The Elements of Architectural Visualization

Leo Casado, Associate AIA – Autodesk, Inc.

AC2172 How do you tell a story with a rendering? How can a 3D model be transformed into a work of art? Is it the illumination, the camera settings, the props, or the composition that bring a project to life and transforms it from a flat image into an inspiring representation of your architectural project?

Whether you are a new AutoCAD ® or Revit ® user or a production professional looking for a new angle on your projects, this lecture will immerse you in the creative and technical architectural visualization possibilities available in the Autodesk Building Design Suite.

By learning basic principles of architectural photography, and the qualities of great interior and exterior images, you will gain a fresh perspective for producing renderings that will delight and inspire your clients.

Learning Objectives

- Identify the qualities of great interior and exterior architectural renderings
- Implement best practices for setting up lighting, camera settings, materials and composition
- Acquire knowledge of visualization resources for architectural projects
- Get inspired with a gallery of architectural rendering examples

About the Speaker:
Leo Casado is an architect, with more than 15 years of Autodesk® software experience, and currently working as a Sr. Web Marketing Manager for Autodesk. Before joining Autodesk, Leo worked as an architectural designer and CAD manager in the US and Latin America. He has also taught several CAD classes at the Boston Architectural College.
leo.casado@autodesk.com

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Introduction

Architectural renderings can be much more than 3D representations of your AutoCAD or Revit projects; they are communication tools that give you the opportunity to help clients understand an architectural project before it is built.

"I'm an old-fashioned guy… I want to be an old man with a beer belly sitting on a porch, looking at a lake or something."

—Johnny Depp
b. 1963, American actor

But for clients to be truly inspired by a rendering, you must approach your images at a personal level, so the results are not just "*cool*," but meaningful. This can only be achieved by not only knowing the architectural project itself, but also understanding the vision of how your client sees herself using the architectural space.

The best visualization ideas come from the imagination of your clients, and your job is to illustrate these stories into renderings. But how do you know what stories to tell? You just have to ask questions. Not only questions about square footage, location or number of rooms, but personal questions! If you are rendering a single-family home, ask your client "do you like to cook?" or "how do you spend your free time at home?" or "show me your favorite piece of furniture." This will give you dozens of ideas for 3D images, and it will also inform you how to best focus your time and production resources.

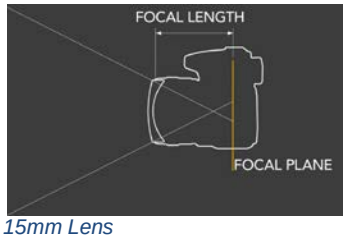
Architectural renderings are not much different that photographs, and once you know what story you want to tell, you can adopt many of the techniques used in architectural photography to improve the quality of your work, regardless of the software application that you are using, or project budget. If you know what you want to communicate, and you have purpose behind the decision of what techniques you use, you will produce work that will impress and delight the most demanding clients.

1. Cameras

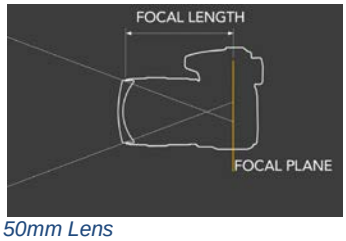
Lenses Focal Length

Camera lenses have a field of view determined by the focal length, which is measured in millimeters from the middle of the lens to the camera sensor or film. In AutoCAD or 3ds Max, there are no physical properties of lenses, instead, there are simulated parameters designed to produce results like in real photography.

