

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

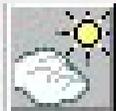


Lighting – Light Types

Light Types available in NX Render



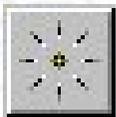
Spot



Ambient



Distant



Point



Eye



View > Visualization > lights

© Copyright LightWork Design Ltd 2005

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



Cone Angle	60.0000	▲▼
Delta Angle	1.0000	▲▼
Beam Fall Off	Rapid	▼

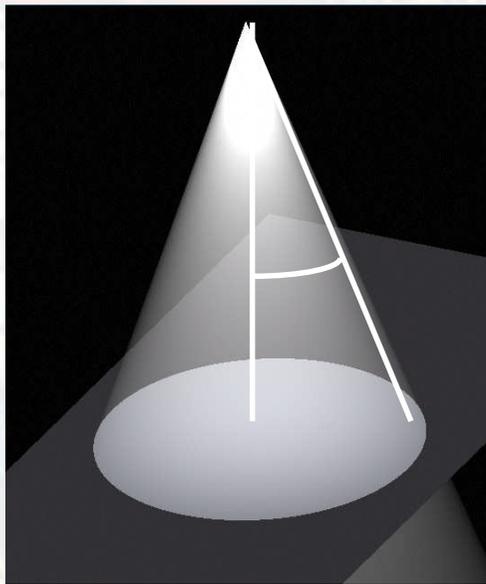
Cone Angle	60.0000	▲▼
Delta Angle	1.0000	▲▼
Beam Fall Off	Gradual	▼

Cone Angle	60.0000	▲▼
Delta Angle	5.0000	▲▼
Beam Fall Off	Gradual	▼

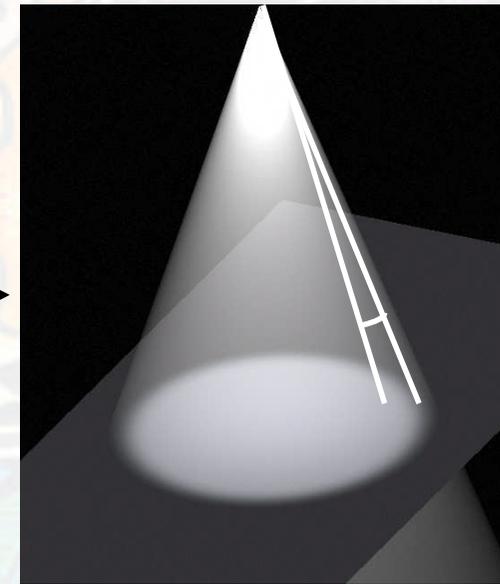
Lighting - Spot Parameters



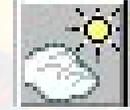
Use *Delta Angle* to soften highlight edges
Rapid *Beam Fall-off* can be too soft



Cone Angle	60.0000	▲▼
 Delta Angle	5.0000	▲▼
Beam Fall Off	Gradual	▼



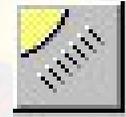
Lighting - Ambient



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

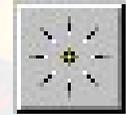
Lighting - Distant



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



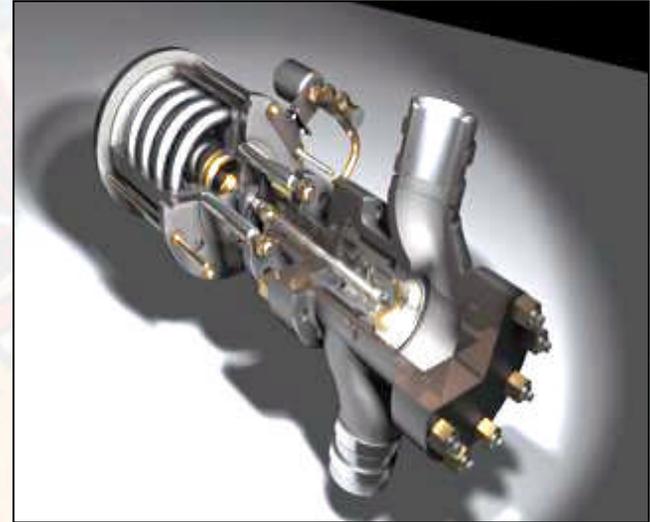
Finite source emits light in all directions

- ◆ 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



← Shadow Map
← Standard
← Fine
← Extra Fine
← Raytraced

Visualization > Advanced Lights > More Options > Detail

Shadows - Shadow Maps

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

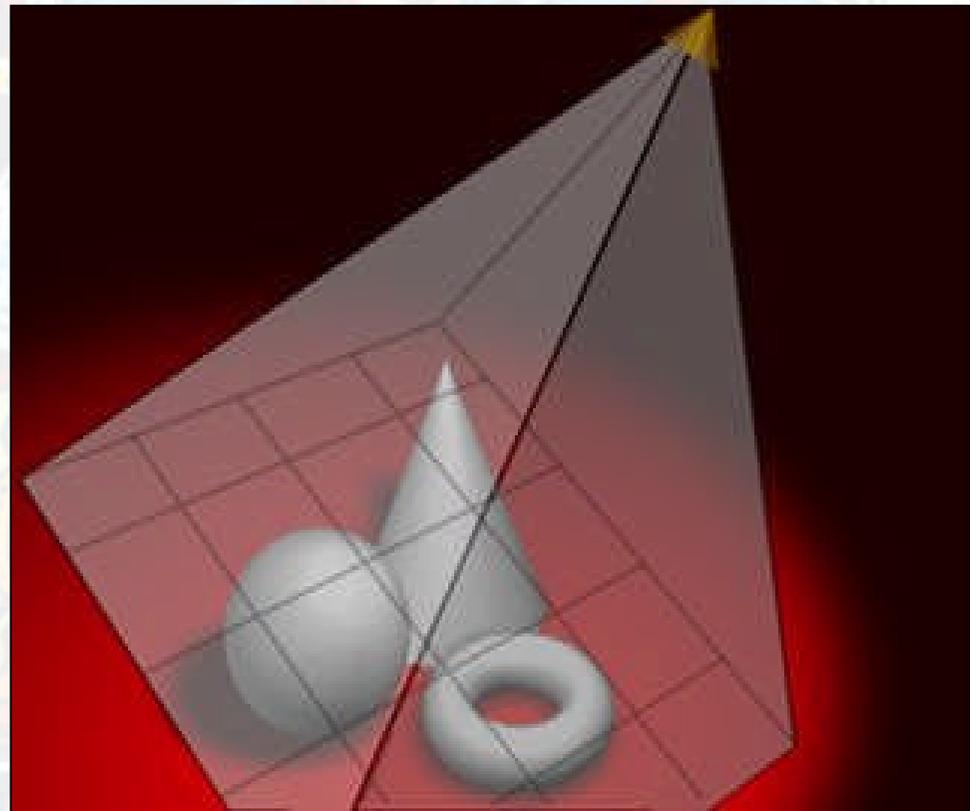
This information is used at render time to create the shadow

- ◆ Produces soft edged shadows
- ◆ Softness can be controlled - *Edges*
- ◆ Accuracy is dependent on the map resolution defined - *Detail*
- ◆ Memory overhead for storing depth information



