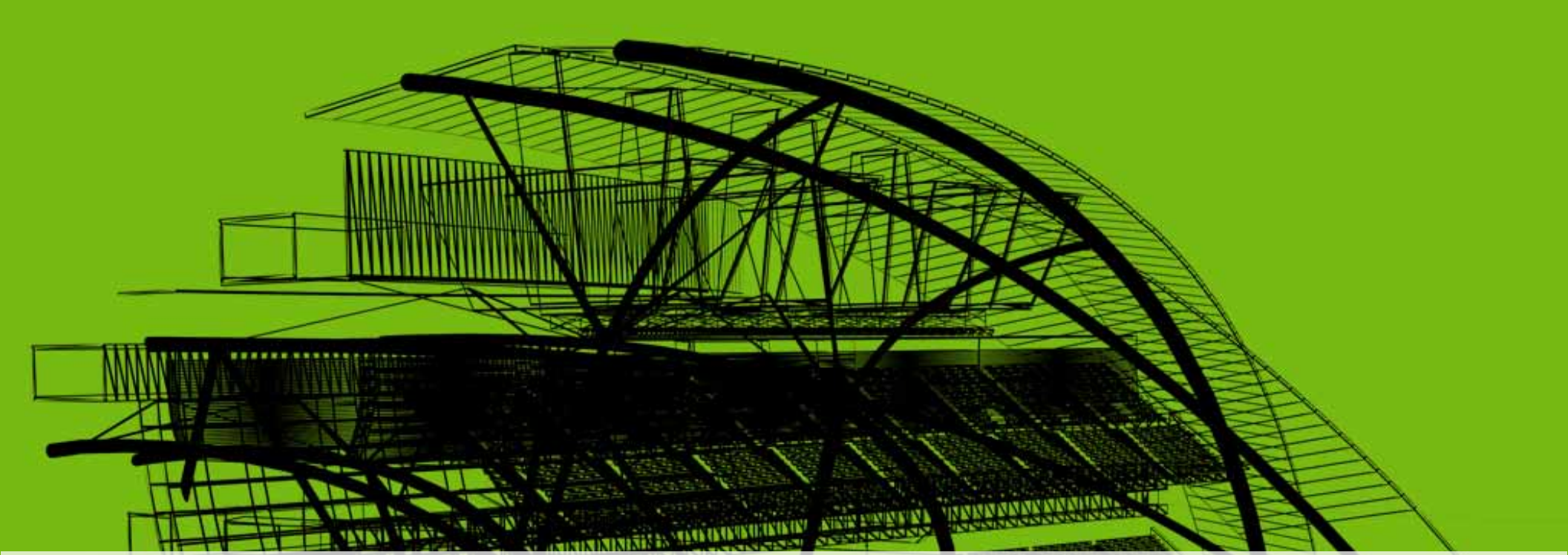


Rendering Techniques in 3D AutoCAD®, Part 1

David Cohn
Independent Consultant

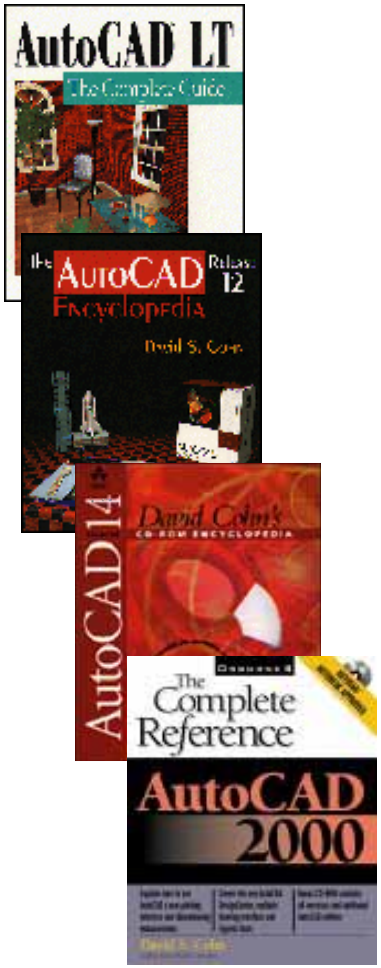
Evaluation Forms

Please remember to fill out your evaluation form

This is session GD111-3

And, please silence your cell phone.

David S. Cohn



- Independent consultant
- Contributing editor *Desktop Engineering* contributing editor
- Former editor of *CADalyst*, *Engineering Automation Report* and *CADCAMNet*
- Frequent contributor to *Computer Graphics World*, *PC* Magazine, and others
- Registered architect—25+ years experience
- AutoCAD experience—20+ years
- Author of numerous books & articles
- President of Eclipse Software

COMPUTER GRAPHICS WORLD DE PC MAGAZINE

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This is part 1 of a 2 part class

Part 1 will cover:

- How rendering has changed from earlier versions of AutoCAD
- Working with lights
- Sun & Sky Background settings
- Working with Materials (including creating and modifying materials)

This is part 1 of a 2 part class

In part 2, we will cover:

- The Render control panel (incl. render destination, render procedure, and output resolution)
- Preparing your model
- Adjusting rendering settings
- Placing cameras and creating views
- Saving rendered images
- Creating walkthroughs and flythroughs

Part 2 will follow this class from 3:15 – 4:45pm

(here in this same room after a 30 minute break)

Rendering in AutoCAD

Creating a 2D image based on your 3D scene

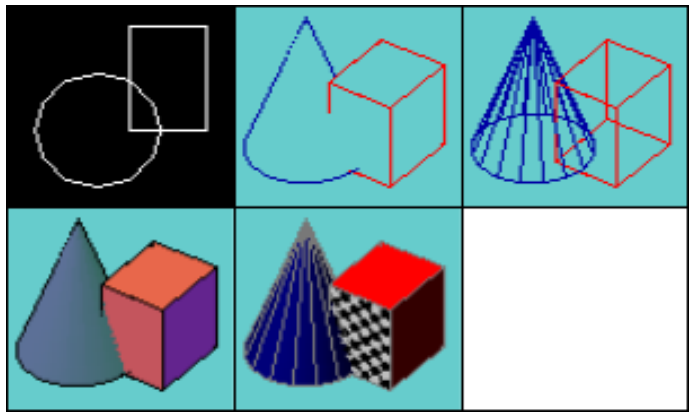
- Rendering tools have existed in AutoCAD for many years, but remained largely unchanged since AutoCAD R12.
  - Completely new beginning in AutoCAD 2007
    - Based on **mental ray®** rendering engine (same as Autodesk® VIZ and 3dsmax®
    - New commands make rendering easier
    - Additional new commands to walk or fly through models

New beginning in AutoCAD 2007

- Can display models with realistic materials, lighting, and shadows
  - Depends on the current active visual style

    Visual style – *a collection of settings that control the display of edges and shading in the viewport*

- AutoCAD comes with five pre-defined visual styles
  - 2D wireframe
  - 3D wireframe
  - 3D hidden
  - Conceptual
  - Realistic
  - *You can create and save your own*



Rendering caveats

If you used rendering tools in earlier versions of AutoCAD

Lights and materials from older versions don't work

- **3DCONVERSIONMODE**

  0=no automatic conversion

  1=automatic conversion (default)

  2=prompt to convert

  If set to 0:

  - **CONVERTOLDLIGHTS** – converts older lights to new format
  - **CONVERTOLDMATERIALS** – converts older materials to new format

NOTE: Procedural materials and material mapping settings do not migrate.