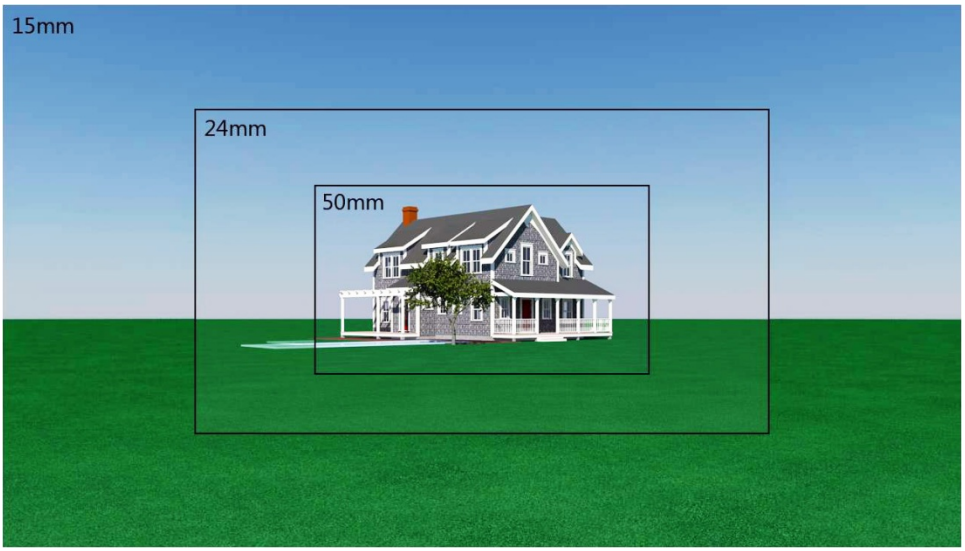
Lenses of 50mm are usually considered to have a normal field of view, as they are close as the human eye field of view. The ones that are longer than 50mm are considered telephoto, and the ones with shorter field of view are considered wide angle. Wide angle lenses are best for architectural photography.

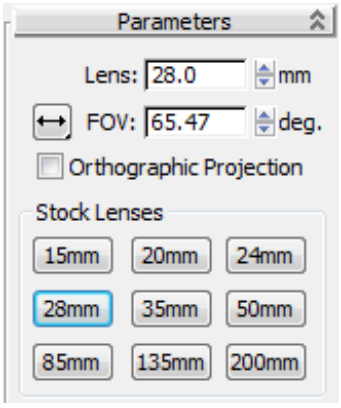


15mm Lens



50mm Lens





Camera Parameters in 3ds Max

When the camera is farther away from the building, there is more compression of the scene; this means that the objects in the foreground and background seem to be closer from each other. But if the camera is closer to the building and a wide lens is used, the image is stretched and there is the illusion of more separation between objects. The focal length that you chose is going to greatly affect the sense of space, and relation between foreground and background objects in the final image.

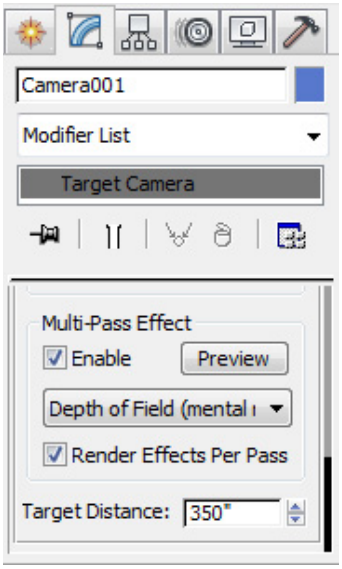
50mm Lens: Image is compressed

15mm Lens: Separation between tree and house

Depth of Field

Depth of field refers to the area of an image that is in focus. A **deep** depth of field (f/11 or more) allows objects in the foreground and background to be in focus, while a **shallow** depth of field (f/2.4 or less) allows focusing on a specific area of an image. While the ideal aperture for architectural photography is between f/8 and f/11, you can use a shallower depth of field to highlight specific elements in your images in a more creative way.

Lenses that allow for a shallower depth of field are called “fast” lenses, and they allow for a wider aperture, and thus more light can get into the camera sensor. These lenses have larger glass components, and are usually heavier and much more expensive than regular kit lenses that come with DSLR cameras.