Shadows - Detail Parameter

A common problem with shadow maps results from the resolution being too low



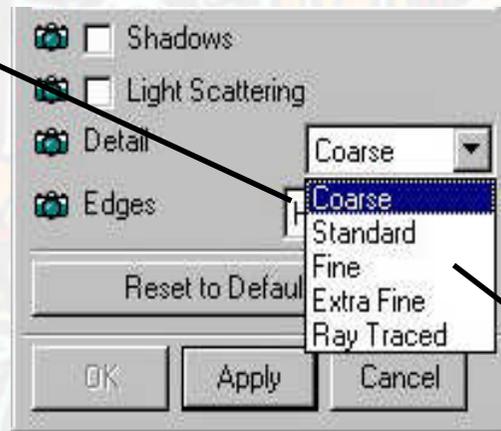
Shadows – Detail Parameter



Shadow Detail too coarse



Softness can make it worse



Same Detail smaller cone angle

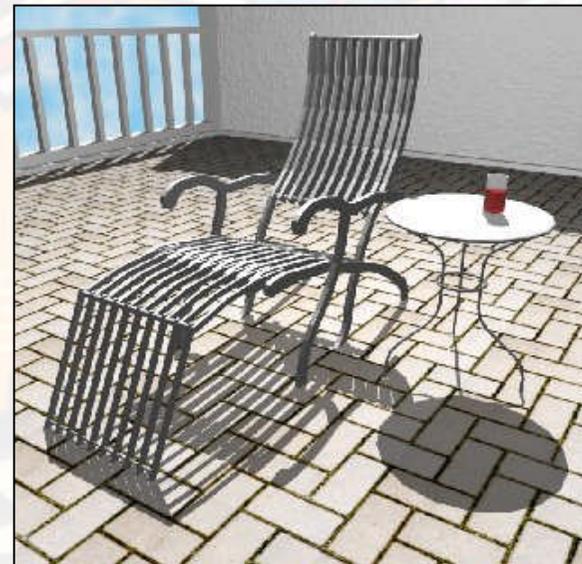


Detail increased

Shadows - Ray traced

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

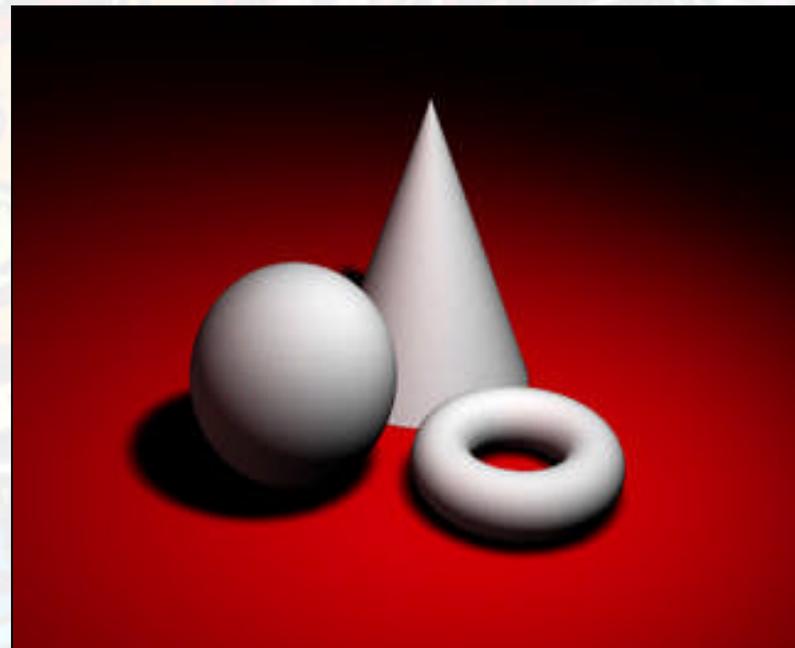
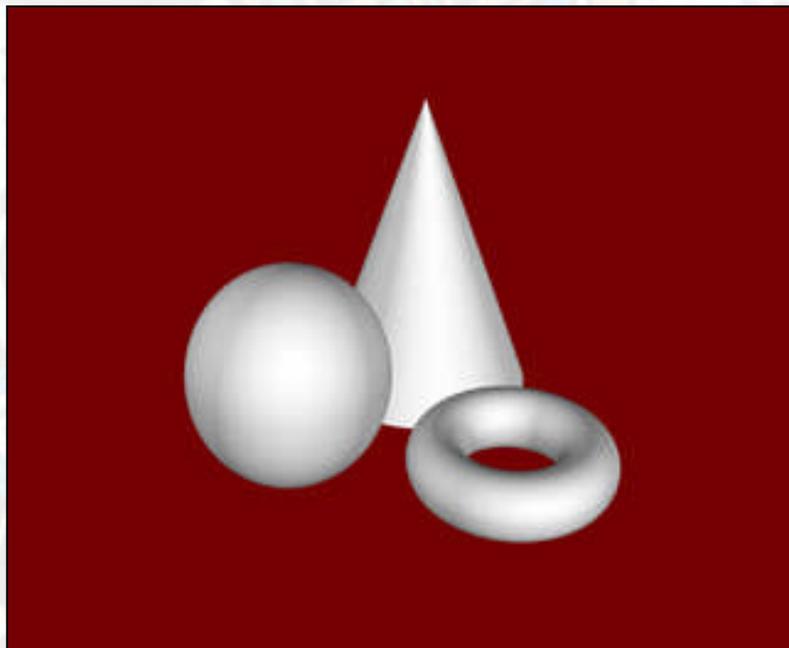