Also:

- Material by ACI no longer supported
- Landscape commands—LSNEW, LSLIB, and LSEDIT— no longer included

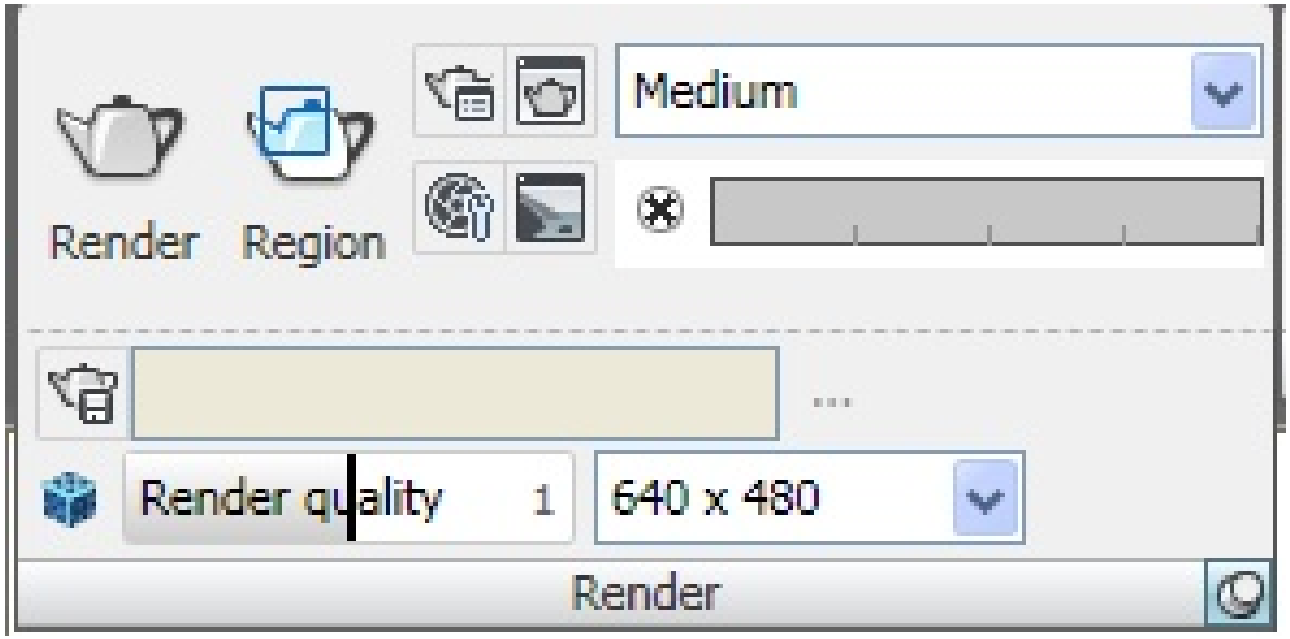
Creating Rendered Images

- Time consuming: you can spend a lot of time adjusting lighting and materials
- You may spend more time creating the rendering than building the model
- Multiple light sources and shadows require fast computers
- You can speed things by first rendering test images on a portion of the model

Four conceptual steps of rendering:

- Create the model
- Place lights
- Attach materials to objects
- Render the image

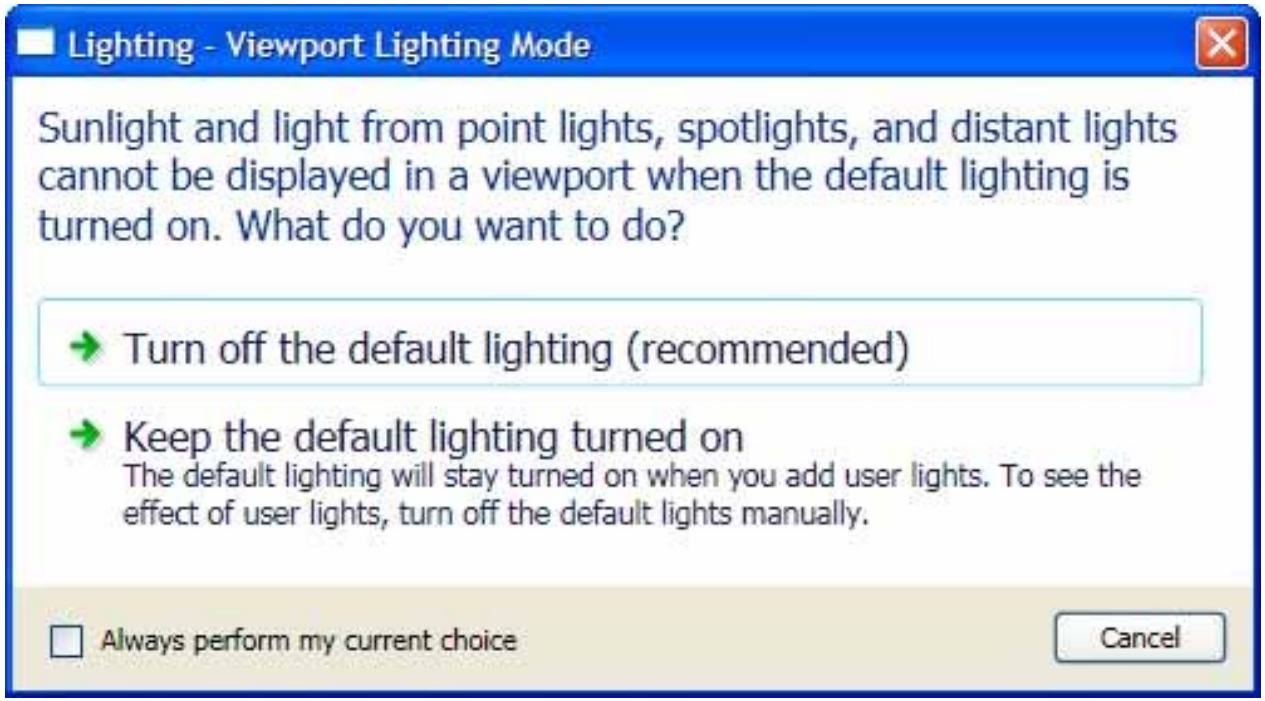
The Render Panel



Working with Lights

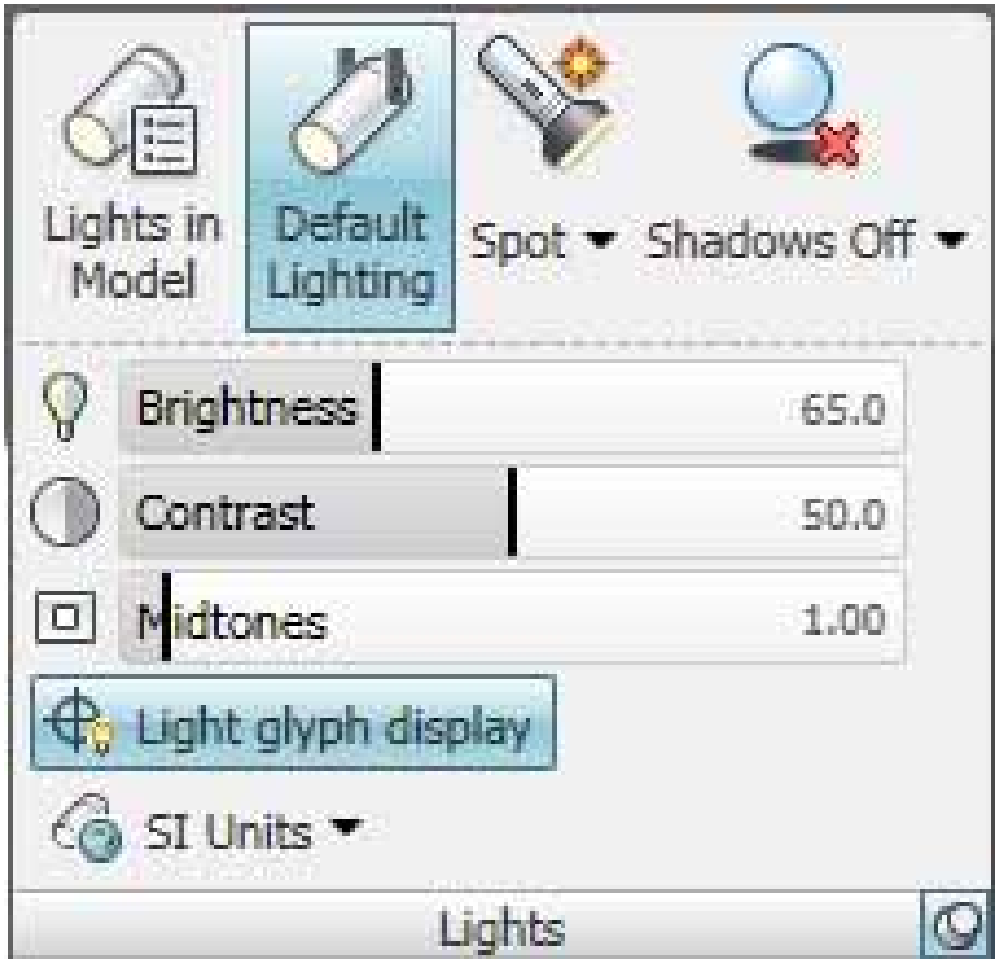
Initially, light comes from two distance light sources that follow the viewpoint as you move around the model.

