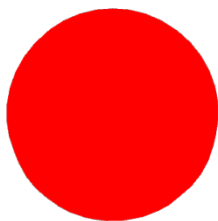


Shaders (Materials)

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.

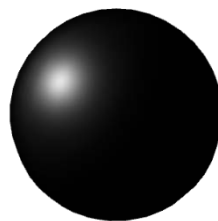
Ambient



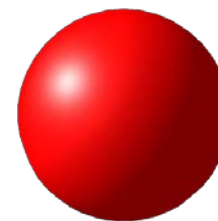
Diffuse



Specular

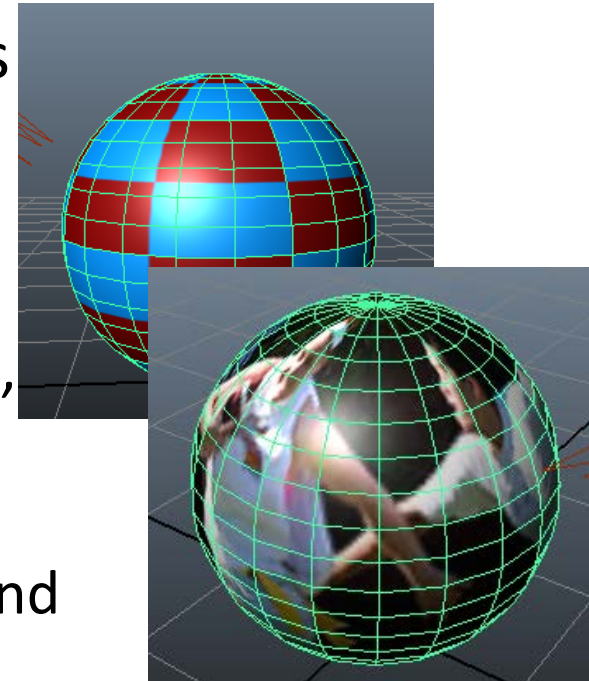


All

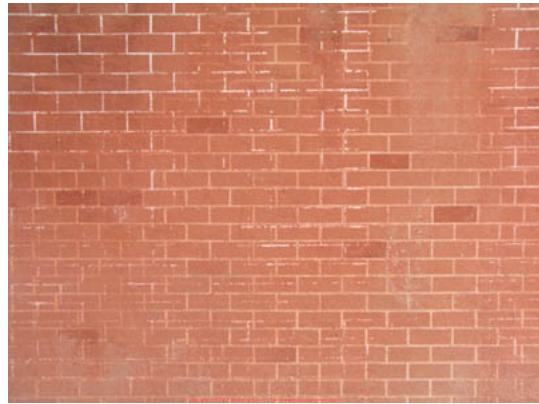
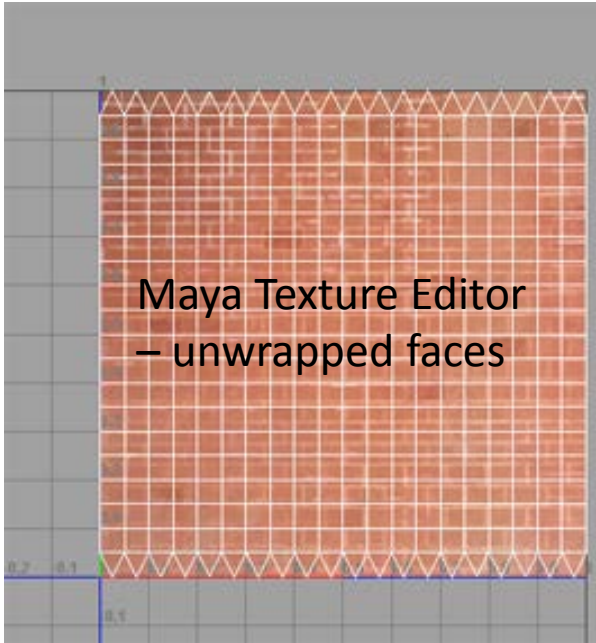
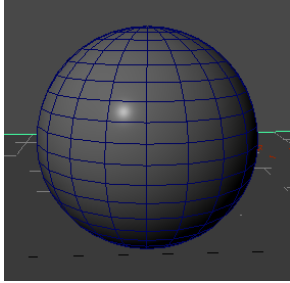
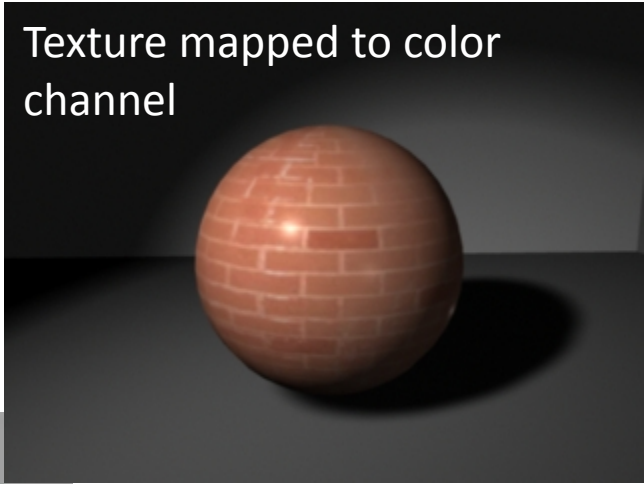
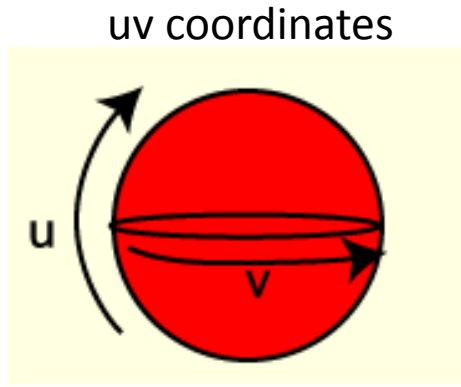
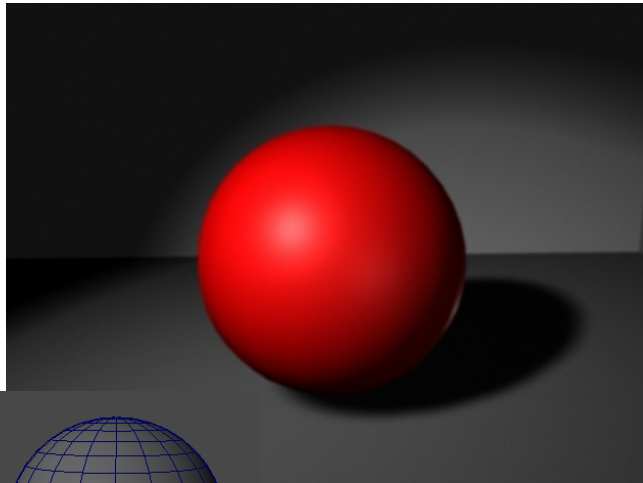


