AS225776

3ds Max Is Revit Software's Best Friend

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Learning Objectives

- Learn how to start using 3ds Max the easy way
- Learn how to use the best render engine for photorealistic and non-photorealistic rendering
- Understand the different and best lighting techniques
- Learn how to create extremely photorealistic materials

Description

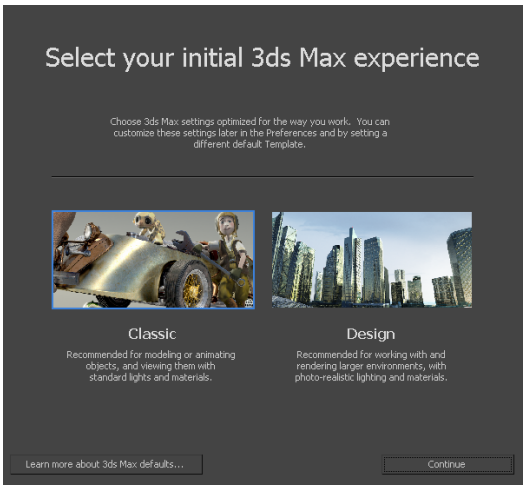
This class is all about getting your Revit data into 3ds Max software and being able to start using 3ds Max for photorealistic rendering, on time and on budget.

Speaker

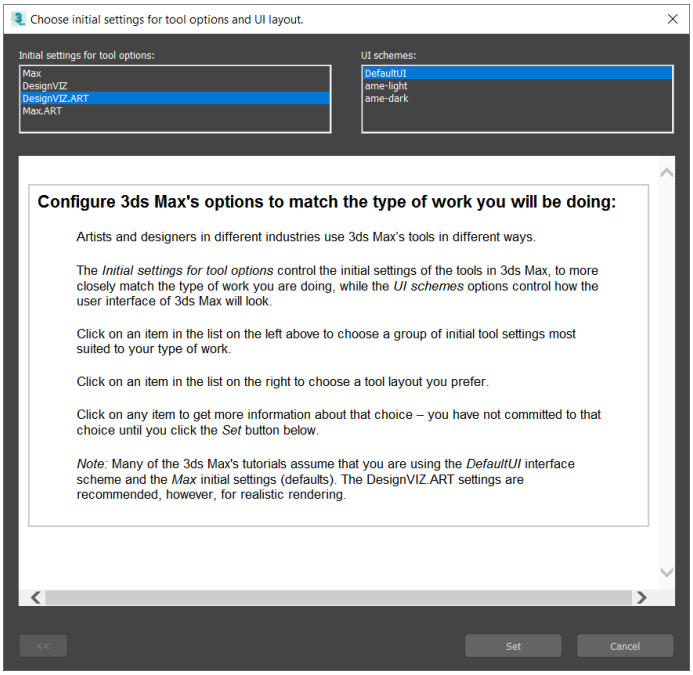
I started using Autodesk products twenty-six years ago. After learning AutoCAD 12 and 3D Studio DOS version 3.0 I started my long career as an AutoCAD draftsman. I became part of Autodesk distribution in 1995 and started delivering technical training and support for AutoCAD and 3D Studio resellers in the Benelux region. As it is today I'm still part of Autodesk distribution and I do support Autodesk and the Autodesk resellers in Benelux, UKI and the Nordics. 3ds Max, 3ds Max Interactive, Maya are the products where I'm currently focusing on.

Learn how to start using 3ds Max the easy way

Starting to use 3ds Max can be quite challenging. From the first moment a lot of users have no clue how or where to start. By setting up a few things your 3ds Max live will be much easier and you will start enjoying the product in combination with your Revit design. But first things first. When you do start 3ds Max for the very first time a dialog will be shown where you have to choose what kind of user you are.



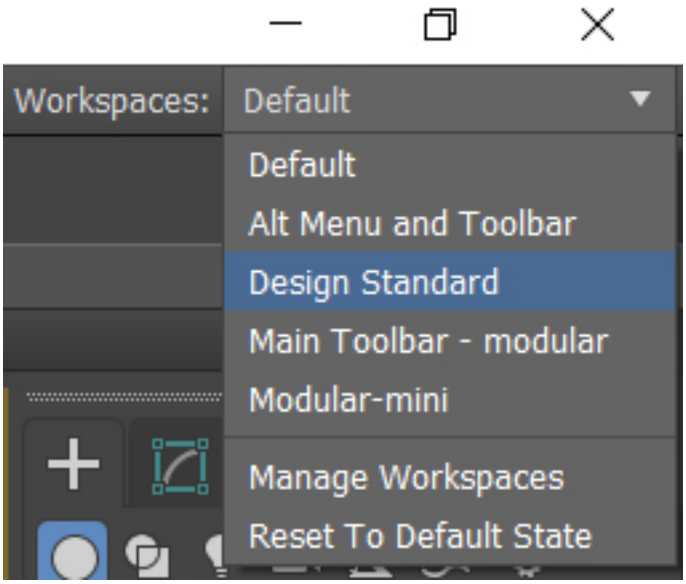
Based on your choice, a lot of preset settings will be made. If you're working in a Design Visualization environment your preferred choice should be the Design preset. If you made a mistake in the presets or if you want to check if the Design preset applies you can always go to the **3ds Max Customize** menu and open up the **Customize UI and Defaults Switcher** dialog.



The Initial Settings in de left upper left part of the dialog box should be set to DesignVIZ.ART. As a result, ART will be the default renderer, you will work in a layer based approach and lots of other default settings or made to make you 3ds Max live much easier.

Design Standard Workspace

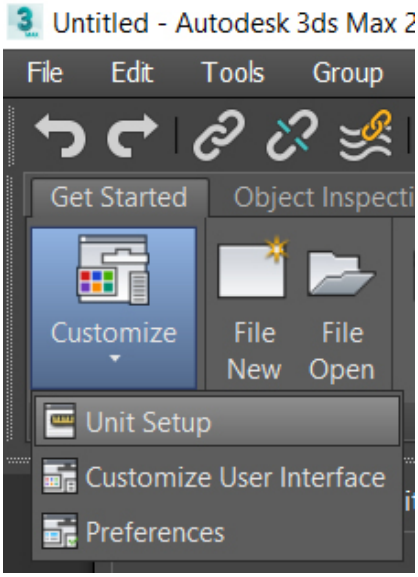
3ds Max commands and options are wide spread through the application which is just too complicated when you're used to a ribbon based approach. 3ds Max does provide a ribbon as part of the application but is not set by default. In the upper right corner of 3ds max you can set the Workspace to the Design Standard workspace. After switching the workspace, you might have to restart 3ds Max so that all the belonging settings are initialized.



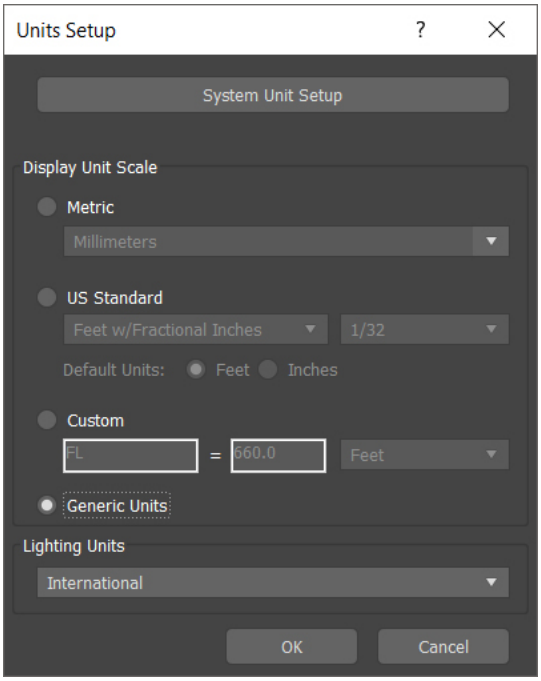
When you've switched to the Design Standard Workspace 3ds Max will set that as the default workspace and will automatically remember your preferred choice. The Design Standard ribbon basically works from left to right and does provide a task based approach.

Units Setup

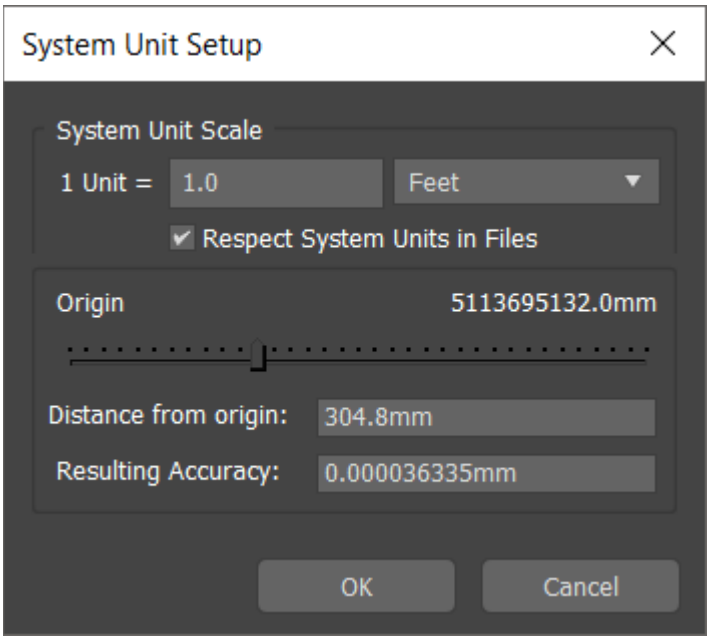
The first "Get Started" Tab of the Design Standard ribbon will show you one of the most important things before you start to import or link your Revit Designs. Below the Customize button in the Options panel of the Design Standard ribbon you will find the Units Setup.



When activating the Unit Setup command the Units Setup dialog box will appear.



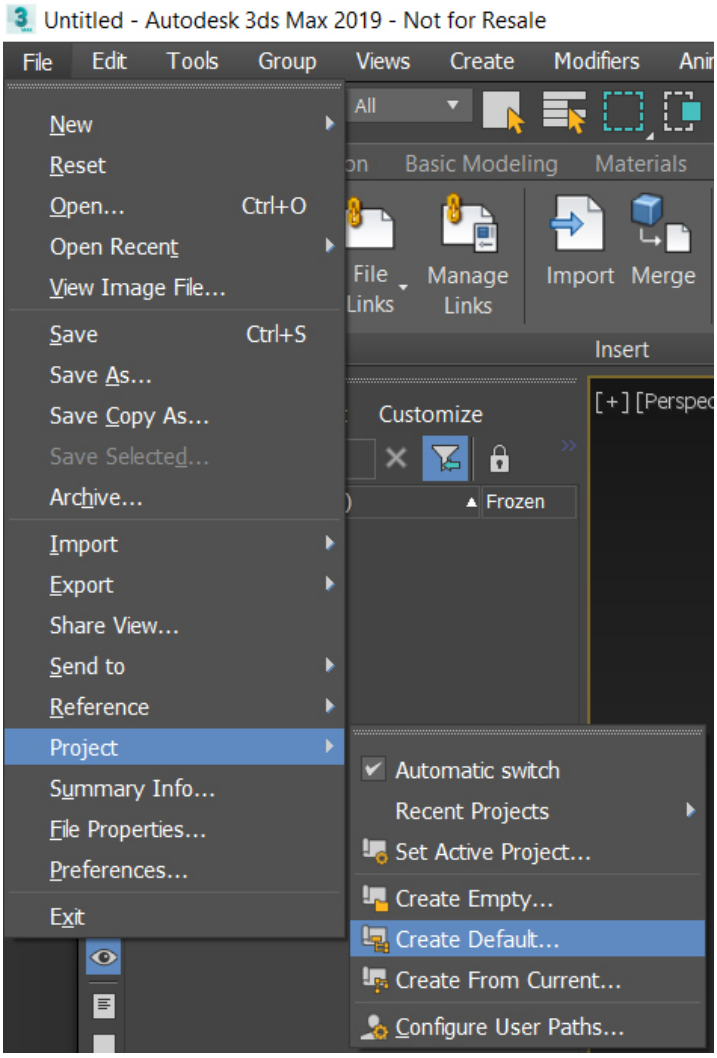
By default, the units are set to Generic units. The Display Unit Scale is not the most important one in this dialog box. This is just all about how you would like to display your units if you measure something for instance. The most important one is the System Unit Setup which can be set by just clicking on the System Unit Setup button.



If you're dealing with Revit data, your System Unit Scale must be set to Feet since that's the default hardcoded unit of Revit. If you don't set this right you will run into scaling issues later. 3ds Max will remember your system unit scale as long as you don't open up another 3ds Max file with different units. If so you automatically do get a warning.

3ds Max Projects

3ds Max files are being saved based on an active project environment. If you don't set it up all your files will be saved on your local hard drive. A 3ds Max project is nothing else then a Windows folder with a lot of additional sub-folders which can be stored where ever you want. If you want to change the default 3ds Max project, you only have to create a new folder with your Windows file explorer in the location where you want to store your 3ds Max project. In many occasions the name of this particular project folder is the name of the customer or project number. After creating the folder with the Windows file explorer you set it up as a 3ds Max project via the 3ds Max **File menu** followed by **Project** and **Create Default**.



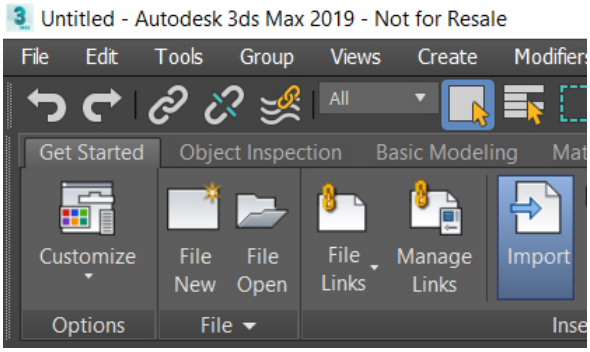
After pointing to the earlier created folder, 3ds Max will take care of all the belonging sub-folders for your 3ds Max files, your renders, your backup's and so on. *With the 3ds Max 2019.2 update installed you get a very handy toolbar for your project management which will be showed by default after installing the .2 update.*

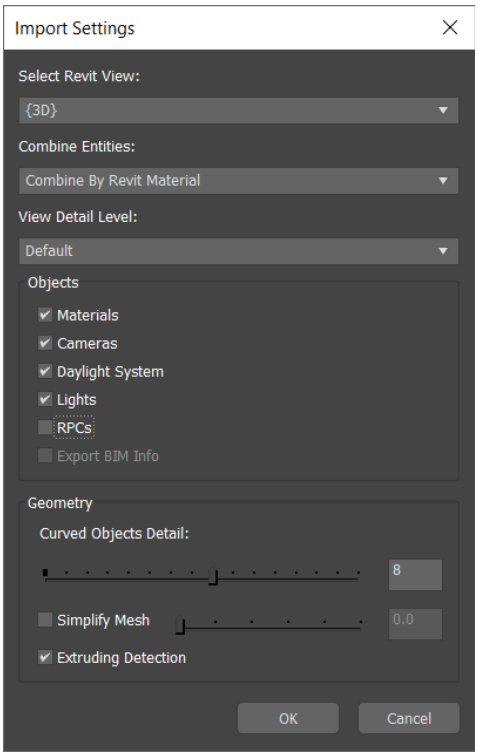
Sending your Revit design into 3ds Max

It's quite obvious if you import your Revit file into 3ds Max you can't send over a design change from Revit to 3ds Max. So really think about it. If you're not sure if there will be any design change you always should link the Revit file into 3ds Max. If your 100 percent sure that it's a final design you could use the import option. Both options do share a lot of the same parameters.

Importing your Revit design in 3ds Max

The Import Revit file option will show all the belonging parameters where the Link Revit file option will trust on available presets. Also keep in mind that in the world of visualization you only pay attention to the parts which will be visible. So if you have a very detailed Revit file and you never ever are going to see the details switch them off in Revit. Based on a Revit View Template you can easily set your visibility graphics and if you want set a section box. 3ds Max will respect the incoming View Template based on the settings you made in Revit. With other words you can have a default 3ds Max view template in Revit which makes a lot of sense for sending your Revit files into 3ds Max. 3ds Max is capable of importing lots of different file types. Besides native Revit files you can import Sketch Up files, AutoCAD DWG files and many mechanical based CAD file formats. When you choose the native Revit file in the import dialog box 3ds Max will show you some very important settings.





Select Revit View:

In the Select Revit View dropdown menu, you can select your Revit view which has all the belonging visibility graphics and or a section box. Based on the view template your Revit objects will or will not be imported in 3ds Max.

Combine Entities:

Based on what you want to approach you have to combine your Revit entities. For many visualization scenarios, including VR **Combine By Revit Material** is a best practice. Based on your Revit materials your objects will be automatically attached together so that you do get a better performance. If you want to create an animation though I would prefer to use the Combine by Revit Family type.

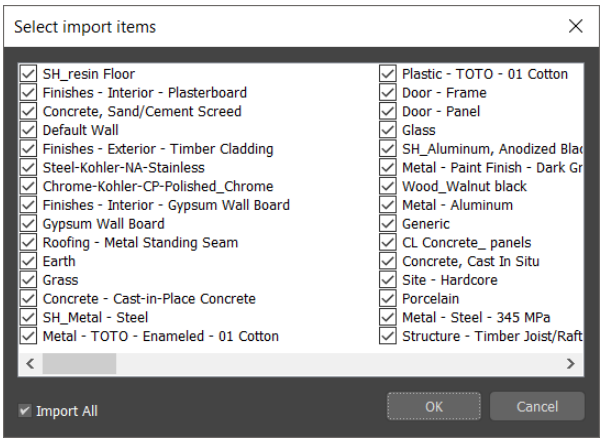
Objects

The default settings in the Object part of the dialog box are importing your Revit materials which is important. Cameras will import all your Revit views as 3ds Max Cameras. The Daylight System will be imported based on geotagged information in your Revit File and Lights will import your Revit Lights. But keep in mind though that only photometric light types (.IES) are imported in 3ds Max. It doesn't make any sense to import the RPCs since 3ds Max doesn't support this natively.

Geometry

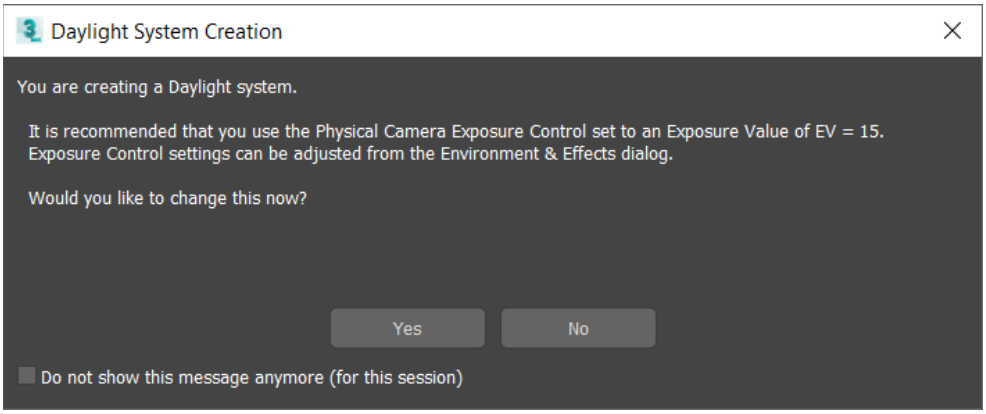
If you have a lot of cylindrical based shapes in your Revit file you could change the tessellation by changing the slider more to the right. In many occasions the default value is perfect.

When you hit the OK button in the Import Settings dialog box the Revit Server will start running in the background and you get an overview of all the materials (object) will be imported in the 3ds Max scene.



In this particular dialog box you still can decide to no import specific Revit objects in your 3ds Max scene.

When you choose to import the Revit Daylight System you automatically do get a warning that your Exposure control needs to be set into Physical Camera Exposure Control with a preset value of 15.

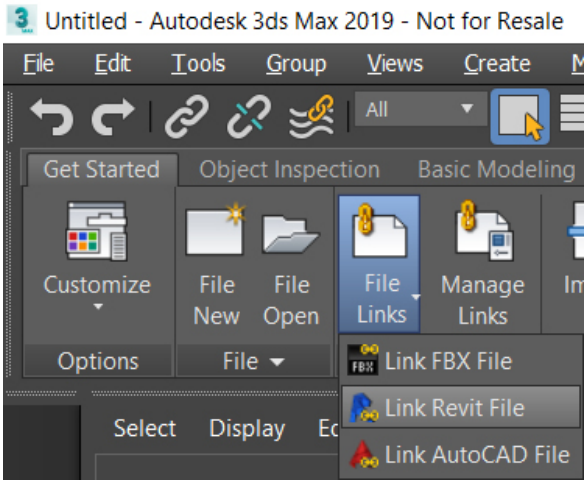


The suggested Exposure Value of 15 is used when your outside at one o'clock in the afternoon. You can always change the amount of Exposure value later on in your 3ds Max session.

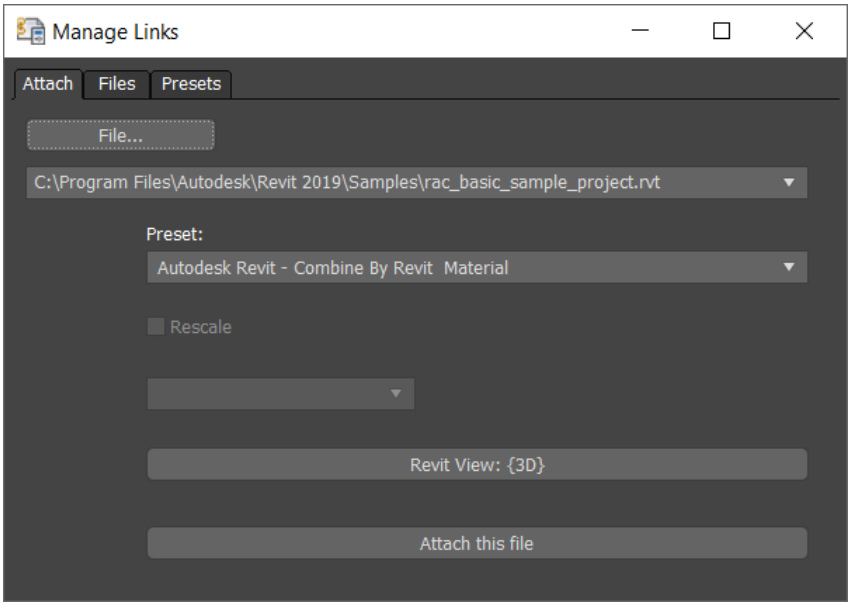
When your Revit file is imported into 3ds Max your Revit design will be showed in the 3ds Max viewport and on the left side of the 3ds Max User Interface you do get a list with all your imported objects based on material. The UI part on the left side is called the Scene Explorer. When the Scene Explorer is not visible you can always open it up in the **Tools menu**.

