AUTODESK UNIVERSITY 2014

Using 3ds Max® Design, Revit®, and iray® to Render Compelling Photographic Scenes

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VI5195 This class introduces designers to the real world use of and best practices for rendering Revit models using 3ds Max and Iray. Learn key techniques for working with Revit models inside of 3ds Max, and what it takes to render photographic quality images using Iray. Explore the creation and application of Autodesk Library materials to quickly create accurate surface textures. Utilize the daylight lighting system to simulate outdoor lighting. This class will introduce the use of traditional architectural photographic techniques and composition to create compelling images. Learn how to control the camera through the use of composition techniques like the rule of thirds and diagonals. Use 3ds Max exposure controls to adjust the scene exposure and set up and render using the Iray renderer. See how you can get ahead of the competition by creating visually compelling, photorealistic renderings using photographic compositions and Iray.

Learning Objectives

At the end of this class, you will be able to:

- Successfully link to a Revit model from within 3ds Max Design 2013
- Edit and apply Autodesk Library materials to a model.
- Create and configure the daylight system, and place cameras using the rule of thirds and diagonals to create compelling images
- Adjust scene exposure to establish the optimum light levels and render a scene using the iray renderer.

About the Speaker

Steven attended R.I.T.'s film/animation in 1989 & A-B Tech's Entrepreneurship in 2011. Opened Spectralight Images in 1989 to deliver 3D training and animation. Moved to Orlando, FL in 1990. As VP of Computer Animators Plus (1995) began teaching 3D at Seminole State College. With a love of art, opened Gallery 611 in 1997, and formed the Orlando Visual Artists League in 2000, president until 2004. In 1998 he became an Autodesk® training specialist, and has contributed to Autodesk's certified training material for 9 releases of 3ds Max®. He was a co-developer of Autodesk's ACI Program, and Autodesk's 3ds Max® fundamental standards. Now he develops 3ds Max / Maya training courseware for CAD Learning's online training. Spectra3D Technologies provides 3ds Max, Maya & AutoCAD training. Steven teaches classes for end users, companies, Autodesk University, & others. Past trainees: Disney, Guess, US Army, and more. In 2014 Spectra3D Technologies expanded into 3D printer sales and support offering an array of 3D printers, design services and 3D printing training.

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Introduction

As an architect or designer you can use Autodesk's Revit software to create buildable designs for anything from simple framed structures all the way to complex, multi-floor high-rise buildings. There are many times when it is a requirement to render a design using a method that provides photorealistic results. While Revit is capable of high quality renderings of your design, often it is beneficial that you have a higher level of control over the look of the final image, and the rendering tools used to generate the final image.

Iray is a rendering tool that provides an exceptional level of rendering quality and a true photographic view of your design. 3ds Max Design is the ideal environment for the creation of photorealistic renderings of your Revit designs. You can import your Revit models into 3ds Max Design by linking to the Revit file directly. Once imported, you can edit materials that were assigned in Revit, or assign new materials you create.

Often, 3D Revit models will come into 3ds Max design with a default Daylight system that is used for rendering the direct sunlight and the scattered skylight. Once imported, you are able to modify the Daylight system. You can change the time and date, as well as the location that you want to use for the rendering.

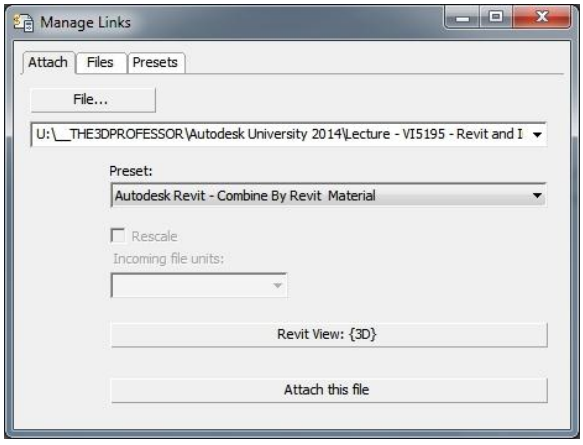
Controlling the cameras point of view is a critical part of generating a compelling rendering. By using simple compositional rules you can set up a camera view that will present a compelling and dynamic rendering of your design. Once you set your view point, you need to decide what the output will be for the final rendered image.

In many cases images are rendered to a file that will be used either for printing or digital presentation. The size and level of quality of final rendering will usually be based on specific output requirements. For generating truly photographic quality renderings, you can use the iray renderer. If you're running a test to if the image looks the way you want it to, you can set a short rendering time limit. When it comes time to creating a final high quality rendering, you only need to change the amount of time you will allow for iray to render.

This class will discuss and outline the steps you would take to go from an Autodesk Revit design file to a fully rendered photorealistic image using 3ds Max Design and the iray renderer.

Linking to a Revit model

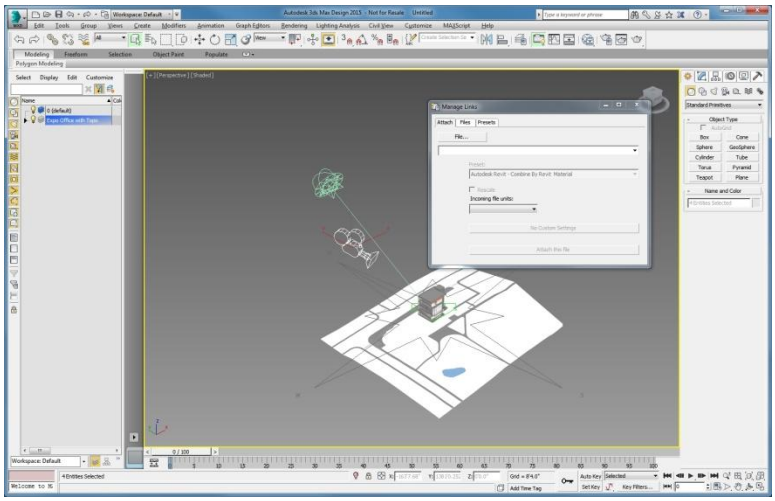
You're going to link a file verses importing a file because if your design changes, you can reload it through the file link manager. The file link manager is the dialog that gives you access to the file link tools. You can choose what file you wish to link, choosing from DWG, FBX, and Revit. Once you link to a Revit file, you're able to choose from a number of preset options which control how the file is linked into 3ds Max Design.



