Lighting Techniques in NX Render
Overview

- Light types in UG
- Shadows in UG
- General lighting principles
- 3 Point Lighting in NX Render
- Creating a “photographic” lighting studio in NX render
- How to approximate exterior lighting in NX Render
Lighting – Light Types

Light Types available in NX Render

- Spot
- Ambient
- Distant
- Point
- Eye

View > Visualization > lights
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Lighting - Spot

Cone of light cast from a location in a specified direction
- Location specified by “to” and “from” points
- Shadows can be cast
- Highlight appearance can be controlled
- Often used as primary light source
**Lighting - Spot Parameters**

*Cone Angle* - Defines the extent of the highlight

*Delta Angle* - bigger value/softer edge

*Beam Fall off* - max to min intensity across the highlight
Use *Delta Angle* to soften highlight edges

*Rapid Beam Fall-off* can be too soft
Lighting - Ambient

Used to approximate reflected diffuse light in a scene

- Colour and intensity parameters
- Independent of visibility, therefore no shadows
- Adds colour value to each pixel
- Effect can be controlled from material reflectance
- Too high a value washes out images
Parallel rays of light as if from a distant source

- Location independent
- Direction vector specified using to and from points
- Shadows can be cast
- Used to simulate sunlight or as a secondary light source
- Difficult to use with Showroom Environments and scenery when shadows are enabled
Lighting - Point

Finite source emits light in all directions
- Location specified
- Can be localised using fall-off
- Shadows can be cast
  - Generated in six directions – can be visually confusing
- Good for representing the form of complex surfaces
- Mainly used
  - Simulating lightbulbs
  - Instead of ambient light for interiors
  - For special effects
  - As secondary light sources
Shadows

Shadows are used to:
- Define spatial relationships of objects
- Give geometry a feeling of weight
- Add contrast
- As a tool for composition
Shadows – Shadow Creation Methods

Two forms of shadow creation

Shadow maps
- Pre processing step

Ray traced shadows
- Performed at render time
Shadows - Shadow Maps

Pre-processing step - renders depth information into a buffer from the point of view of the light.

This information is used at render time to create the shadow

- Produces soft edged shadows
- Softness can be controlled - *Edges*
- Accuracy is dependent on the map resolution defined - *Detail*
- Memory overhead for storing depth information
A common problem with shadow maps results from the resolution being too low.
Shadows - Detail Parameter

1. Shadow Detail too coarse

2. Softness can make it worse

3. Same Detail - smaller cone angle

4. Detail increased
Raytrace shadows are computed on the fly

- Produces hard edged shadows
- No memory overhead
- Highly accurate shadows from detailed geometry
- Time overhead for tracing rays
- Render in Raytrace render mode to anti-alias the shadow edges
General principles – Modelling with Light

Aim of lighting is to convey 3D form in a 2D image
Need to use a wide dynamic range
Shadows can increase contrast
General principles - High Key

High Key lighting – Main areas of the image are light
General principles - Low Key

Low Key lighting – predominantly dark
Light Direction - Front

- Flattens out the object
- Flattens bump maps
Light Direction - Side

- Shows form and texture
- Shadows prominent
Light Direction - Back

- Produces silhouettes
- Can be used as rim lights
- Shadows prominent
Light Direction - Top

- Produces intense shadow directly underneath the object

- Good for making objects appear to be on the base plane
Light Direction - Below

Can be used at low level to approximate light bouncing off a base plane
User defined Light Studios in NX Render

- Creating a default light studio other than the supplied default lights will produce better results
- Provides a good basis to create a new lighting set-up
- Save as a visualisation template to use with other parts
Lighting techniques - 3 point lighting

3 point lighting is a technique used by photographers and film makers. The same principles can be transferred to CG.

Main lighting comes from the side light. Called the key light.
Lighting techniques - 3 point lighting

Lower intensity light from opposite side called the fill light
Lighting techniques - 3 point lighting

Backlight to illuminate the “rim” of the objects
Lighting techniques – 3 point lighting

Combined together
Photographers use high intensity diffuse sources for “product” shots.
Produce soft light and shadows.
Often use shiny bases such as acrylic sheet underneath the subject to produce reflections – called acrylic shadows.
Lighting techniques - photographic light

- Flood reflector angled behind the subject
- Subject
- Table
- Camera/viewpoint
- Reflecting card front
- Reflecting card left and right
Reflective (raytraced) objects need objects to reflect so create scenery geometry like the real light studio
Create a base plane underneath the objects
Create a plane for the area light above the objects
Angle the plane (about 45 degrees)
Create reflector planes left and right
Creating the studio in NX