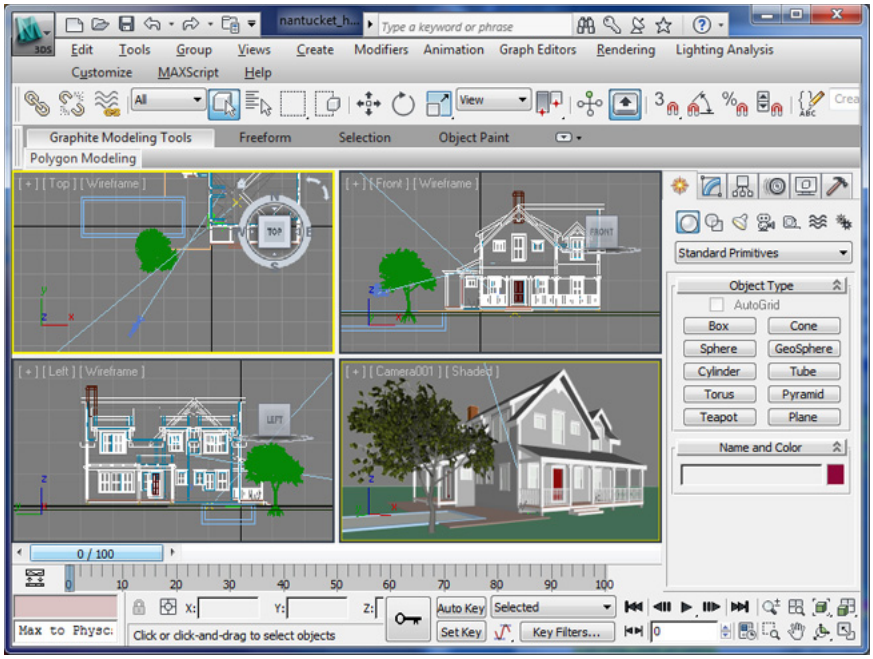
Mental Ray Depth of Field camera parameters in 3ds Max

50mm lenses, in configuration of f/1.8, f/1.4 and f/1.2

One good thing about architecture visualization is that the camera settings allow for an unlimited configuration, simulating lenses that would otherwise cost thousands of dollars. AutoCAD and Revit do not have these options, but the Mental Ray engine in 3ds Max can be configured to recreate shallow depth of field effects that work very well in still images or animations.

3ds Max Design Cameras

When you link a DWG file into 3ds Max Design, cameras are added to the scene, corresponding to the saved views in the AutoCAD DWG file. These cameras may or may not have the desired settings that you would like for your rendering. You can adjust the settings, but are at risk of losing them when you reload the DWG file. However, you can also create new cameras in the 3ds Max Design scene, that are independent from the DWG linked model.



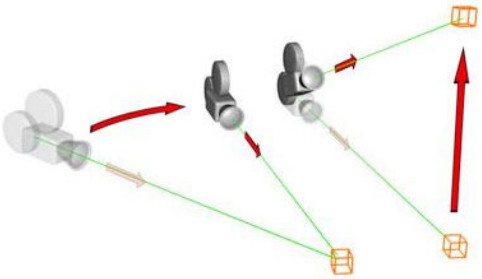
Cameras are created when linking a DWG file into 3ds Max Design

Camera Types

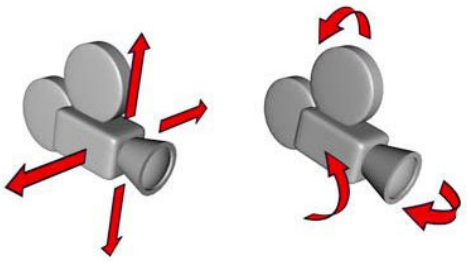
Camera tip

*3ds Max offers several tools that can help with architectural composition. The **Camera Match Utility** allows you to create a perspective that matches the viewpoint of a background photo, and the **Camera Correction Modifier** lets you correct a camera view to get vertical lines in the 3D model vertical*

Target Cameras: When you create a target camera, you see a two-part icon representing the camera and its target. The camera and the camera target can be moved independently, so target cameras are easier to adjust to obtain the desired point of view.



Free Cameras: When you create a free camera, you see a single icon representing the camera and its field of view. The camera icon appears the same as a target camera icon, but there is no separate target icon to move. Free cameras are typically used when animated along a path.



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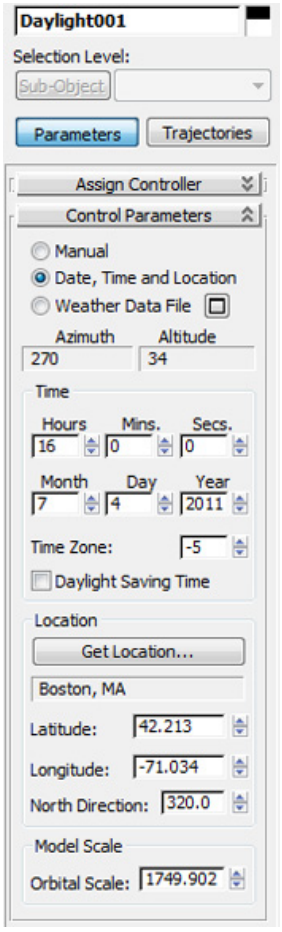