From the 3ds Max Design application button, click on the Import option, and then click on the Link Revit File option. You first need to select a Revit View, once selected, the File Link Manager becomes available.

Using the preset that organizes the scene based on Revit materials will make it easier to edit the materials that are assigned to different objects in the scene. Then click on the “Attach this file” button to link the Revit model. During the import process, you may get a Daylight System Creation dialog. This asks if you want to create a Daylight system in the current scene.

Once the import process is complete you will see the File Link Manager and the linked model in the viewport.



Using Autodesk Library materials

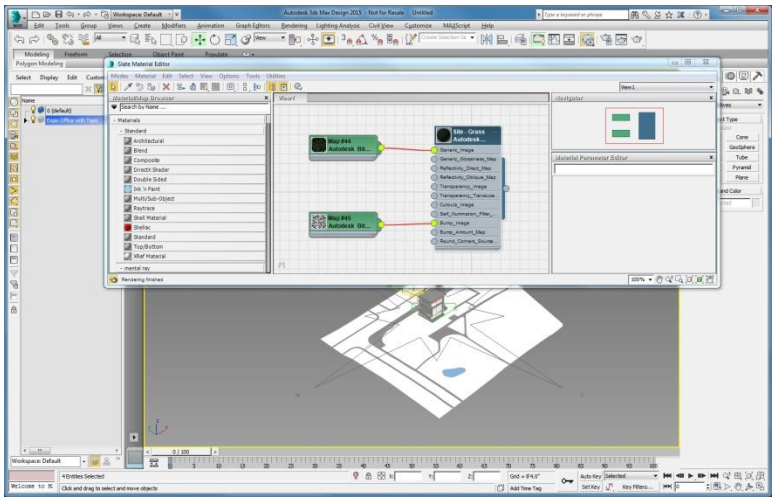
Now you are going to work with the materials in the scene. Linked Revit models, like other types of imported models contain the materials that were applied to the individual objects from the Revit project. When working in 3ds Max there are a few ways to work with materials that are applied to the linked objects in the scene.

First, you can edit existing materials by getting the material from the scene. You can easily select materials on objects and instance them into the material editor. Once a material is instanced into the material editor any changes you make are reflected directly in the material applied to scene objects. This allows you to make changes to materials that were applied in Revit but did not look quite the way you wanted them to.

The second option is to create and assign new materials from the Autodesk Material Library built into 3ds Max. Autodesk materials are designed to provide photorealistic materials that you can apply to objects in your scene that provide settings that are simple to adjust.

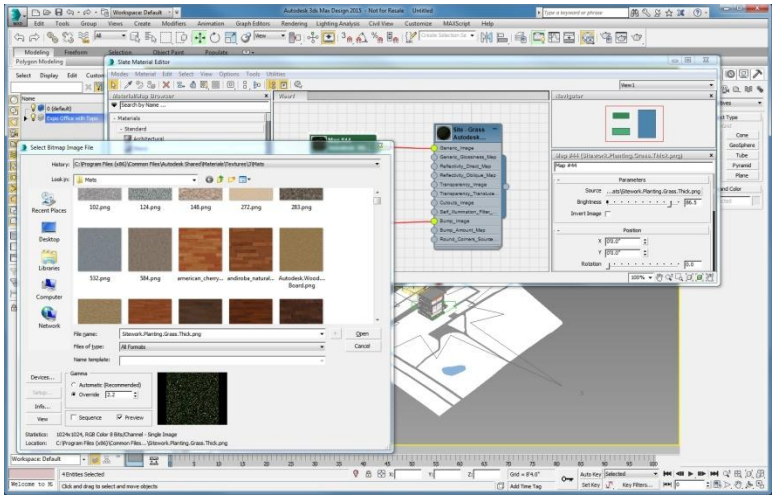
Selecting current materials

For this you will work in the Slate material editor, since the Slate material editor gives us a good look at the overall structure of the material at a glance. You will open the Slate material editor by selecting the Slate material editor from the Material Editor flyout. One of the nice features of the Slate material editor is the ability to have the material/map browser available all the time. Once open, you can scroll to the Scene Materials rollout. When you open the Scene Materials rollout you can view and select any material currently applied to objects in the scene listed in alphabetical order.



Editing existing materials

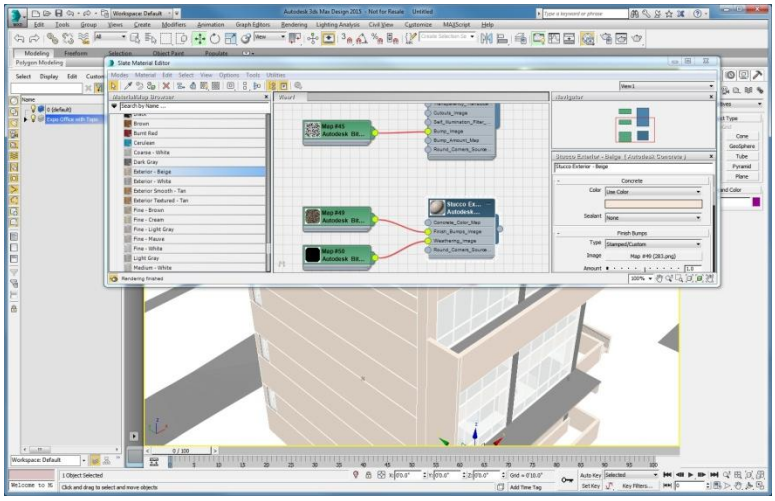
To adjust the parameters of a material in your scene, go to the material/map browser, and click and drag a material into the work area. Select Instance from the dialog that pops up and click OK. That will bring an instance of the material into the work area of the Materials Editor. Making any change to this material will change any material that is in the scene.