- All faces are illuminated
- You control brightness and contrast, but do not need to place lights
- Default lighting must be turned off in order to display lighting from user-created lights or the sun



Working with Lights (con't)

Controlled using the Light control panel



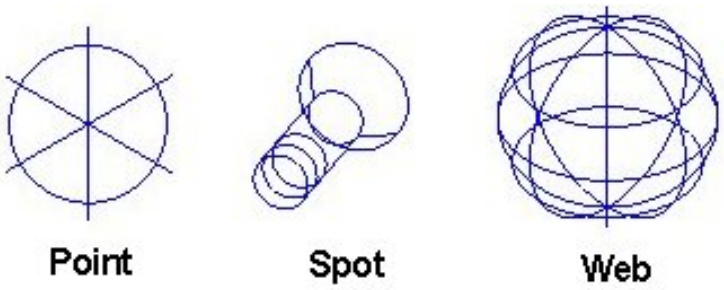
Working with Lights (con't)

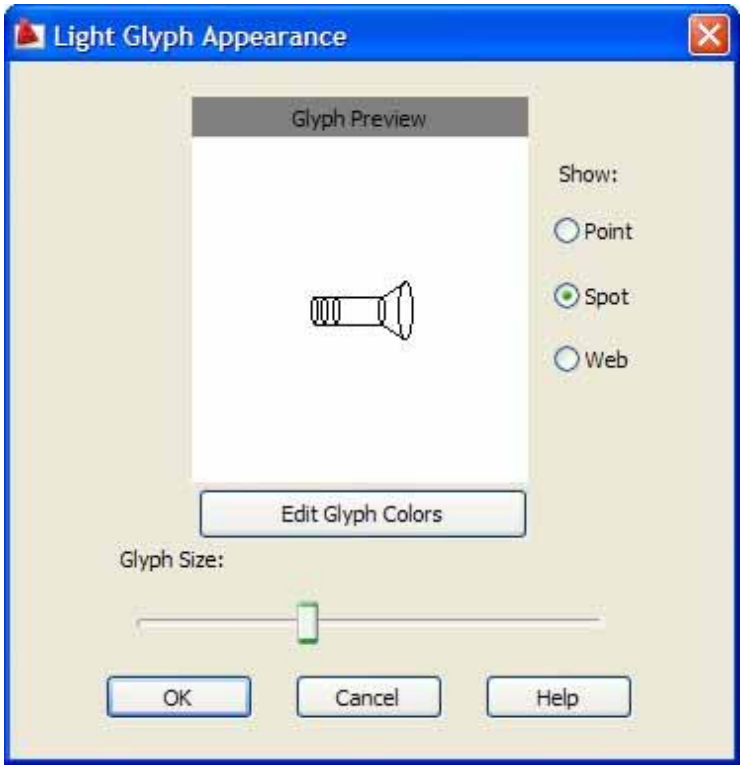
After placing lights, you can

- Modify them using grips
- Control them using the Properties palette

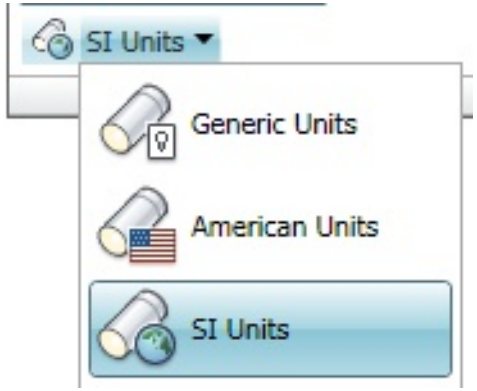
Spotlights and point lights are represented by glyphs.

- Glyph appearance can be controlled using a dialog box





Photometric Lights



New starting in AutoCAD 2008

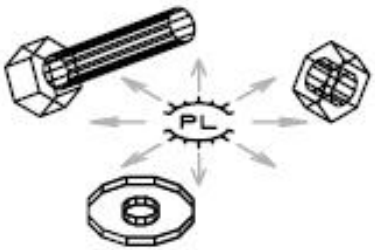
- Use photometric (light energy) values
- More accurately define lights as they would be in the real world
- Lamp intensity expressed in Candela, Lumen, or Lux

Controlling via LIGHTINGUNITS system variable

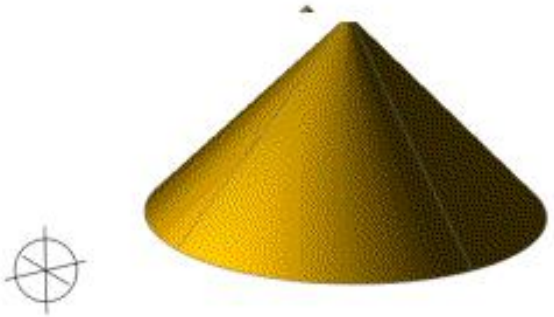
Value	Description
0	No lighting units used; standard (generic) lighting is enabled (system used in AutoCAD 2007 and earlier)
1	Photometric lighting enabled using International lighting units
2	Photometric lighting enabled using American lighting units

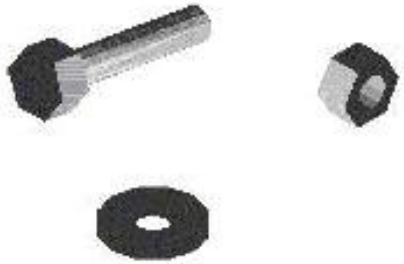
Types of Lights

- **Point Light** (a light bulb)
  - Radiates in all directions
  - Intensity diminishes over distance
  - In ACAD2008/2009, can add a target point



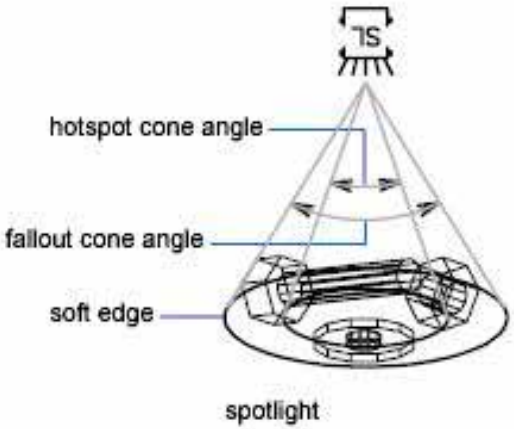
point light



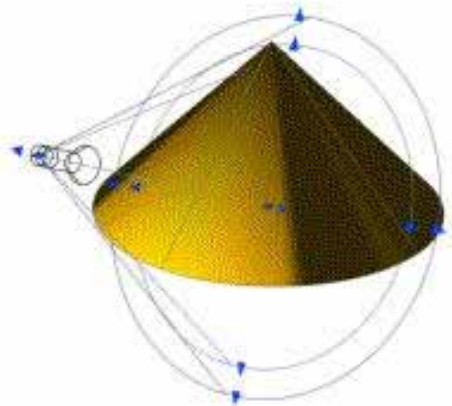

rendering with point light

Types of Lights (con't)

- **Spotlight** (a spotlight)
  - Emits a directional cone of light
  - Intensity diminishes over distance
  - You can control the hotspot and falloff
  - In ACAD2008/2009, can add a FREESPOT (has no target)



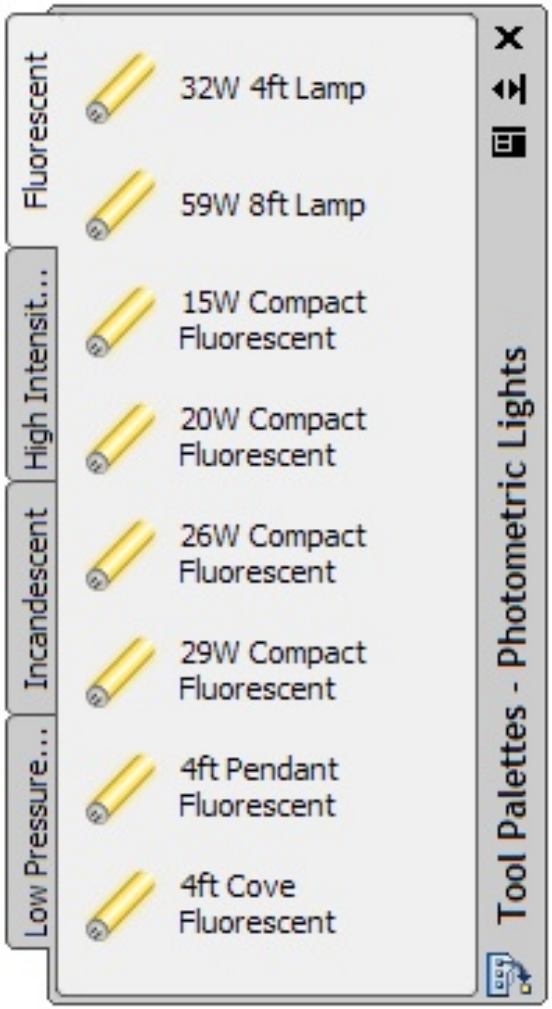
spotlight




rendering with spotlight

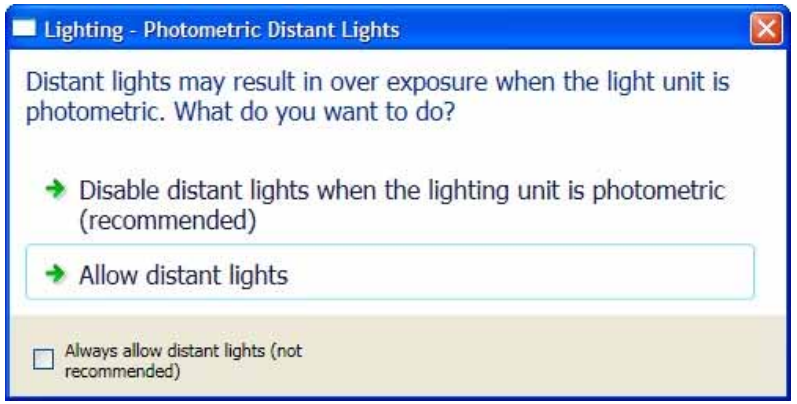
Types of Lights (con't)