Linking your Revit design in 3ds Max

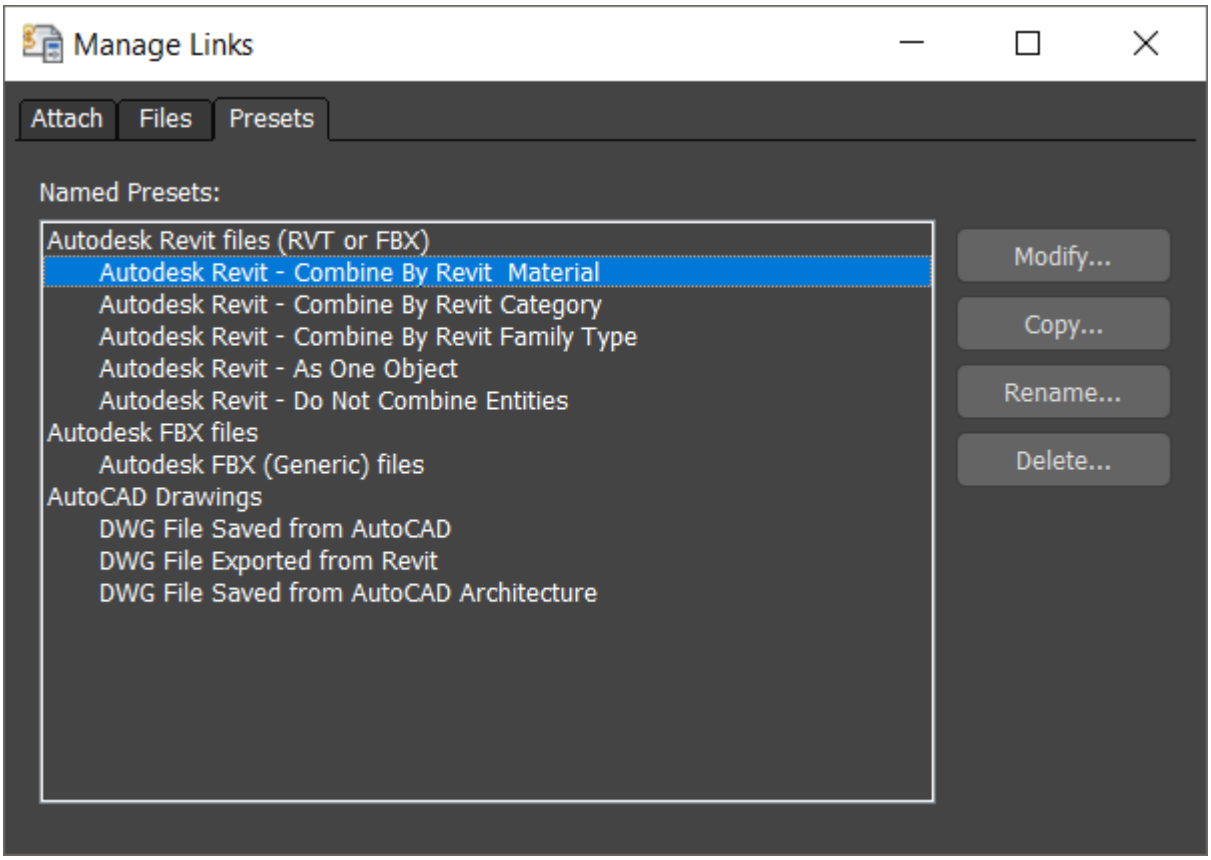
When you do realize that your Revit design is not in a final stage it should be wise decision to link the Revit file to 3ds Max. The File Link option can be found in the Get Started tab in the Design Standard workspace. Native .RVT files, .DWG files and .FBX files can be linked to 3ds Max.



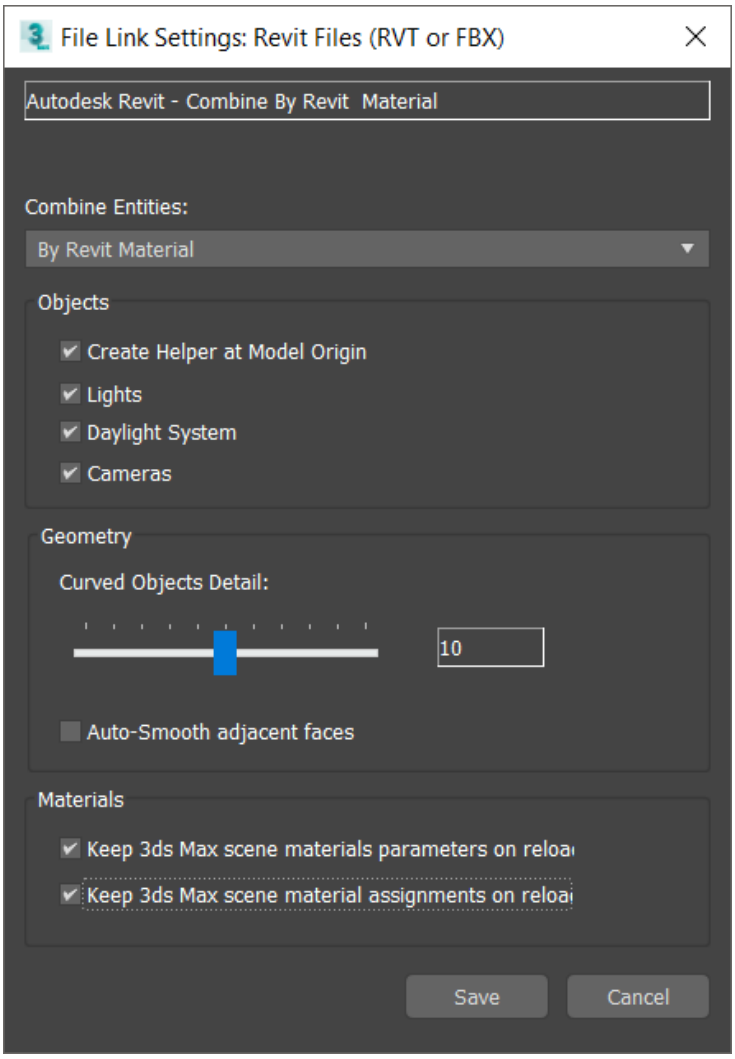
When making a Revit File Link you basically get the same available options while importing your Revit file. Most of the settings though are available in different presets.



In the Presets tab you do get an overview of all the available presets and you are able to customize this on your own preferred preference.

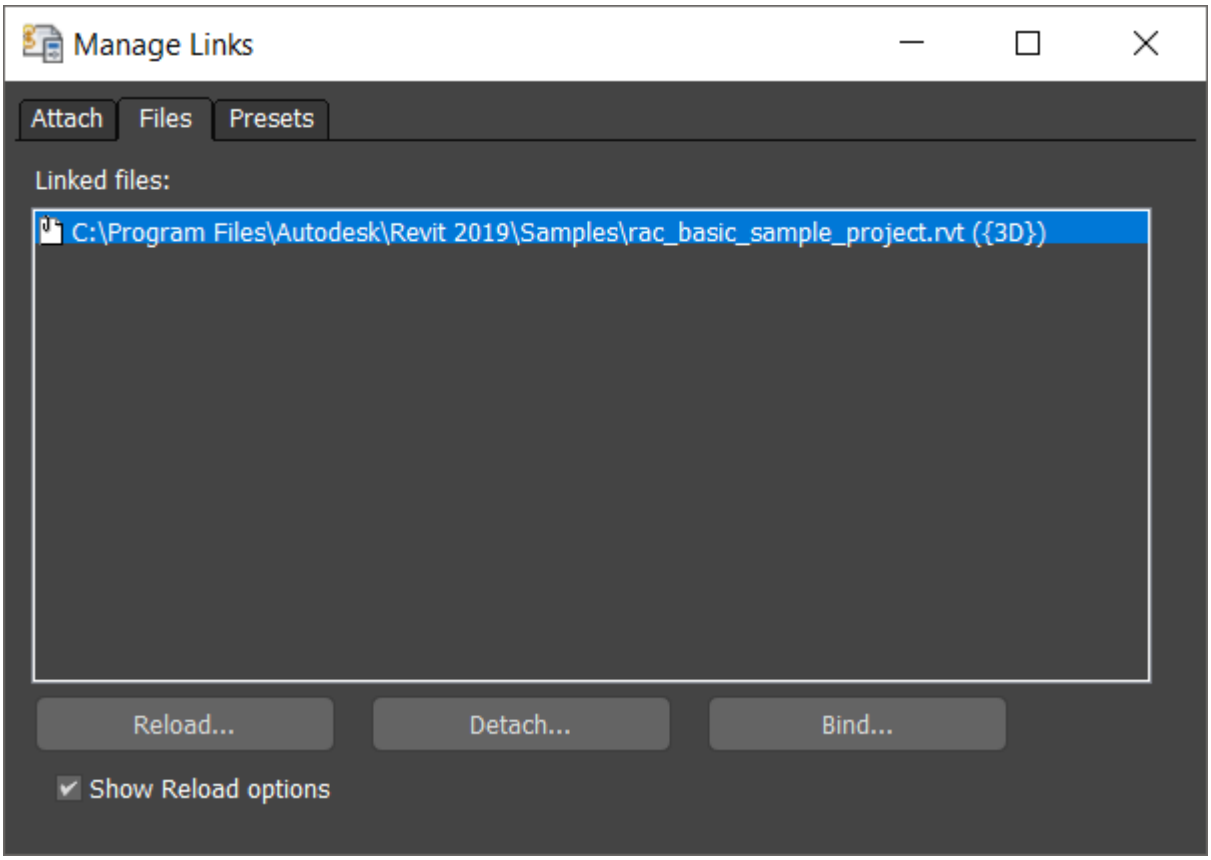


A best practice would be to modify the Autodesk Revit – Combine by Revit Material preset.



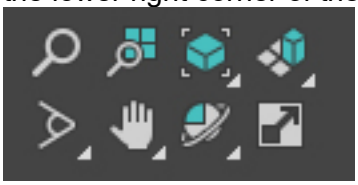
Both materials options should be checked if you opt for much better materials in 3ds Max and to be sure that you do reload your Revit file that you lose all your assigned 3ds Max materials.

After attaching the Revit file, the Revit design is showed in the 3ds Max viewport. If you go back to Revit and change anything in the Revit file you can reload the Revit file in 3ds Max. This is not happening automatically though. You have to manually open up the File Links dialog box where you have to reload the Revit file into 3ds Max. If you want to get rid of the Revit file you can easily detach it or break the link by using the bind option in the dialog box.

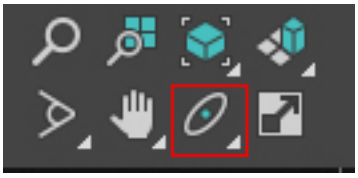


Navigation in the 3ds Max viewport

The navigation in the 3ds Max viewport can be done by using the viewport navigation tools in the lower right corner of the 3ds Max User Interface.



Besides the official 3ds Max navigation commands you can also use your three button mouse for zooming, panning and orbiting. Keep in my though that the ALT key is the shortcut key in combination with the middle mouse button for orbiting in 3ds Max. It's also a best practice to set the default orbit to Orbit Point of Interest.



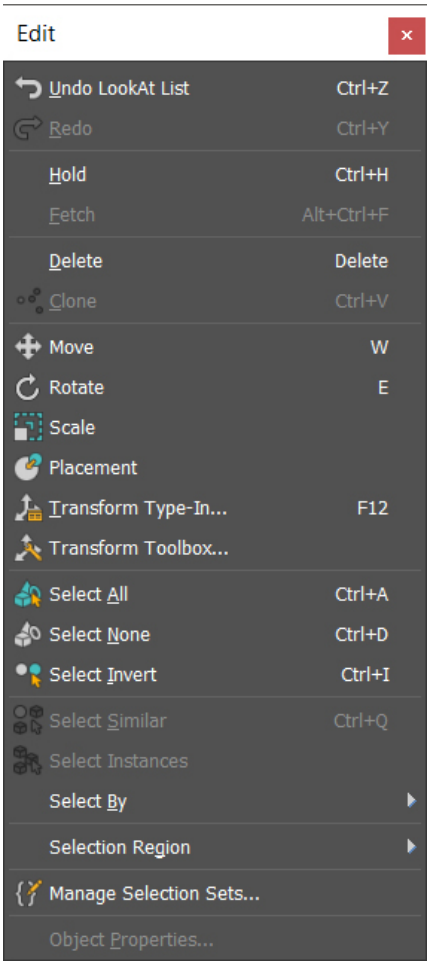
3ds Max also has some very handy shortcuts for navigating in the 3ds Max viewport

3ds Max shortcut keys for Navigating in the 3ds Max viewport

Z = Zoom Extents Selected
Control + ALT + MMB (Middle Mouse Button) = 3ds Max Zoom
ALT + MMB (Middle Mouse Button) = 3ds Max Orbit

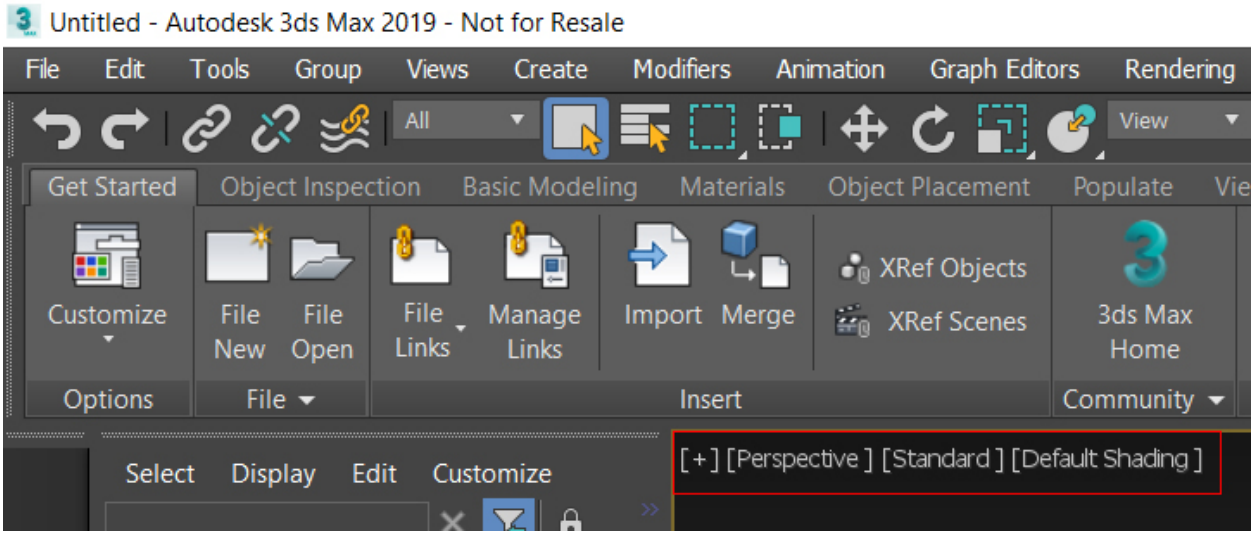
Selecting objects in 3ds Max

Selecting an object in the 3ds Max viewport can be done by using the Select object tool or you can select any object in the Scene Explorer at the left side of the 3ds Max User Interface. By using the Ctrl and Shift keyboard key you can make any kind of selection as you are probably used to do. In the 3ds Max **Edit menu** you will find many different options for selection your objects in the 3ds Max viewport.



3ds Max Viewport Labels

3ds Max is using similar viewport labels as AutoCAD. In the upper left corner of the 3ds Max viewport you do have four different menus available.

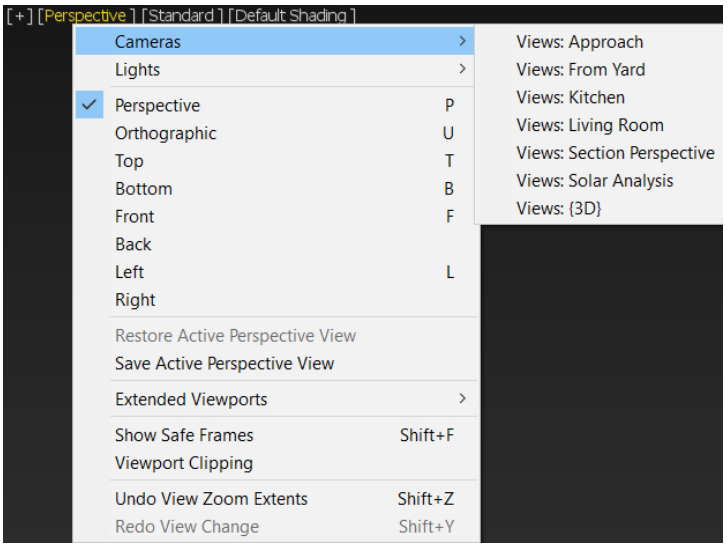


+ Viewport label

De + Viewport label holds a couple of interesting tools like switching the Grid On or Off. It also provides you access to the ViewCube of 3ds Max. The most important option in this particular menu is the **Maximize Viewport** option (**Alt+W**) if you ever want to switch your current maximized viewport to your current viewport layout.

View Viewport label

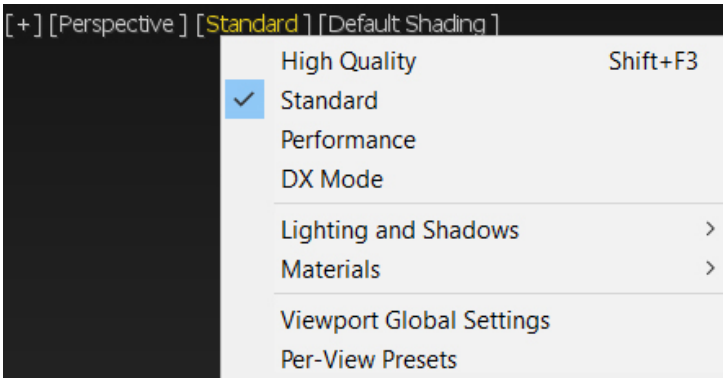
The second Viewport label which mentions Perspective is used to switch the 3ds Max current view. In this Viewport label you're able to switch to an Orthographic viewport or to one of the imported Revit views found in the Cameras sub-menu.



In this Viewport label you will also find the **Show Safe Frames (Shift+F)** option which is a very important option when rendering your final frame. The Show Safe Frames option is actually showing a yellow border in your viewport based on the current render resolution. The View Viewport label is also showing the latest navigation steps and can be undone from this menu or just by using the **Shift+Z** and **Shift+Y** shortcut keys.

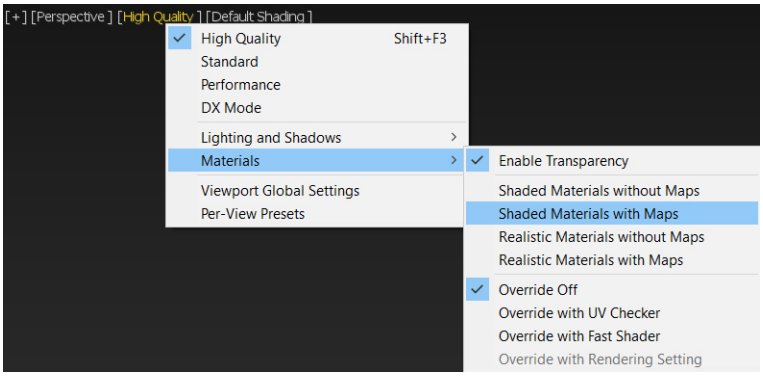
Shading Viewport label

The Shading Viewport label is by default set to Standard shading. Standard shading is not going to provide any kind of shadows in the 3ds Max viewport.



When you change to a **High Quality** shading you automatically get shadows and ambient occlusion in the 3ds Max viewport based on the current lights available in the 3ds Max viewport. Switching to High Quality mode might take some time based on your graphics card capabilities. All the belonging shaders are automatically compiled and stored in a cache file on the local hard drive. Next time when switching to High Quality mode will be much faster. By default, the textures used in the Revit materials are not showed in the 3ds Max viewport. By activating the

Shaded Materials with Maps option in the Materials section of the Shading viewport label the used Revit textures will be visible in the 3ds Max viewport.

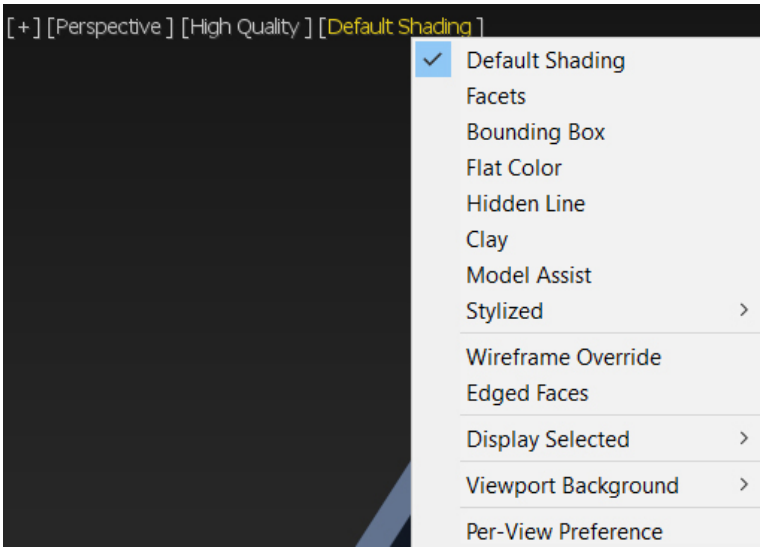


When activating both High Quality and **Shaded Materials with Maps** you do get a much more interesting 3ds Max viewport. Keep in mind thought that the 3ds Max viewport will only show direct light and that the indirect light needs to be calculated in the rendering.

If you are working with very large scenes and your graphics card is not the best you might use the **Performance** mode which is also part of the Shading Viewport label. When activating the Performance mode your complete model will be showed in a basic grey color and all the lights will be simplified. Keep in mind this is only happening in the 3ds Max viewport and not in the render.

Default Shading Viewport label

In the fourth and last Viewport label called Default shading you will find all the different shading levels your design can be showed in the 3ds Max viewport.



Many shading style are self-explanatory but keep in mind that these are just display settings for the 3ds Max viewport and not for the render. The **Stylized** shading styles are quite nice in 3ds Max if you ever wanted to have that non photorealistic render effect.

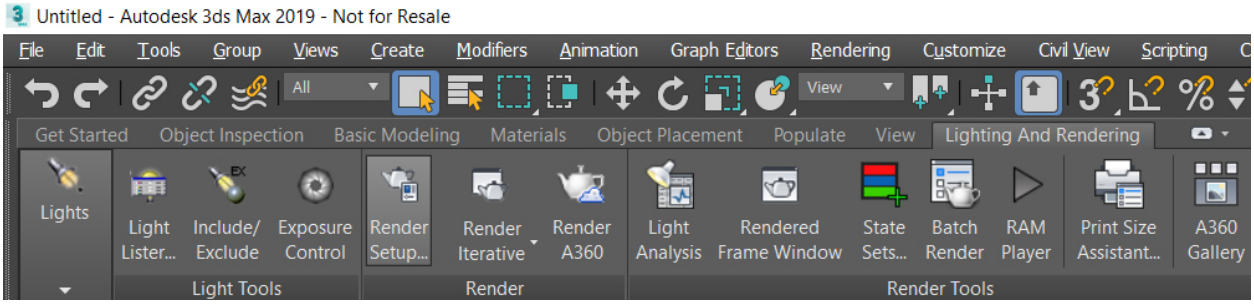
Another interesting and important option in the Shading Viewport label is the **Viewport Background**. In the Viewport Background options, you can set the 3ds Max viewport background display. Gradient color is the default value but if you have an Environment, which comes automatically with your Revit file you might want to change it to **Environment Background**.