*You can modify the Daylight System by selecting the object, and adjusting the parameter on the **Modify** command panel*

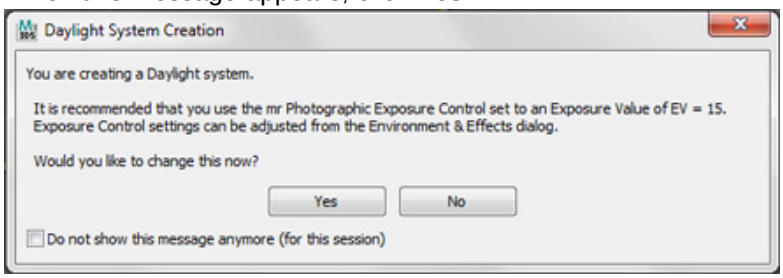
2. Illumination

The quality of the illumination used in a 3D scene is crucial to the success of a rendered image. Without a defined source of light, 3ds Max Design uses default illumination to give the illusion of 3D, but with this type of light, renderings result in flat images.

The easiest way to illuminate the exterior of an architectural 3D model is with the sun. 3ds Max offers a Daylight System that simulates sunlight based on geographic location, date and time of day. This is a very effective system to produce quick and accurate outdoor renderings.

Creating a Daylight System in 3ds Max Design

1. Select the **Top** viewport
2. Under **Light Analysis** menu, select **Create > Daylight System**
3. When this message appears, click **Yes**

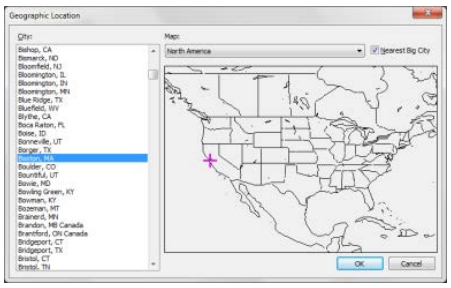


4. Click on the center of the 3D model to place the Daylight System object
5. Drag to create the radius of a compass rose (the radius is for display purposes only), and then release the mouse button
6. When prompted to create a **mrSky**, click **Yes**
7. Click on  to release the Daylight System command

To adjust the position of the sun, relative to the time, date and location of the current scene, follow these steps:

8. Select the **Daylight** object
9. Click on the **Modify** command panel
10. Click on 

11. Use these parameters:
    Location: **Boston, MA**
    North Direction: **320.0**
    Time: **16:00:00, Date:** Date: **7/4/2011**



After setting up the location and north arrow parameters, the shadow representation should provide a realistic simulation of shadows for this project on its current site.

Apps like LightTrac can help you plan the best sun light and shadows for the date, time and location of your project

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3. Composition

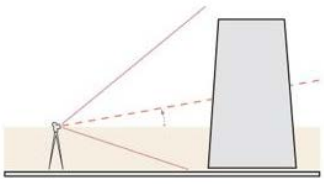
Rule of thirds

Great renderings require more than accurately linked models and cameras that are properly placed. With computer-generated renderings, you are communicating design ideas to your client, and proper composition can help create a balanced and interesting image.

The rule of thirds in visual arts, primarily in photography, states that any rectangular image should be divided in equally spaced thirds, horizontally and vertically. The grid lines resulting from these divisions should be used to align the most significant features of the image. This technique permits images that are more balanced and aesthetically pleasing.

Keystone Effect

When we look at buildings, our brains automatically compensate for the perspective distortion of our field of view; however, when we see photographs or architectural renderings, vertical lines that are convergent give the illusion of an unbalanced building that can be aesthetical compromised.



3ds Max camera and target at different Z-value produce the undesirable keystone effect

When setting up your cameras in 3ds Max, you should avoid the keystone effect as much as possible by keeping both camera and target objects at the same elevation, so all vertical lines in the 3D model remain vertical in the final rendered image.