General principles – Modelling with Light

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



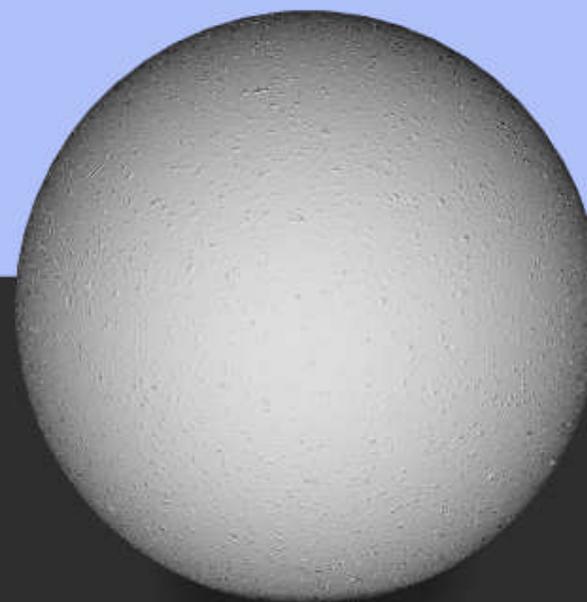
General principles - Low Key

Low Key lighting – predominantly dark



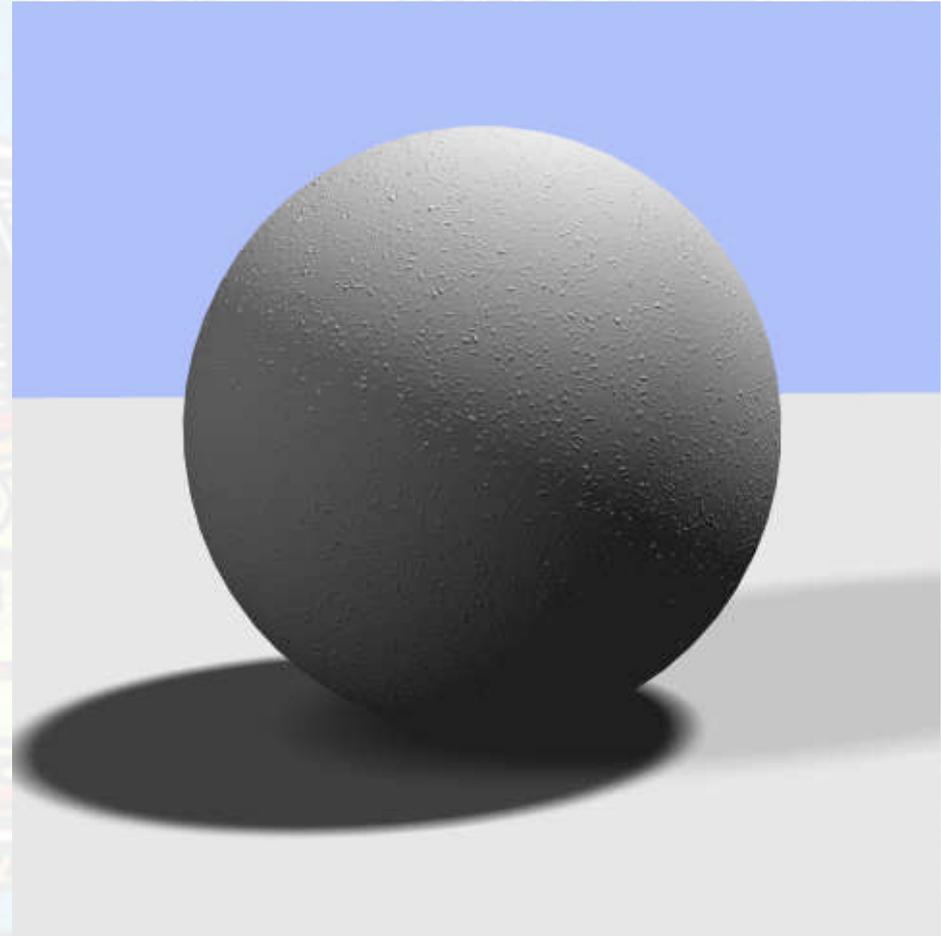
Light Direction – Front

- ◆ Flattens out the object
- ◆ Flattens bump maps



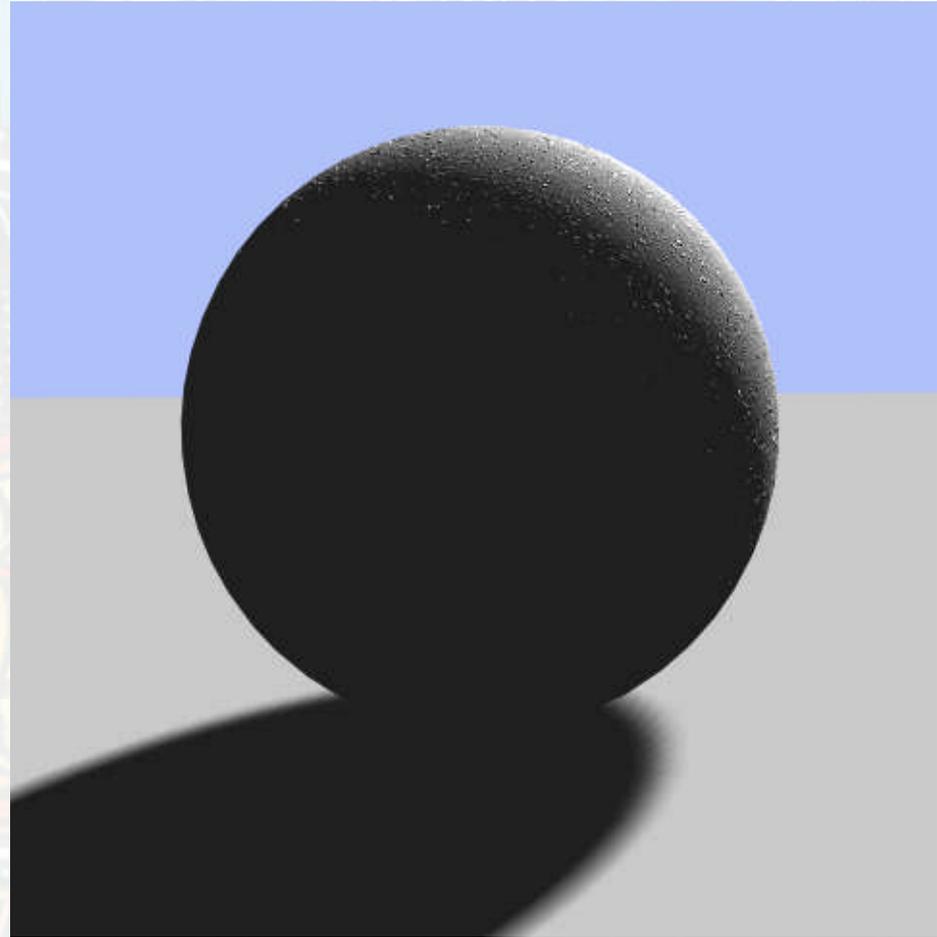
Light Direction - Side

- ◆ Shows form and texture
- ◆ Shadows prominent



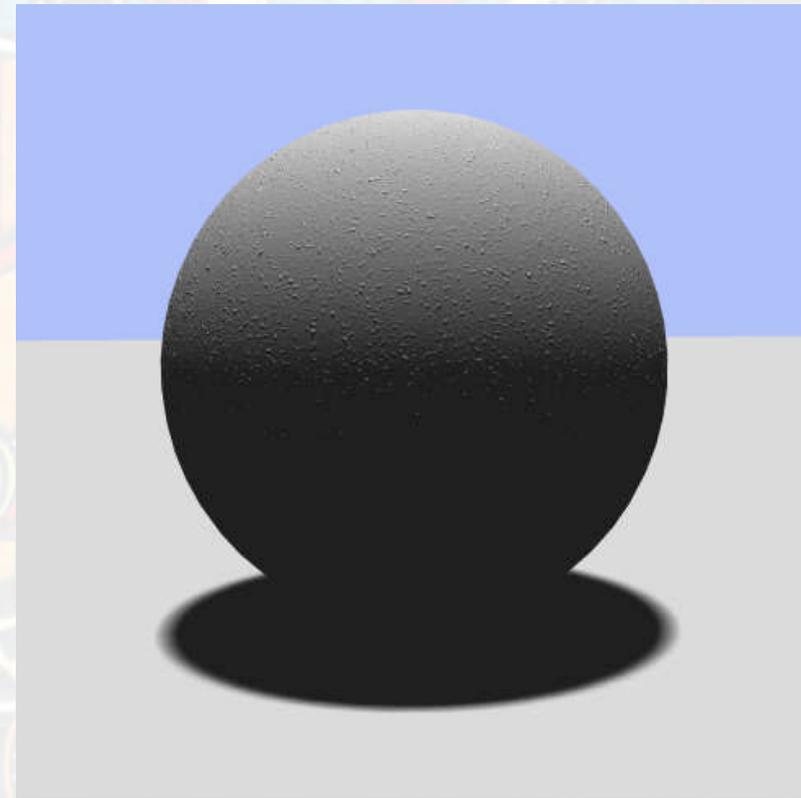
Light Direction - Back

- ◆ Produces silhouettes
- ◆ Can be used as rim lights
- ◆ Shadows prominent



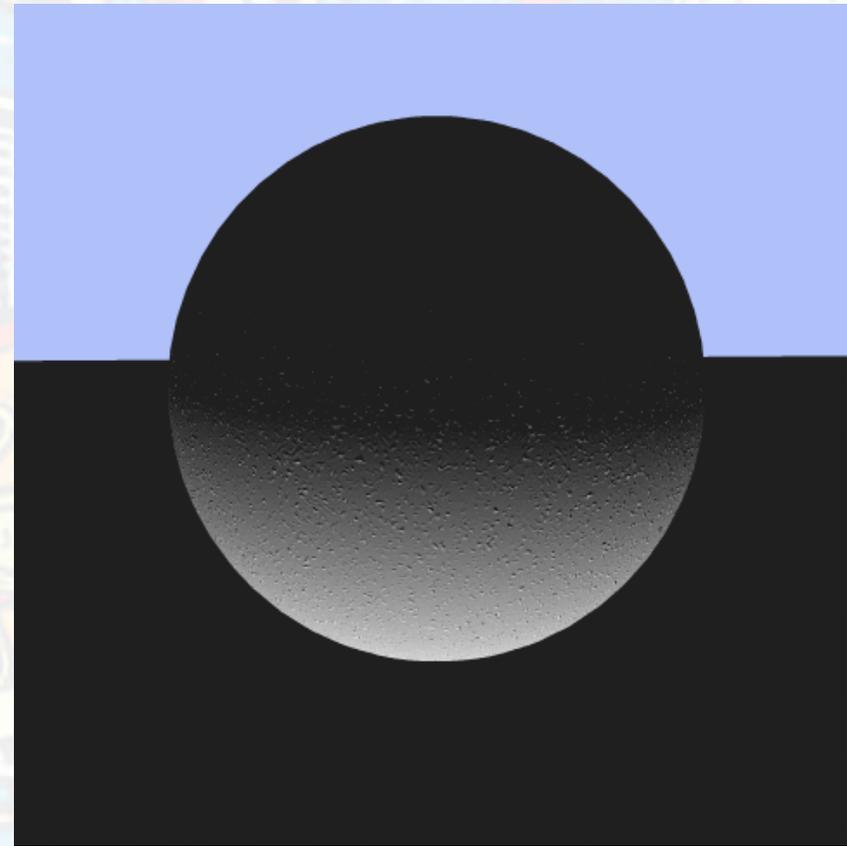
Light Direction - Top

- ◆ Produces intense shadow directly underneath the object
- ◆ Good for making objects appear to be on the base plane



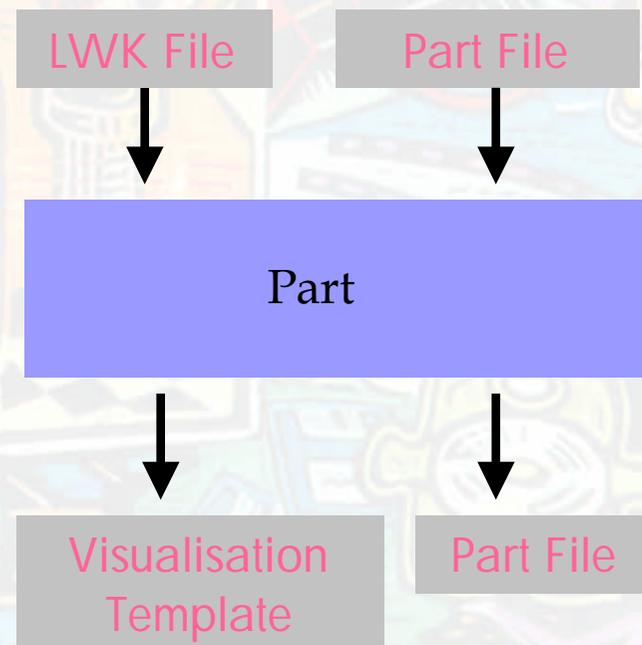
Light Direction - Below

Can be used at low level
to approximate light
bouncing off a base
plane



User defined Light Studios in NX Render

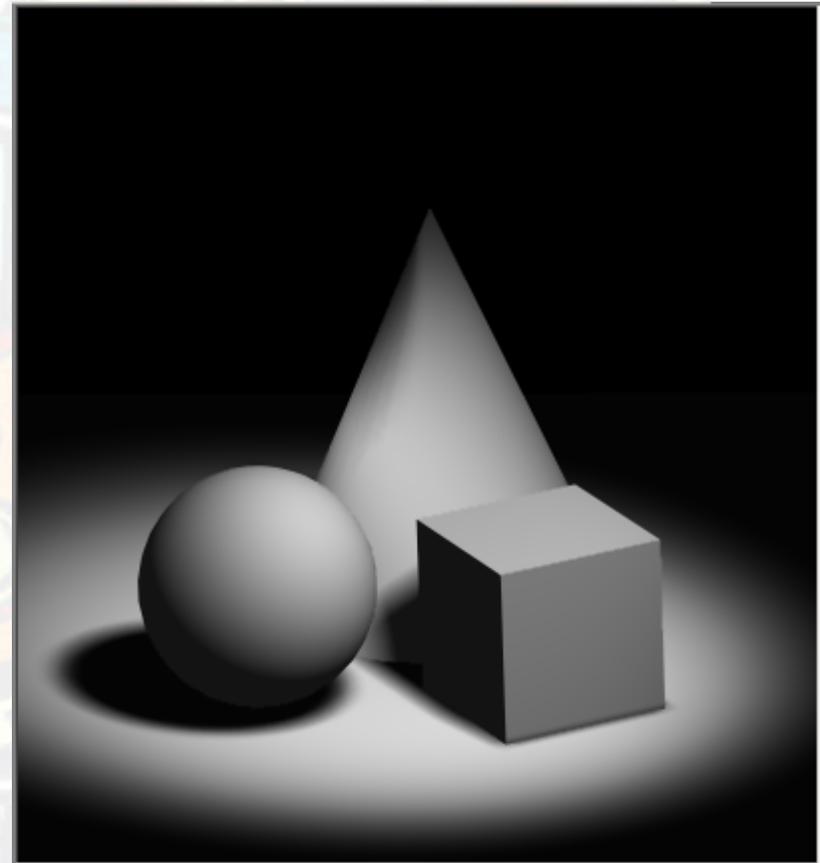
- ◆ Creating a default light studio other than the supplied default lights will produce better results
- ◆ Provides a good basis to create a new lighting set-up
- ◆ Save as a visualisation template to use with other parts



