Rendering

Kenda Albertson, John Jackson, Katie Watson, Daniel McKee, Derek Bronish, Brett Kizer, Chris Domas
Rendering In Maya

Rendering - the process of generating an image from a model
Topics of Discussion

• Playblast
• Controlling rendering quality
• Shading networks
• Shader and material types
• Digital cinematography
• Software vs. hardware rendering
• Render output
• Non-linear editing of video & soundtrack
• Layers
Playblast

A faster way to render than Maya's software rendering.

Uses screen captures one frame at a time to produce the animation.

Often used to fine-tune animations.

Make sure that the area to be playblasted is not obscured by other windows. The screensaver can also disrupt long playblasts.
Window > Playblast
Window > Rendering Quality > Render Settings

Quality settings for the various rendering types.
Example of quality settings for Hardware Rendering

<table>
<thead>
<tr>
<th>Quality</th>
<th>Setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preset</td>
<td>Intermediate quality</td>
</tr>
<tr>
<td>Number Of Samples</td>
<td>1 Sample</td>
</tr>
<tr>
<td>Frame buffer format</td>
<td>RGBA: 8 bits fixed per channel</td>
</tr>
<tr>
<td>Transparency sorting</td>
<td>Per object</td>
</tr>
<tr>
<td>Color resolution</td>
<td>256</td>
</tr>
<tr>
<td>Bump resolution</td>
<td>512</td>
</tr>
<tr>
<td>Texture compression</td>
<td>Disabled</td>
</tr>
<tr>
<td>Non-power-of-two texture</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Options:
- High quality lighting
- Accelerated multi-sampling
Shader and Material Types

- Each shader is made up of a set of material nodes.
- The material nodes hold all the rendering information, such as shininess, color and opacity.
- Each object in a scene has these properties.
Hypershade in Maya

Window > Rendering Editors > Hypershade
Hypershade Overview
Lambert Shader

No highlights or sheen
Phong Shader

Glossy shading with highlights
Blinn Shader

Almost the same as Phong, but slightly different highlights
Anisotropic Shader

Wavy specular highlights
Layered Shader

- Allows you to layer multiple materials on top of one another.
- Allows development of interesting effects by changing the transparency of the materials.
Material Settings

- Double Click on any material to bring up this menu.
- Edit as desired.
Material Shader
- Defines material and color of the surface
Mental Ray-Custom Shaders

Shadow Shader
• Defines how a material's shadow looks
**Volume Shader**
- Defines shading within the volume of the material
- Used for fog, smoke, etc.
Mental Ray-Custom Shaders

Photon Shader
• Defines how material affects photons (i.e. how it reflects, absorbs and scatters)
Mental Ray-Custom Shaders

Phot Volume Shader
- Defines how photons behave inside a material
Displacement Shader

- Allows the position of micro-polygons to be altered before shading
- Allows for accurate shading of rough surfaces
Mental Ray-Custom Shaders

Environment Shader
- Shading for environmental things such as a cloudy sky
- Require no object in scene
- Infinite
Mental Ray-Custom Shaders

**Light Map Shader**

- Makes light calculations into file textures
Contour Shader

- Used to create cartoon-like contours and lines over the object
Shading networks
Digital Cinematography

- Light Source Model
- Use of Cameras
- Shadows
Lights

• Ambient Light
  o Uniform light through the entire scene
• Area Light
  o Rectangular light source (ceiling panel)
• Directional Light
  o Parallel light rays from one specific direction (sun)
• Point Light
  o Light emitted from a point in all directions (light bulb)
• Spot Light
  o Cone shaped (spotlight)
• Volume Light
  o 3D light source (fire or candle)
Lights

• Create > Lights > Light Type
• Translate, Rotate, Scale
• Common Attributes:
  o Color and Intensity
• Spot Lights
  o Cone angle
  o Penumbra angle (can be positive or negative)
  o Drop off
• Decay Rate (area, point, spot)
• Fog and Glow effects (area, volume point, spot)
Cameras

• Viewing Cameras
  o Used in modeling, animating, shading, etc.
  o Perspective view, orthographic view (front, top, side)
  o Press space bar to bring up all 4.