Assigning new materials

To assign a new material, click on any Autodesk material available from the material/map browser. Click and drag the material into the work area. Select Instance from the dialog that pops up and click OK. That will bring an instance of the material into the work are of the materials editor, making any change to this material will change any material that is in the scene. Double clicking on the material allows us to access the material parameters. Then, select the objects in your scene, select the desired material, and click the Assign Material to Selection button in the Material Editor toolbar.

Double clicking on the material allows you to access the material parameters. To change the material type, for example, you would right-click on the material, choose Change material/map type from the right-click menu and select a new material.

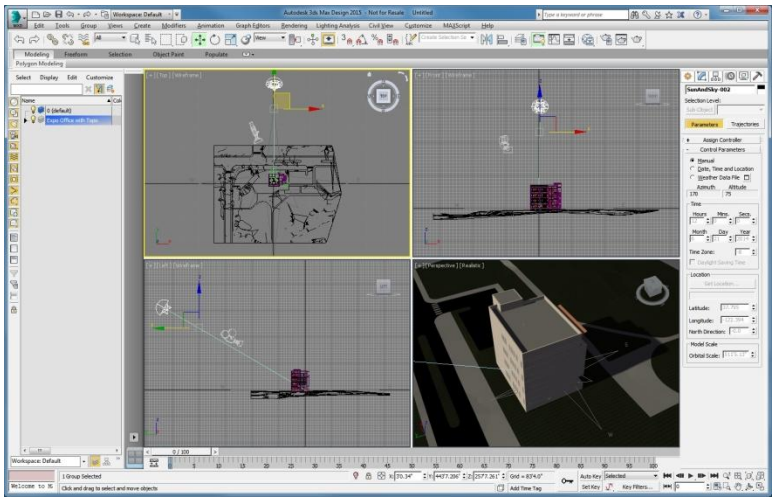


Working with the Daylight System

Introduction to the daylight system

One advantage of linking to a Revit file is that you are able to use the Daylight system that is imported through the link. The daylight system is a lighting system that is designed to simulate the effects of outdoor sunlight and skylight. The sunlight provides the direct illumination and direct shadows, where the skylight provides the light that is scattered by the atmosphere. When used in combination, the finished rendering can be visually accurate and highly Photoreal.

The daylight system also provides a simple interface for placing the sun in the sky in relationship to the scene. All you have to do is set the time of day, the date and the location in order to accurately place the sun. In order to orient the scene geometry, you can simply determine what the north direction should be and reorient the daylight system to match that orientation.



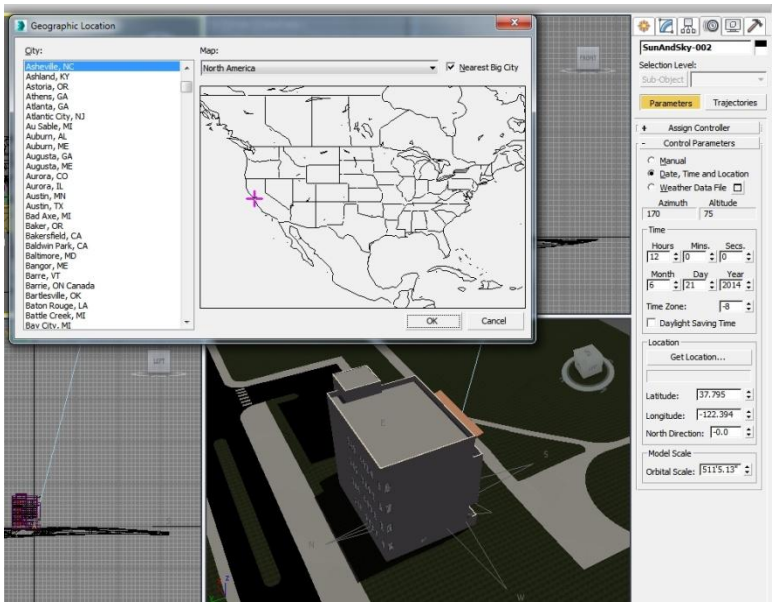
Modifying the time, date and location

Editing the daylight system in your current scene is a simple process. Then you will set the location and reorient north so the building is facing in the proper direction.

To edit the daylight system, select the Daylight object in your scene and click on the Motion panel. This is the key to the daylight system and contains the sun and sky objects as well as the location parameters. In order to change the time and date, select the Date, time and location option and modify the parameters.

You can also change the geographic location of the building. Click on the Get Location button, which opens a dialog containing a map and city list.

The last thing to do is determine the orientation of the building. To orient the building correctly, enter the required angle in the North Direction entry and press enter.

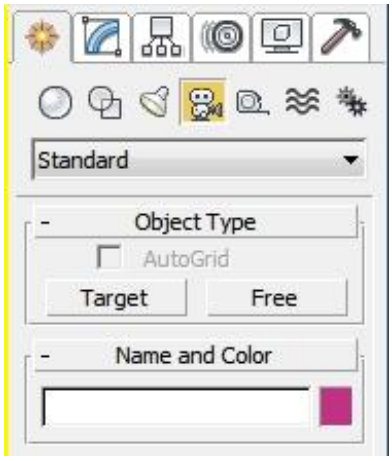


Establishing a Point of View

At this point you are ready to establish a camera view. Choosing a point of view is not as simple as just placing a camera in the scene and rendering the scene. If you want a compelling image, it is important to understand and employ a few basic rules of image composition.