Lighting techniques - 3 point lighting

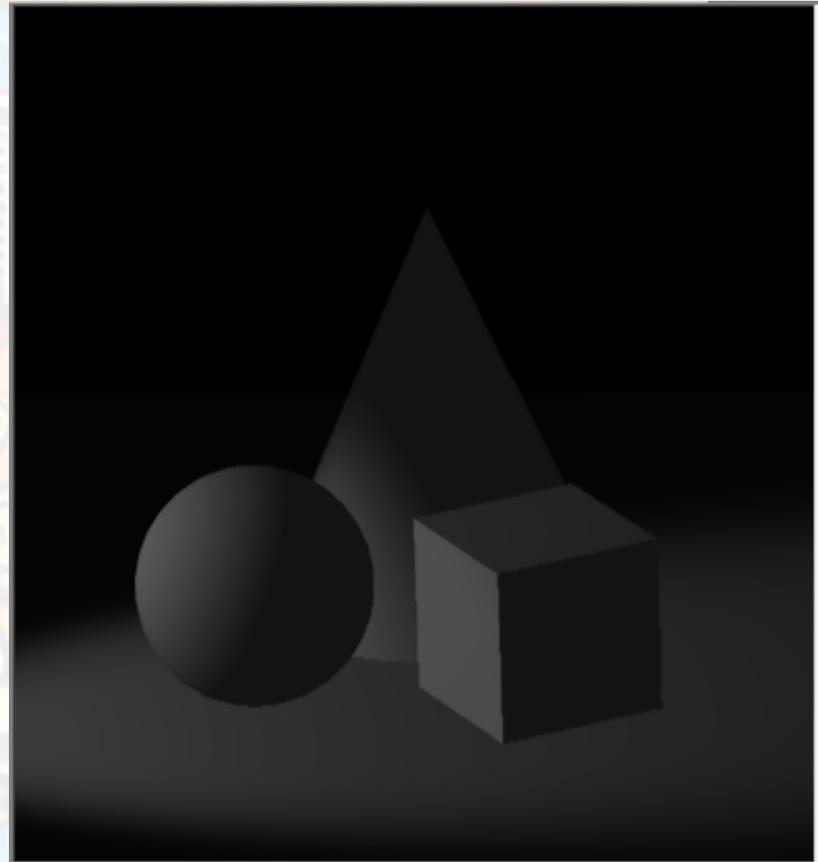
3 point lighting is a technique used by photographers and film makers. The same principles can be transferred to CG

Main lighting comes from the side light. Called the key light.



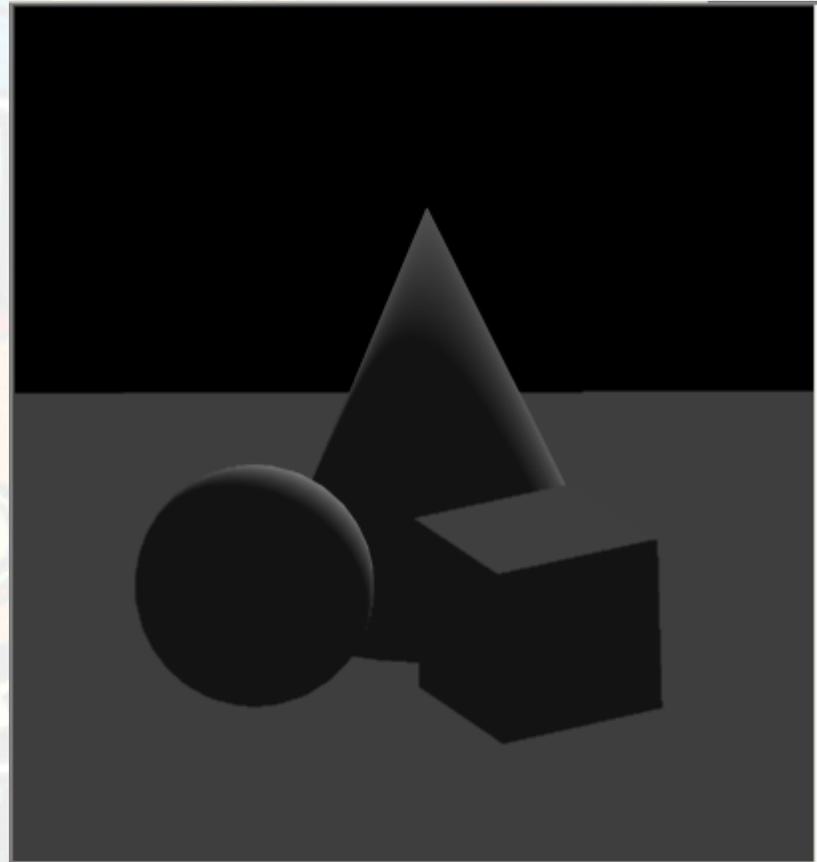
Lighting techniques - 3 point lighting

Lower intensity light
from opposite side
called the fill light

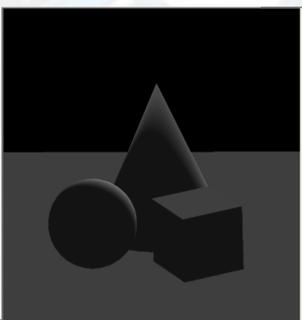
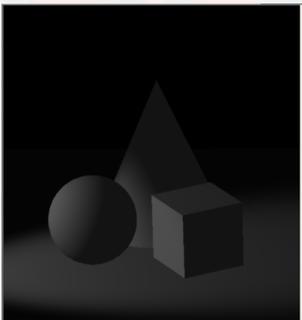
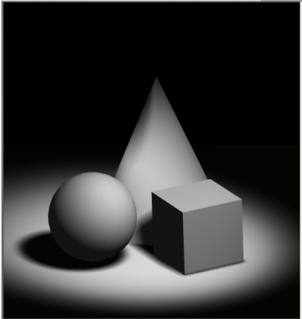


Lighting techniques - 3 point lighting

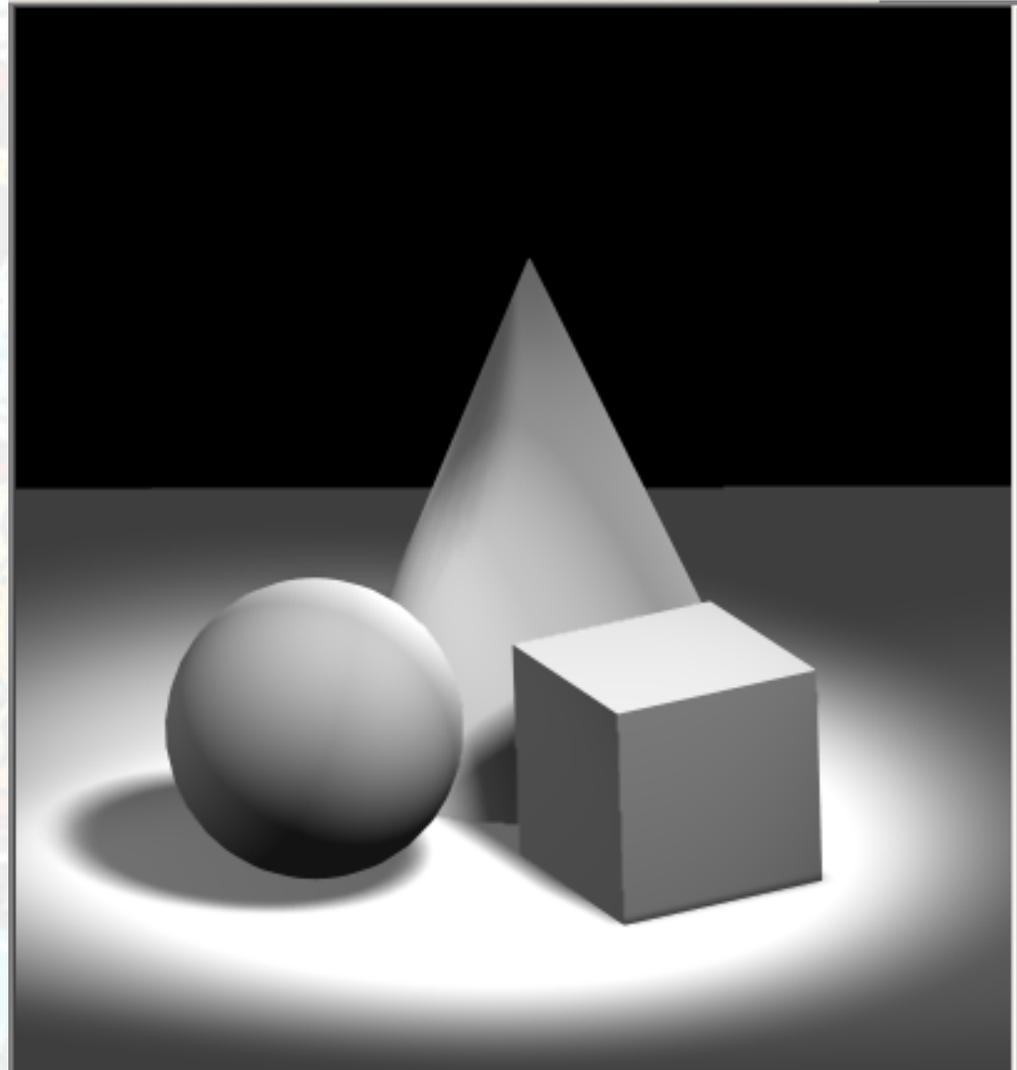
Backlight to illuminate
the “rim” of the
objects