Learn how to use the best render engine for photorealistic and non-photorealistic rendering

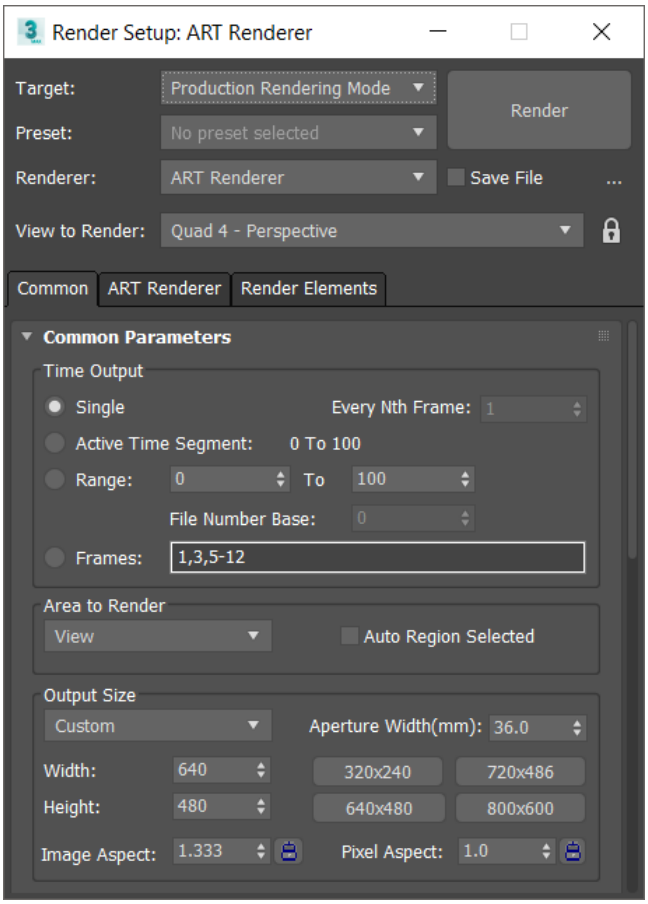
The default render engine in 3ds Max is the ART render engine. ART or the Autodesk Ray Tracer is besides 3ds Max the standard render engine in AutoCAD, Revit, Inventor and Fusion 360. Although it's the same renderer 3ds Max renders a CAD file much faster and in much better quality by default. ART is trusting on all your CPU cores so the GPU is not used during the rendering process.

Render Setup

In the **Lighting And Rendering** tab of the Design standard workspace you will find most of the render options. The most important one is the **Render Setup**.

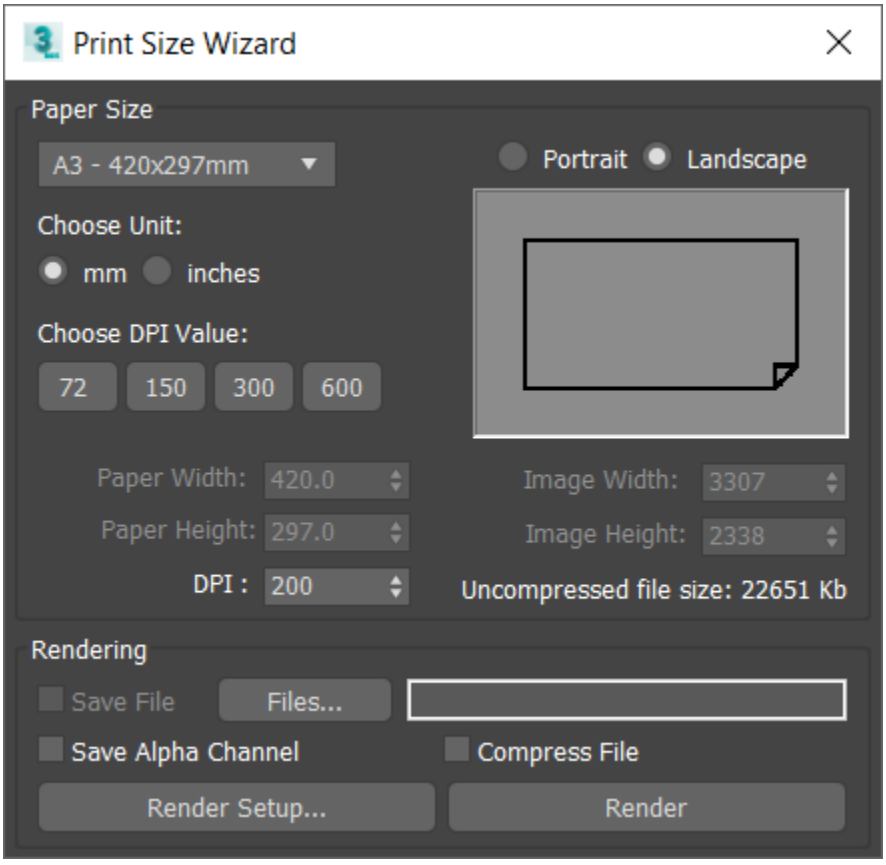


The Render Setup can also open by using the **F10** shortcut key on the keyboard.
There are a lot of legacy options in the Render Setup dialog box. The most important settings are the current Renderer, by default set to the ART Renderer and the **Time Output**. Single for a still frame and Active Time Segment for animation. The Area to Render is set to **View** by default and the last most important thing is the **Output Size** which is set by 640 pixels by 480 pixels by default. Since the Output Size is set to Custom you can type in exactly how many pixels you want to render for Width and Height. 1280 pixels by 720 pixels is a good starting point for a render which is going to send by e-mail are showed on a standard display. But keep in mind though if you want to have a larger image you need to render more pixels = more time to render.



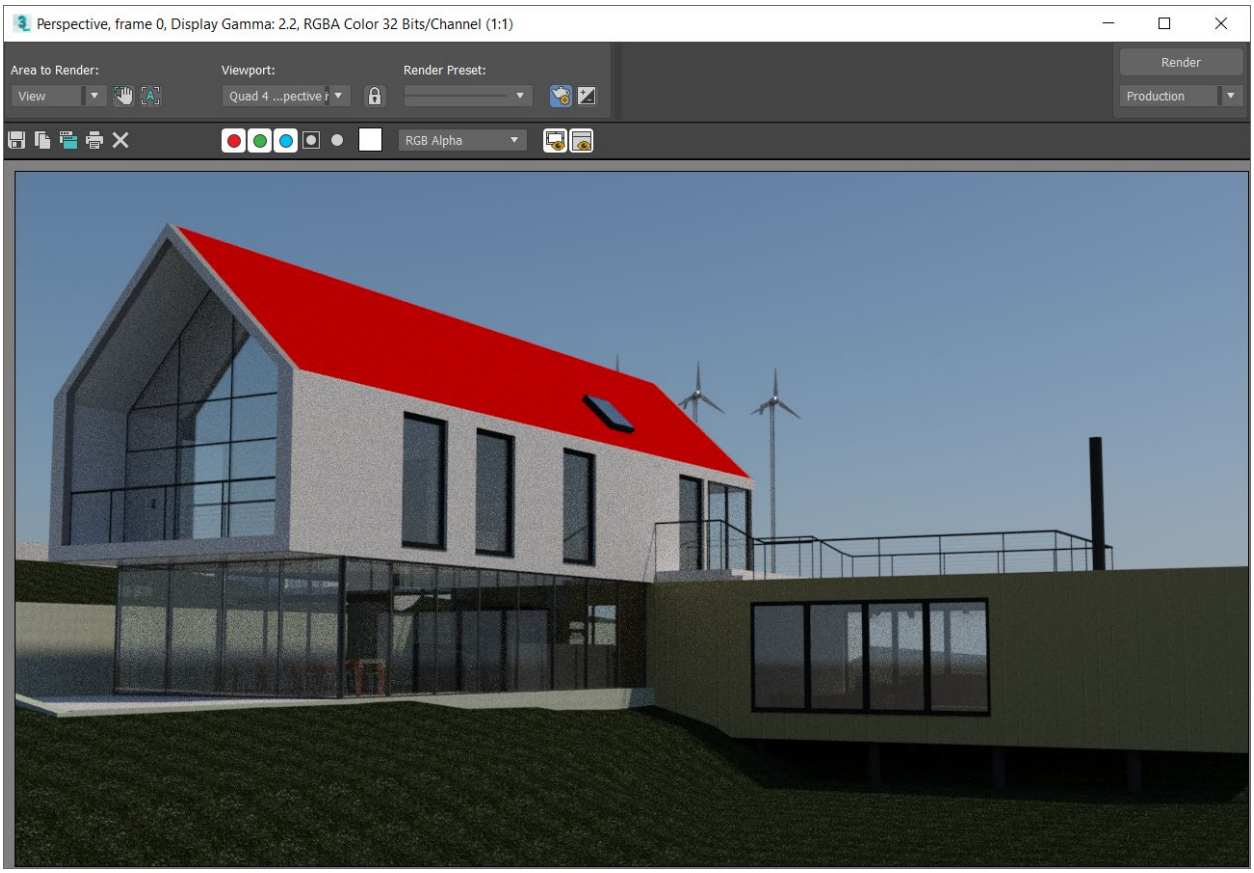
Print Size Assistant

If you want to render for print you might want to use the **Print Size Assistant** which also can be found in the Lighting And Rendering tab of the Design standard workspace. The Print Size Assistant is self-explanatory.

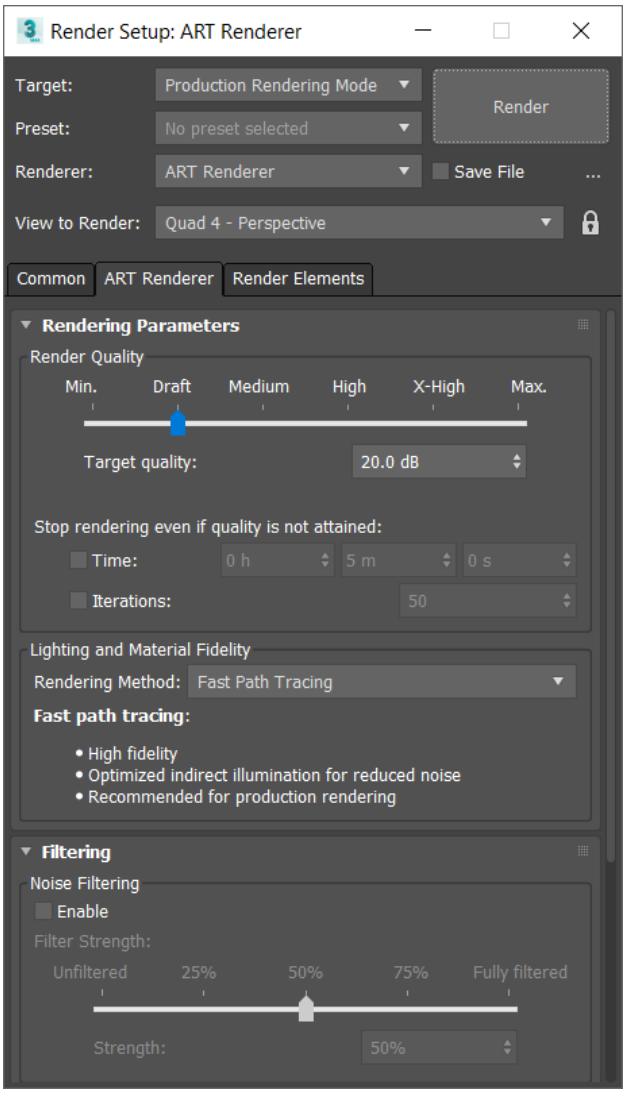


Render Frame Window

When you start your first render the ART renderer start to initialize all your objects. When this is done the **Render Frame Window** will be showed and the render will be showed in a couple of seconds.



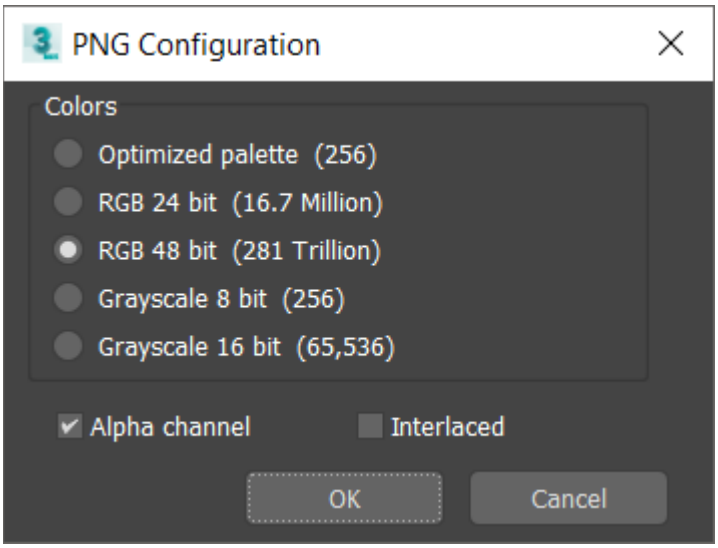
On a dual Xeon workstation, the default render takes no more than 30 seconds but still looks a bit noisy. The ART render engine needs to render longer to get rid of all the noise. This can be all set in the ART renderer tab of the Render Setup dialog box.



The **Render Quality** slider never ever should be set to the Maximum. For an exterior render, depending on render resolution, between Medium and High should me more than enough. The **Target quality** is expressed in decibel since we are de-noising. If you're not sure how long the render is going to take or you are facing a tight dead-line you can also set the Time value by activing the Time checkbox. Besides that, when 3ds Max is rendering you can save the rendered image whenever you want from the Render Frame Window and 3ds Max will keep rendering when it was not finished yet.

The Render Frame Window itself is showing an uncompressed image in 32 Bits color per channel. When you save your render from the Render Frame Window you have to decide how many compression you want or how much quality you want to lose. If you just want to have the maximum file compression you should save to a **.JPG file format**. For production you always should save your image from the Render Frame Window at least to a **.PNG file format**. By using the Render Frame Window option in the Lighting and Rendering tab of the Design

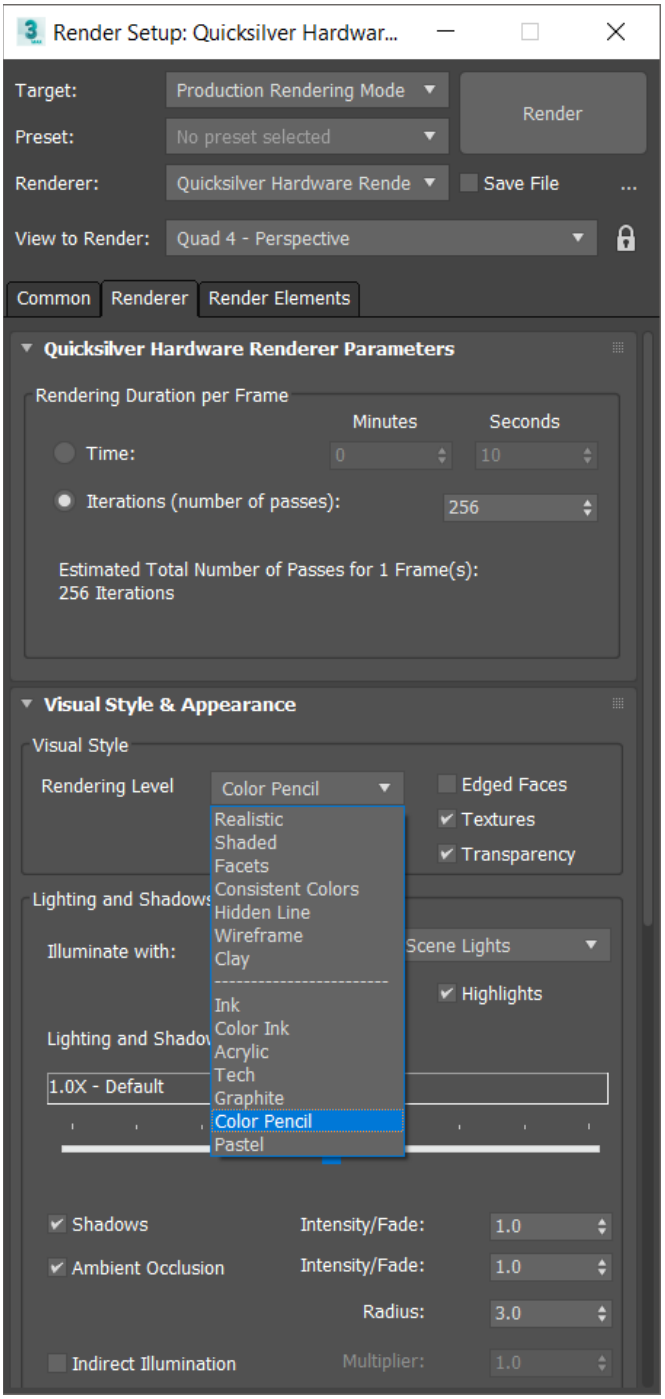
standard workspace you can always open up your latest rendering and save your rendered image if you forgot to do so. In the upper left corner of the Render Frame Window you find the Save Image option. In the Save as type part of the Save Image dialog box you should set the file extension to .PNG and give the file a name.



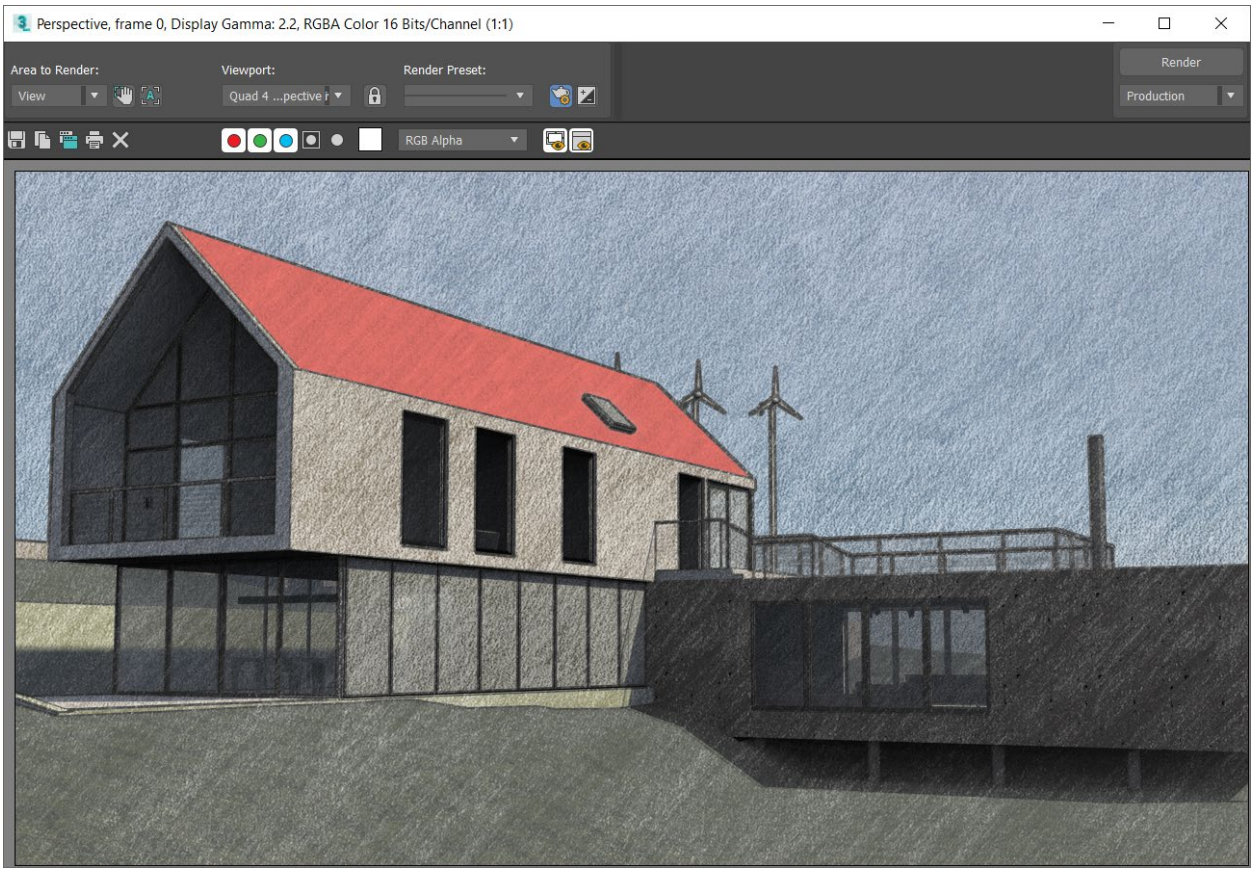
A .PNG file format does provide you 16 Bit color per channel including an Alpha channel for transparency. So it's super easy to change the background in Adobe Photoshop for instance.

Quicksilver Hardware Renderer

When you don't want a realistic but a non-photorealistic render you should change the render engine to the Quicksilver Hardware Renderer. The Common tab of the Render Setup stays exactly the same as with the ART renderer when you do so.



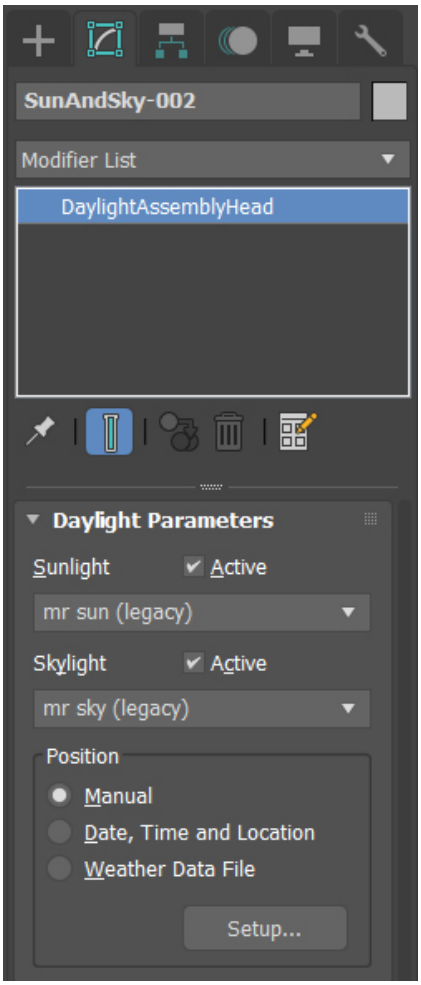
The Renderer tab of the Render Setup dialog box will show the specific Quicksilver Hardware Renderer settings. The most important one is the Rendering Level. In the Rendering Level you will find all the different non-photorealistic rendering styles. To have the effect of Ambient Occlusion you have to check this option in the Lighting and Shadows rollout.



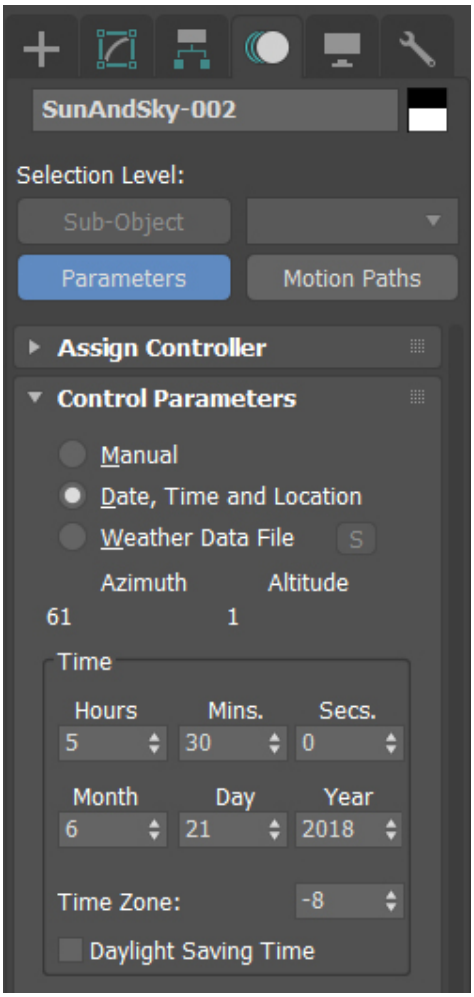
By combining those kind of images in Adobe Photoshop you can achieve come very nice results in a couple of minutes.