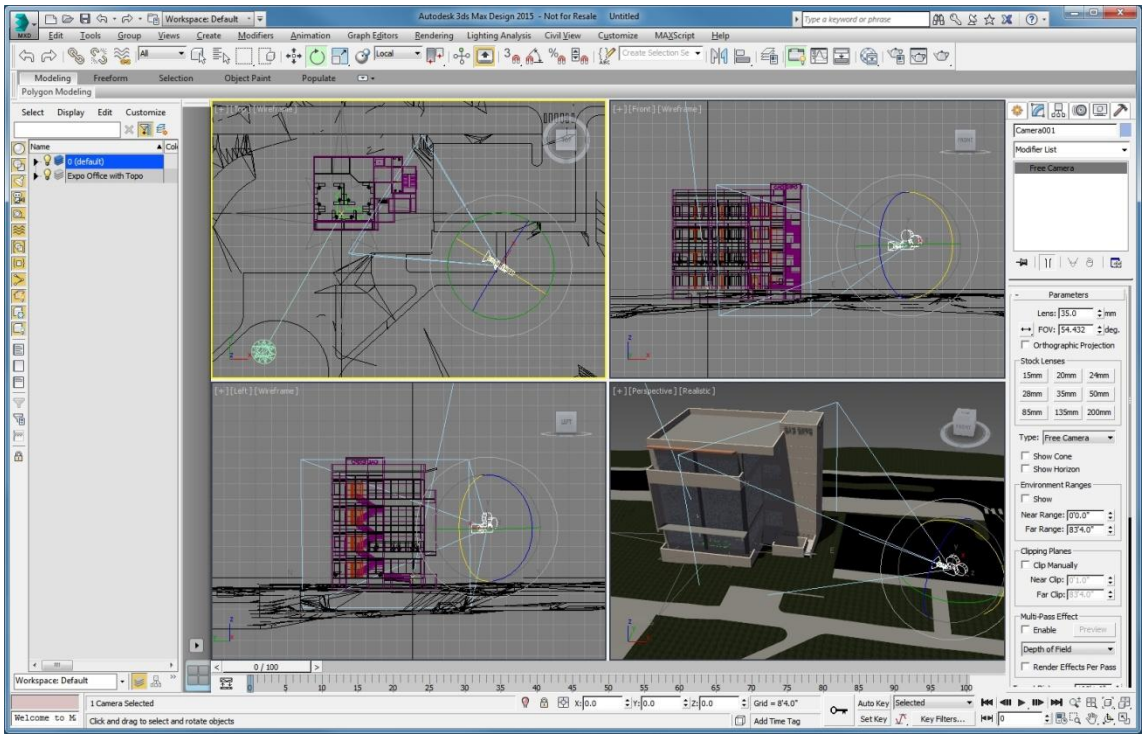
Creating a camera

There are two types of camera in 3DS Max, the Target camera and the Free camera.



A Target camera is attached to a target, so it views the area around the target object. When you click and drag in a viewport and create a Target camera, you will create a two-part icon. The first icon represents the camera and the second icon produced is the camera's target (displayed as a white box). The camera and the camera target can be animated independently.

A Free camera is a free-standing object that views the area in the direction that you have aimed the camera. When you click in a viewport and create a free camera, you see a single icon. This icon represents both the camera and its field of view (FOV). Once the camera is located in your scene, the icon for the camera will look the same as a Target camera, but the Free camera does not contain a separate target. Free cameras are useful when you need to animate a camera along a path.



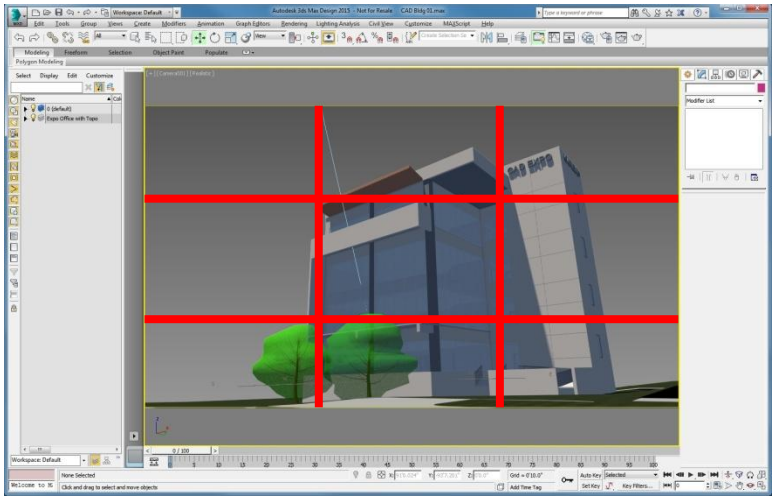
Composition basics

If you want a compelling image, it is important to understand and employ a few basic rules of image composition. Many of the rules of composition have been around for centuries. You are going to take a look at two simple rules that can easily be implemented to give you better looking images almost immediately.

Rule of 3rds

The first rule is the rule of thirds. This rule breaks the screen into three sections vertically and three horizontally. When composing a scene using the rule of thirds you use the two vertical lines and the two horizontal lines to locate key horizontal and vertical image elements.

There are four key interest points that get created at the intersection of each of the one third lines. When there is a particular object or scene element that is to be the focus, it can be placed at one of the intersection points. By using this rule, you can create an image with a more interesting composition.