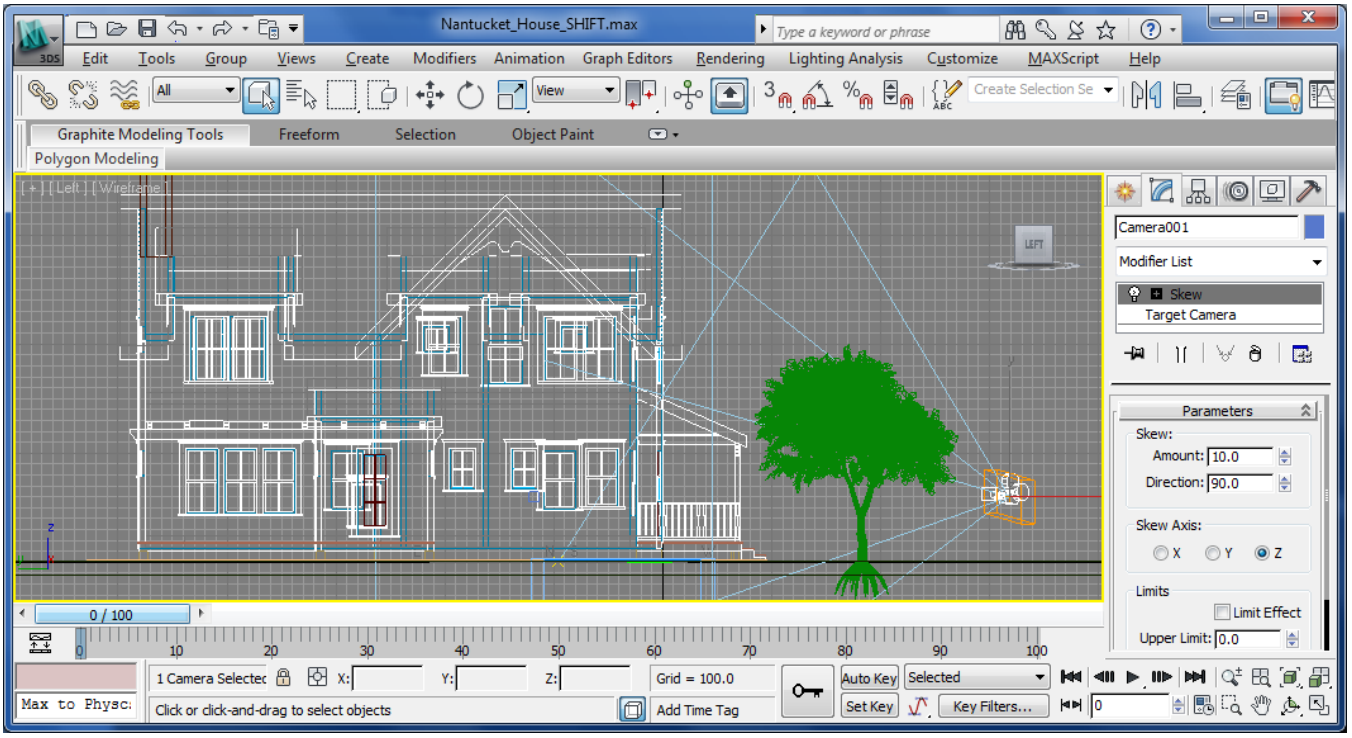
The "shift" feature of tilt-shift lenses is used in architectural photography to improve composition, while avoiding the keystone effect

Camera Height: 60"

Camera Height: 160"

Camera Height: 60" shifted

As a rule of thumb, the best camera location is at a distance of about one to three times the height of the building.

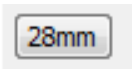


In 3ds Max design, you can add a Skew modifier to the camera, to simulate the effect of a tilt-shift lens. Use 90 degrees for vertical direction, and any 'amount'.