Texture Maps and UV Coordinates

- 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



2D image texture

Anti-Aliasing

- [Aliasing](#)
 - “jaggies” caused by under sampling.
- [Anti-aliasing](#) techniques.
 - Pixel color is sampled at multiple points and then averaged.
- **Maya Software Renderer:** “Production Quality” applies anti-aliasing techniques to smooth out images.
- **Mental Ray:** default is pretty good but can also increase “quality” or # of samples if needed.



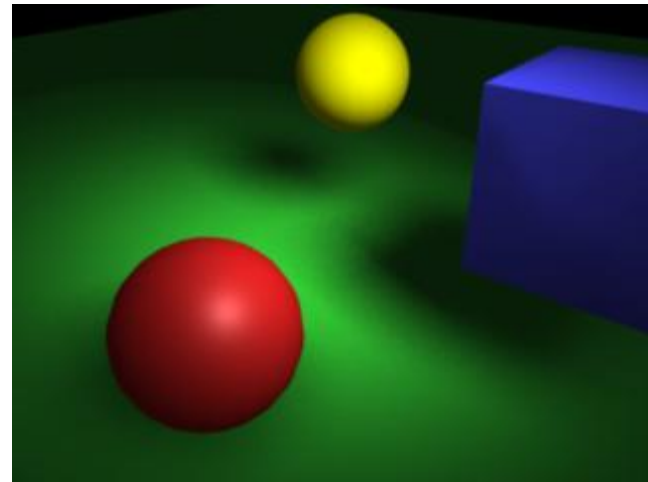
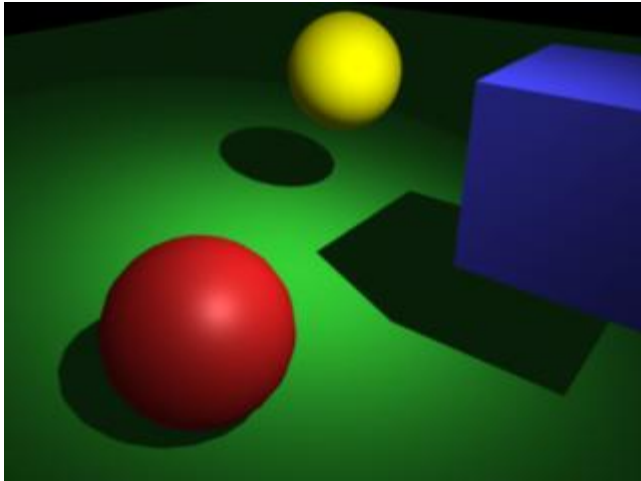
Shadows