Apply separate visualisation materials to:
The area light
- Colour 1, 1, 1
- Reflectance: constant
Side reflectors
- Colour 0, 0, 0
- Reflectance: constant
the baseplane
- Colour 1, 1, 1
- Reflectance: matte
Creating the studio in NX - Lights

Use an array of 9 spot lights parallel to each other to approximate the large area light
Position behind the objects (relative to the view)
Wide cone angle (120)
Delta angle 0
Beam falloff gradual
Shadows on
Detail Extra Fine
Edges Hard
Intensity low (0.15)
Creating the studio in NX

- Add 2 distant lights left and right pointing down at a shallow angle
- Low intensity (0.2)
- No Shadows (scenery geometry would cast shadows)
- Used to simulate reflected light
Creating the studio in NX

- Add a distant light at the front
- Low intensity (0.2)
- Cast Shadows (no geometry in the way)
- Used to simulate reflected light
Creating the studio in NX

Render in NX

Soft, extended shadows to the front

Good rendering of form
Creating the studio in NX - Raytrace materials

Apply a mirror reflectance to the base
A raytrace material on the objects (polished gold)
Creating the studio in NX

- Set background to be ray cube
- Primary shader is plain white (the background in view)
- Secondary is white (the background in reflection)
Creating the studio in NX

Effect of the Raycube secondary setting

Clouds

Plain - purple

Graduated white to red
Creating the studio in NX

Effect of the side reflectors
Set to black
Reflectance - constant
Creating a hemispherical light

Approximation of a skylight using an array of distant lights

Distant lights are defined as a vector so this light studio will work independently of model size.

Illumination is constant from all directions around the model so it works well for animation and QTVR.

Save in a Visualisation Template for use on different models.
Creating a hemispherical light

Position distant lights evenly across the surface of a virtual hemisphere (radius 1) pointing to the origin.
Check shadows on for each light.
Set the shadow softness to ultra soft.
Set the shadow detail to Standard.
Intensity required depends on number of lights.
- I used 17 lights with an intensity of 0.2.
Creating a hemispherical light

The result is even illumination with very soft shadows as if from an extended light source such as the sky.
Setting Light Colour

There are colour temp values for real light sources widely available
These can be converted to RGB
BUT This does not take into account adaption and will result in over-saturated colours
These RGB values will produce a more realistic result.

<table>
<thead>
<tr>
<th>Light Source</th>
<th>Kelvin temp</th>
<th>RGB Values</th>
<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candle</td>
<td>1900</td>
<td>255, 147, 41</td>
<td></td>
</tr>
<tr>
<td>40W Tungsten</td>
<td>2600</td>
<td>255, 197, 143</td>
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<tr>
<td>100W Tungsten</td>
<td>2850</td>
<td>255, 214, 170</td>
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<tr>
<td>Halogen</td>
<td>3200</td>
<td>255, 241, 224</td>
<td></td>
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<tr>
<td>Carbon Arc</td>
<td>5200</td>
<td>255, 250, 244</td>
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<tr>
<td>High Noon Sun</td>
<td>5400</td>
<td>255, 255, 251</td>
<td></td>
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<tr>
<td>Direct Sunlight</td>
<td>6000</td>
<td>255, 255, 255</td>
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<tr>
<td>Overcast Sky</td>
<td>7000</td>
<td>201, 226, 255</td>
<td></td>
</tr>
<tr>
<td>Clear Blue Sky</td>
<td>20000</td>
<td>64, 156, 255</td>
<td></td>
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</tbody>
</table>
## Setting Light Colour

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<thead>
<tr>
<th>Light Source</th>
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<th>Colour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Fluorescent</td>
<td>255, 244, 229</td>
<td></td>
</tr>
<tr>
<td>Standard Fluorescent</td>
<td>244, 255, 250</td>
<td></td>
</tr>
<tr>
<td>Cool White Fluorescent</td>
<td>212, 235, 255</td>
<td></td>
</tr>
</tbody>
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Guidelines for Lighting

Think of UG Render as a virtual photographic studio

- If in doubt start with 3 point lighting
- Create re-usable photographic studios in NX for specific effects
- Soft lighting from extended sources can be approximated by using multiple standard lights
- You will need to consider creating geometry around reflective objects
Lighting - Summary

- Lots of lights soon become unmanageable so work with one light at a time during set-up
- Get as much contrast as possible in your images
- Take ideas from real photographic lighting and photographs
Further information on lighting

http://members.shaw.ca/jimht03/light.html
http://www.itchy-animation.co.uk/light.htm