Understand the different and best lighting techniques

The current daylight system in the 3ds Max viewport is based on Revit geo-tagged information. When you want to achieve a much better or interesting look of your render it might be a good start to change the most important parameters of the **Daylight System**. First you have to select the daylight system in the 3ds Max viewport or in the Scene Explorer at the left side of 3ds Max. When you expand the Compass001 object in the list you have the option to select the SunAndSky-002 object in the list. By going to the 3ds Max M**odify panel** at the right side of the 3ds Max User Interface you have access to all the belonging parameters. Keep in mind though that 3ds Max is already pointing out to you that the default daylight system brought over from Revit is a **legacy system**. The Sun Positioner is the newer daylight system in 3ds Max and by using the **scene converter** you can automatically convert your legacy daylight system into a Sun Positioner.



By default, the Position of the daylight system is set to Manual. By changing the Date, Time and Location by selecting that option followed by Setup you can get a much nicer environment.



Try to think like a photographer and set the time of the day to the golden hour (one hour after sunrise and one hour before sunset) to get that much more interesting looking sky.

https://www.digitaltrends.com/photography/when-is-golden-hour-and-what-is-it/

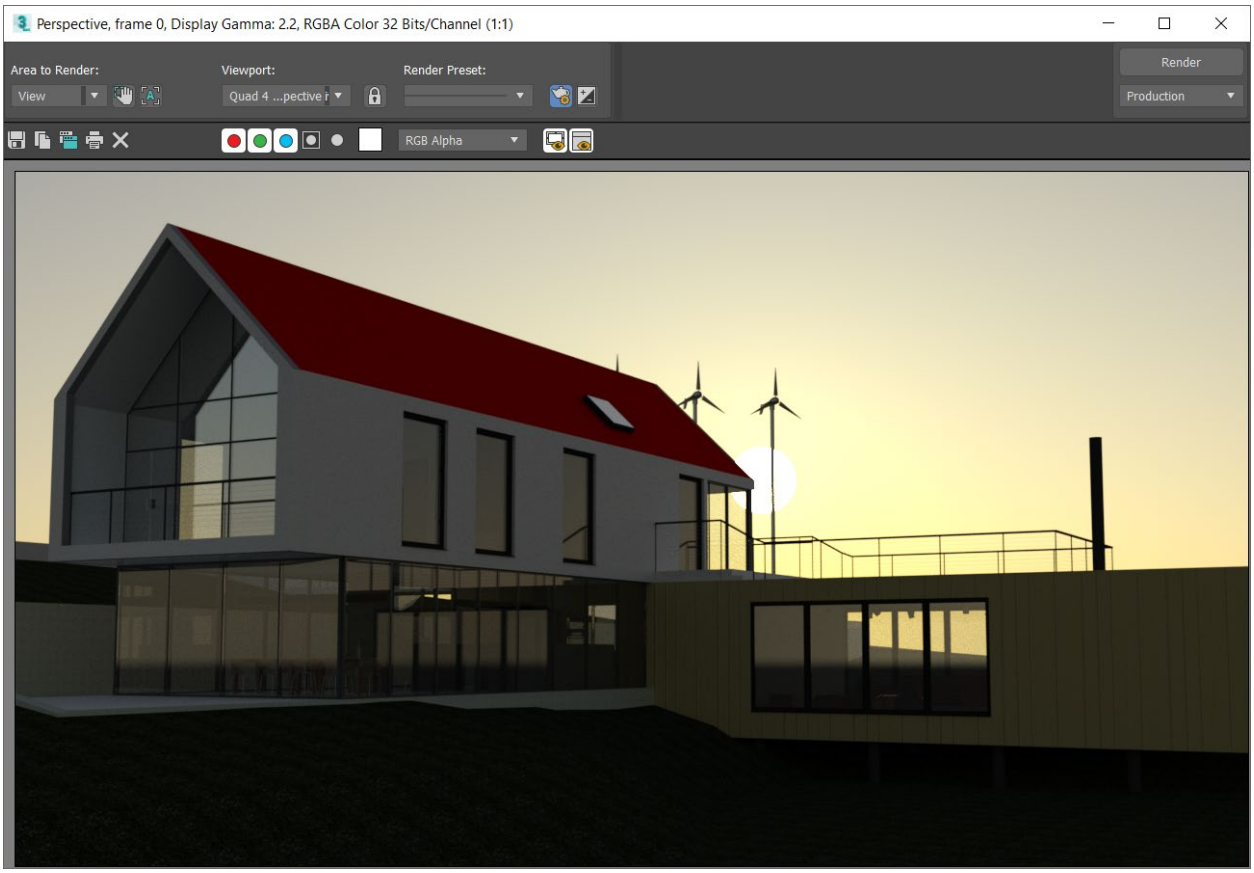
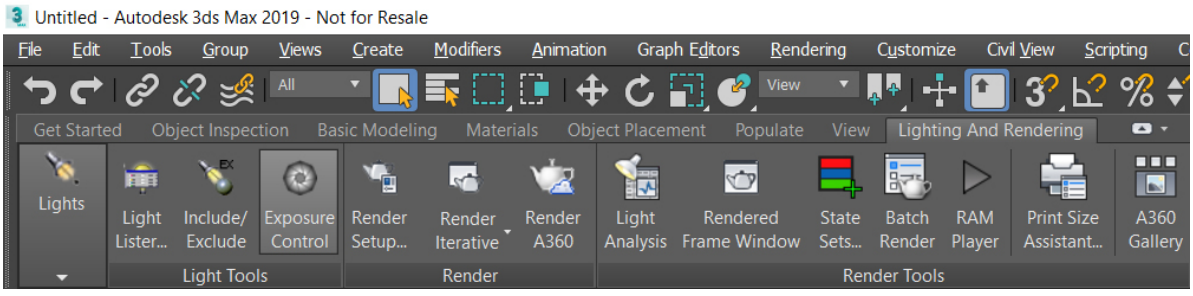
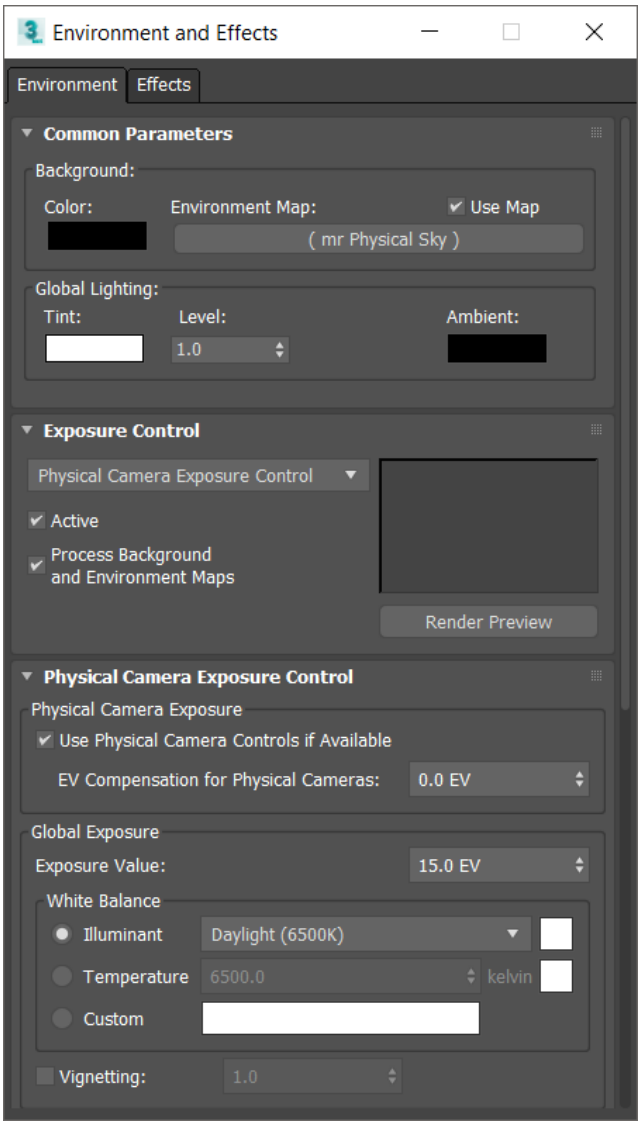


Image Based Lighting

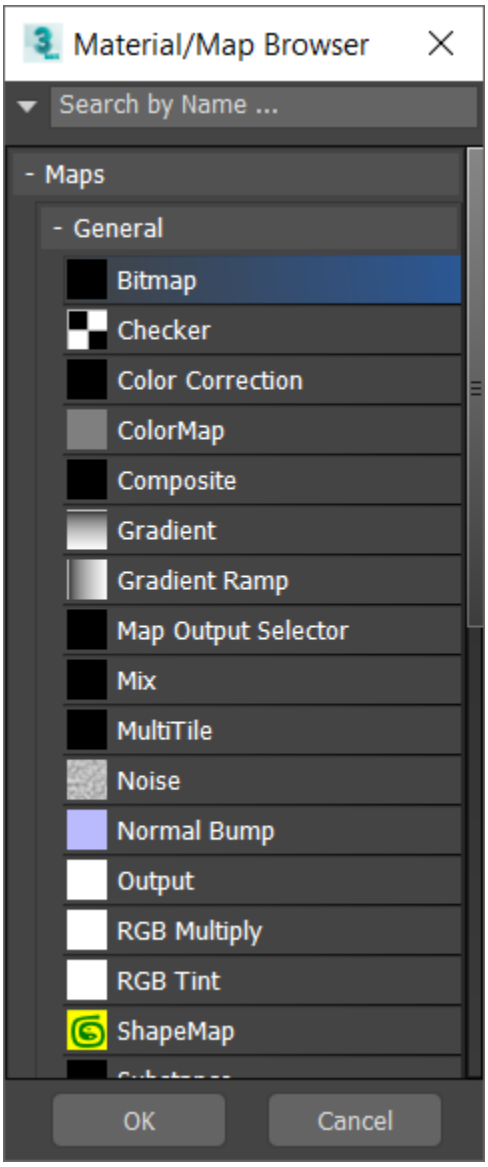
Another very interesting technique to lit your 3ds Max scene is a technique called Image Based Lighting. Actual light data can be captured in an image if the image is in the High Dynamic Range format (.HDR). The ART render engine is capable of lighting your 3ds Max scene based on the captured light data in an .HDR image. There are many free of charge HDR images available on the internet (www.hdrihaven.com) . Keep in my mind though that the contrast, lights and colors of the HDR image are responsible for the initial render.

An HDR file is placed in the **Environment Map** which can be found via the **Exposure Control** option in the **Lighting And Rendering** tab of the Design Standard workspace.

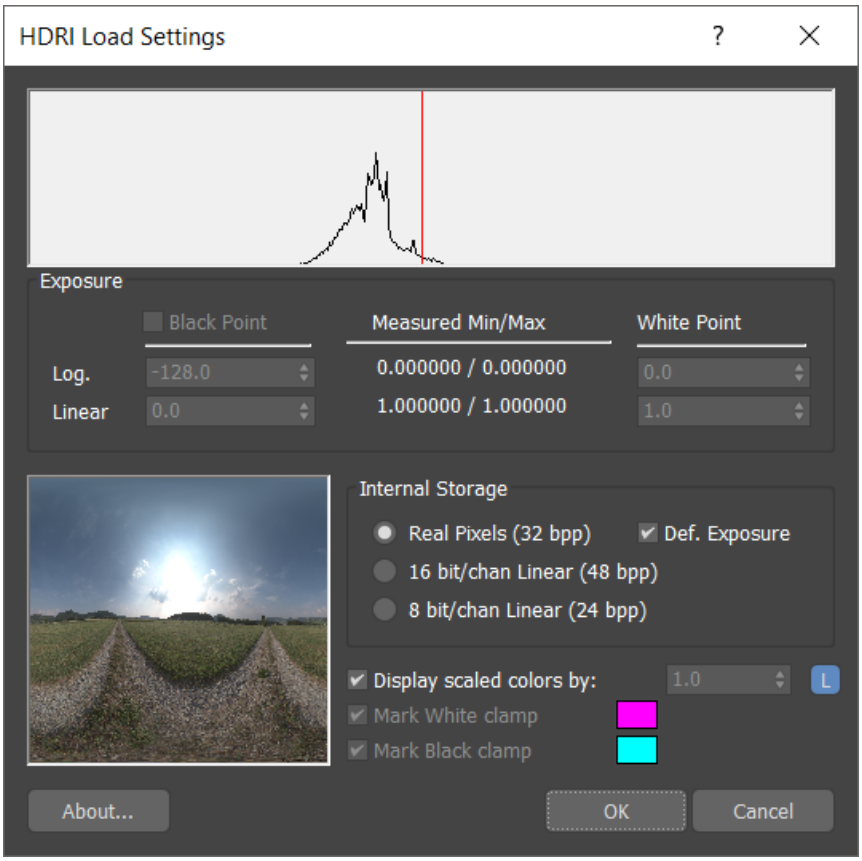




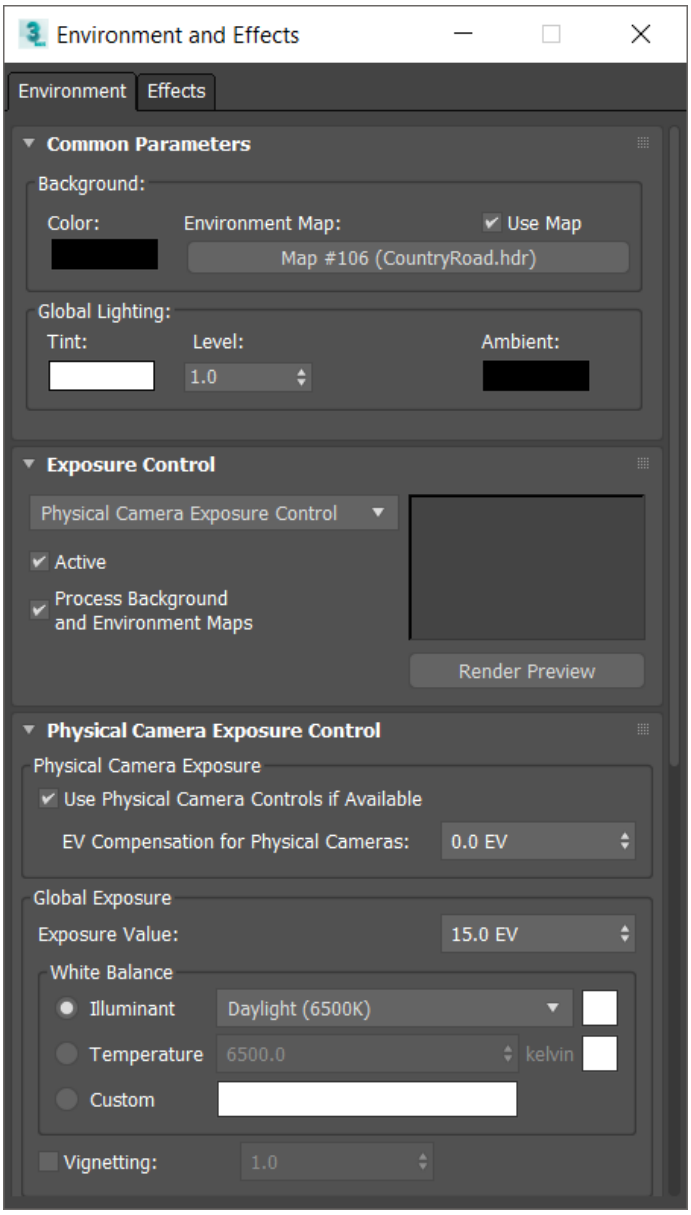
In the upper part of the Environment and Effects dialog box you are able to setup an **Environment Map**. In a complete empty 3ds Max scene the wide button is mentioning the word None. If you have imported a daylight system from Revit the legacy Mental Ray (mr) Physical Sky is being used. By clicking on the wide button you're able to load in a different map for the environment by choosing the **Bitmap** type.



After you choose for the Bitmap type you're able to browse to the location of the HDR image file you want to use in the 3ds Max scene. The **HDRI Load Settings** dialog box will be showed but there is no need to change any parameter in this dialog box.



After selecting the **OK** button, the mr Physical Sky map will be replaced with the HDR image file of your choice.

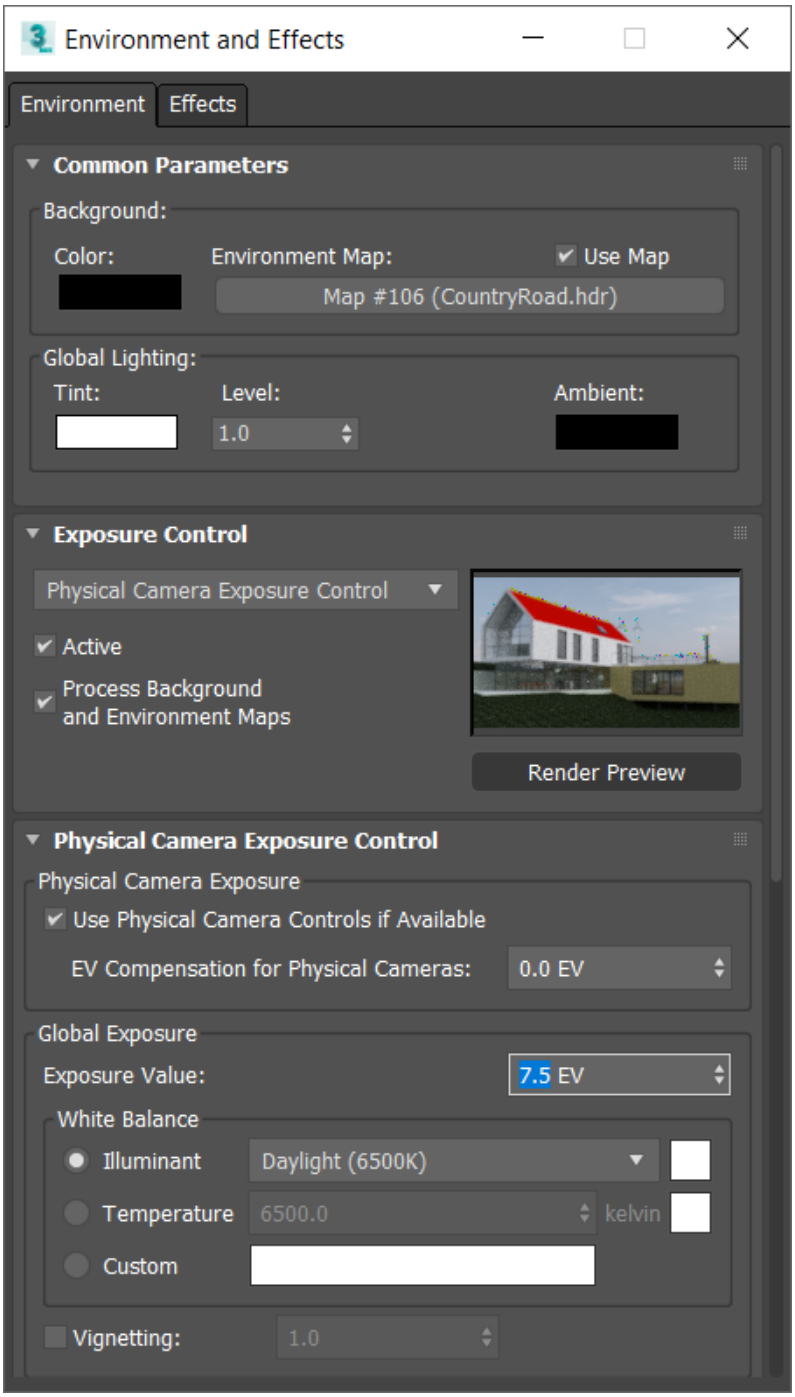


As a result of loading in a different Environment Map your 3ds Max scene and rendering might be showed very dark.

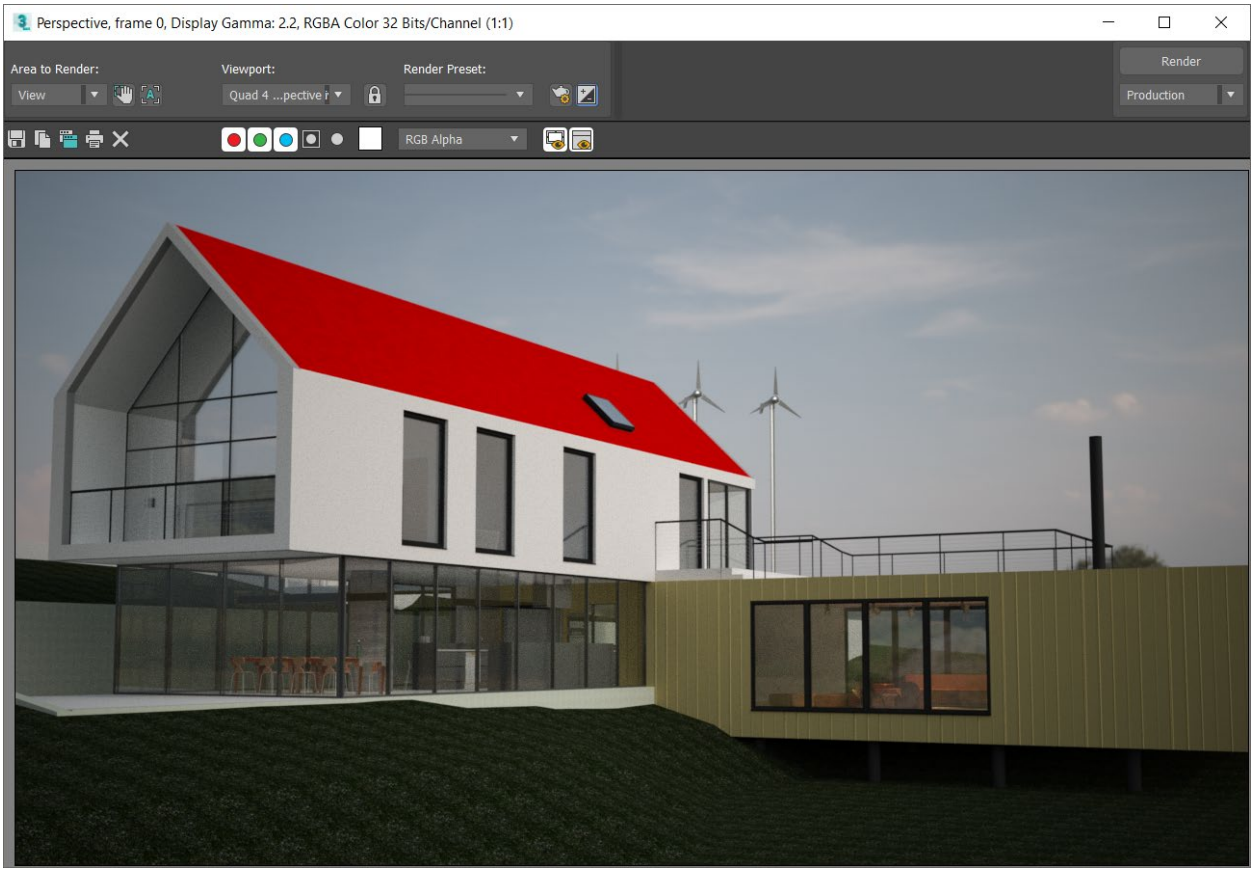
Exposure Control

Based on the HDR image file you're using your rendering might look too dark or too bright. Based on the captured light in the HDR image file you always have to adjust your Exposure Control before you start rendering. 3ds Max is using **Physical Camera Exposure Control** and should always be the preferred Exposure Control type. In the Exposure Control rollout, it's quite easy to identify if the actual Exposure Value is set to a correct value by using the **Render**

Preview. If the Render Preview is too dark you have to lower the **Exposure Value (EV)**. When it's too bright you have to go up with your Exposure Value. When adjusting the Exposure Value, the Render Preview will be adjusted in real-time. Keep in mind though when you're using **Physical cameras** you adjust the Exposure Value in the actual camera itself in the 3ds Max Modify panel.