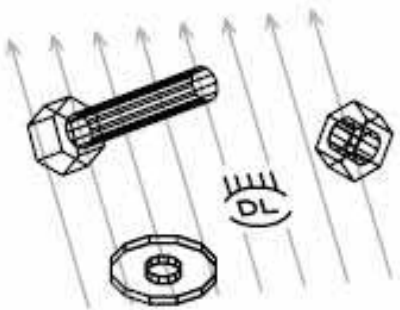
- **Web light** (a 3D representation of light intensity distribution)
  - Available when LIGHTINGUNITS set to 1 or 2
  - Represent non-uniform light distribution derived from data provided by manufacturers
  - Added using WEBLIGHT or FREEWEB command
  - Commonly used for defining photometric lights, including fluorescent, low pressure sodium, incandescent, and high intensity discharge
  - Available on Lighting tool palette



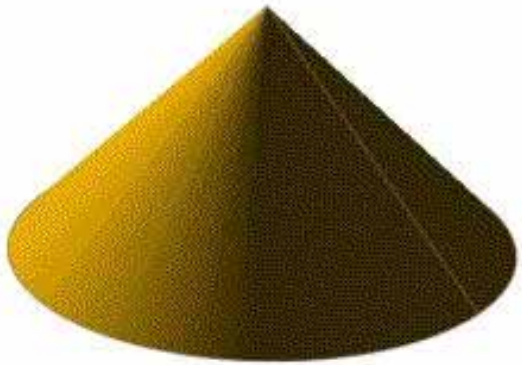
Types of Lights (con't)

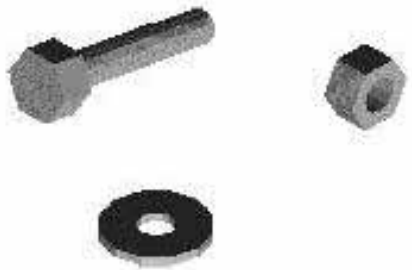
- **Distance Light**
  - Travels in parallel rays in one direction
  - Intensity doesn't diminish over distance
  - You specify FROM and TO point
  - No glyph
  - Not accurate when LIGHTINGUNITS = 1 or 2





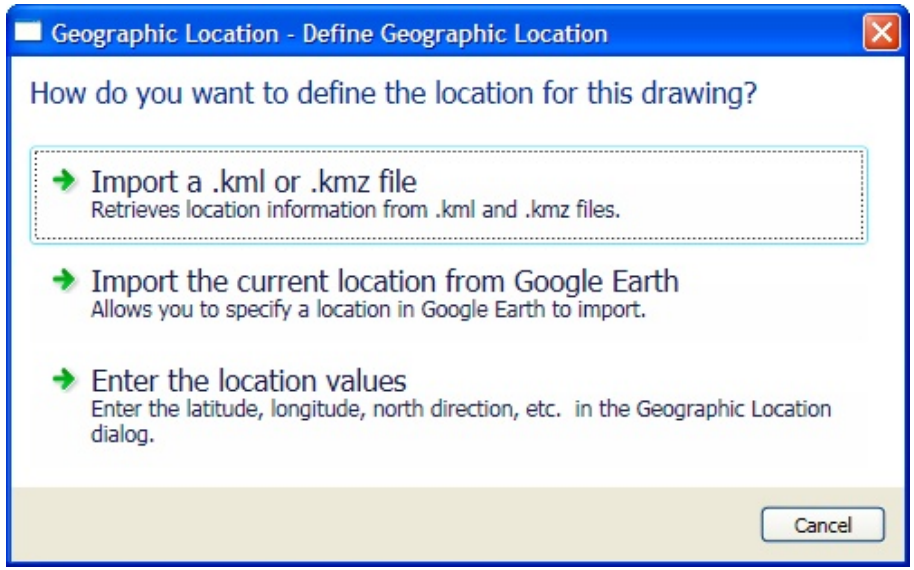
distant light




rendering with distant light

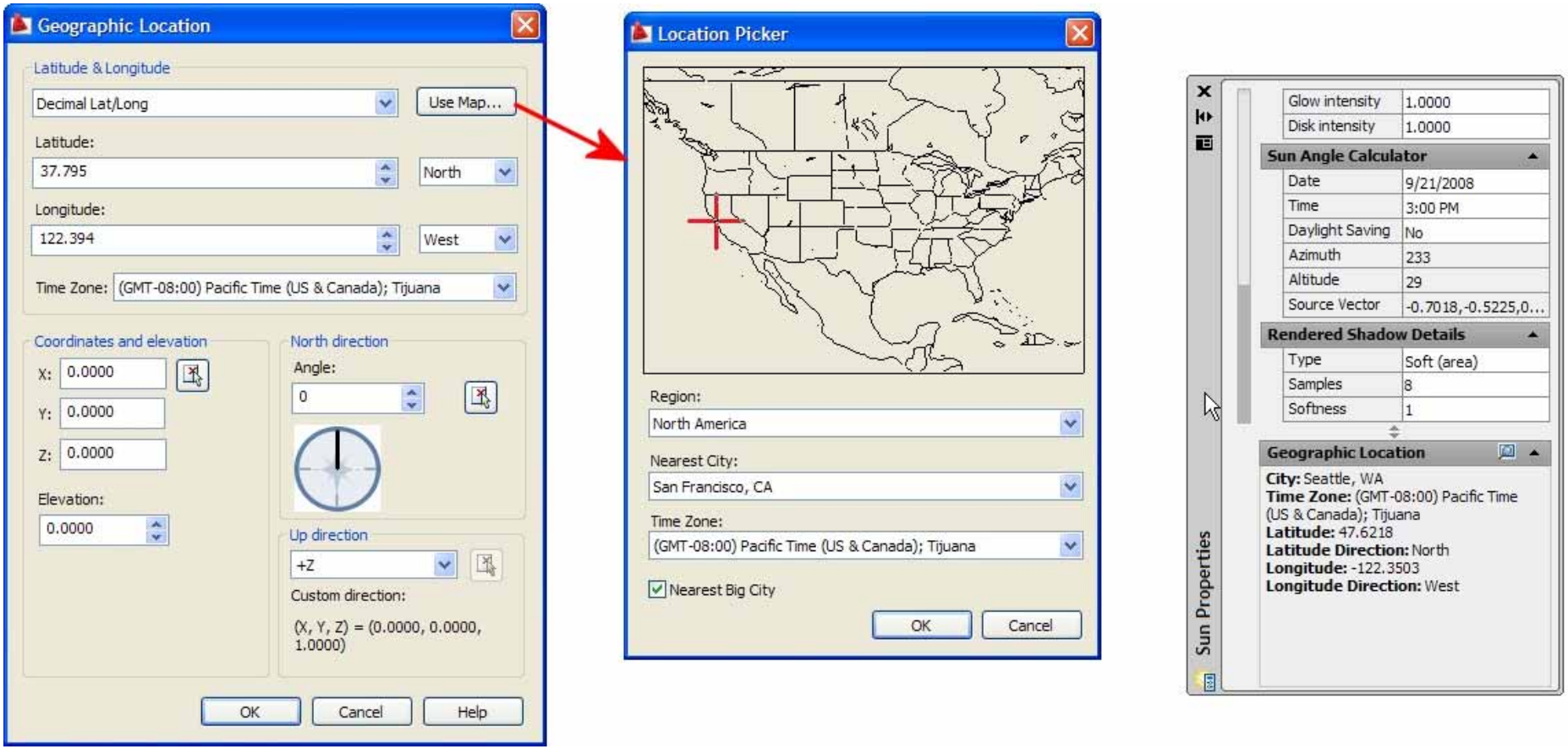
Types of Lights (con't)