Lighting techniques – 3 point lighting



Combined
together

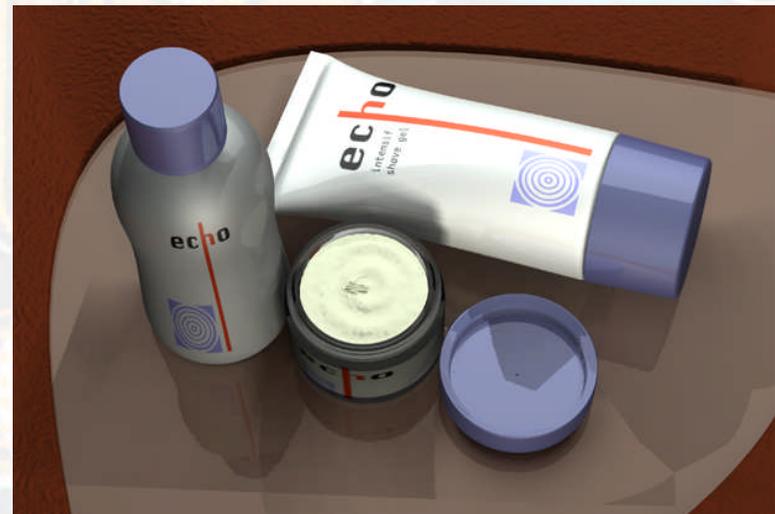


Lighting techniques - Photographic light

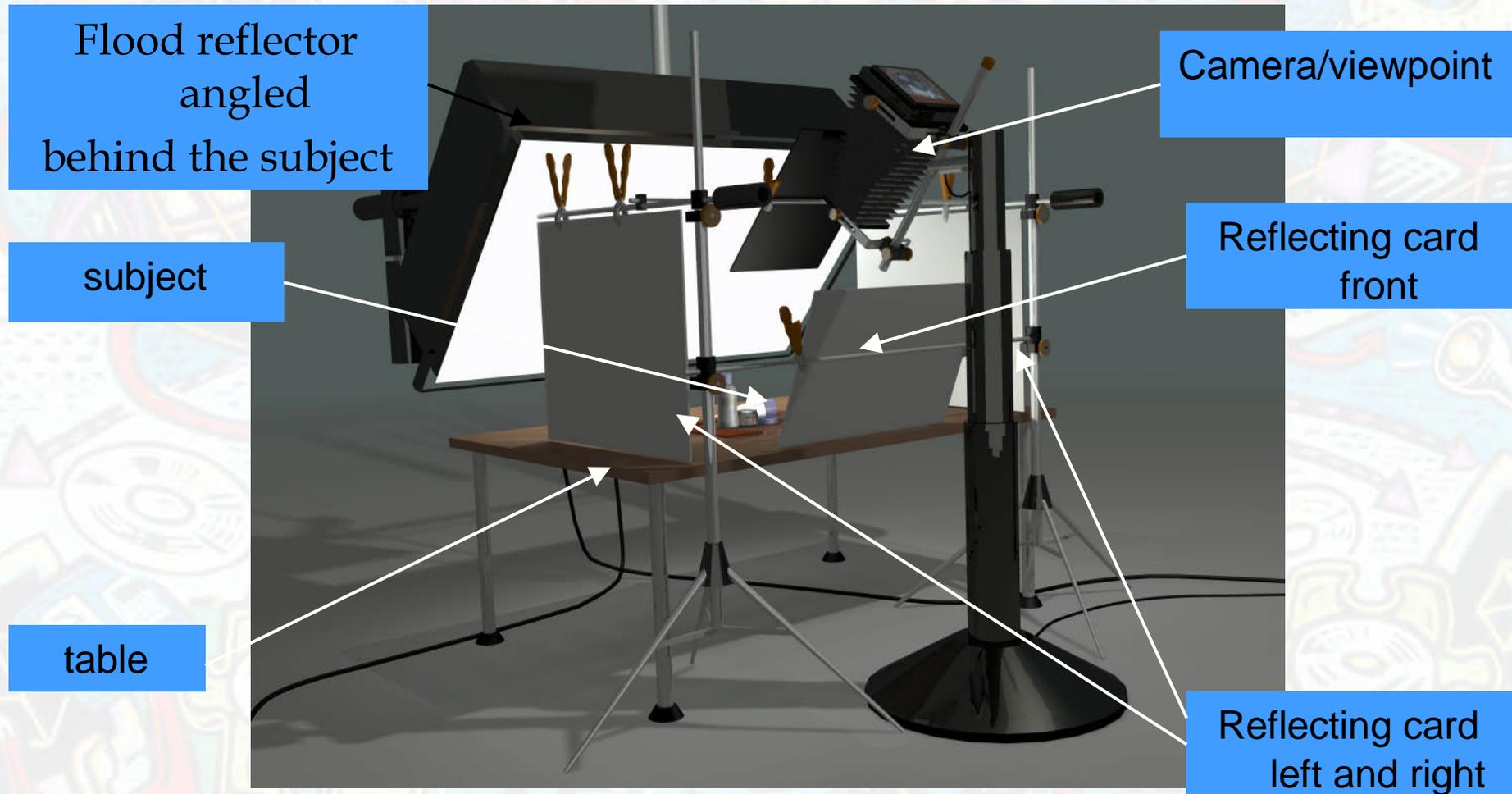
Photographers use high intensity diffuse sources for “product” shots

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



Creating the studio in NX - Geometry

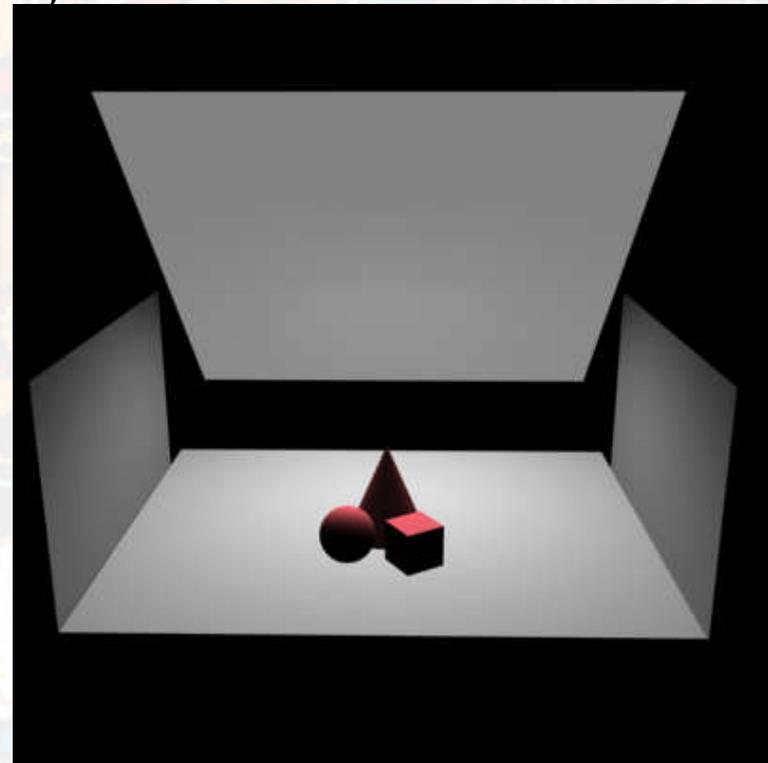
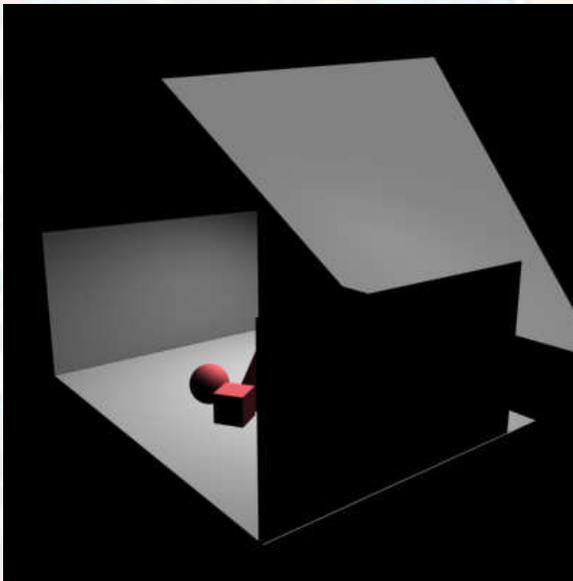
Reflective (raytraced) objects need objects to reflect so create scenery geometry like the real light studio