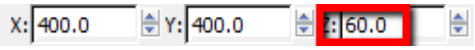
Camera Settings and Skew Modifier in 3ds Max Design

1. Select the **Top** viewport
2. Select the **Street View** camera object
3. Click on the **Modify** command panel

4. Change the camera **Stock Lens** to



5. Click on  to select and move the camera object
6. Change the Z value to 60.00

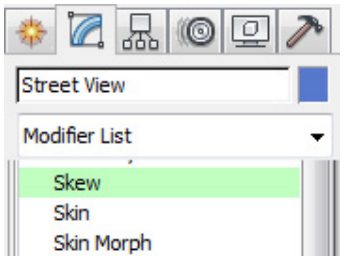


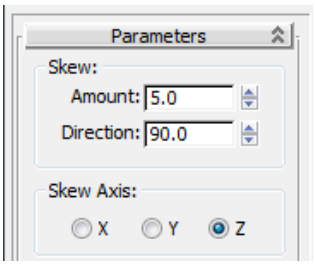
7. Click on  and select **Street View.Target** by name
8. Change the Z value to 60.00

Sixty inches are used for Z value, to show the point of view of the average height of the human eye above ground level. However, this centers the horizon vertically on the image, which is not the ideal composition. To lower the horizon to a third of the image, follow these steps:

9. On the camera view, click on 

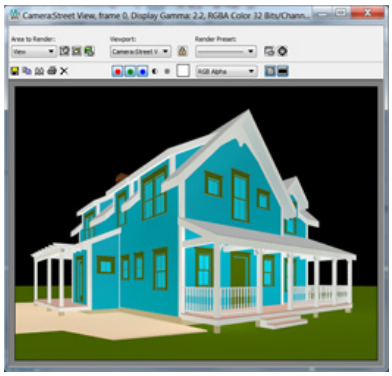
and select **Show Safe Frames**
10. Select the **Street View** camera object
11. On the Modifiers list, select **Skew**





12. Change the **Direction** value to **90**
13. Change the **Amount** to a number around **5.0**
14. On the **Top** viewport, move the camera to adjust the final composition

At this point, the final composition of the render is done. If you were to render the image without lights and materials, it would look like the image on the right.



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Appendix — Styling

Interiors

It is well known that successful architectural photography requires that you remove, remove and remove objects from the scene. With less clutter, you let the space speak for itself without distracting elements that get the attention of the viewer. In architectural visualization, your scenes are already empty, so it is just a matter of avoiding the temptation of adding unnecessary objects.

You should always render the space where the action happens, for example, kitchen countertops and central isles are very important for clients and thus should be highlighted. Any decoration should be neutral of any significant style, and it is always best to get the architect involved in the selection of furniture and interior design objects. The acceptance of the design can be challenged if the interior design is not what the client expects.

*Every object in your rendering with an on/off switch should be **on**; this includes TVs, fireplaces, showers and all light fixtures. This is particularly true in bathrooms, which are tricky spaces that require wide angle lenses, and avoiding having cameras in the way of mirror reflections*

Exteriors

In addition to your 3D building, one consideration that you can have for your renderings is to add landscaping elements, cars, street lights and people. This will help to communicate the function of the building, and how it is intended to be used. It is always a good idea to keep seasons and time of the day in mind when planning for styling exterior renderings, as the colors, illumination, vegetation and even clothing can affect what the image communicates.

Using people in a rendering is a good idea for getting a sense of scale; however, you should be careful with this approach, since these images can be very distracting, as people draw most of the attention in images. Julius Shulman's architectural photography from the 60's is a good example of using people to show functioning architecture, but when in doubt, simply use shapes, or avoid using people altogether.

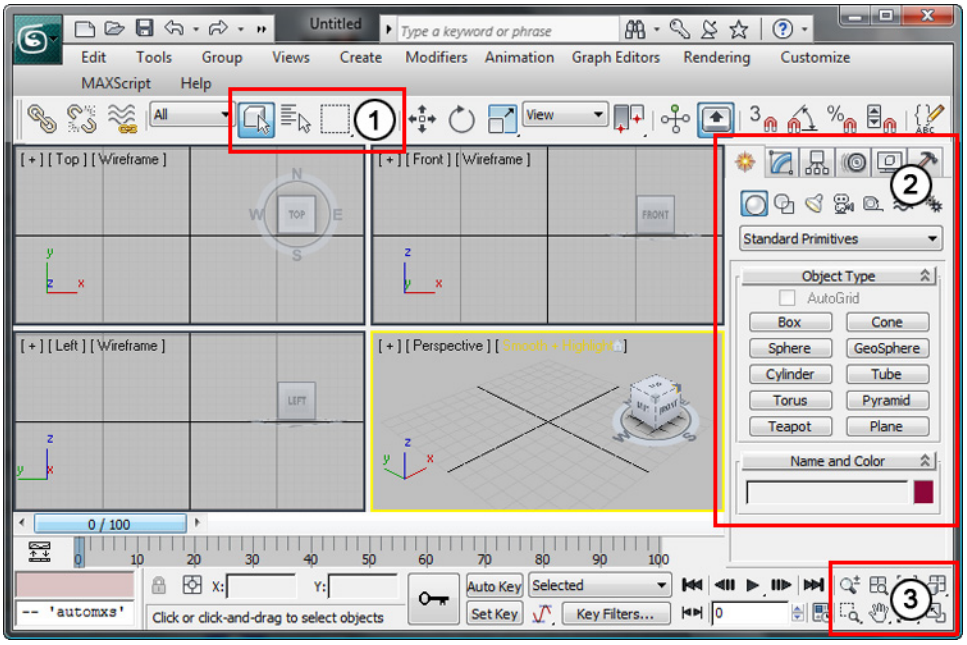
Julius Shulman, 1960.
Use of people in architectural photography