- **Sunlight**
  - Simulates the sun (parallel rays with same intensity over any distance)
  - Properties controlled using Sun panel on Visualize ribbon bar; angle of light controlled using Time & Location panel
  - Can choose method to locate the model



Types of Lights (con't)

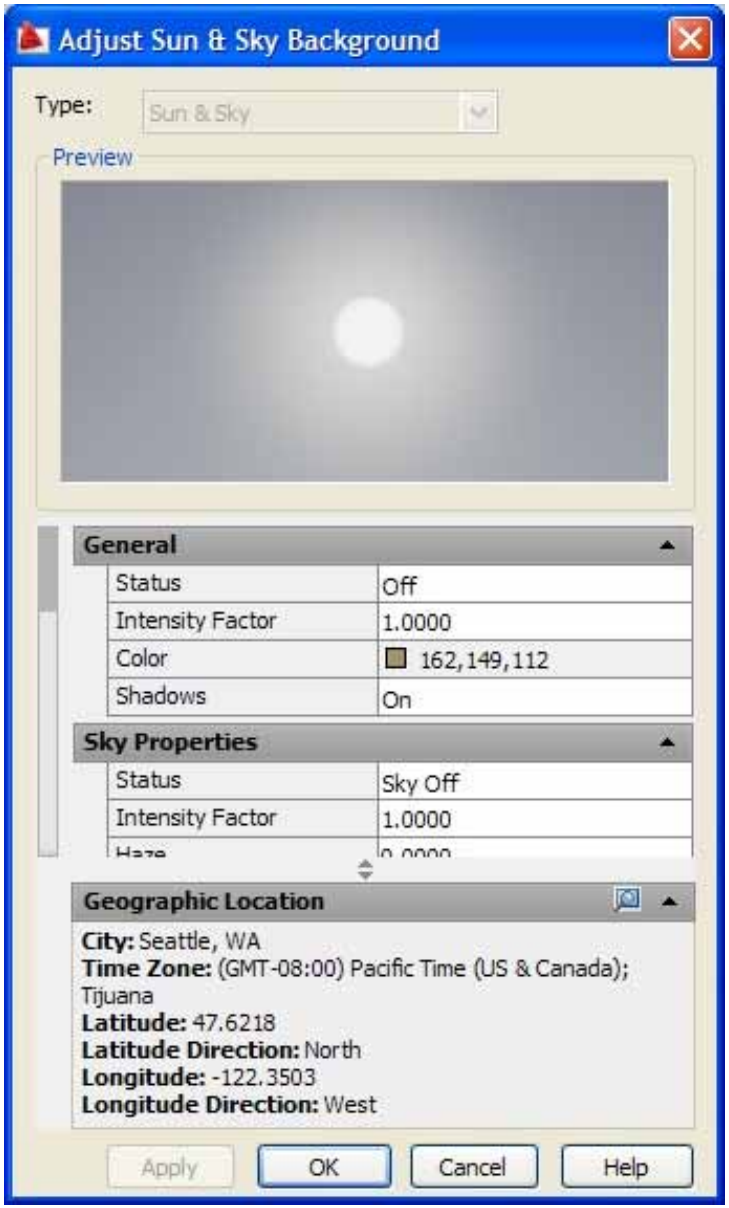
- **Sunlight**
  - Different methods to specify location
  - Change settings using Sun Properties palette



Sun & Sky Background

Available when using photometric lights

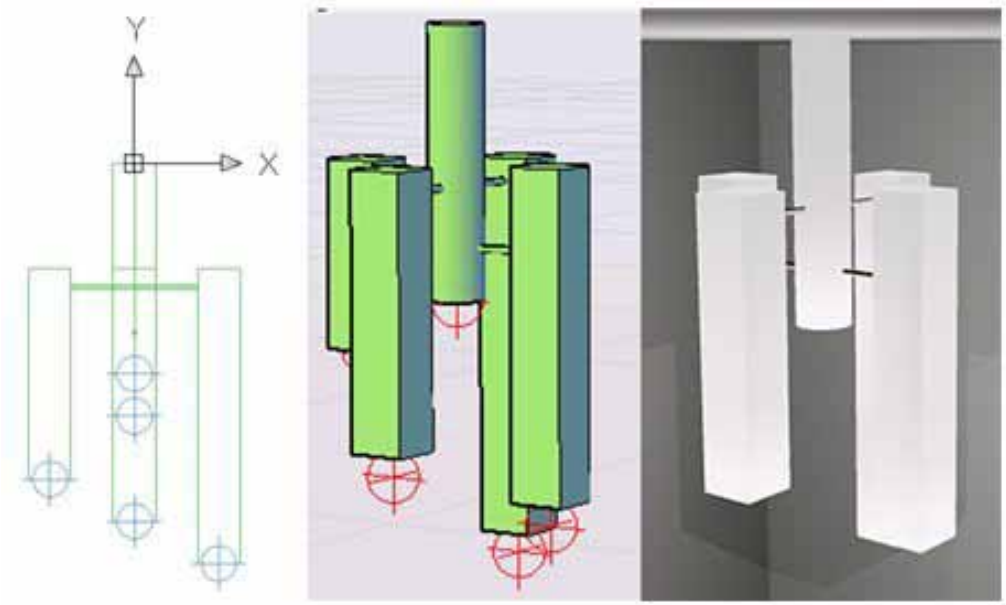
- Control sky properties
- Ground plane (horizon)
- Haze
- Scale and appearance of a sun disk
- Other sky and background settings



Using Luminaire Objects

Embed photometric lights in blocks

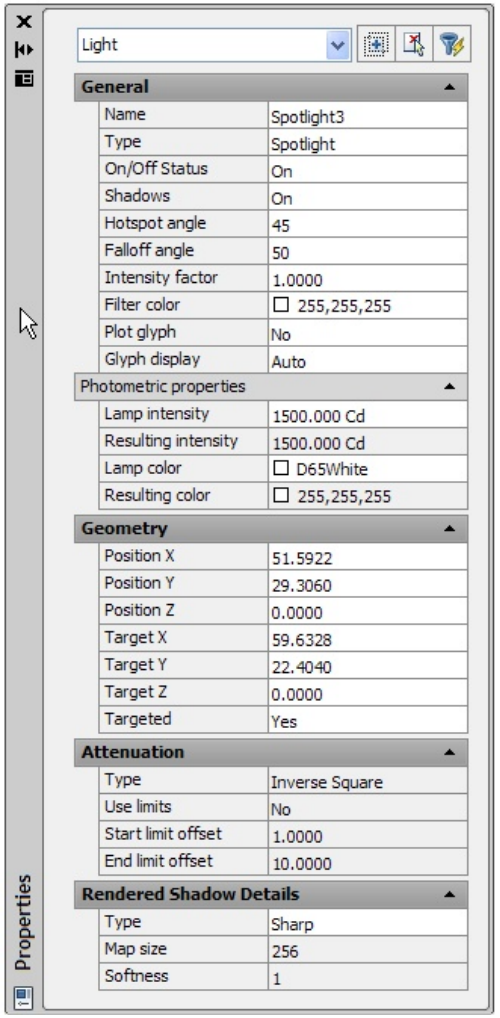
- Create light fixture that models both physical and photometric properties of actual lighting fixtures
  1. Model 3D light
  2. Select photometric light from Photometric Light tool palette
  3. Position it within the model of the physical light
  4. Create a block containing geometry and light

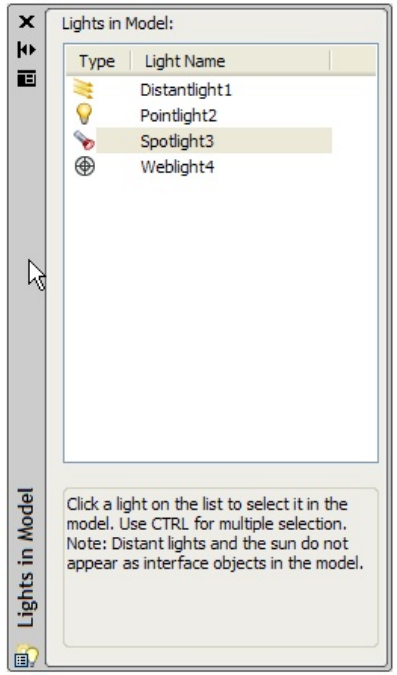


Controlling Lights

Each light (except sun & lights in blocks and xrefs) appears in the Lights in Model palette and can be controlled in the Properties palette

- Type
- Status
- Shadows
- Intensity
- Color
- Other settings
  - attenuation
  - shape