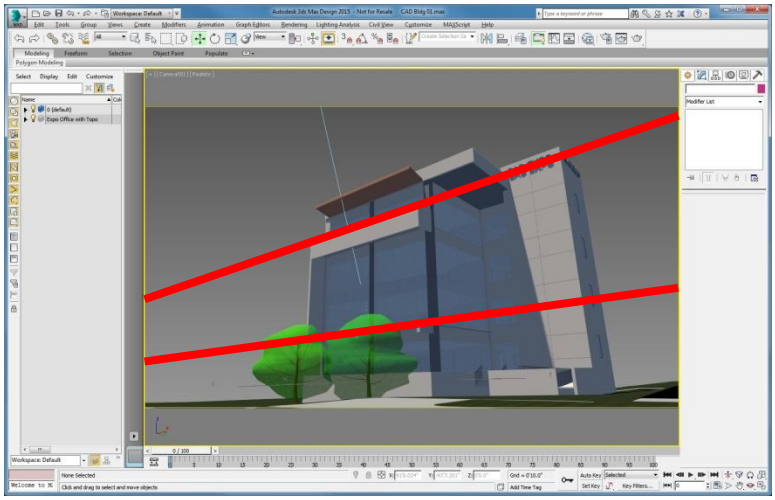


Diagonals

The second rule you will look at is the use of diagonals within the image frame. By incorporating diagonal lines into any image, you can create a more dynamic image and lead the viewer's eye through the scene. Diagonals are easy to incorporate into a final image, and by using it in combination with the rule of thirds you can create an image that will appeal to a much wider audience.

The last thing you will touch on is the use of camera correction. Since this is to be an architectural rendering you want to make sure the vertical lines are all vertical. You can accomplish this by adding a camera correction modifier to the camera.

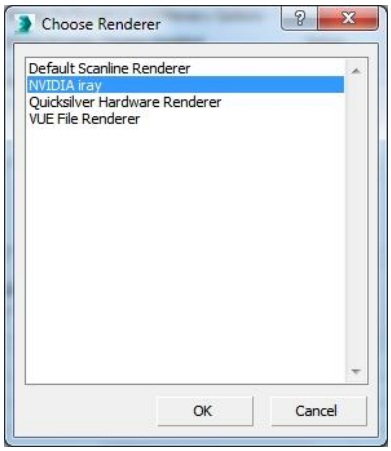
To add a camera correction modifier to a camera in your scene, right-click on a camera and choose the Apply Camera Correction modifier. In the Modify tab, in order to establish the correct amount of correction and obtain a 2 point perspective view you need to enter a value. Once the proper value is entered, the camera view will have vertical object lines that are perfectly vertical.



Rendering the scene

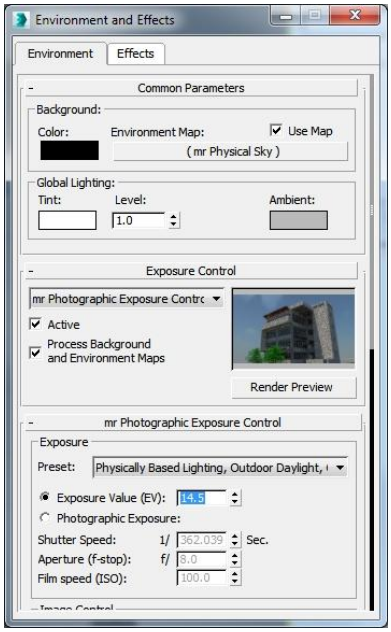
Rendering a virtual photograph has become increasingly simpler as the quality and simplicity of advanced renderers have improved over the years.

The rendering options in 3ds Max Design are no exception. With the release of 3ds Max Design 2012, you now have the iray renderer available to everyone. This renderer is very simple to configure, only needing a time limit or a maximum number of iterations. The iray renderer is a highly photorealistic renderer capable of generating physically accurate lighting with very little worry about rendering settings. It does this by tracing the path of light through a scene. The longer iray renders the better the image quality.



Once you set and configure the renderer it is important to make sure the exposure is properly set. You can use the mental ray photographic exposure control available in the Exposure control section of the Environment and Effects dialog.

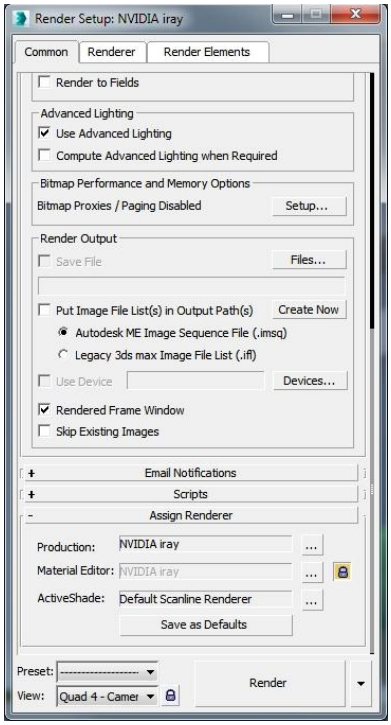
If you do not properly set the exposure value, the final image may end up either too dark or too light. Once you set the proper exposure you are ready to render the scene.



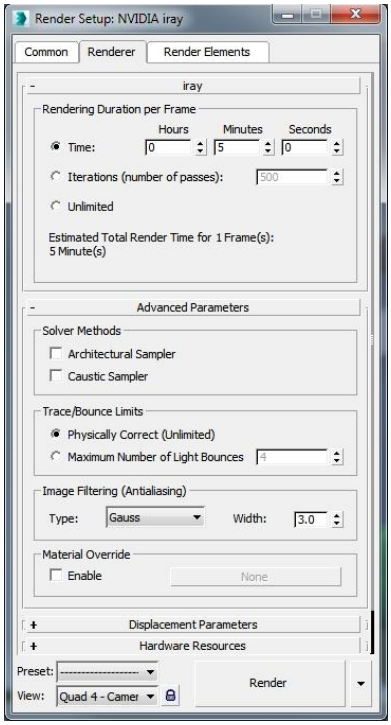
Configuring the renderer

The default renderer in 3ds Max Design is typically the mental ray renderer. Let's change the renderer to use the newer iray renderer.