The dusk shot is a very common example of a great way to render residential design. It is intended to simulate the time of the day just after sunset, when the atmosphere is still visible as blue, and with tungsten interior lights. It adds a lot of warmth to an image, which is usually very well received by clients.

Bridge House by Joeb Moore + Partners

Appendix — From AutoCAD to 3ds Max Design

If you have a 3D model with cameras setup from AutoCAD, you can easily bring it into 3ds Max Design for visualization. Let's take a tour of the 3ds Max Design user interface.



[1] Selection Commands
Located in the main toolbar, provide quick access to commands for selecting and manipulating objects

[2] Command Panels
Provide access to parameters, and are grouped by function such as Create, Modify and Display

[3] Viewport Navigation Controls
Used to navigate viewports and adjust camera views

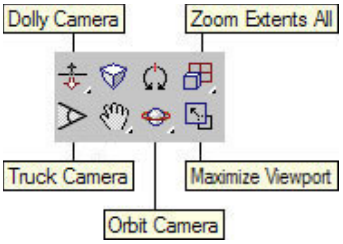
Viewports Navigation Controls

The viewports in 3ds Max Design can be configured to display different views, including camera views from any of the cameras in the 3ds Max Design scene.

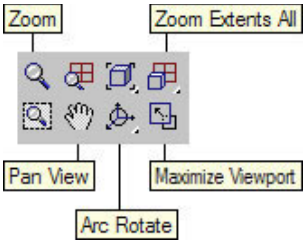
Cameras and Perspective Views: The Viewport Controls in a camera or perspective viewport allow you to adjust the camera angle.

Parallel Views: The Viewport Controls in a parallel view such as Front, Top, left or Right, provide traditional display tools such as pan, zoom, and arc rotate.

Additionally, you can change the Rendering Method of each viewport, to display the faces or wireframe with any desired shading level.



Camera and Perspective
viewport controls



Parallel view
viewport controls

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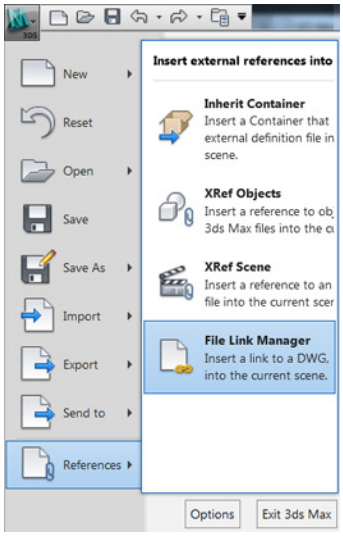
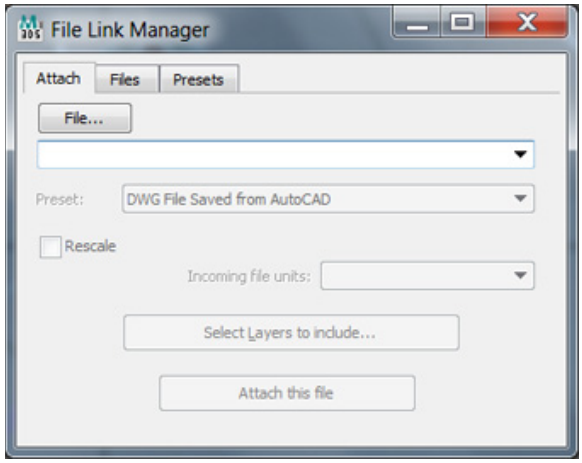
Using the File Link Manager

The File Link Manager in 3ds Max allows to link DWG files into the scene in a similar way in which AutoCAD allows files to be inserted as external references.