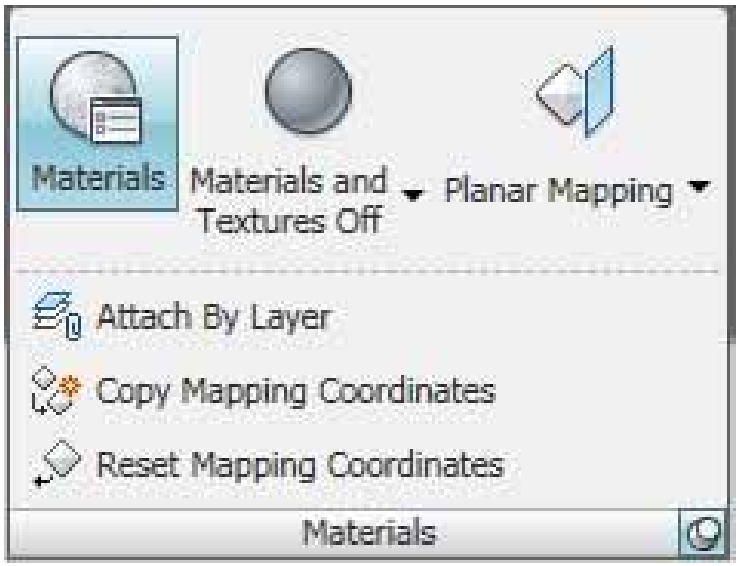


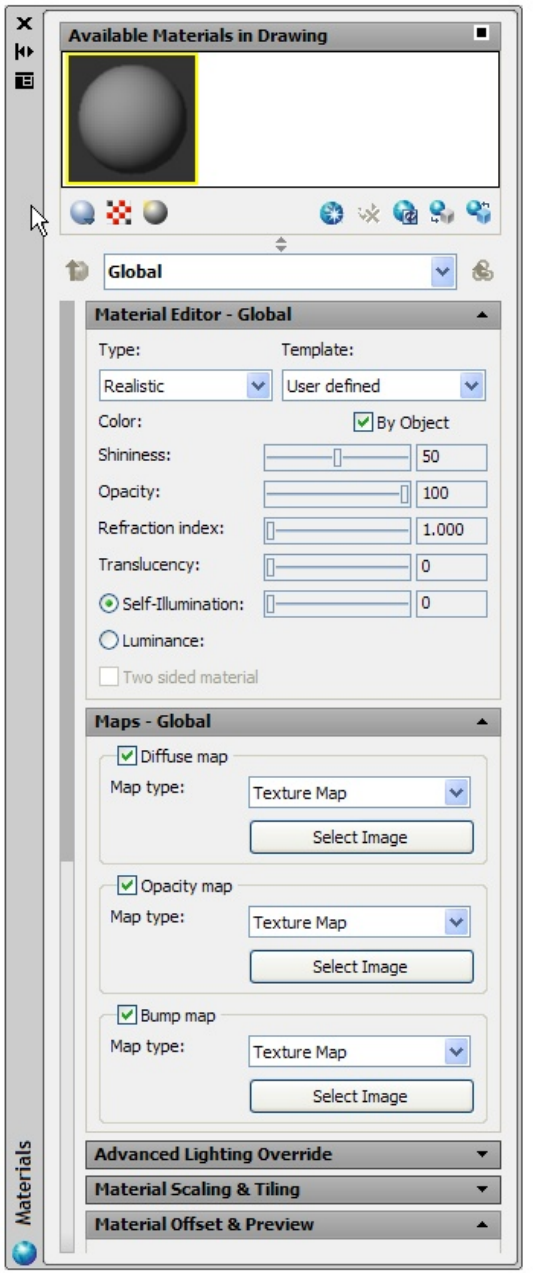


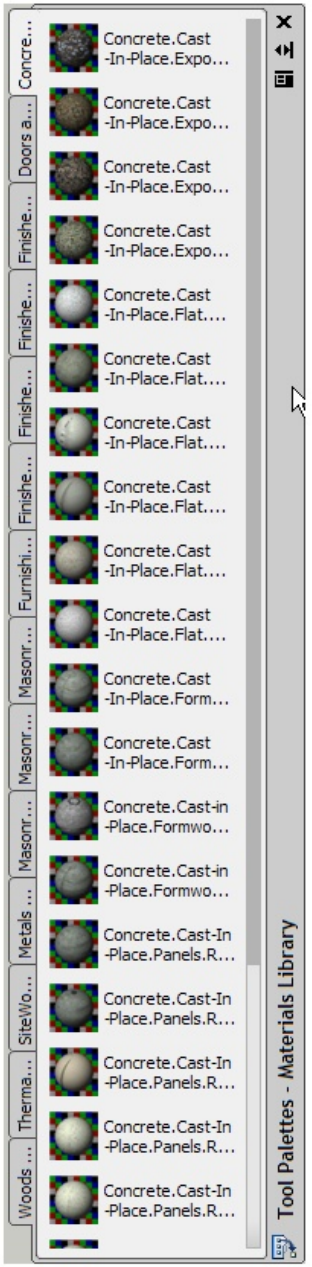
Working With Materials

400+ materials

- Need to install material library (during install or use Add/Remove programs)
- Available on palettes
- Materials in current drawing appear in a Materials window

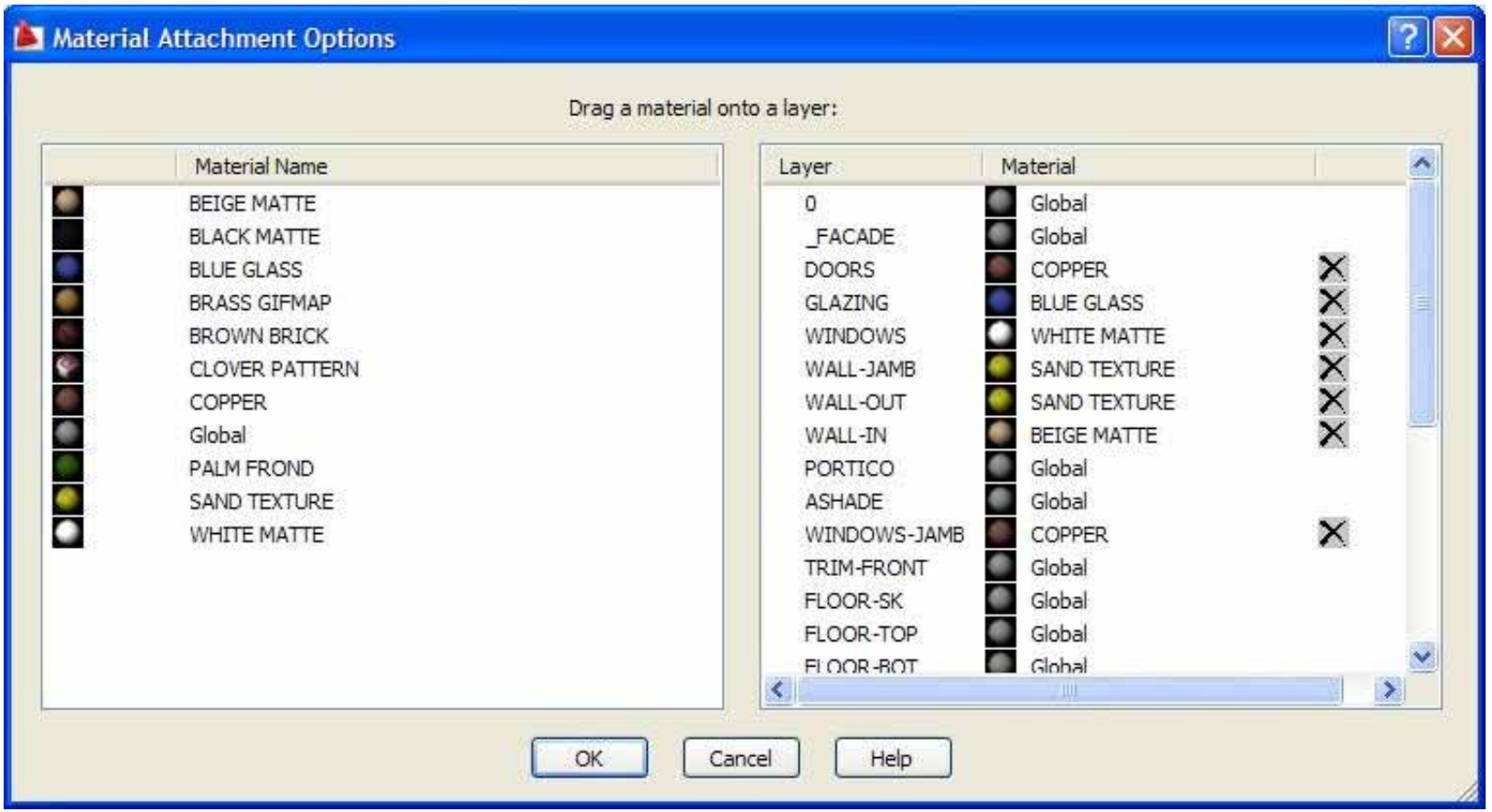






Applying Materials

- To an object – drag onto object or use Apply Material to Object button
- To a face – press Ctrl and drag onto face of object
- By layer – use Attach by Layer button to display dialog box