In the main toolbar, open the Render Setup dialog. On the common panel, open the Assign renderer rollout. Clicking on the production renderer option opens the choose renderer dialog. Double clicking on iray will assign it as the current renderer.



In the render setup dialog, select the Renderer tab. Notice that there are very few options for the iRay render. For initial draft renders, set the Time value to 5 minutes or less. The longer you set the time, the better the final image quality will be.



In the iray Advanced Parameters, you can fine-tune the rendering in several ways.

Under Trace/Bounce Limits, you can limit the number of light bounces, which can speed up rendering time. This option can be helpful when you want to render a preview that doesn't have to have full and finished reflections. If you limit the number of light bounces, scenes can appear darker than the final rendering with unlimited bounces would appear. This is true especially for interior scenes, and exterior scenes that are lit from all around (typically by the sky).

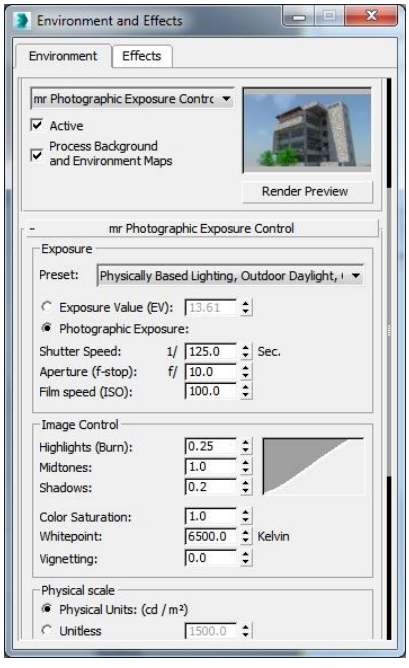
Under Image Filtering (Antialiasing), you can select the Type and Width of the sample area. Increasing the value of Width can soften the image, but it increases render time.

Under Material Override, you can render a scene with all its materials replaced by a single master material. For example, if you want to do a shadow study using only a single uniform color, use these controls to specify a neutral gray material. When you render, all surfaces will use the gray material.

Adjusting scene exposure

Before you render a final image, you need to adjust the exposure of the scene.

From the rendering menu option, select Exposure Control. This opens the Environment and Effects dialog and the Exposure Control rollout. Choose the mental ray photographic exposure control option from the drop down list.



mr Photographic Exposure Control allows you to modify your rendered images with controls similar to those used with real-world cameras. You can set a general Exposure Value or, if you

are accustomed to working with cameras, you can set specific shutter speed, aperture, and film speed settings as you would with actual photography. It also gives you image-control settings with values for highlights, midtones, and shadows. The light levels of the scene do not change; only the sensitivity and amount of light entering the virtual camera is changed.

Exposure Presets can be used to initially set up a scene's exposure setting, but settings typically have to be fine-tuned. The four Physically Based Lighting presets are for Outdoor Daylight Clear Sky, Outdoor Nighttime, Indoor Daylight and Indoor Nighttime. Two methods are available to fine-tune the exposure settings; either the Exposure Value (EV) setting or the Photographic Exposure settings (Shutter Speed, Aperture or f-stop, and Film Speed or ISO) can be modified. Whichever method is used, adjusting the value of one also changes the other (for example, changing the EV will also change the Shutter Speed setting).

If you are familiar with camera settings, using the Photographic Exposure settings will be most suitable to use. For non-photographers, the EV value is easier to use. The single Exposure Value setting corresponds to a combination of the three Photographic Exposure values. Each increment or decrement in the EV value corresponds to halving or doubling, respectively, the effective exposure, as expressed in the resultant change in the Shutter Speed value. The general rule of thumb is that higher EV values result in darker images, and lower values result in brighter images. The default EV is 15, which typically results in a darker rendered image.

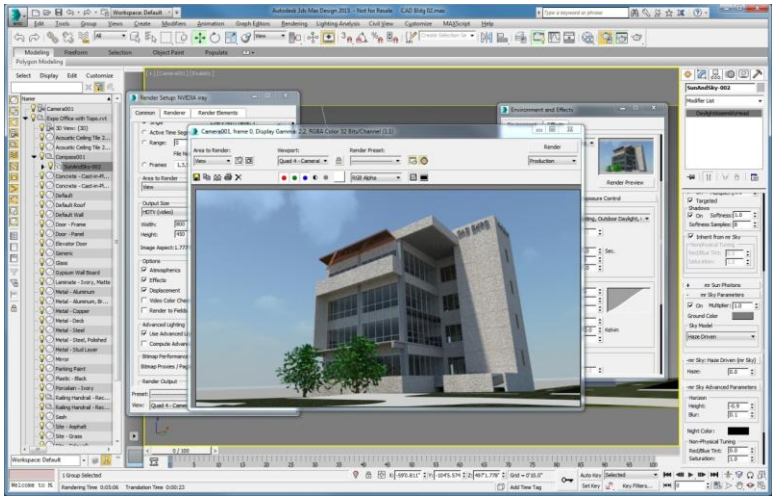
The Photographic Exposure settings only affect exposure. The Shutter Speed is the duration, in fractions of a second, that the shutter is open (the higher the value, the greater the exposure). The Aperture setting is the size of the opening of the camera iris, expressed as a ratio (the higher this value, the lower the exposure). The Film Speed (ISO) setting is the sensitivity of the camera film, expressed as an index (the higher this value, the greater the exposure). For an exterior setting on a sunny day, you would combine a faster shutter speed with a small aperture to compensate for the bright environment (for example, Shutter Speed of 1/250s and f-stop of f/11). If the day is cloudy, however, you might want to reduce the speed so that more light travels through the lens and your shot will not appear too dark (for example, Shutter Speed of 1/100s and f-stop of f/11). If there were fast moving objects in the environment, you would want a faster Shutter Speed to prevent blurring and would open the Aperture to let in more light (for example, Shutter Speed of 1/500s and f-stop of f/2.8).