Together with the Exposure Value you can define the **White Balance**. By default, the Daylight (6500K) is being used. There are many templates available or you can setup your own Temperature value based on kelvin temperature. Higher values yield into much warmer colors (red) and lower values will be the opposite (blue). There's also a **Vignetting** option available. There is no good and wrong with the combination of all these settings. Again try to think as a photographer when playing with all these different controls. When you're ready and happy with the Render Preview you can start the final render which will look much better compared with the previous mr Physical Sky. The compass and Sun and Sky light is still part of your 3ds Max scene but doesn't contribute any light. All the light comes from the HDR image loaded in the Environment Map and the Revit imported Photometric Lights.

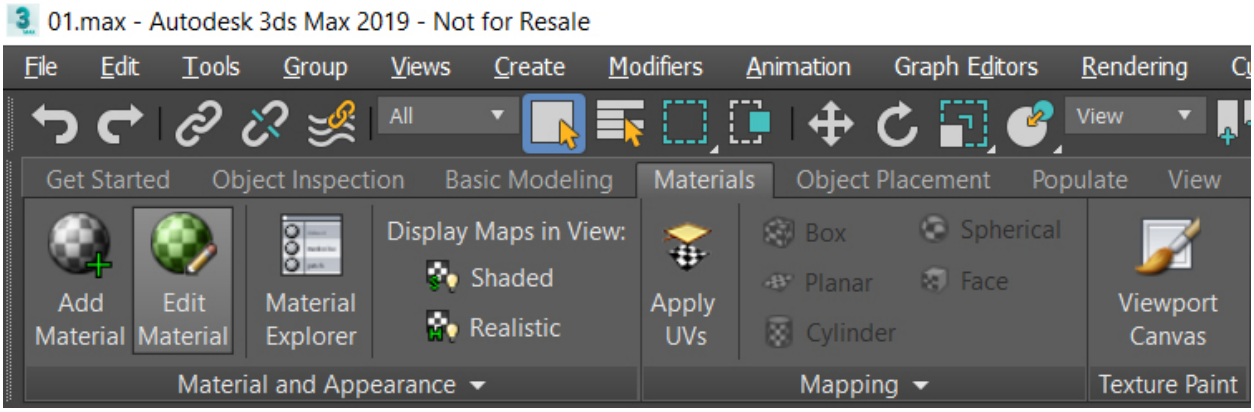


Learn how to create extremely photorealistic materials

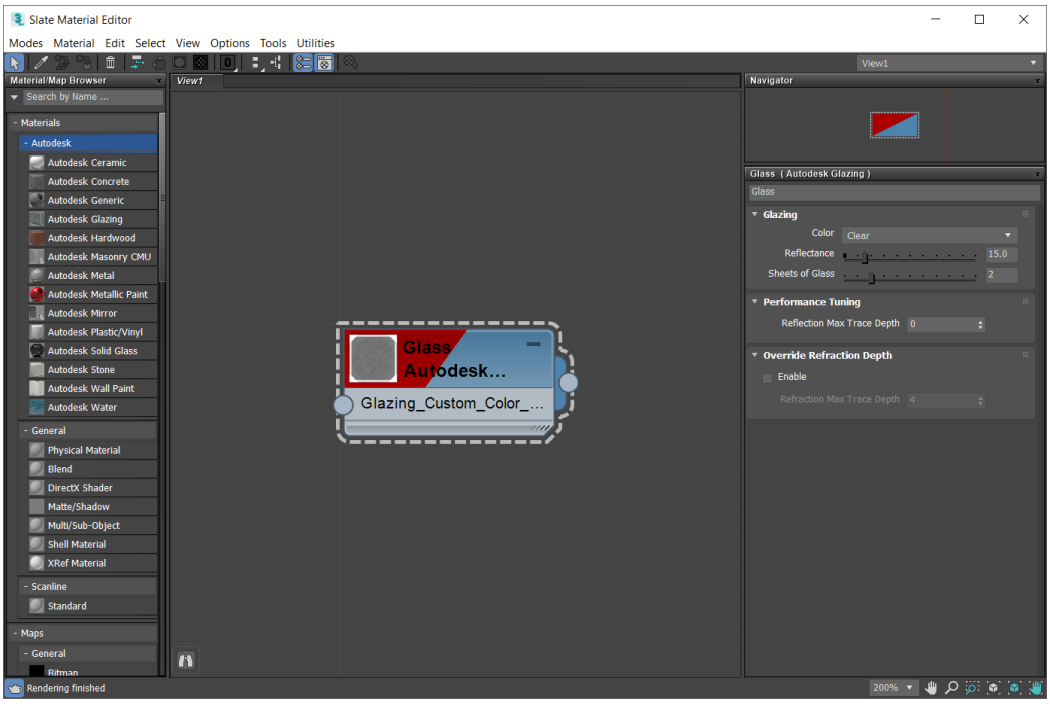
Physical Material

When you import or link a Revit file into 3ds Max your Revit materials are brought over to 3ds Max as **Autodesk materials**. The Autodesk material library is shared between AutoCAD, 3ds Max and Inventor. Although the Autodesk materials are in fact legacy materials (based on Mental Ray) ART is able to render Autodesk materials. The Arnold render engine does not

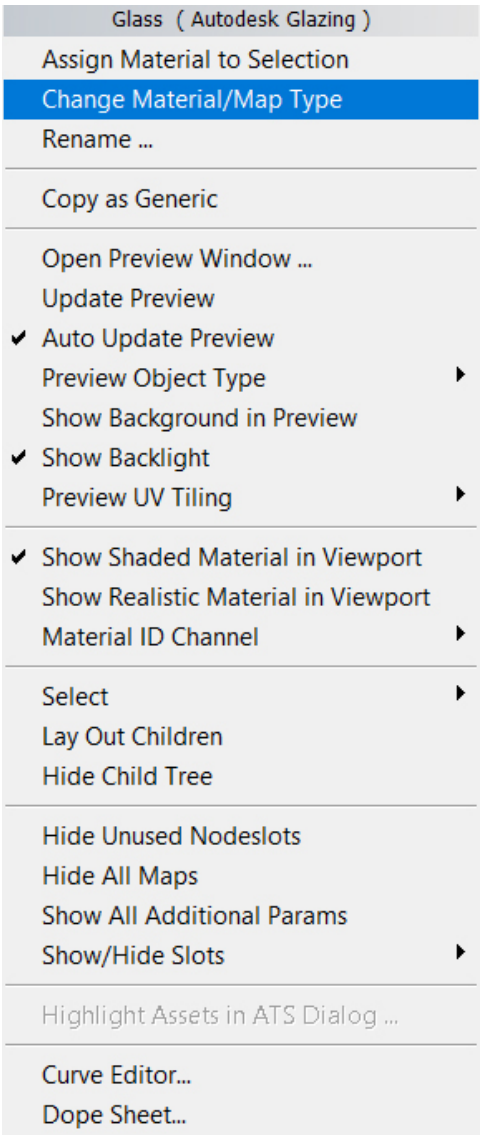
support Autodesk materials so you should always convert your Autodesk materials into Arnold ready materials if you want to render with Arnold. A much better material in 3ds Max for rendering with both ART and Arnold is the **Physical Material**. It's not only faster for rendering but it also provides a much better quality. The Physical Material is a user friendly material and acts and does provide you almost all of the physical aspects of a real-world material. Since there are many Autodesk materials already assigned to a Revit design it's quite easy to change an Autodesk material into a Physical Material. Based on a selection in the 3ds Max viewport or in the Scene Explorer you can Edit the assigned material by using the **Edit Material option** in the Materials tab in the ribbon of the Design Standard workspace.



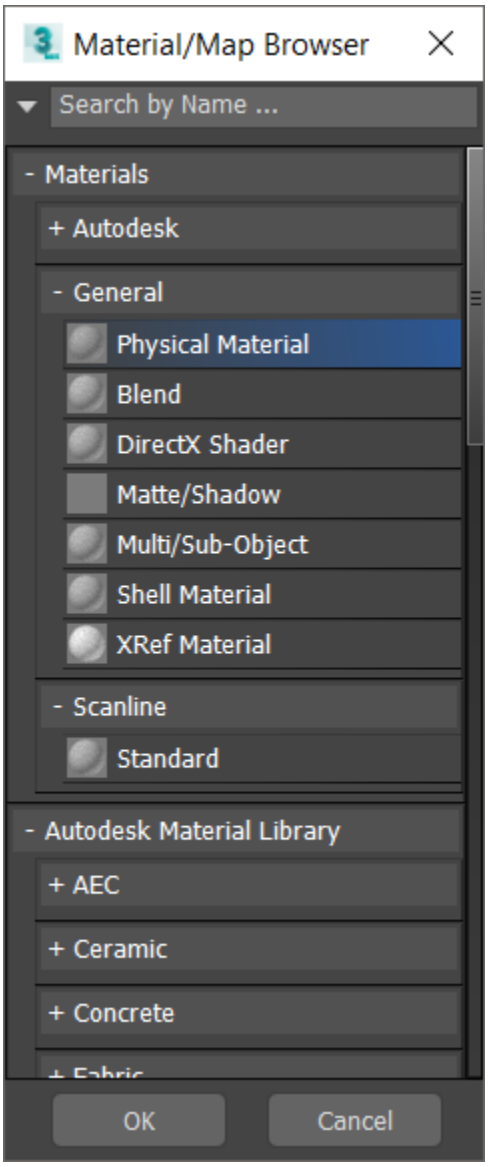
This will open up the **3ds Max Slate Material Editor**. The Slate Material Editor consists of three important parts. At the left side you have an overview of all the available materials and maps based on the current render engine **(Material/Map Browser)**. The **View** (grid) in the middle is your working area where you build your materials. At the right side of the material editor User Interface you will find the **Parameter Editor**. When double clicking on a material the material will be surrounded by a dashed line. The dashed line means that the material is active and the belonging properties are showed in the Parameter Editor Editor on the right side of the Slate Material Editor.



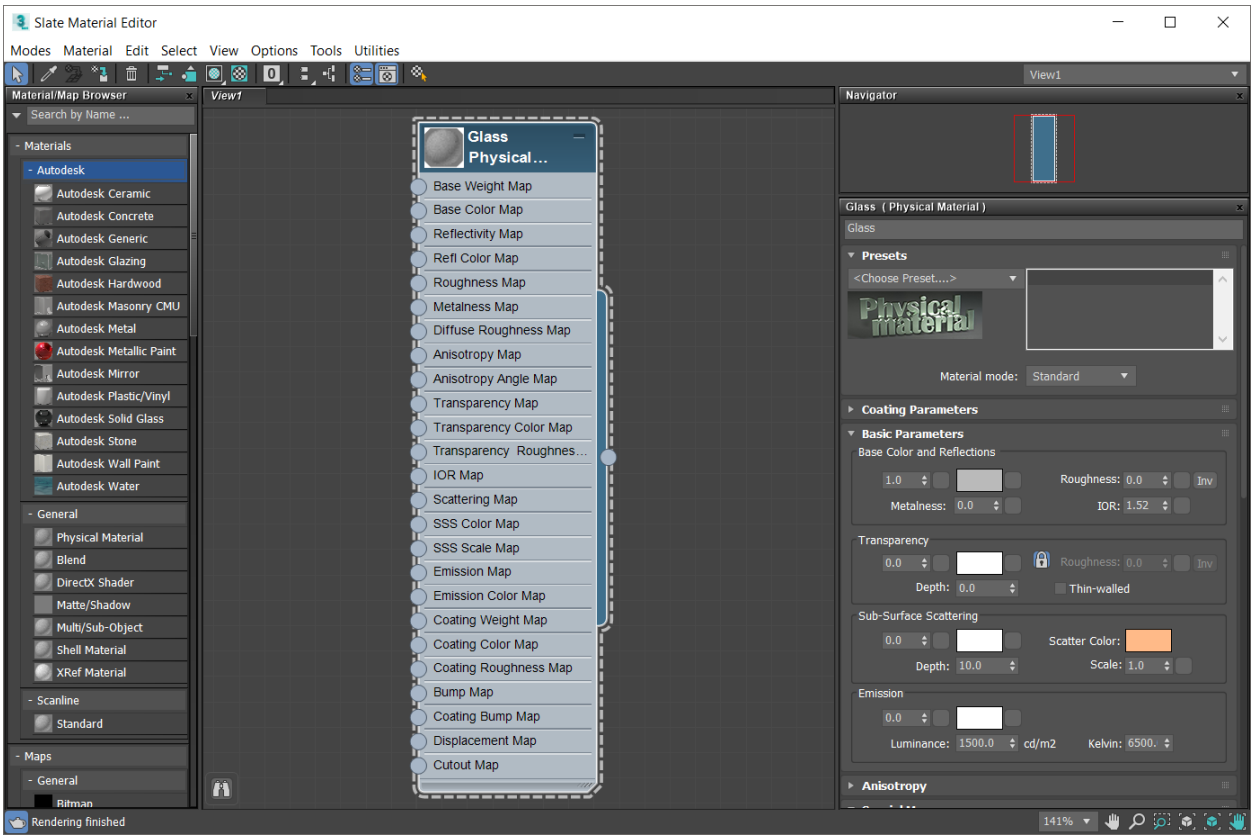
There is no need to change the name of the material since the material name is already defined in Revit. Every material holds a right-click menu where you can **Change the Material/Map type** into another material type.



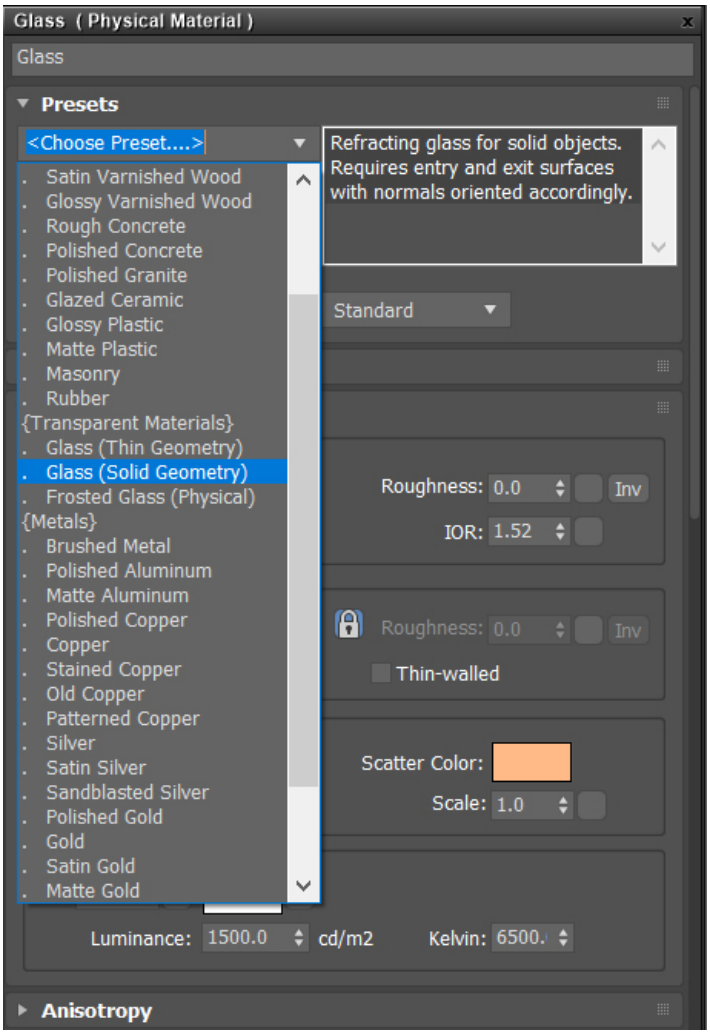
The Physical Material is part of the General materials roll-out and it might be a best practice to collapse the Autodesk materials category since we're not using them in 3ds Max anymore.



When you change the material type you have to double click the material to activate the material and be able to change the belonging parameters in the Parameter Editor.



After changing the Autodesk Material into a Physical Material the material will start with a default grey material. In the Presets roll-out of the Physical Material you can find many good presets which can be used as a starting point.



The Physical Material consists of four parameters roll-outs only when the Material mode is set to standard. By default, the Basic Parameters are showed.

Base Color and Reflection

Base Color is the color of the particular object defined in 32-bit RGB color values. If you have any old 8-bit RGB color value, you just can divide this value by 255 to get the corresponding 32-bit value. The **Metalness** value is 0 by a non-metallic material and 1 when it's a metallic material. The **Roughness** parameter controls the amount of roughness of the reflection. A higher roughness yields into a blurrier material like Brushed metal. The amount of reflections is based on the actual **IOR** (Index of Refraction) and the corresponding value for many materials can be found on the internet.

https://pixelandpoly.com/ior.html

Transparency

When a material is transparent you use the **Transparency settings**. 0 means no transparency where a value of 1 creates a full transparent material. The color of the transparency is set by the **transparency color** and not in the Base Color value. If you don't want to have any kind of refraction in your transparent material, you simply activate the Thin-walled option. The **Depth** parameter enables absorption into the material. If the depth is 0.0, a traditional computer graphics model of transparency is used, where light becomes colored at the surface and is not effected by travelling inside the medium. Therefore, the object's thickness has no affect.

Sub-surface scattering and Translucency

This parameter models scattering of light inside the object. Unlike transparency, which makes the object see-through, sub-surface scattering is about transporting light within the material without actually being able to see through it in any meaningful way. Light is bounced around and different wavelengths are absorbed differently, allowing the light to become colored the further it travels in the material.

Sub-surface Scattering

The Sub-Surface Scattering (SSS) parameter shares its energy with diffuse shading, so increasing its weight fades from normal diffuse shading to shading with SSS. The SSS Color is the color at the surface, essentially the colorization of the entire SSS effect.

The **Depth parameter** defines how deeply light penetrates into the object. **Scale** is a pure linear scale to depth that can be texture-mapped, allowing the scale to change across the object. When the depth is 0.0, the shading is effectively identical to pure diffuse shading. The higher the depth, the more light penetrates the object.

The **Scatter Color** parameter defines how light gets tinted as it travels inside the medium. Technically, the depth multiplied by the scale is the *mean free path* of scattering within the medium and the scatter color is an additional scale factor for the red, green and blue paths.

White surface color with Scatter Color=blue, green and red respectively
Generally, red light scatters further than green, which scatters further than blue. For this reason, the default Scatter Color of 1.0, 0.5 and 0.25 is a reasonable starting point.
When **Thin-Walled mode** is enabled, it becomes classic **translucency**. This is because SSS is a volumetric effect and Thin-Walled mode has no volume.

Emission

The Physical Material supports an **emissive** component, additive light on top of other shading. Emission identity is defined by the weight and color multiplied by the luminance, and also tinted by the Kelvin color temperature (where 6500=white).

Anisotropy

Anisotropy is an effect seen in materials such as brushed metal, where a particular grain direction gives the visual effect of having a different surface roughness in different directions. Highlights and reflections appear "stretched" in a particular direction.
The **Anisotropy** parameter defines how "stretchy" the effect is. In principle, it is the ratio between the horizontal and vertical roughness values. This means a value of 1.0 is not stretched. The anisotropy effect can be rotated using the Rotation parameter, where 0.0 to 1.0 is a full 360-degree rotation.

Coating

The Physical Material has a feature to coat the material. It acts as a **clear-coat layer** on top of all other shading effects. The coating is always reflective (with the given roughness) and is assumed to be dielectric. Reflectivity is based on the Fresnel equation from the given **Coating IOR**, and reflections are always white. The coating layer can also have differing **roughness** values.

In the real world, when a material is coated there is a certain amount of internal reflections on the *inside* of the coating. This causes light to bounce onto the surface multiple times before escaping, allowing the material's color to have an enhanced effect. An example of this is varnished wood. This effect can be achieved using the **Affect Underlying Color** parameter.

The coating itself can also have a **color**. This is the color of the coating layer's transparency. The coating also has an **Affect Underlying Roughness** parameter. This causes the coating's roughness to have an effect on the underlying layer's roughness, simulating the blurring effect of being seen through the top layer. The Coating parameter also has a **separate bump map**.

If you want to know more about the Physical Material, there is a very good video tutorial available on the **3ds Max YouTube Learning Channel**.

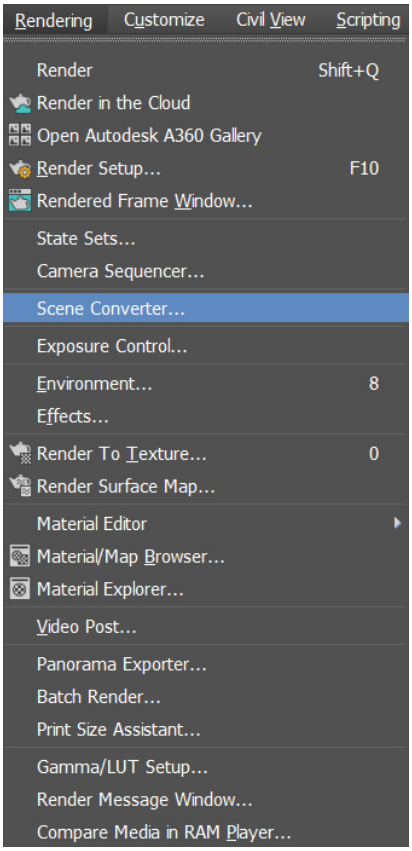
https://www.youtube.com/watch?v=48YtLmJCPzE

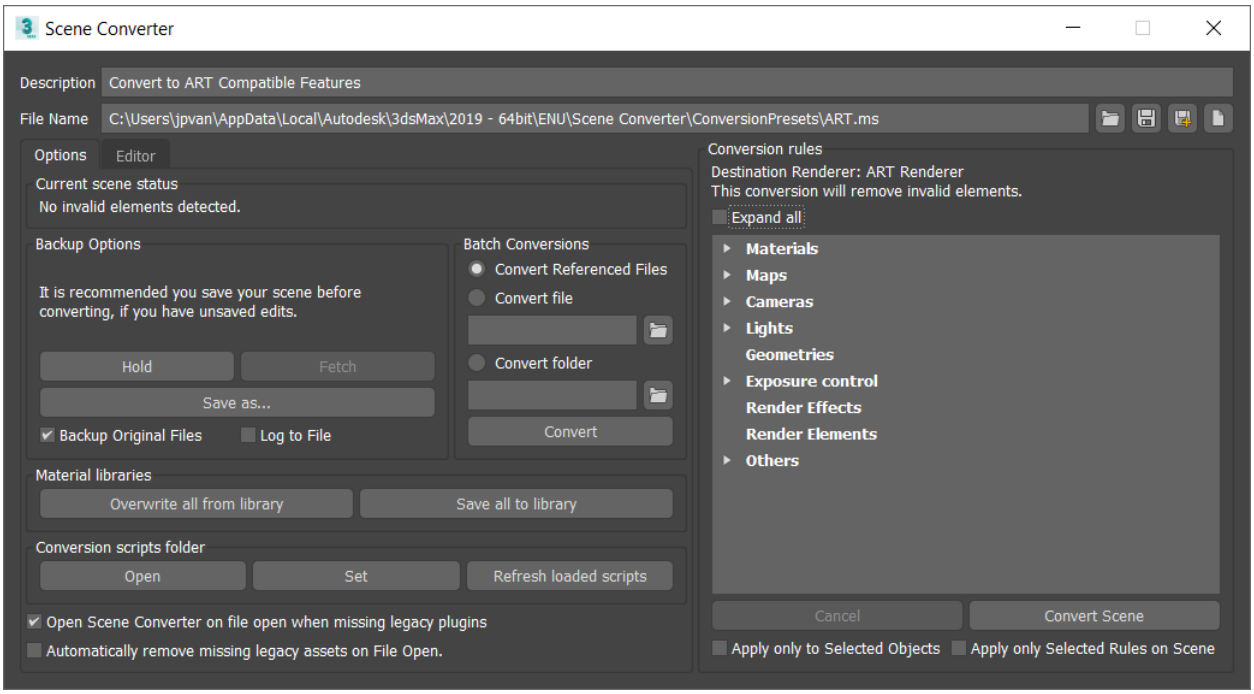
Almost all the Physical material parameters can be controlled by using textures. If you're looking for better textures, you might want to start by using Roughness maps and Normal maps. These kind of texture maps are not being used in Revit. On https://www.textures.com/browse/pbr-materials/114558 you can find an amazing collection of textures which can be used within a Physical Material. After downloading the textures you want to use you can easily drag them from the Windows File Explorer into the 3ds Max Slate Material Editor. In there you can make the proper connections. Roughness goes into the **Roughness map** of the material, a metallic map goes into the **Metallic map** of the material and the normal map goes into the **Bump map** of the material.