• Perspective Cameras
  o Three types
    ▪ Camera
    ▪ Camera and Aim
    ▪ Camera, Aim, and Up
Cameras
Cameras

- Center of Interest
- Focal Length
  - Increasing zooms in, Decreasing zooms out
- Camera Scale
  - Scales the size of the camera relative to the scene
- Near and Far Clipping Planes
- Shutter Angle (blur)
  - Larger angle, objects appear more blurry
Cameras

• Create > Cameras > …
• Camera
  o Simple animations
• Camera and Aim
  o Two node camera
  o Follows erratic path of a bird
• Camera, Aim, and Up
  o Three node camera
  o Travels along a looping roller coaster
Cameras

• To view the scene through camera:
  o Panels > Perspective > created camera

• To make camera renderable:
  o Window > Rendering Editors > Render Settings
  o Under the Renderable Cameras section, select Add Renderable Camera from the drop-down box
  o Render the scene
    ▪ Render > Render > created camera
Shadows

- No Shadows
  - default
- Depth Map
- Ray Traced
  - more realistic
  - slow render
Shadows

• To enable shadows
  o Select the surface(s) on which you want to cast a shadow.
  o In the Render Stats section of the surface’s Attribute Editor, turn on Casts Shadows.

• To render depth map shadows:
  o Select light source for which you want to produce a shadow.
  o In the Shadows section of the light’s Attribute Editor, turn on Use Depth Map Shadows.

• To render ray traced shadows:
  o Select the light for which you want to produce a shadow.
  o In the Shadows section of the light’s Attribute Editor, turn on Use Ray Trace Shadows.
  o Window > Rendering Editors > Render Settings > Raytracing Quality. Turn on Raytracing.
Software Rendering

• The computation is performed by the CPU, not specialized hardware.
• Pro: Arbitrarily programmable, not restricted like graphics hardware.
• Con: More likely to be slow, because we are not running on hardware specifically tuned for the task.
Hardware Rendering

- GPUs can either exist on separate cards, or complement the CPU on the motherboard.
- Typical primitives: drawing basic shapes, operations to combine bitmaps efficiently, transforms used for image/video compression, etc.
- Render farms/render walls
Synergy

- Graphics hardware was originally extremely limited: the ISA only allowed a particular kind of “look”
- Software rendering was superior because it was entirely customizable/programmable
- Graphics cards began to incorporate “shaders”: instruction sets that can be used to program/customize the GPU pipeline itself.
Maya

- Maya has built-in software and hardware renderers. Select what you want in the Render Settings window (Window -> Rendering Editors -> Render Settings)
- Maya also offers other rendering engines, such as mental ray, which is a highly parallelized software renderer comparable to Pixar’s proprietary renderer
Render Output

Image Formats:
Default – Maya Image File Format (IFF)
Save an image in either bitmap or vector file format
- Bitmap: uses pixels to describe the image
  TIFF, GIF, BMP, etc.
- Vector: uses lines and curves to describe the image
  SWF, AI, SVG, etc.

Render Settings
- Pixel aspect ratio and image resolution
Bitmap -

Vector -
Color, Depth, and Alpha Channels

- Each pixel has three color channels: r, g, b

- Mask (Alpha) Channel can be used to achieve transparency

- Depth channel represents how far away an object is from the camera
Frames vs. Fields

Fields
- Interlacing: refresh odd rows of pixels and then refresh even rows of pixels

Frames
- Images rendered in one stage
Display Layers

• Organization – Hide/Show
• 3 types
  o Normal
  o Template – can see, cannot snap, cannot select, cannot modify
  o Reference – can see, can snap, cannot select, cannot modify
Render Layers

- Organization
- Flexibility in Rendering
  - Only objects in a specific layer contribute to that layer (e.g. lights, reflections, shadows, etc)
  - Control render properties on a per layer basis
Motion Blur / Depth of Field
Motion Blur

• Can be set in rendering options
• Can be set on a per object or per layer basis
Depth of Field

- Camera/Eye is focused on one object (depth), objects (depths) further/nearer are out of focus
The End