- 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

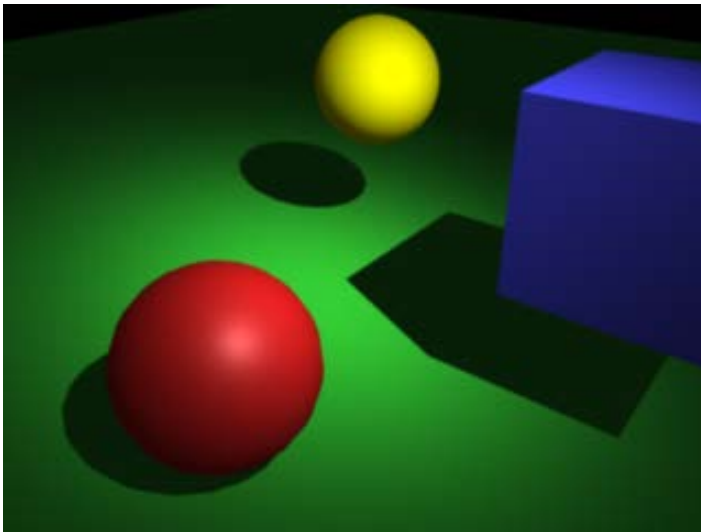
Depth Mapped Shadows

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

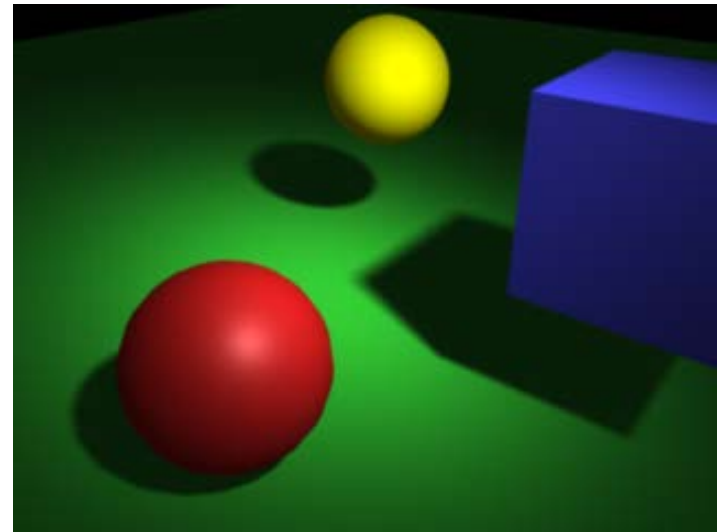


Ray Traced Shadows

- 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



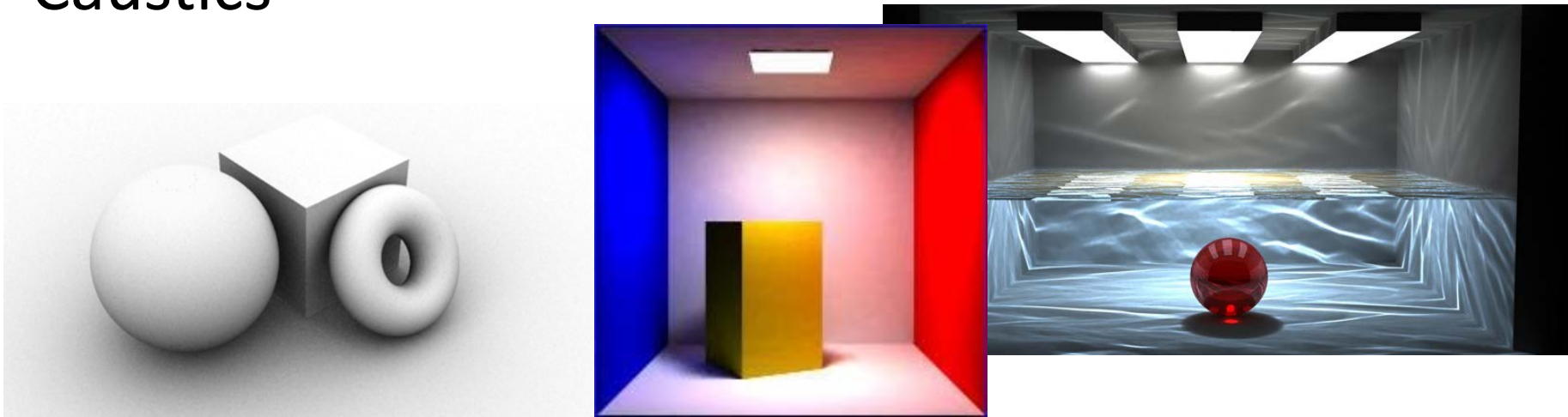
Light Radius = 0, Shadow Rays = 1



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.