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

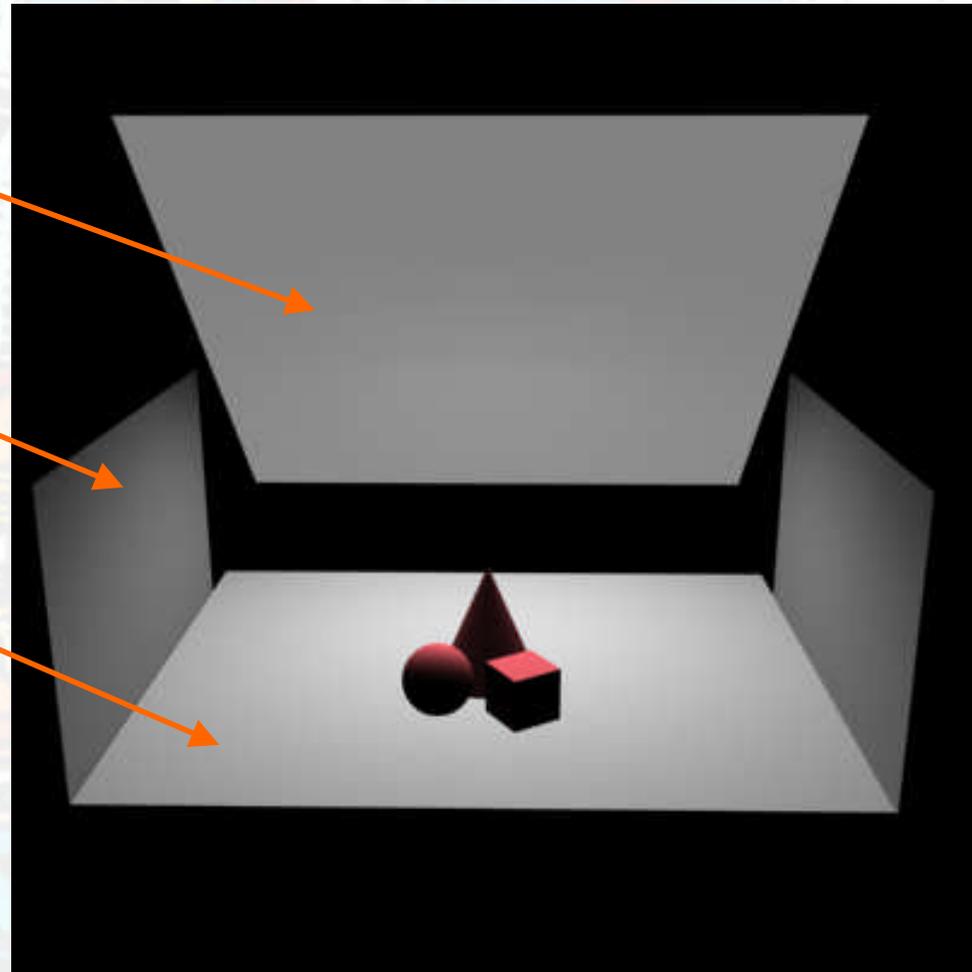
- ◆ Colour 1,1,1
- ◆ Reflectance: constant

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

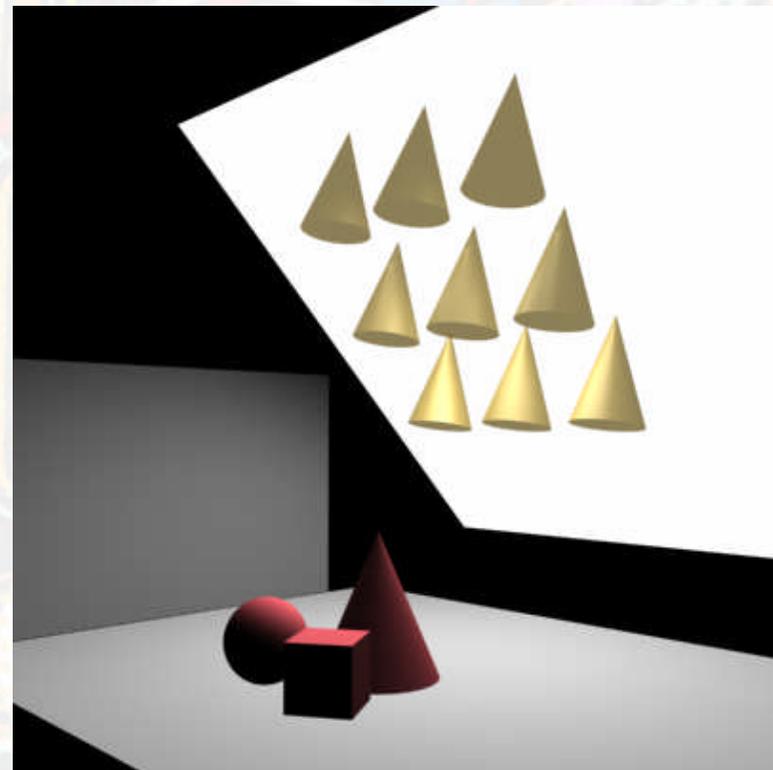
Beam falloff gradual

Shadows on

Detail Extra Fine

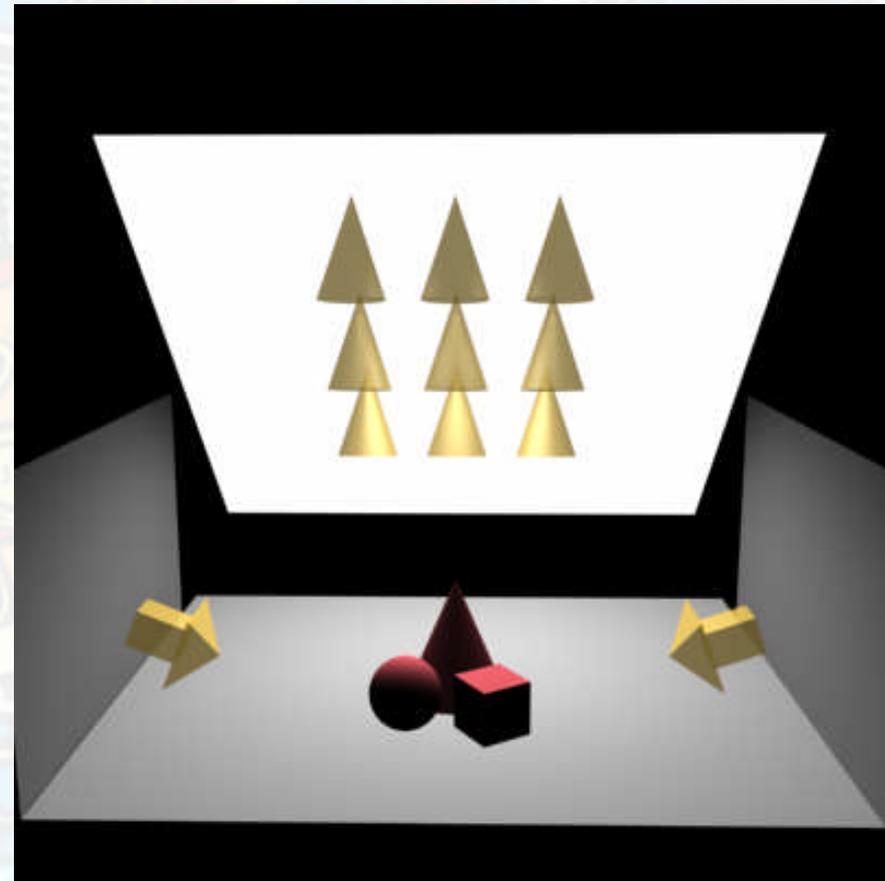
Edges Hard

Intensity low (0.15)