Creating and Modifying Materials

- **Realistic & Realistic Metal** – based on physical properties
- **Advanced & Advanced Metal** – materials with more options

You can create or modify materials in either the Material tool palette or the Materials window:

- Changes made in the tool palette affect the materials library
  - Make a copy first and then modify the copy
- Changes made in the Materials window affect only the drawing
  - You can add any new materials to the tool palette so that they will be available for use in other drawings

Creating and Modifying Materials (con't)

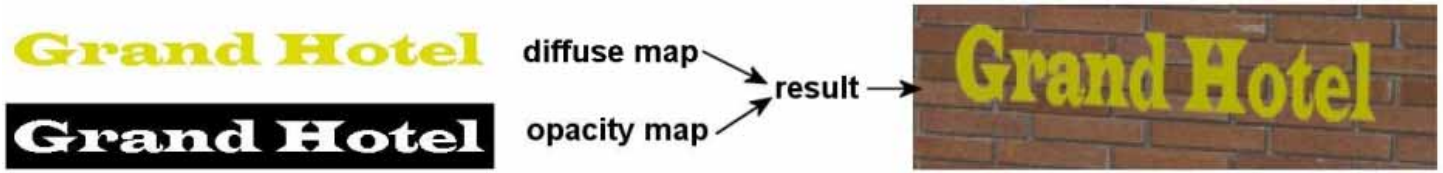
- **Template** – specifies type of material
- **Color** – color of material
- **By Object** – material color based on color of object attached to
- **Diffuse** – main color of material (Advanced & Advanced metal templates only)
- **Ambient** – color of faces lit by ambient light only (Advanced & Advanced metal templates only)
- **Specular** – color of highlight on shiny material (Advanced only)
- **Shininess** – reflective quality of material
- **Opacity** – how much light passes through surface (not available for metals)
- **Reflection** – how reflective (Advanced & Advanced metal templates only)
- **Refraction index** – bending of light rays (1.0 = no distortion; 1.5 = significant distortion (Not available for metal templates)
- **Translucency** – percentage of light transmitted through object;
  0.0 = not translucent, 100.0 = as translucent as possible
  (Not available for metal templates)
- **Self-illumination** – material appears to emit light; does not cast light on objects (Not available for metal templates)
- **Luminance** – material appears to be lit by photometric light source; no light is cast on other objects
- **Two-sided** – both sides of material are rendered in scene

Using Texture Maps

Texture maps add additional realism to a material by including a 2D image or map projected onto the surface of an object

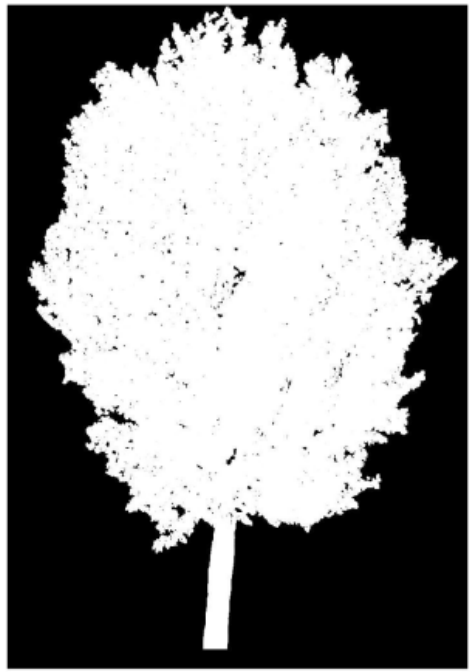
- **Diffuse map** – assigns a pattern or texture to a material's diffuse color (or select a procedural map)
- **Reflection map** – simulate scene reflected on a shiny surface (512x480 min.)
- **Opacity map** – areas of opacity and transparency (white = opaque; black = transparent)
- **Bump map** – embossed appearance (dark = no depth; light = projecting)

Opacity Maps



Previous versions of AutoCAD included landscape objects such as trees and people. Those commands are no longer available, but you can achieve similar results by creating new materials using texture maps and opacity maps.

- Use old ACAD image files
  - Diffuse map: shows tree
  - Opacity map: white is solid/ black is transparent

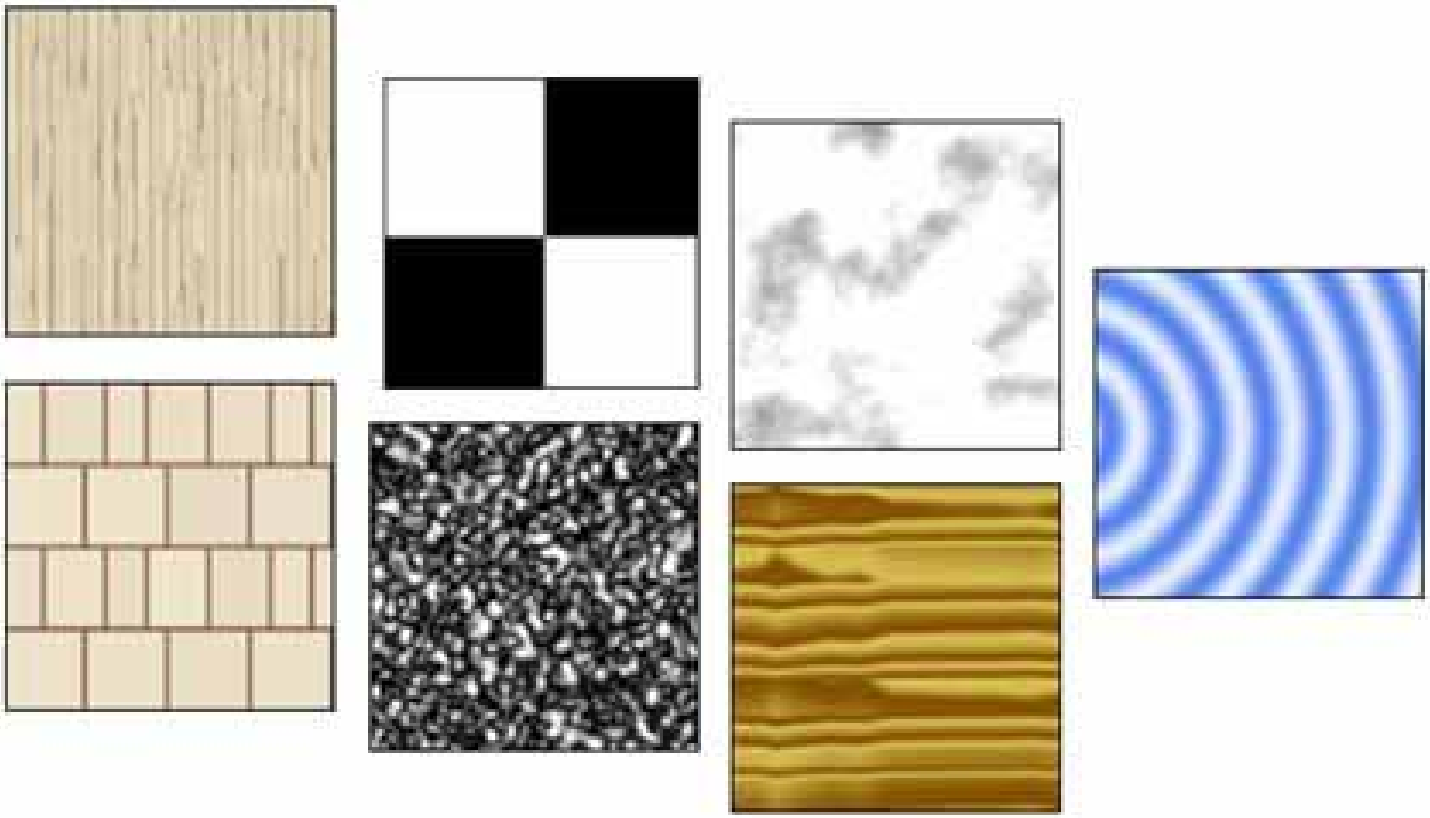


Procedural Maps

Add realism by generating appearance of material mathematically.