*The File Link Manager can be accessed from **3ds Max Design Application button**, under the References section*



The File Link Manager

There are several options to control the linking process, including settings for imported geometry, materials, lights, and categorization of DWG objects in the 3ds Max scene.

Additionally, the process allows layers to be excluded, and the building model scale to be adjusted before the DWG file is linked in.

Linking a DWG file into 3ds Max

1. Start a new scene in 3ds Max
2. On the **3ds Max Design** application button, select **References > File Link Manager**
3. On the **File Link Manager** dialog box, select the **Attach** tab
4. Click **File**
5. Browse for <***filename.dwg***> and click **Open**
6. On the **Preset** pulldown, select **DWG File Saved from AutoCAD**
7. Check the **Rescale** box, and under **Incoming File Units**, select **Inches**
8. Click **Select Layers to include**…
9. On **Select Layers** dialog box, check **Skip All Frozen Layers,** click **OK**
10. Click **Attach this file**
11. The AutoCAD DWG file will now appear in 3ds Max, ready for visualization
12. Click on the  icon to minimize the camera viewport

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AutoCAD 2014
http://www.autocad.com

System Requirements
Microsoft® Windows® 8, 7, or XP; Intel® Pentium® 4 or equivalent AMD Athlon® dual-core processor; 2 GB RAM

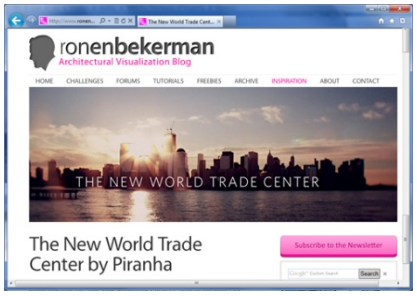
Autodesk 3ds Max Design 2014
http://www.autodesk.com/3dsmax

System Requirements
Microsoft® Windows® 8, 7, or XP; Intel® Pentium® 4 or equivalent AMD Athlon® dual-core processor; 4 GB RAM Direct3D 10 or OpenGL-capable graphics card

Resources

The AREA
http://www.the-area.com

AREA is an Autodesk online community for 2D and 3D artists, with free tutorials and downloads, movie and image galleries. It is a great resource for learning and to find inspiration for architectural visualization projects

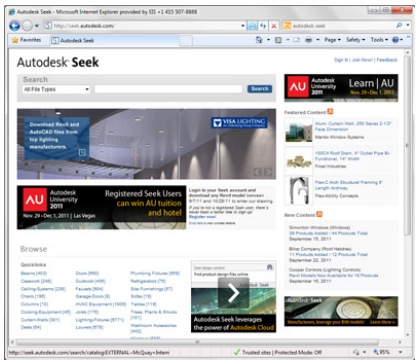


Ronen Bekerman's Architectural Visualization Blog
http://www.ronenbekerman.com

International community for sharing and learning about 3d architectural visualization. Simple and easy to follow tutorials for 3ds Max Design

cgarchitectc.com
http://www.cgarchitect.com/

Architectural visualization community, tutorials, gallery and news. Primary focus on 3ds Max and V-Ray.



Autodesk Seek
http://seek.autodesk.com

Online source for product specifications and models to use in Revit, AutoCAD, 3ds Max, Maya and other CAD applications

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Final Image

Architectural project designed by CWA Architects

Conclusion

There are many classes that you can take about tools and software for visualization, including rendering plug-ins and post-production tools. But the principles from this class, like composition, how camera lenses work and scene illumination, can be applied to Autodesk products, as well as products made by many other companies. Whatever tools and technology you learn today—AutoCAD, Revit, 3ds Max or Photoshop—it will not provide knowledge that will last forever.

But if you develop some foundations—how people perceive light, how people are emotionally affected by a story, how people think, how people make choices and translate that into behaviors like approving an architectural design, then that knowledge will serve you for the rest of your career.