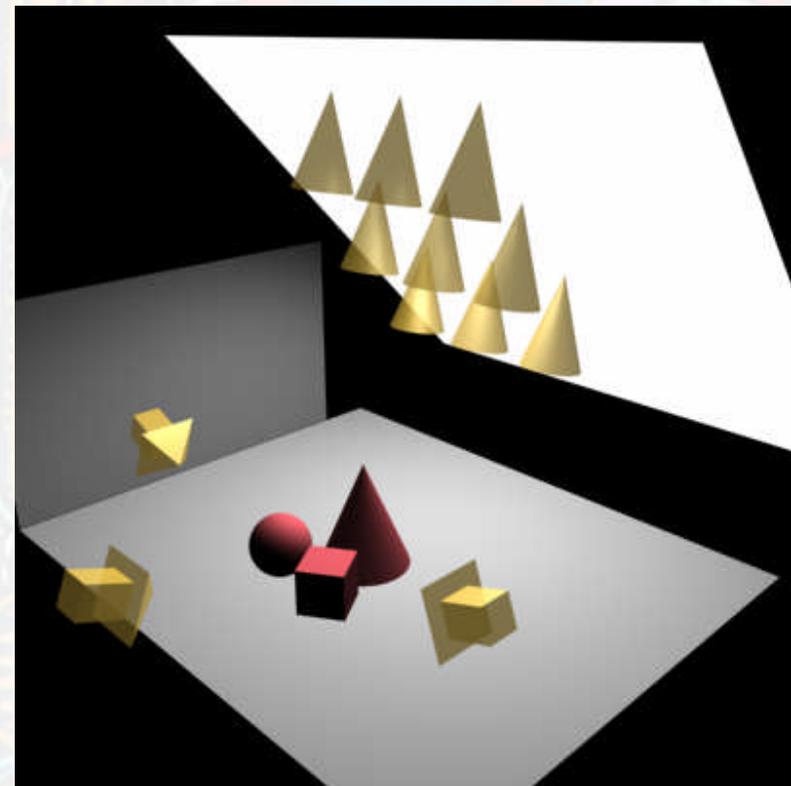
Creating the studio in NX

- ◆ 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



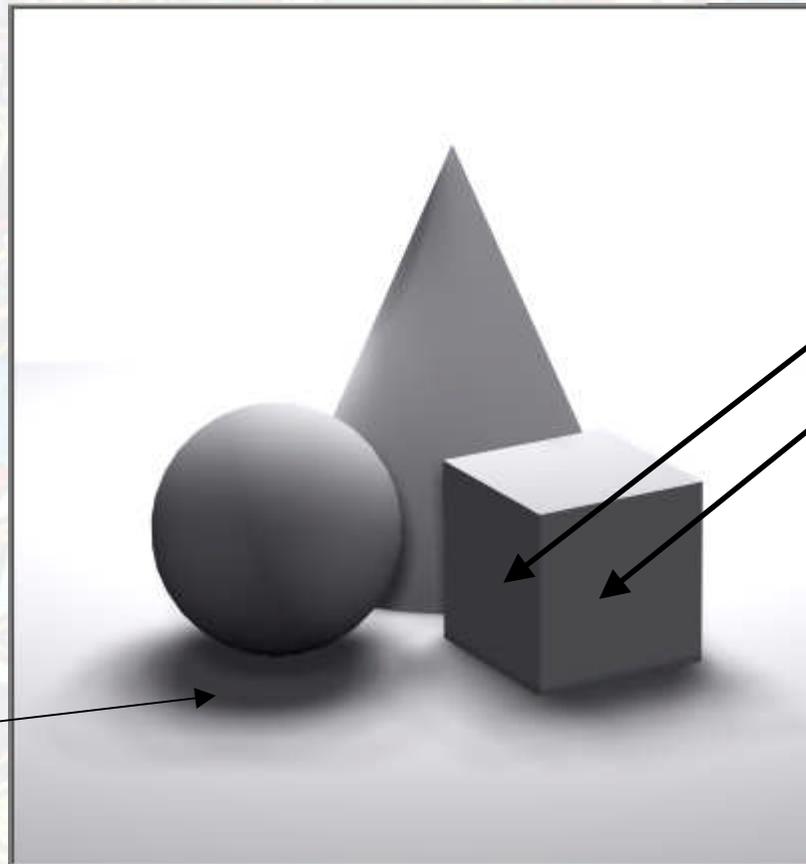
Creating the studio in NX

- ◆ 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



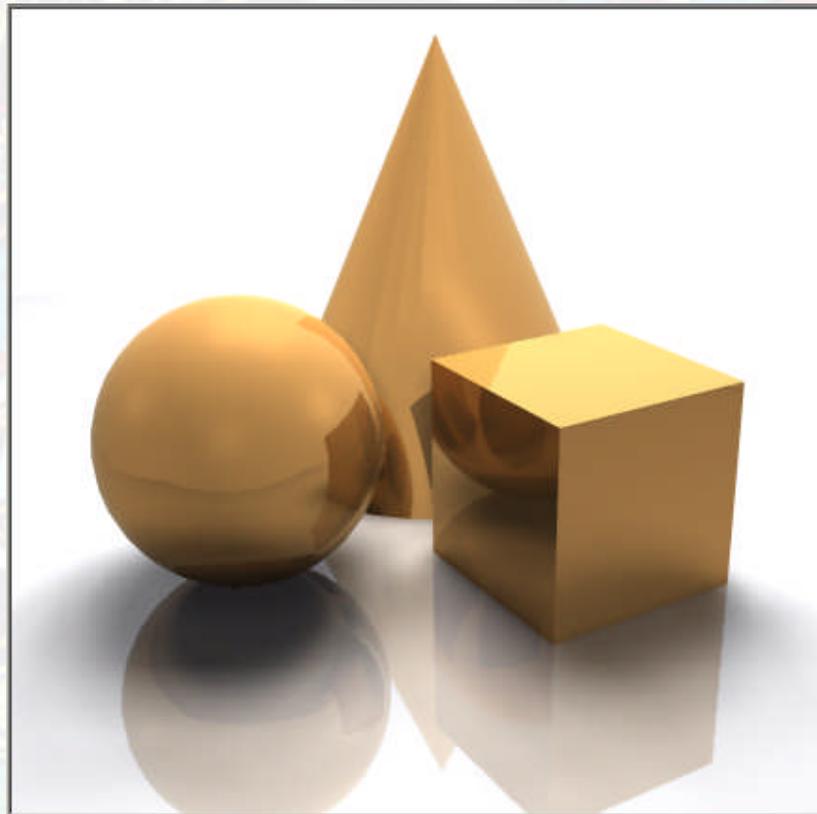
Soft, extended shadows to the front

Good rendering of form

Creating the studio in NX – Raytrace materials

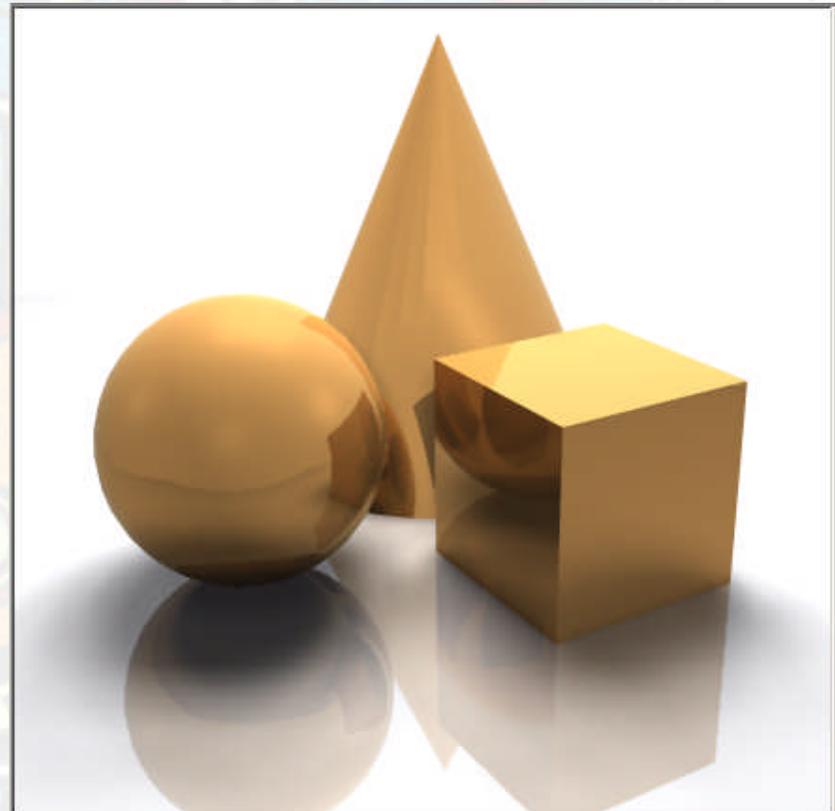
Apply a mirror reflectance to the base

A raytrace material on the objects (polished gold)



Creating the studio in NX

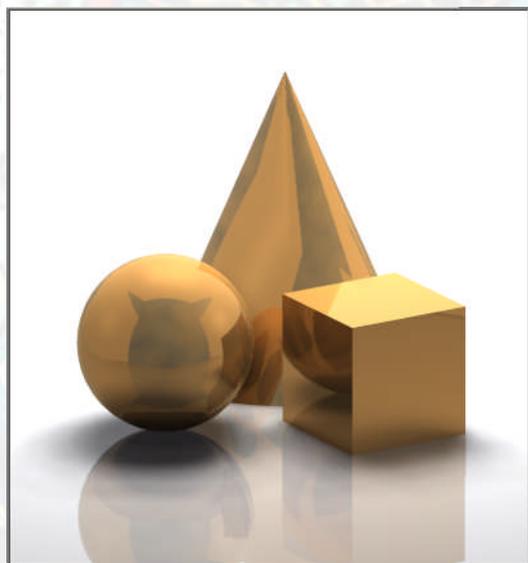
- ◆ Set background to be ray cube
- ◆ Primary shader is plain white (the background in view)
- ◆ Secondary is white (the background in reflection)