Seven types now in AutoCAD

- Checker
- Marble
- Noise
- Speckle
- Tiles
- Waves
- Wood

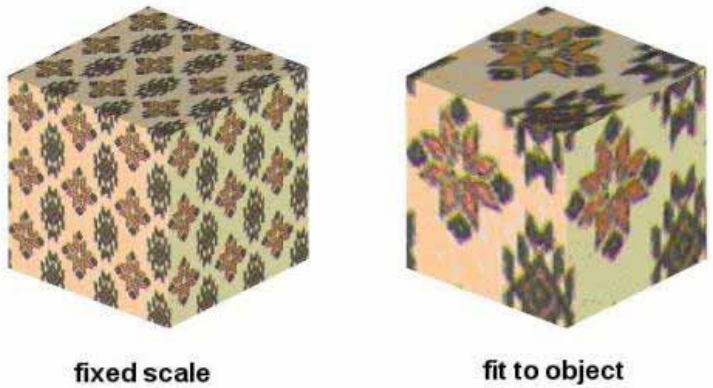


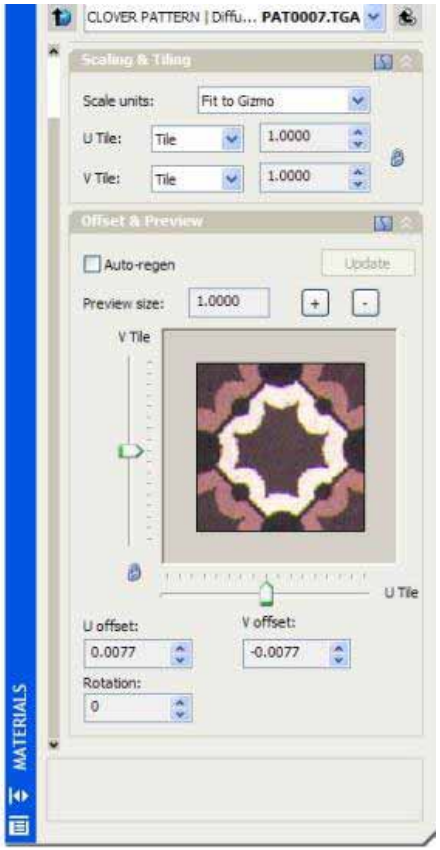
Modifying Map Properties

You can change the way bitmaps are applied.

Controlled within the Scaling & Tiling are of the Materials palette

- **Fixed Scale** – bitmap is scaled to face or object using a fixed scale
- **Fit** –bitmap is scaled to fit the face or object





Preparing Your Own Bitmaps

You can create your own bitmaps—scan or digital photo

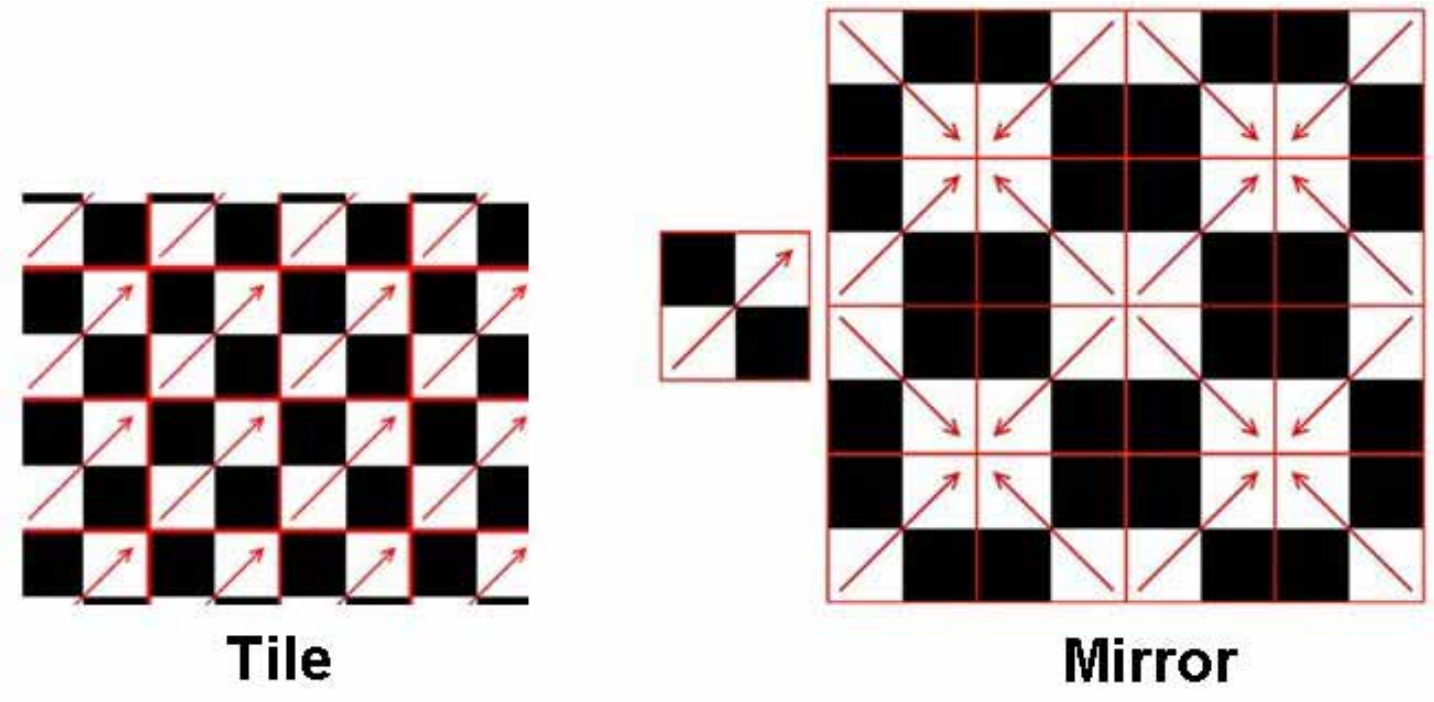
- –Save as BMP, GIF, JPEG, PCX, PNG, TGA, or TIF
- –Make sure that they tile seamlessly

No longer needed with addition of Mirror mapping

Modifying Map Properties (con't)

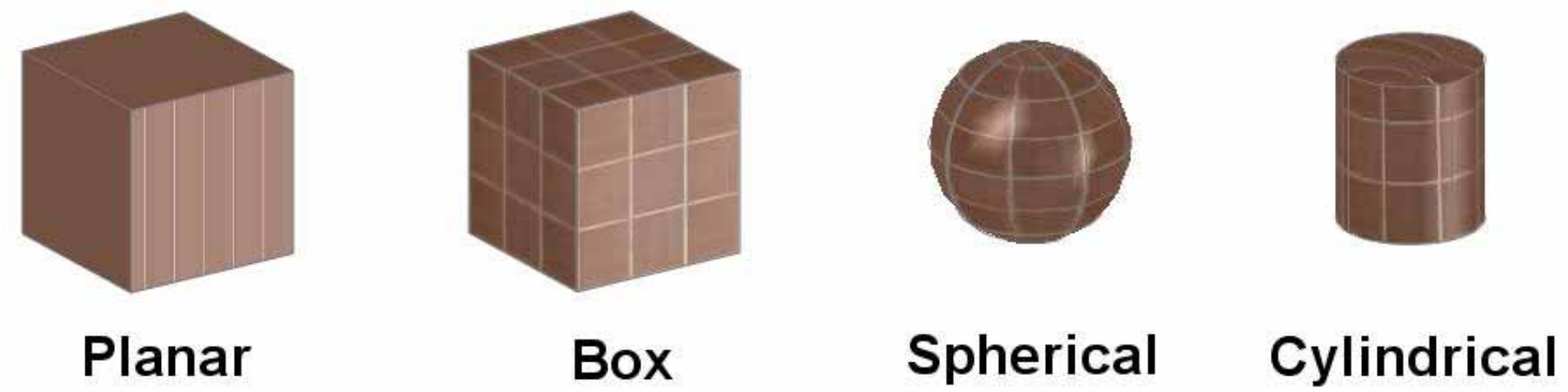
Use controls to adjust the scaling and tiling of a material

- **None** – pattern is not repeated
- **Tile** – pattern repeats as a series of tiles
- **Mirror** – doubles map, flips the doubled copy, and then represents the doubled pattern as a series of tiles



Adjusting Material Mapping

After attaching a material with texture, you can adjust the orientation of the texture map, using Mapping tool in Materials panel of the Visualize ribbon bar




Grand Hotel

Evaluation Forms

Please remember to fill out your evaluation form

This is session **GD111-3**

To be continued…

This class will continue with
Rendering Techniques in 3D AutoCAD,
Part 2

GD115-2

Here in this room starting at 3:15

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