Scene Converter

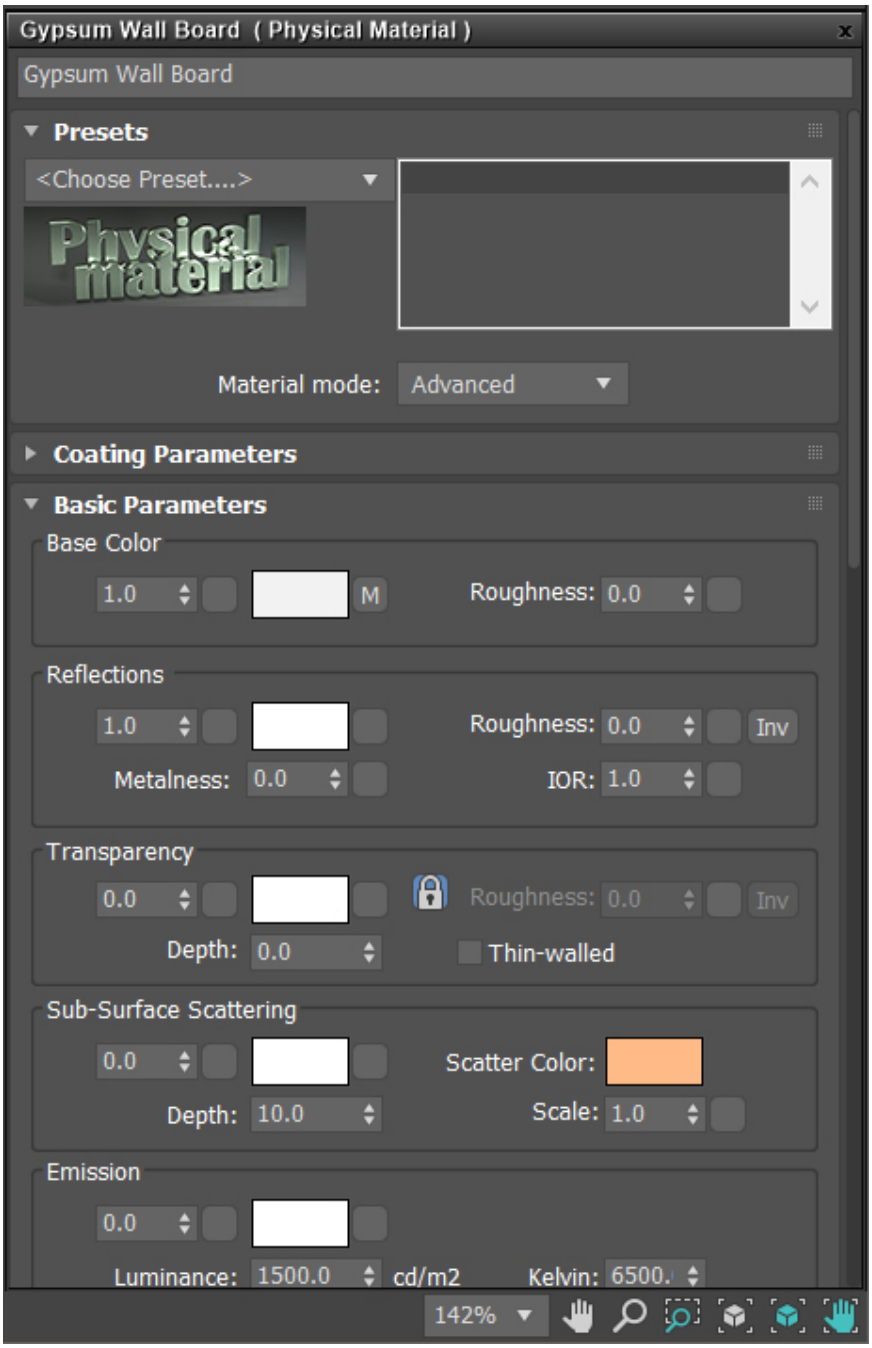
Besides manually changing your Autodesk materials into Physical Materials you can also benefit from the 3ds Max **Scene Converter** to automate this. The 3ds Max Scene Converter will not only convert your Autodesk Materials into Physical Materials but will also convert your legacy Daylight System into a Sun Positioner. The Scene Converter will also convert your Revit

standard cameras into 3ds Max Physical Cameras. The 3ds Max Scene Converter can be found in the 3ds Max **Rendering menu**.





The 3ds Max Scene Converter makes a Backup of the original 3ds Max file by default and will also remove legacy plug-ins when opening up a 3ds Max scene file. The downside of converting your 3ds Max scene with the 3ds Max Scene Converter is that you manually have to check all your materials. The converted Physical Materials will be showed in **Advanced mode** and the reflection value of most of the materials is just not right. By choosing a preset or by manually changing the IOR value you can get rid of the too extreme reflections. By setting the **IOR value** to 1.0 you don't get any reflections anymore.

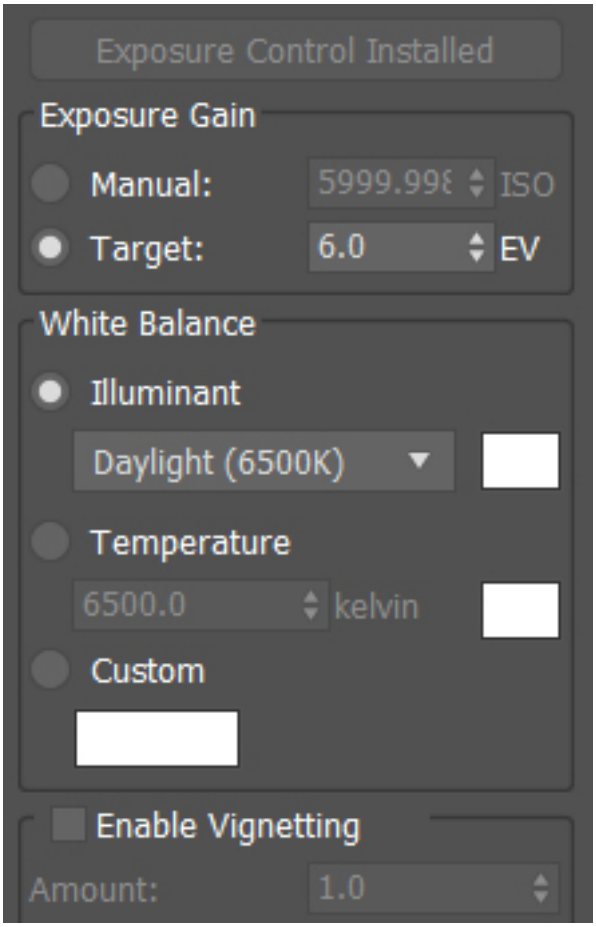


Physical Camera

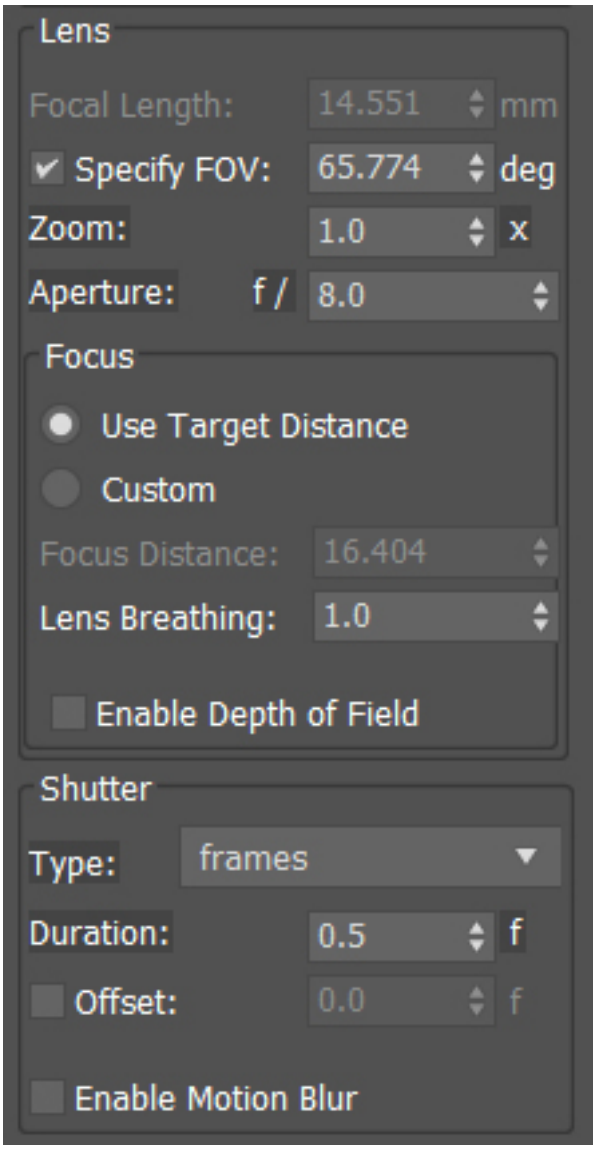
Keep in mind that after converting your 3ds Max scene with the 3ds Max Scene Converter your standard Revit cameras automatically converts into 3ds Max Physical Cameras.

If you change your 3ds Max view to a Physical Camera based view and your rendering is too dark or too bright you have to compensate the Exposure Value found in the Physical Camera settings and not in the general Exposure Control dialog box!!

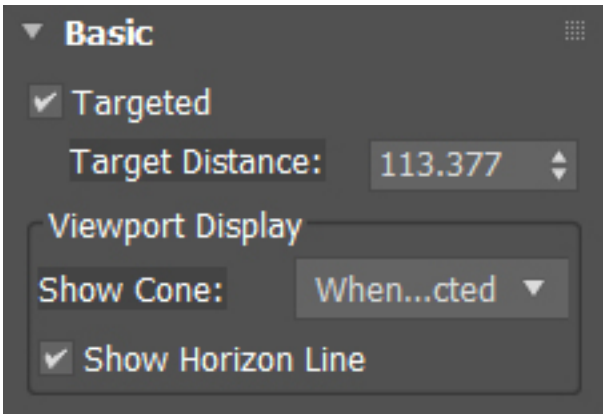
The Physical Camera does hold a huge amount of additional parameters compared with Revit's standard camera. When switching the 3ds Max view to a Physical Camera and selecting the Physical Camera you can easily access all the belonging parameters in the 3ds Max modify panel on the right side of the 3ds Max User Interface. In the Exposure roll-out of the Physical camera you can define the amount of exposure based on a **Target EV value**.



If you're more into photographic based parameters you can switch from Target to Manual and define the **ISO value** combined with a **Lens Aperture** and **Shutter**.



By enabling **Depth of Field** you automatically do get a Depth of Field effect based on the film width, lens focal length and aperture f-number in the 3ds Max viewport and in the rendering. The Lens itself can be defined based on a specified Field of View in degrees or Focal Length in millimeter. The target of the camera can be used as a focus plane. By using the **Target Distance** option of the camera you can change the focus plane of the camera. You might have to active the **Targeted checkbox** of the Physical camera.

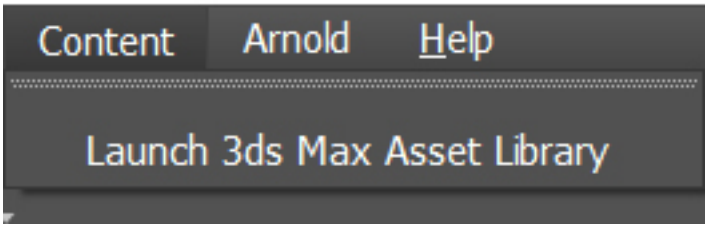


To set the Target Distance it's easier to switch your 3ds Max view to a **Top view**. By doing that you can easily identify where the current Target Distance is being set and where it's in focus.

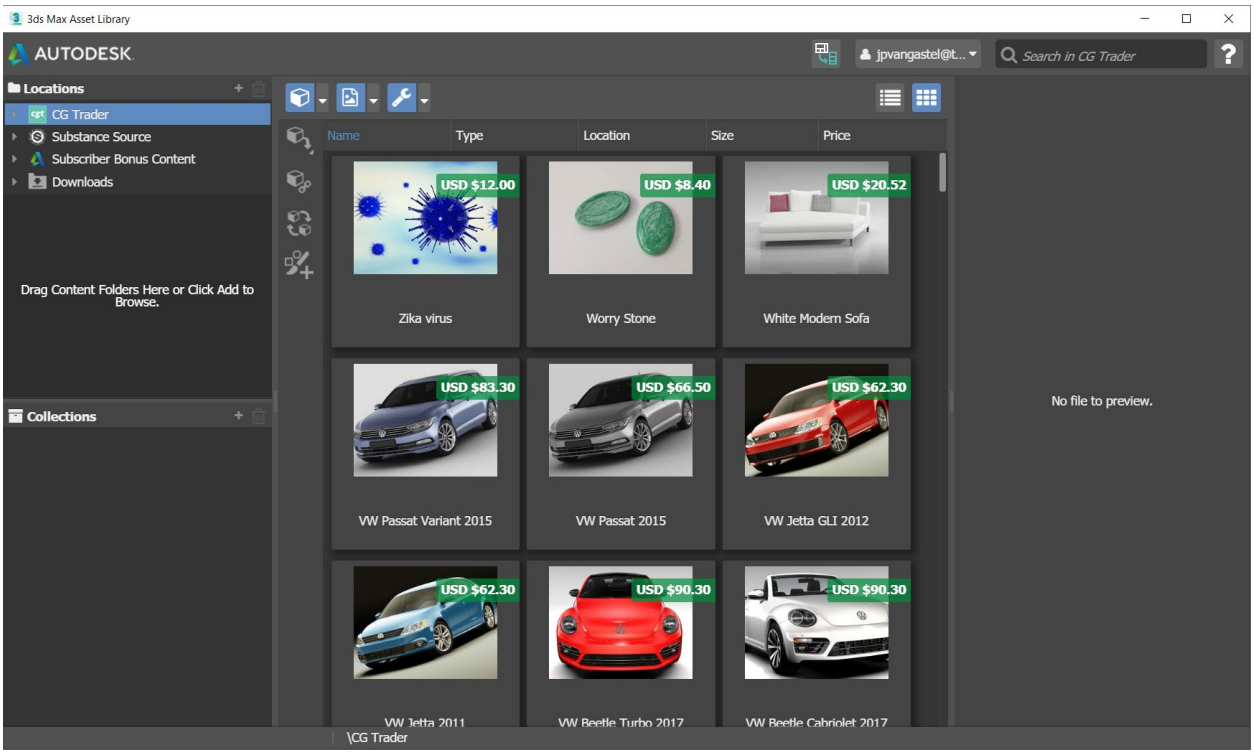
Set dressing your 3ds Max scene with the 3ds Max Asset Library

A very important task of your 3ds Max project is called 'set dressing'. Placing 3D vehicles, trees, plants, flowers and 3D people gives a sense of scale to your 3D render. 3ds Max does have a library filled with 3D vehicles but they or only part of the Object Placement library of Civil View and a bit hidden. It's much better to generate a separate library with assets which can be managed by the 3ds Max Asset Library. The 3ds Max **Asset Library** is not installed by default

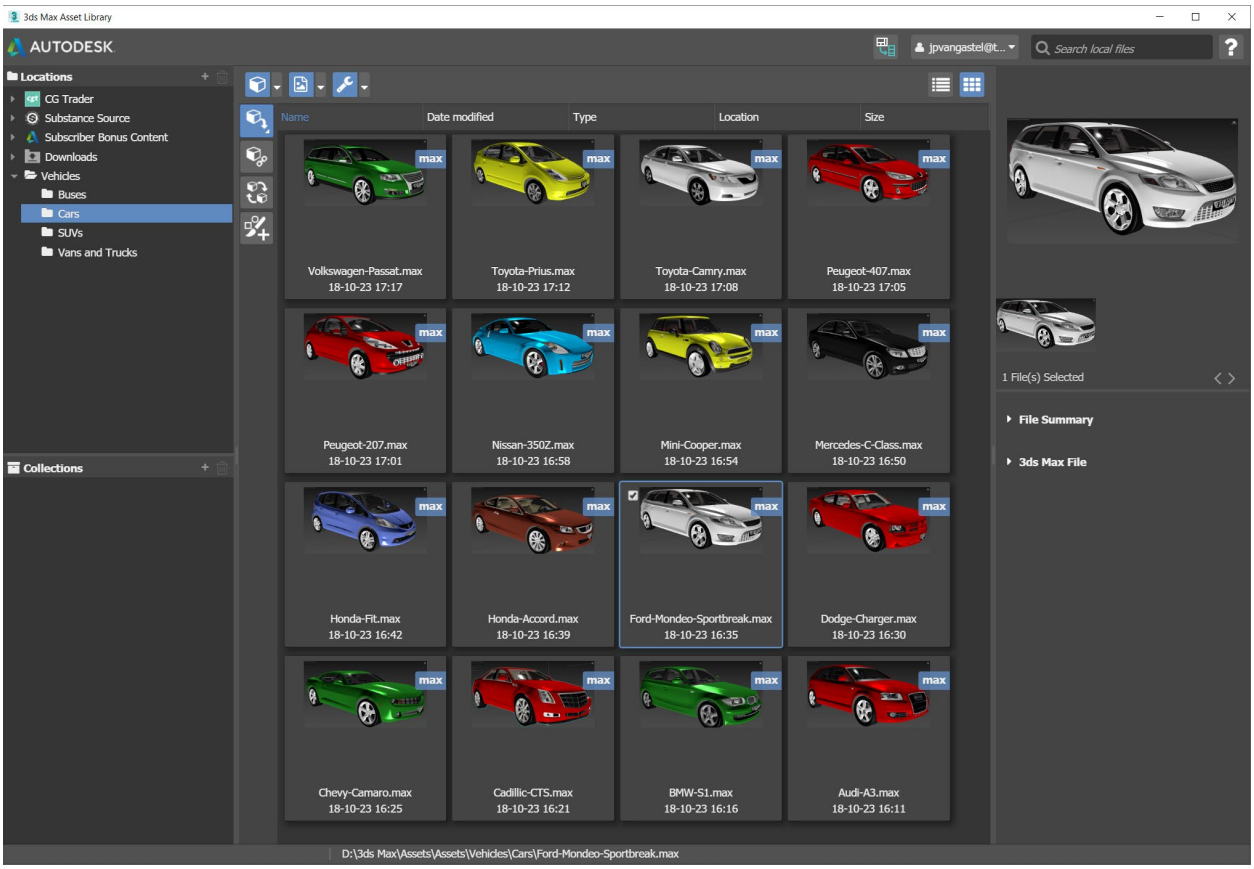
but can be downloaded from the **Content menu** of 3ds Max.



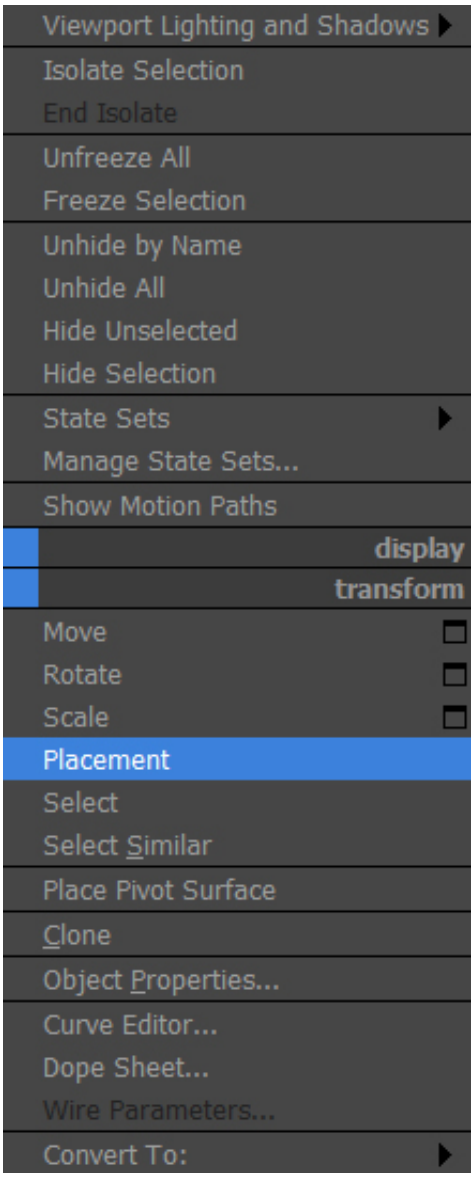
After downloading and installing the 3ds Max Asset Library you do get an additional application on your windows desktop. The 3ds Max Asset Library works as a standalone application.

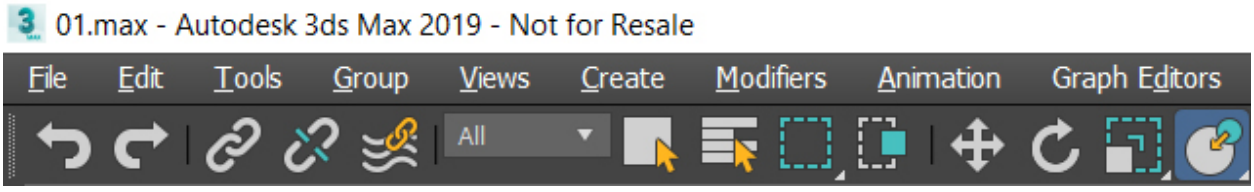


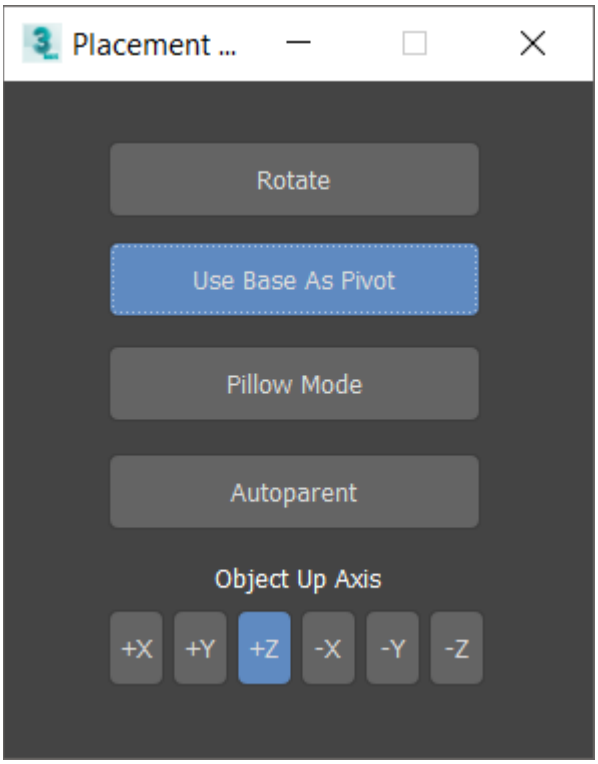
By default, you have access to three different commercially based **Locations** where you can buy assets for 3ds Max. Your own folders filled with 3ds Max assets (.max scene files) can be dragged from the Windows File Explorer straight into the Locations folder. 3ds Max will setup a **path mapping** to the particular content folder. From the Asset Library you can drag any asset into the 3ds Max viewport. By default, you're importing/merging the .max file into the current 3ds Max scene. There's also an option to replace the current selected object in the 3ds Max scene or to start the Object Paint based on the incoming object.