To preview the render to see what the current exposure looks like, click on the Render Preview button.

Once it is complete, the Exposure Value can be modified as needed to increase or decrease the brightness of the final rendered image.

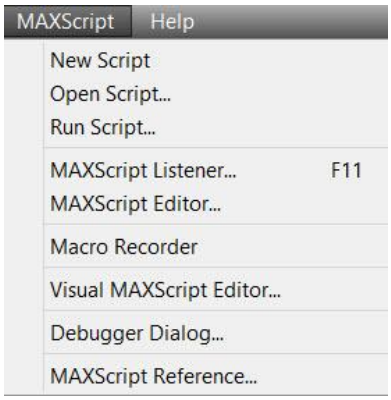
Rendering a final image

Once the rendering is complete you can see the result of the material changes, the lighting and exposure settings.

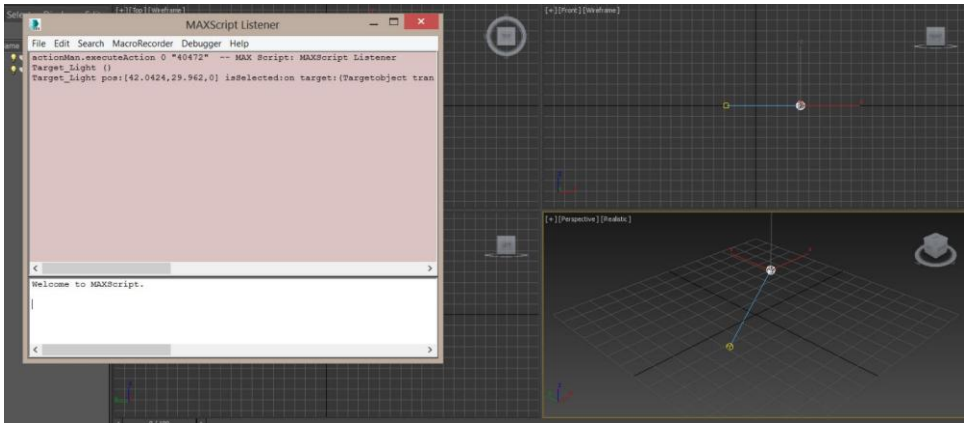


Automating with MAXScripting

MAXScripting can be a valuable tool for automating the process of adding lights and cameras as well as setting up your iray render settings. MAXScripts are ASCII text files that are created and edited in simple text applications such as Microsoft Notepad. MAXScripts are run from MAXScript > Run Script…



When first learning MAXScript, turn on the Macro Recorder (MAXScript > Macro Recorder), then use the MAXScript Listener (MAXScript > MAXScript Listener…) to see the code that displays as you add or edit objects in your 3ds Max scene. The code can then be copied and pasted into a .ms file (an ASCII text file) and run as a script.



Adding Lights

Since the Daylight System is imported automatically when you link the Revit file, it is in its proper position in the scene and you can modify its settings directly. If you would like to add additional lighting, it can be scripted with a MAXScript file. The script below places three lights based on the location of two cameras that exist in the scene.

First, variables are created that contain the x, y and z coordinates of the cameras.

c1x = $Camera01.position.x
c1y = $Camera01.position.y
c1z = $Camera01.position.z
c2x = $Camera02.position.x
c2y = $Camera02.position.y
c2z = $Camera02.position.z

Variables for the coordinates of each light need to be assigned.

LightPos1 = c1x + 300
LightPos2 = c1y + 500
LightPos3 = c1x + 600
LightPos4 = c1y - 200
LightPos5 = c1x + 900
LightPos6 = c1y - 300
LightPos7 = c1x - 200
LightPos8 = c1y + 200

Then the lights are created in the scene. An example using Standard lights is shown below.

Omnilight rgb:(color 255 255 255) shadowColor:(color 0 0 0) multiplier:1 contrast:0 softenDiffuseEdge:0 nearAttenStart:0 nearAttenEnd:40 farAttenStart:80 farAttenEnd:200

decayRadius:40 atmosOpacity:100 atmosColorAmt:100 shadowMultiplier:1 pos:[LightPos1,LightPos2,700] isSelected:on

Omnilight rgb:(color 255 255 255) shadowColor:(color 0 0 0) multiplier:1 contrast:0 softenDiffuseEdge:0 nearAttenStart:0 nearAttenEnd:40 farAttenStart:80 farAttenEnd:200 decayRadius:40 atmosOpacity:100 atmosColorAmt:100 shadowMultiplier:1 pos:[LightPos3,LightPos4,450] isSelected:on

targetSpot rgb:(color 255 255 255) shadowColor:(color 0 0 0) multiplier:1 contrast:0 softenDiffuseEdge:0 nearAttenStart:0 nearAttenEnd:40 farAttenStart:80 farAttenEnd:200 decayRadius:40 atmosOpacity:100 atmosColorAmt:100 shadowMultiplier:1 hotspot:43 falloff:45 aspect:1 showFarAtten:off useFarAtten:off showNearAtten:off useNearAtten:off pos:[LightPos5,LightPos6,1200] isSelected:on target:(Targetobject transform:(matrix3 [1,0,0] [0,1,0] [0,0,1] [LightPos7,LightPos8,20]))

An example using Photometric lights is shown below.