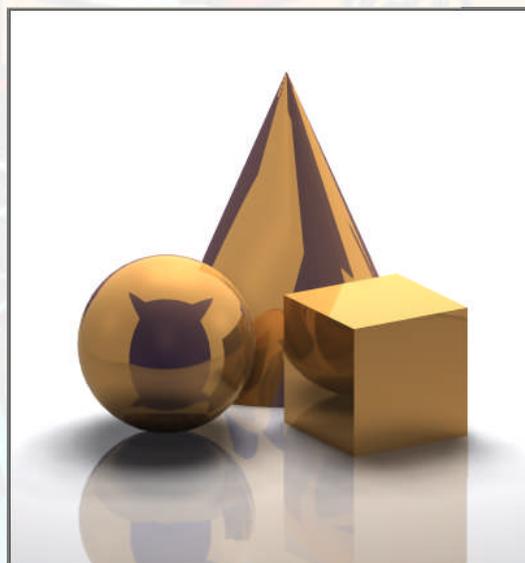
Creating the studio in NX

Effect of the Raycube secondary setting

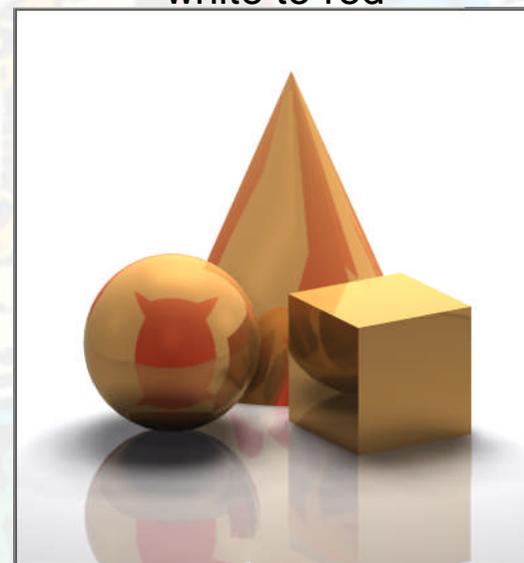
Clouds



Plain - purple

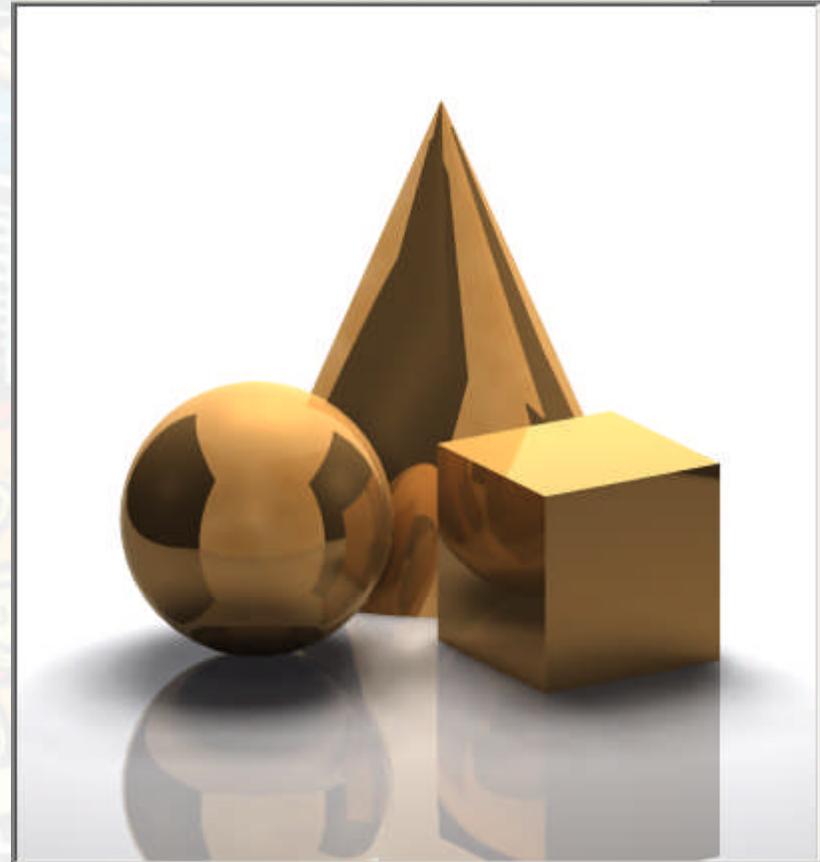


Graduated
white to red

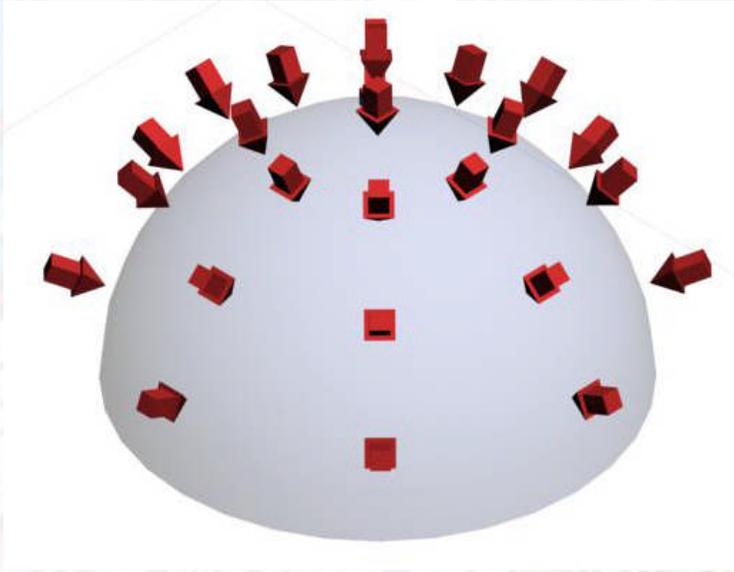


Creating the studio in NX

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

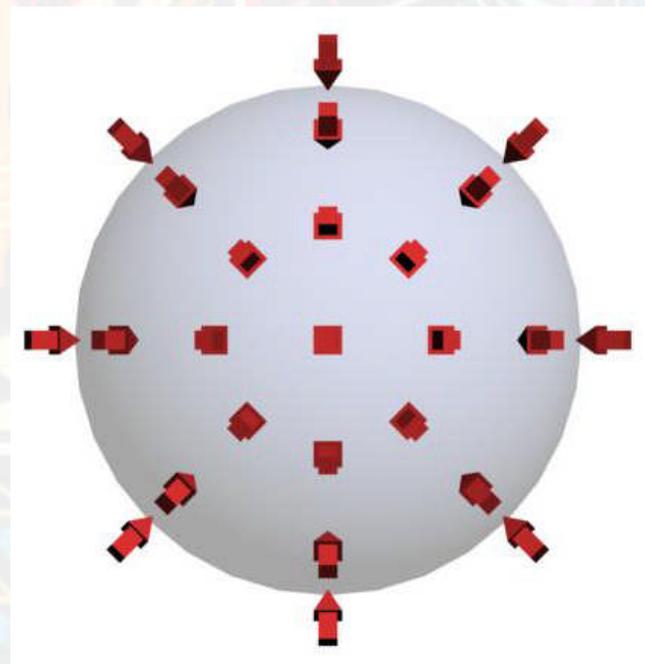
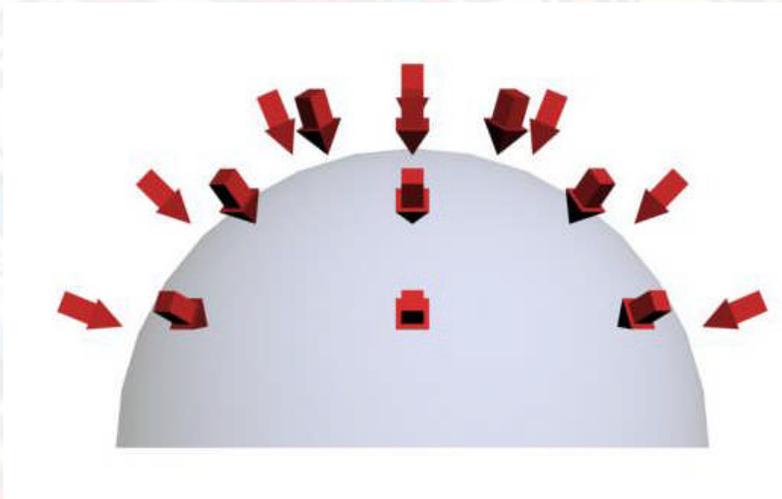
Check shadows on for each light

Set the shadow softness to ultra soft

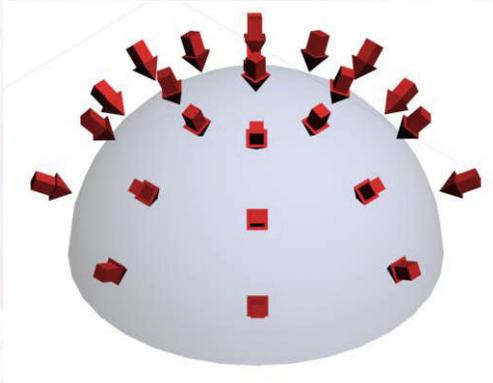
Set the shadow detail to Standard

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

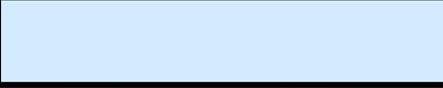
BUT This does not take into account adaption and will result in over-saturated colours

Light Colour

These RGB values will produce a more realistic result

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

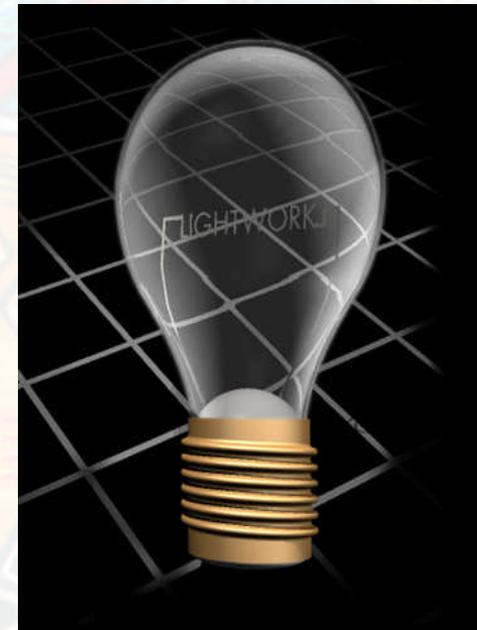
Setting Light Colour

Light Source	RGB Values	Colour
Warm Fluorescent	255, 244, 229	
Standard Fluorescent	244, 255, 250	
Cool White Fluorescent	212, 235, 255	

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>