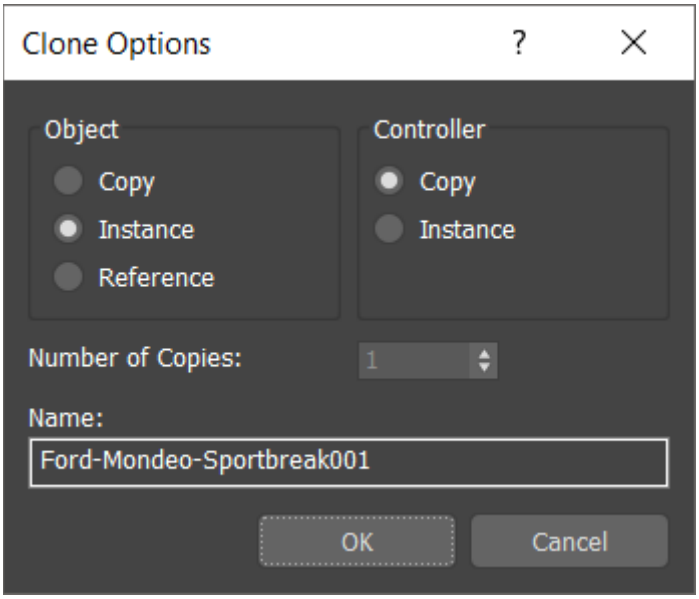
To easily place your 3D assets in the 3ds Max scene the **Select and Place** or **Placement** would be the best option available. The Select and Place is originally developed by Ikea in Sweden and can be found in the **Default Quad menu** (Right mouse button in the 3ds Max viewport) or in the **Main Toolbar**. With the 3D asset selected and the Placement tool active you can easily reposition the 3D asset which will start snapping on existing surfaces. By default, the Placement tool is using the actual **Pivot point** of the 3D Asset. You might change this behavior to snap always to the base of the object independent of the Pivot point location. This can be done with **right-clicking** on the Select and Place option in the Main toolbar.

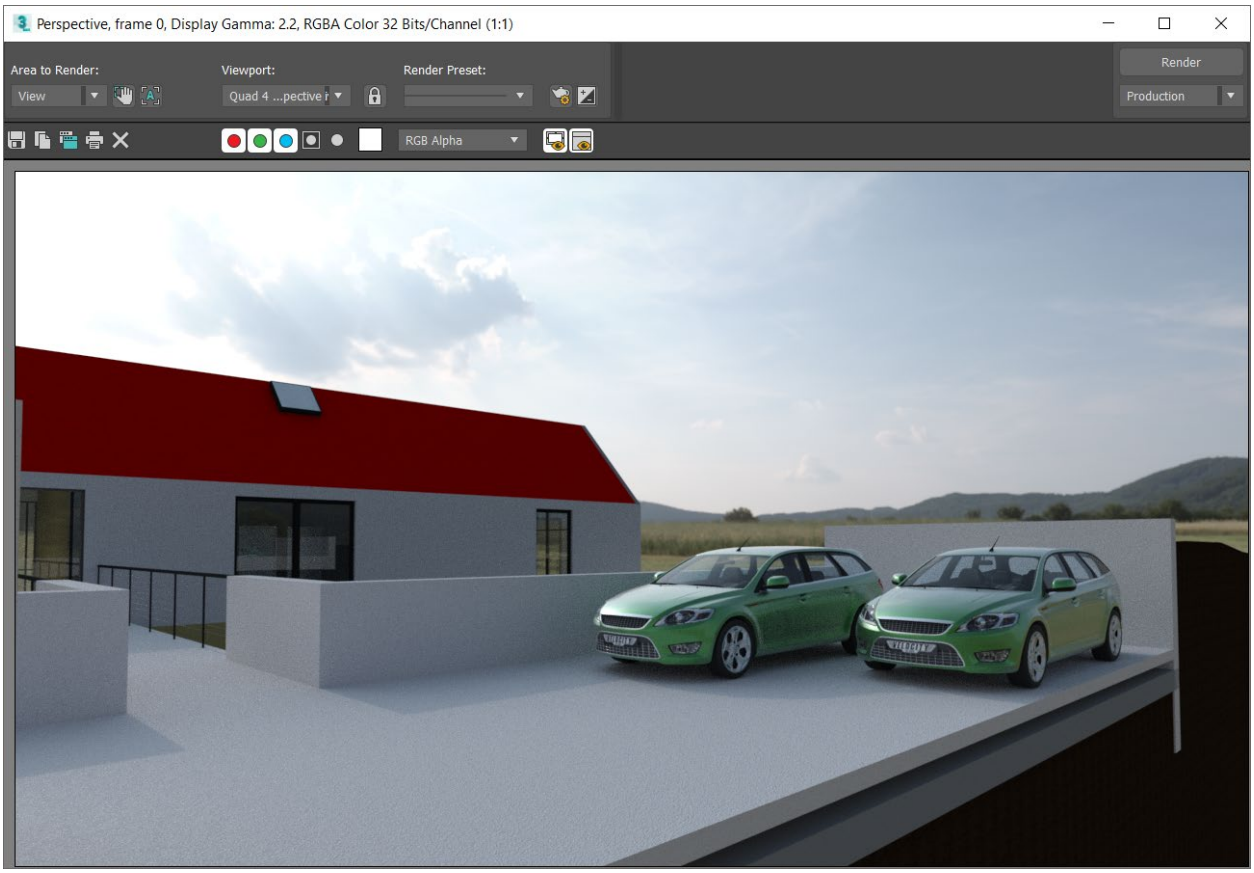

Viewport Lighting and Shadows
Isolate Selection
End Isolate
Unfreeze All
Freeze Selection
Unhide by Name
Unhide All
Hide Unselected
Hide Selection
State Sets
Manage State Sets...
Show Motion Paths
display
transform
Move
Rotate
Scale
Placement
Select
Select Similar
Place Pivot Surface
Clone
Object Properties...
Curve Editor...
Dope Sheet...
Wire Parameters...
Convert To:


01.max - Autodesk 3ds Max 2019 - Not for Resale
File Edit Tools Group Views Create Modifiers Animation Graph Editors
All



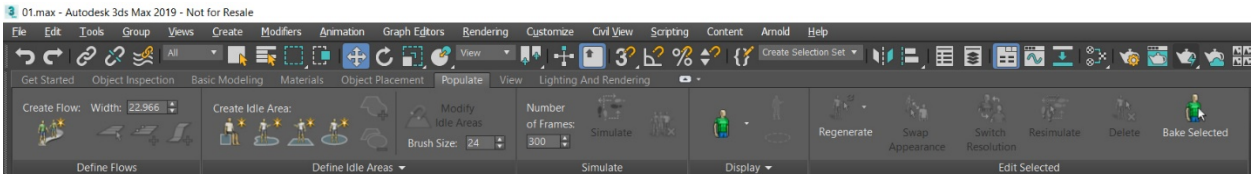
In the Placement settings dialog box you also find the option for **Rotation** and which Axis is the Up Axis. This last option is also completely based on the Pivot point location of the selected 3D asset. With the keyboard combination **Shift** + the Select and Place you easily can copy an object in the 3ds Max viewport. The default **Instance** option doesn't copy the object in the database compared with placing a Revit family multiple times in your Revit design.



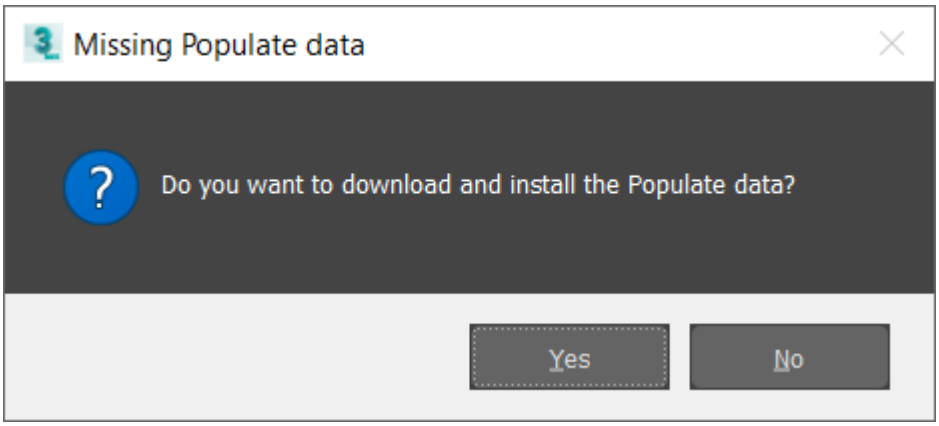


Populate Characters

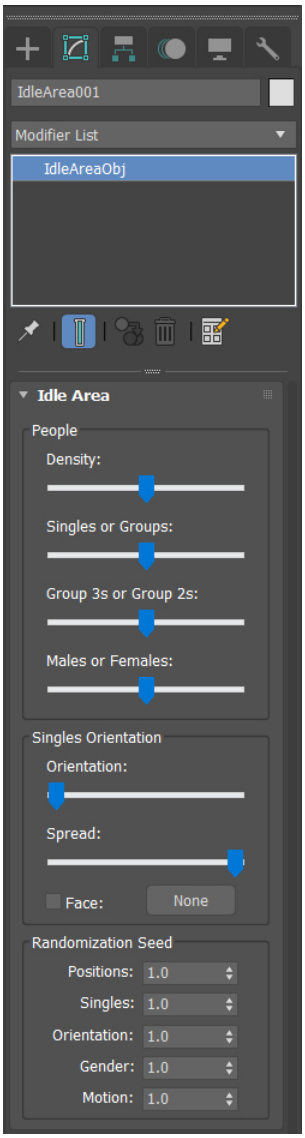
If you want to populate your 3ds Max scene with 3D characters you can use the Populate tools available in the **Populate tab** of the ribbon. The Populate 3D characters can be placed based on a **Flow** if you want to have walking or running 3D characters. You can also add an **Idle area** with seated or moving 3D characters.



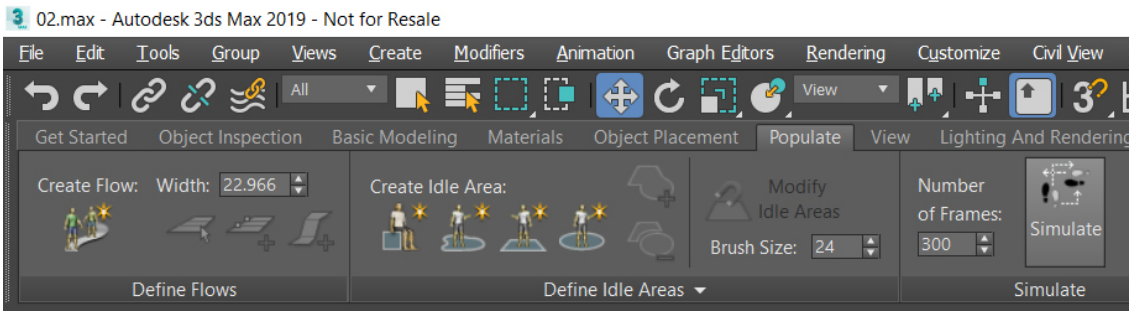
The database with the 3D characters is **not installed by default**. For the very first time you active the **Simulate** tool a download will automatically start.



There are many options available in the Populate ribbon tab. If you want to load in another motion you can use the **Resimulate** option with a populate character selected. If you want to have a higher quality, you can use the **Switch Resolution** option. With a Flow or Idle Area selected in the 3ds Max scene or Scene Explorer you have many self-explanatory options available in the 3ds Max Modify panel.



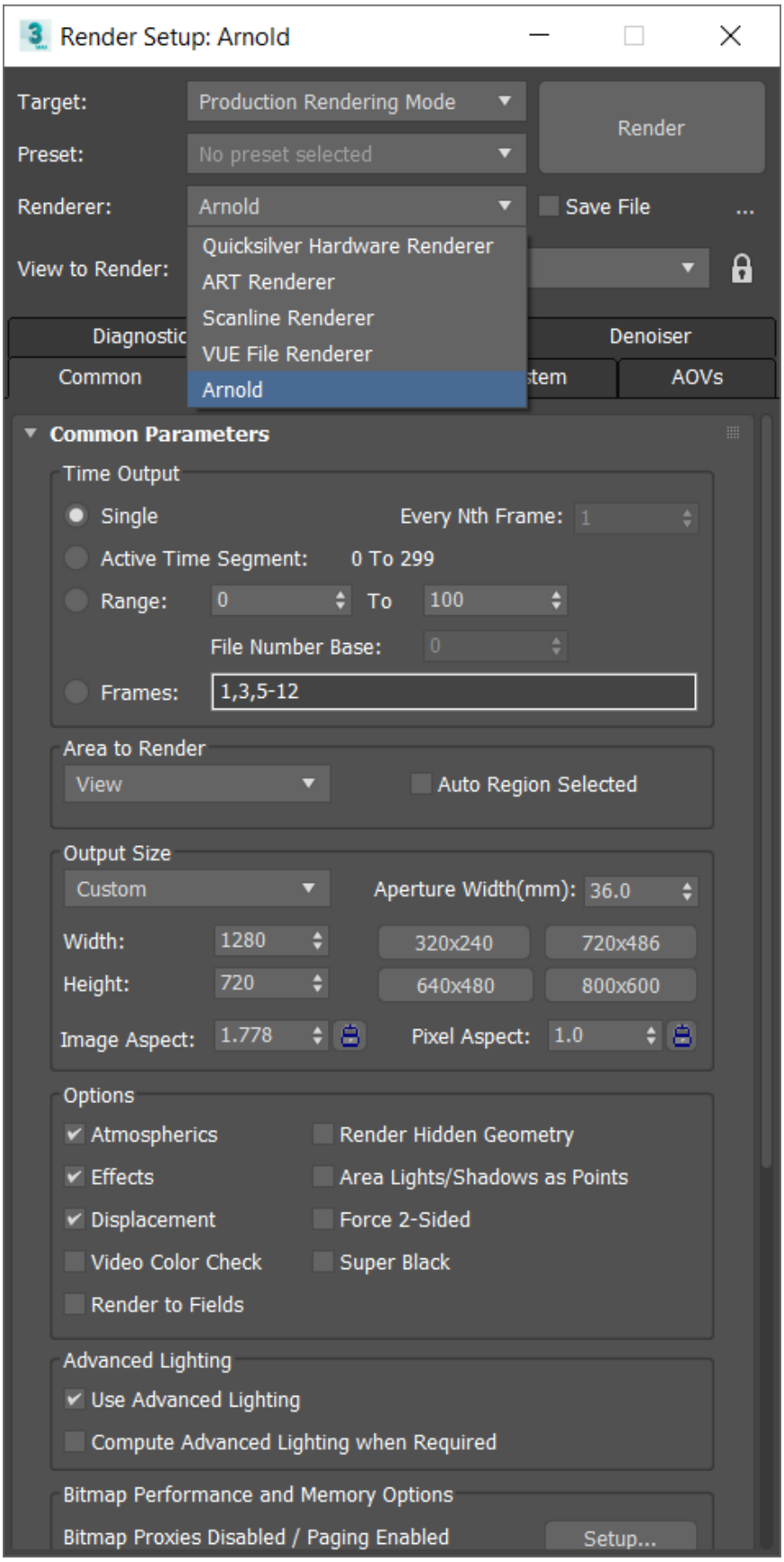
Keep in mind though if you change any parameter in the 3ds Max Modify panel you have to use the **Resimulate** option in the Populate tab of the ribbon to update your 3ds Max populate characters.



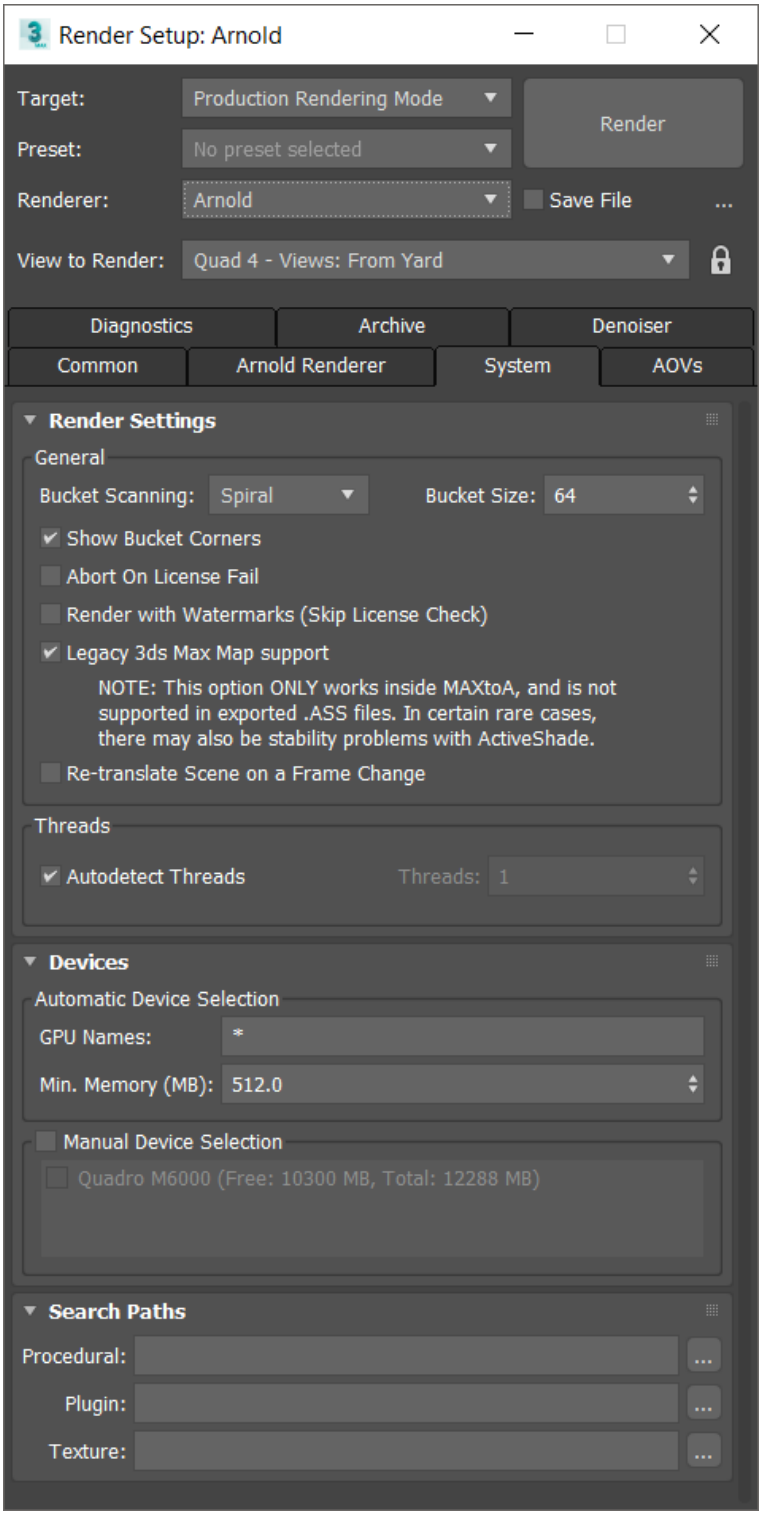
3D Grass with Forest Pack

Creating 3D grass in Revit is quite challenging, and that's an understatement! There are tools available in 3ds Max for creating decent looking grass in 3D but it takes too much time to set it up. The industry standard tool for creating vegetation like grass, trees etcetera is **Forest Pack** from iToo software. https://www.itoosoft.com/forestpack

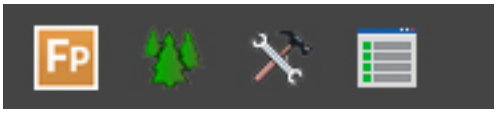
Forest Pack has a **free version** and a **paid version** available. The free version only **supports flat surfaces** and you can only have a maximum of **3 scattered distribution** objects in your 3ds Max scene. The library itself is limited to two different presets. Besides those limitations you have to render with 3ds Max scene with the **Arnold render engine**. The ART renderer is not supported! To setup a the Arnold render engine is just an easy process. In the **Render Setup** you just change the renderer from the ART Renderer to **Arnold**.


Render Setup: Arnold
Target:
Production Rendering Mode
Render
Preset:
No preset selected
Renderer:
Arnold
Save File
View to Render:
Quicksilver Hardware Renderer
ART Renderer
Scanline Renderer
VUE File Renderer
Arnold
Diagnostic
Denoiser
Common
AOVs
Common Parameters
Time Output
Single
Every Nth Frame: 1
Active Time Segment: 0 To 299
Range: 0 To 100
File Number Base: 0
Frames: 1,3,5-12
Area to Render
View
Auto Region Selected
Output Size
Custom
Aperture Width(mm): 36.0
Width: 1280
320x240
720x486
Height: 720
640x480
800x600
Image Aspect: 1.778
Pixel Aspect: 1.0
Options
Atmospherics
Render Hidden Geometry
Effects
Area Lights/Shadows as Points
Displacement
Force 2-Sided
Video Color Check
Super Black
Render to Fields
Advanced Lighting
Use Advanced Lighting
Compute Advanced Lighting when Required
Bitmap Performance and Memory Options
Bitmap Proxies Disabled / Paging Enabled
Setup...

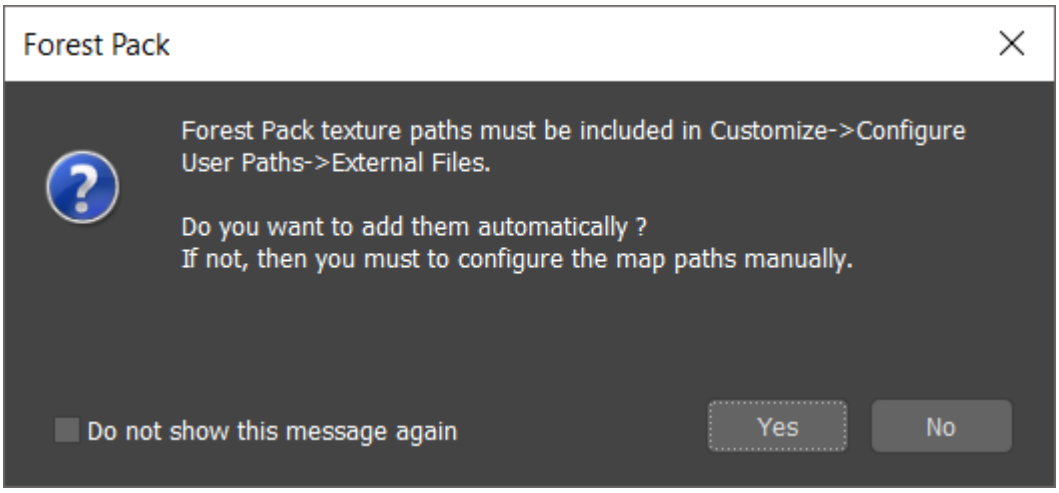
To avoid warnings about not supported maps when the Arnold render starts you should enable the **Legacy 3ds Max Map support** in the **System tab** of the Arnold renderer.