Free_Light intensityAt:10 webfile:"{00000000-0000-0000-0000-000000000000}" on:on castShadows:off rgb:(color 255 255 255) rgbFilter:(color 255 255 255) intensity:1500 kelvin:3600 useKelvin:off intensityType:1 originalintensity:1500 useMultiplier:off multiplier:100 shiftColorWhenDimming:off useFarAttenuation:off displayFarAttenuationGizmo:off startFarAttenuation:80 endFarAttenuation:200 contrast:0 softenDiffuseEdge:0 projector:off affectDiffuse:on affectSpecular:on ambientOnly:off targetDistance:240 light_length:48 light_Width:24 light_Radius:5.5 atmosShadows:off atmosOpacity:100 atmosColorAmt:100 shadowMultiplier:1 shadowColorMapEnable:off shadowColor:(color 0 0 0) lightAffectsShadow:off useGlobalShadowSettings:off hotspot:30 falloff:60 showCone:off xRotation:0 yRotation:0 zRotation:0 pos:[100,200,200] isSelected:on

Target_Light pos:[31.879,49.3079,100] isSelected:on target:(Targetobject transform:(matrix3 [1,0,0] [0,1,0] [0,0,1] [-47.3248,-12.5851,0]))

Adding Cameras

Free and Target Cameras can be creating in your scene based on fixed coordinates that you enter into a MAXScript, or you can create a camera from an existing view.

First, set the viewport layout configuration that you want to use, then make the first viewport active.

viewport.setLayout #layout_3ht

```
viewport.activeViewportEx 1
viewport.setType #view_top
viewport.setType #view_persp_user
```

If you want to create a camera from a view, run the macro "Lights and Cameras" "Camera_CreateFromView." The example below selects an object called Location1, zooms to the selected object to set the view, then creates the camera from the view. Render width and height settings are also set and Safeframes are toggled on.

```
if $'Location1' != undefined then(
	clearSelection()
	select $'Location1'
	max zoomext sel
	viewport.activeViewportEx 1
	macros.run "Lights and Cameras" "Camera_CreateFromView"
	select $'Camera001'
	viewport.SetRenderLevel #smooth
	max safeframe toggle
	r1 = 2000
	renderWidth = r1
	r2 = 2000
	renderHeight = r2
)
```

Cameras can also be created at specific x, y, and z coordinates, as in the example below.

```
viewport.activeViewportEx 2
viewport.setType #view_top
viewport.setType #view_persp_user

Targetcamera fov:45 nearclip:1 farclip:1000 nearrange:0 farrange:1000 mpassEnabled:off
mpassRenderPerPass:off pos:[-11.9563,-4.40288,0] isSelected:on target:(Targetobject
transform:(matrix3 [1,0,0] [0,1,0] [0,0,1] [3.84745,1.06654,0]))
actionMan.executeAction 0 "40472"

Freecamera fov:45 targetDistance:16.7234 nearclip:1 farclip:1000 nearrange:0
farrange:1000 mpassEnabled:off mpassRenderPerPass:off pos:[12.4546,-1.89846,0]
isSelected:on
```

Render Settings

Scripting your iray render settings requires you to first set the current rendering engine:

renderers.current = iray_Renderer ()
--renderers.current = Default_Scanline_Renderer |mental_ray_Renderer|iray_Renderer

Then, you select the Duration Mode, which can be set to a specific time in seconds, number of iterations, or unlimited (which is manually stopped by the user). The example below sets the Duration Mode to time, and a total of 5 seconds.

durationMode = time
--durationMode = time|iterations|unlimited

durationInSeconds = 5
--durationPasses = integer

You can then script any of the options that appear on the iray Advanced Parameters Rollout.
--architecturalSamplerEnabled = true|false
--causticSamplerEnabled = true|false
--lightBouncesLimited = true|false
--lightBouncesMaximum = 2 to 1073741824
--imageFilterType = box|gauss|triangle
--imageFilterWidth = 0.0 to 8.0
--overrideMaterialEnabled = true|false
--overrideMaterial = materialname

You can then script any of the options that appear on the iray Displacement Parameters Rollout.
--displacementView = true|false
--displacementSmoothing = true|false
--displacementEdgeLength = 0.0 to 1e+006
--displacementMaximum = 0.0 to 1e+006
--displacementSubdivisionLevel = 0 to 7

You can then script any of the options that appear on the iray Motion Blur Rollout.
--motionBlurEnabled = true|false
--blurAllObjectsEnabled = true|false
--shutterDurationInFrames = 1e-006 to 1e+008
--shutterOffsetInFrames = -1e+008 to 1e+008
--motionSegments = 1 to 15
--iterationsPerMotionStep = 1 to 1024
Then activate the viewport that you want to render. In the example below, the fourth view is activated.

viewport.activeViewportEx 4

Then script the render command and set the pixel height and width of the rendered image.

render outputheight: 3000 outputwidth: 3000

You can also create a dialog that displays after the render is completed so the user has an indication that the render completed successfully.

```
rollout RenderComplete "Render Complete"
  (
  label lab1 "Render Complete" align:#center
  )
  createDialog RenderComplete 300 50
```

Creating dialogs and buttons

You can create a custom dialog with MAXScript that contains buttons for each automated function. Each function is a separate .ms file that can be edited independently.

The first step is to create the dialog using the rollout command.

```
if ((ssRoll !=undefined) and (ssRoll.isdisplayed)) do
(destroydialog ssRoll)
rollout ssRoll "AU Maxscript Controls"
(
group "AU MaxScript"
(
button but_Lighting "Insert Lighting"
button but_Camera "Insert Cameras"
button but_RenderScene "Render Scene"
)
```

Then as each button is pressed on the dialog, a script is run.

```
-- Lighting Button is Pressed

   on but_Lighting pressed do
   (
    scriptfile = "C:\AU\Scripts\AU-Lighting.ms"
```

```
    fileIn scriptfile
   )

-- Camera Button is Pressed

   on but_Camera pressed do
   (
    scriptfile = "C:\AU\Scripts\AU-Cameras.ms"
    fileIn scriptfile
   )

-- RenderSceneButton is Pressed

   on but_RenderScene pressed do
   (
    scriptfile = "C:\AU\Scripts\AU-Render.ms"
    fileIn scriptfile
   )
```

The last step is to set the pixel height and width of the dialog.

```
)
createDialog ssRoll 260 110
```