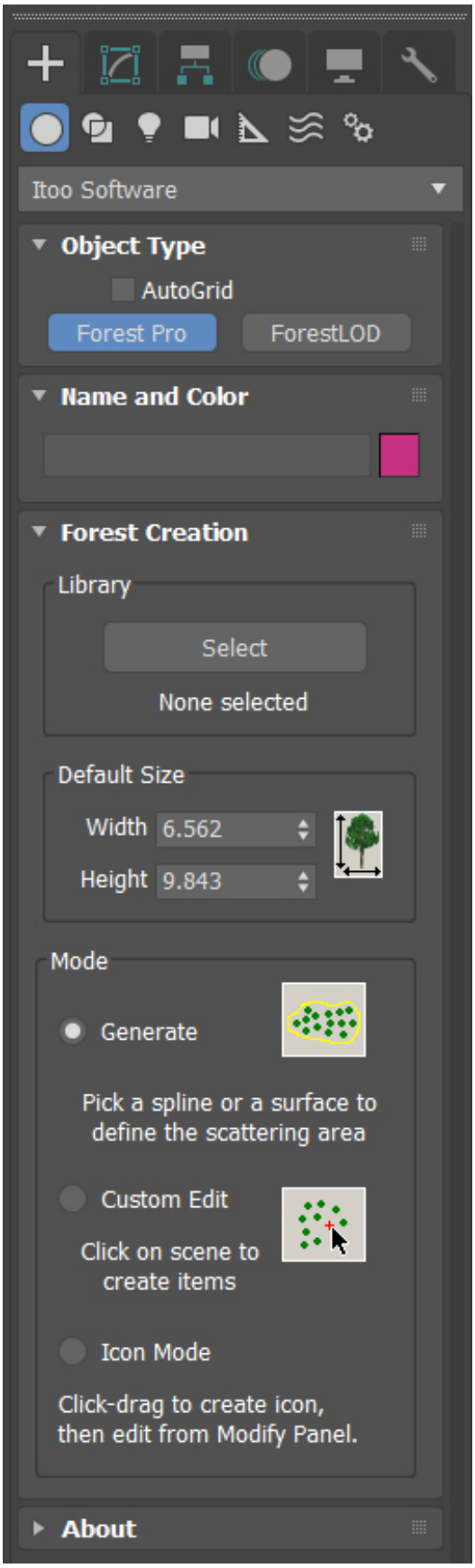
After setting up Arnold as the current renderer you can start using the Forest Pack plug-in in 3ds Max. When Forest Pack is installed in 3ds Max you do get a **Forest Pack toolbar** with the available options in the upper right corner of the 3ds Max User Interface.



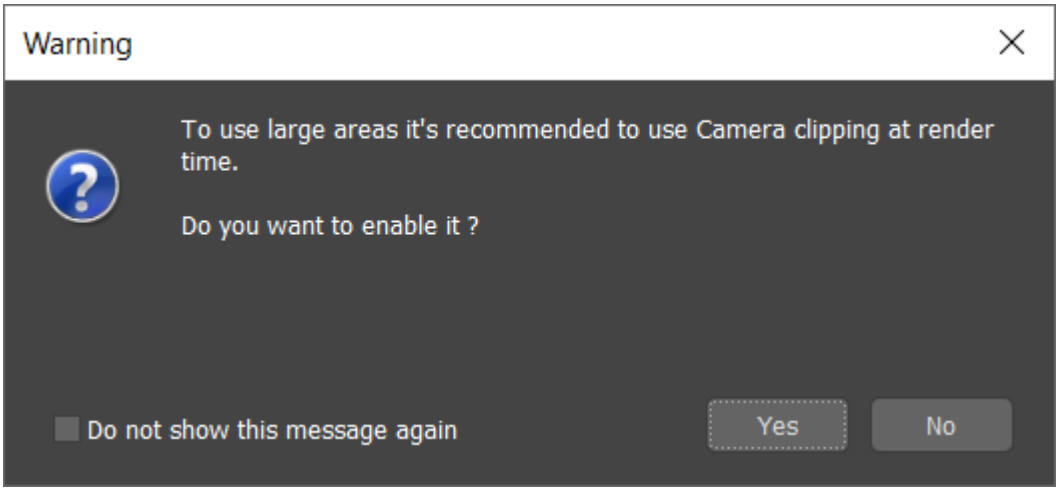
For the very first time you do start the Forest option in the toolbar (the most left one) you do get a warning that 3ds Max needs to add some **external paths**. When selecting Yes in the Forest Pack dialog box this will happen completely automatically.



After selecting Yes in the Forest Pack dialog box, Forest Pack will automatically import some objects which are invisible in the 3ds Max viewport. The next step is to select an object in the 3ds Max viewport. This can be a 3D object or a spline (2D) object which will be used as the scattering object. If you can't select the object you might have to switch to a Perspective view and just orbit your 3ds Max scene a bit.

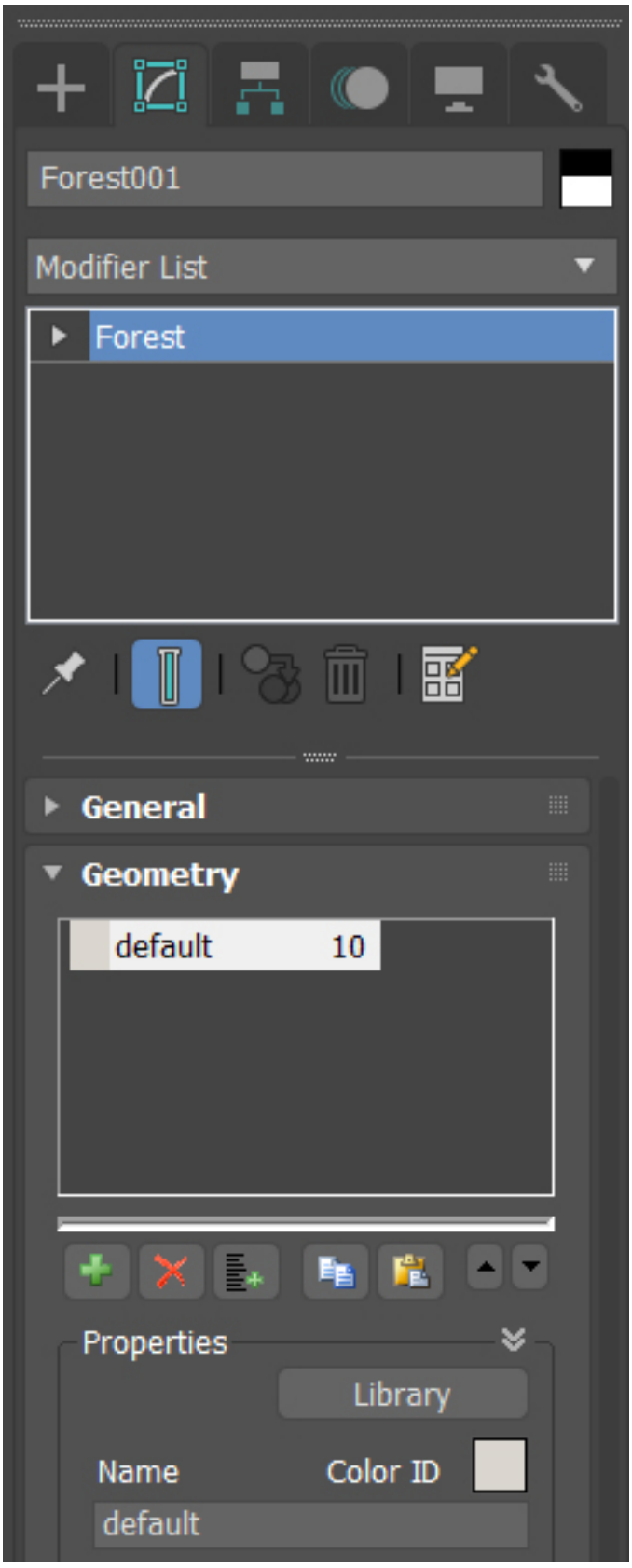

Itoo Software
Object Type
AutoGrid
Forest Pro
ForestLOD
Name and Color
Forest Creation
Library
Select
None selected
Default Size
Width 6.562
Height 9.843
Mode
Generate
Pick a spline or a surface to define the scattering area
Custom Edit
Click on scene to create items
Icon Mode
Click-drag to create icon, then edit from Modify Panel.
About

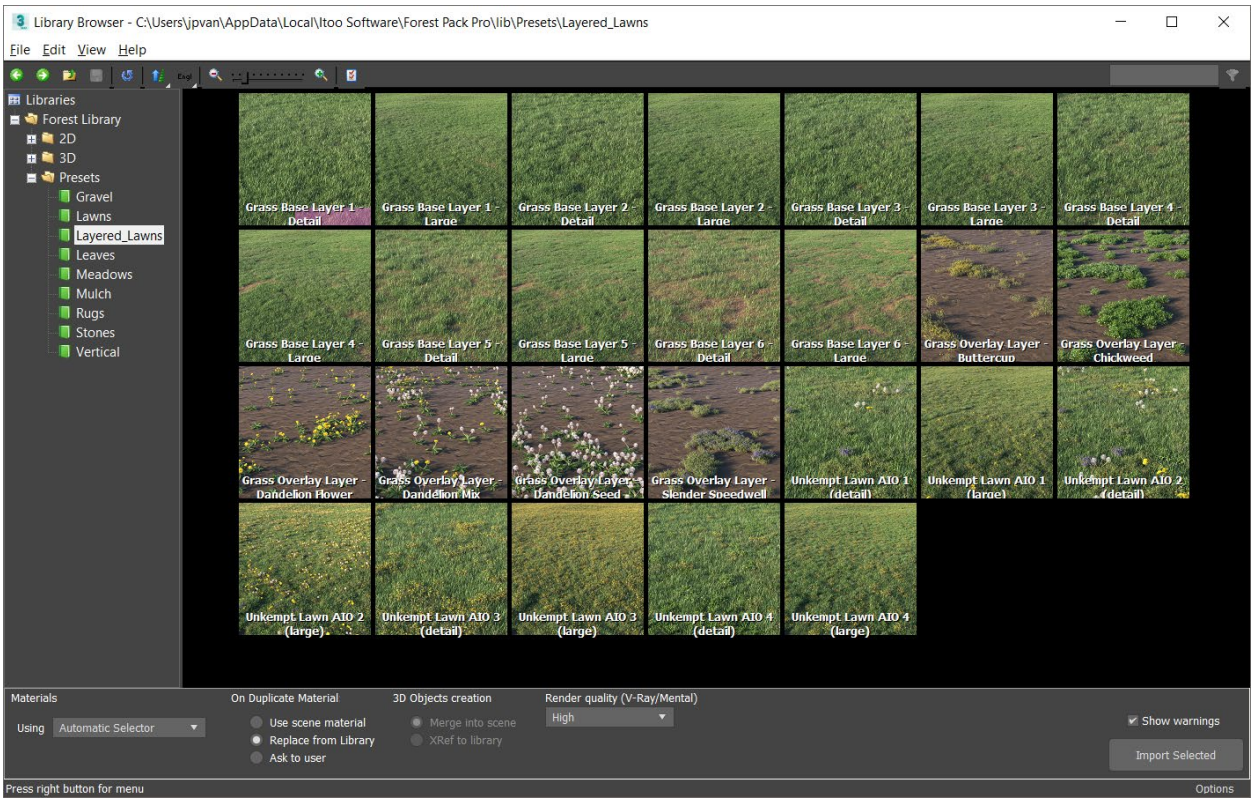
After selecting the spline or surface you might get a warning about large areas. With large areas it's always recommended to use **Camera clipping** at render time. Always choose **Yes** to enable it.



After activating Camera clipping Forest Pack will import a Forest object in the 3ds Max viewport and acts like some kind of low resolution proxy.

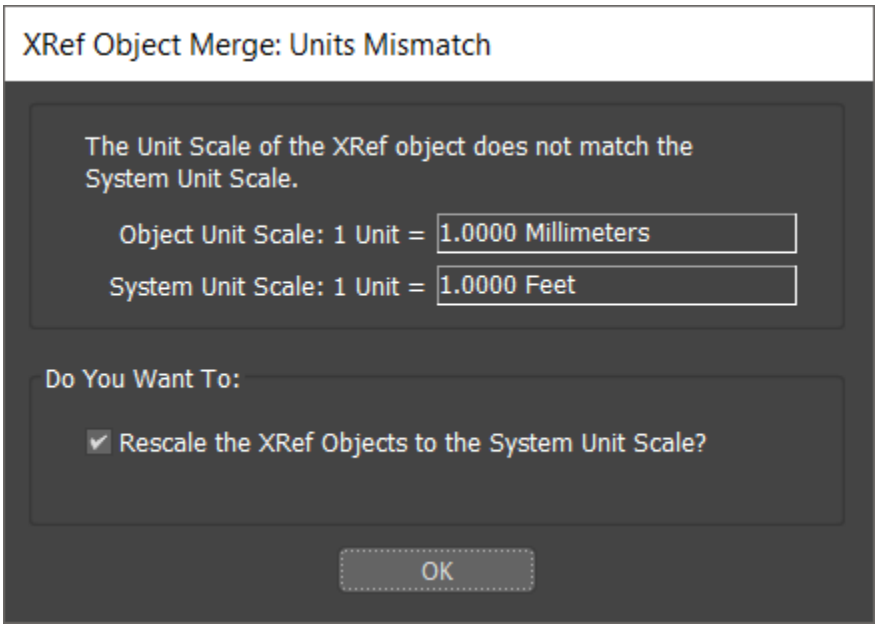
When opening up the **3ds Max Modify panel** with the Forest object selected you do get access to all the Forest Pack parameters. In the **Library** you will find some very handy presets for grass.

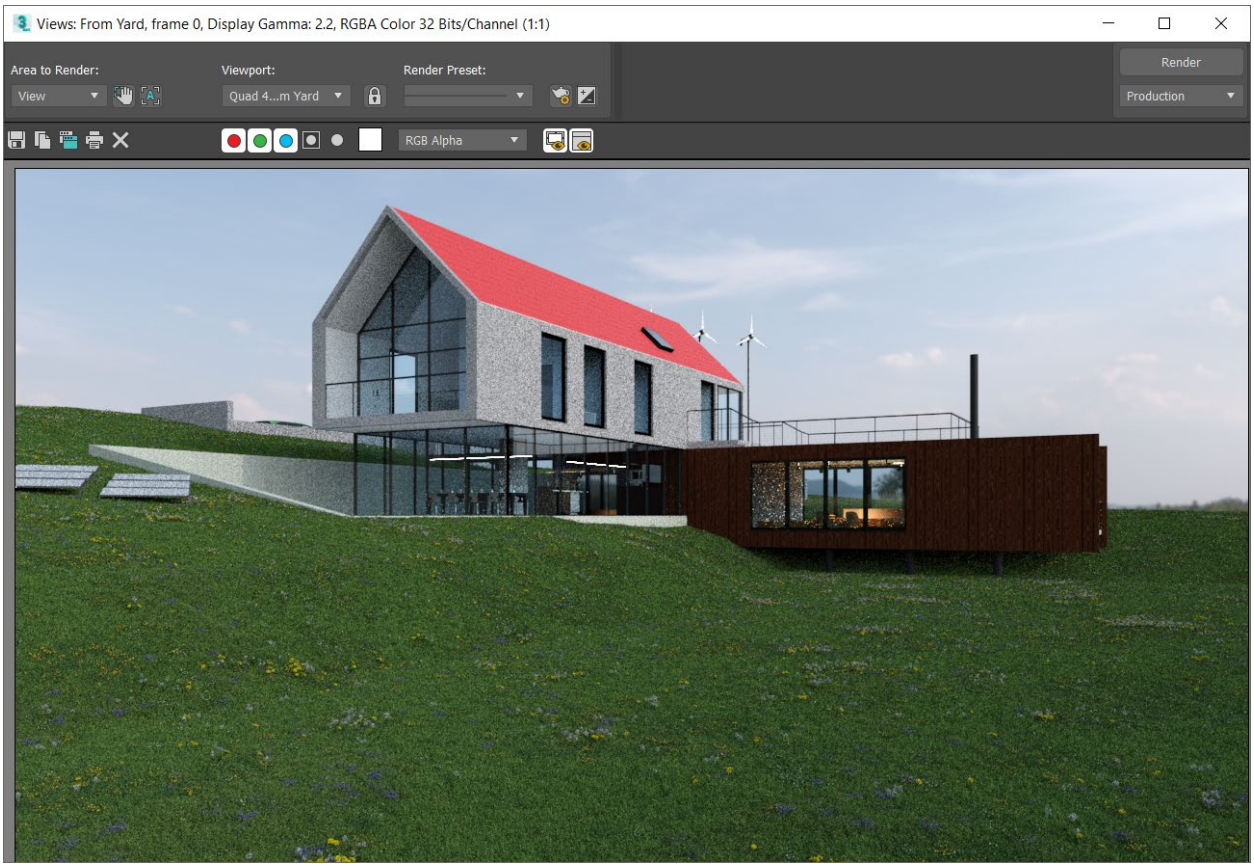

Forest001
Modifier List
Forest
General
Geometry
default 10
Properties
Library
Name
Color ID
default



By double clicking on a preset you're importing the preset.

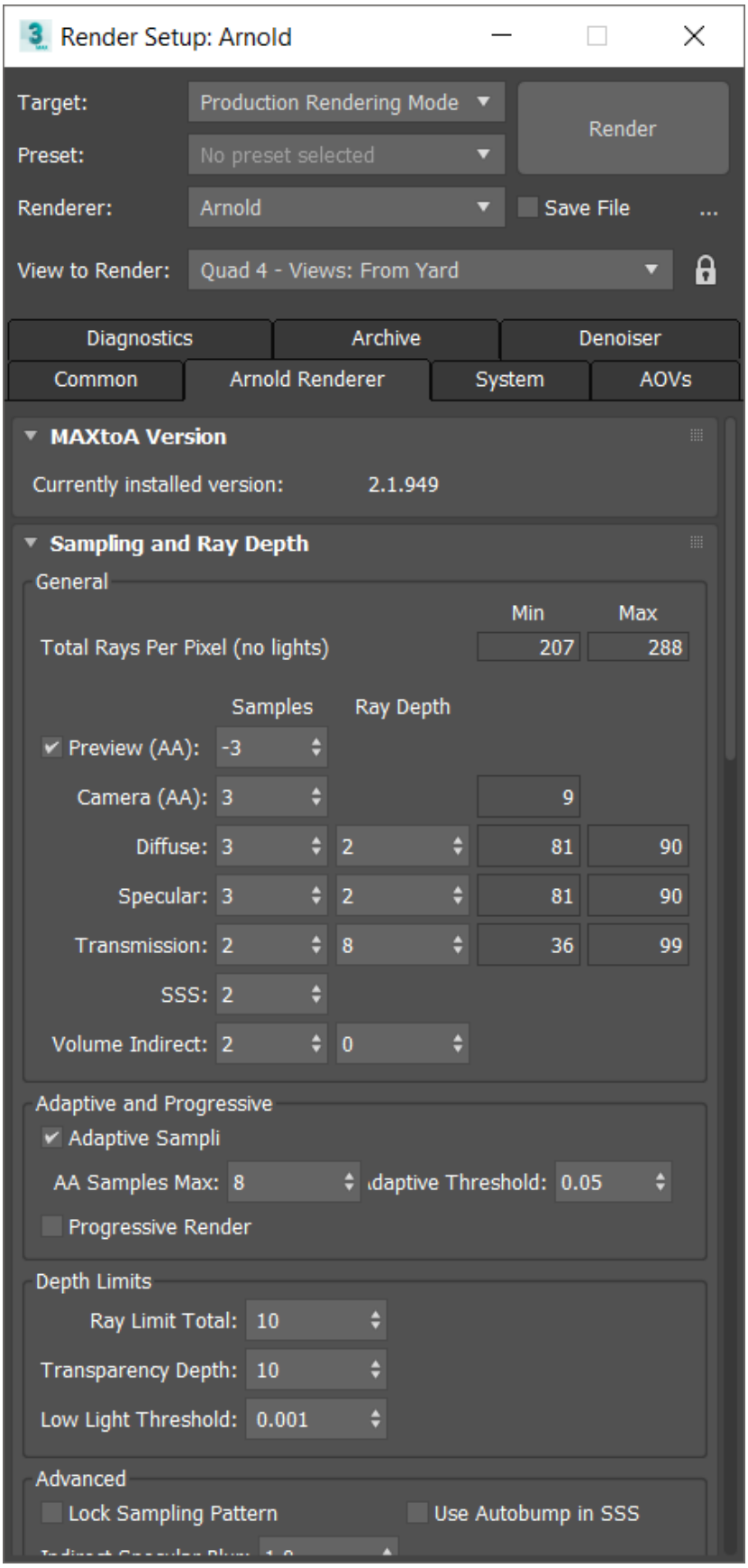
In the **Xref Object Merge: Units Mismatch** dialog box you should always accept to **Rescale the Xref Objects to the System Unit Scale warning**.


XRef Object Merge: Units Mismatch
The Unit Scale of the XRef object does not match the System Unit Scale.
Object Unit Scale: 1 Unit = 1.0000 Millimeters
System Unit Scale: 1 Unit = 1.0000 Feet
Do You Want To:
Rescale the XRef Objects to the System Unit Scale?
OK



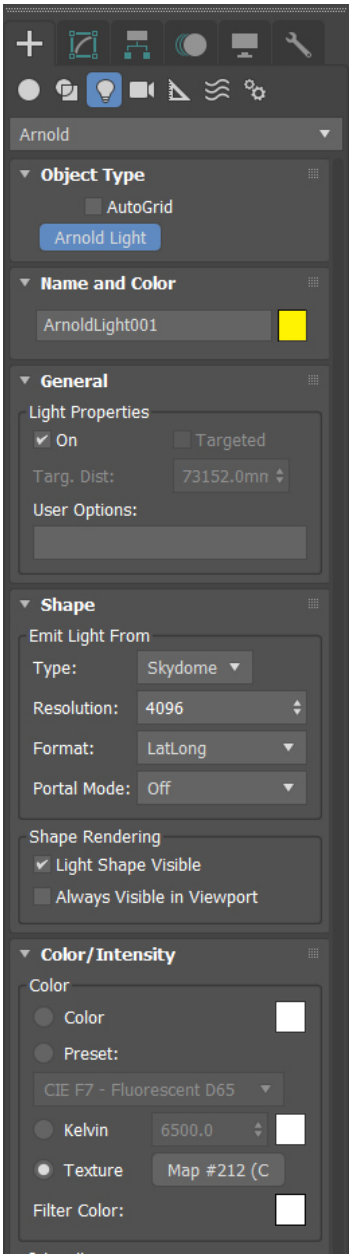
Besides using presets from the Library you can also add your own 3D trees, plants or flowers as scatter objects. Based on settings in the **Transform rollout** you can add randomness to all your vegetation. The distribution itself is based on a greyscale texture which can be set in the **Distribution** rollout of the 3ds Max Modify panel. Forest Pack is a very easy to use plug-in and to have a better understanding of the use of the plug-in you can watch the video tutorials provides by the developer on YouTube. https://www.youtube.com/user/itoosoft/videos

When rendering your final render with Arnold you have to take care of quality settings. Getting rid of noise with Arnold is based on **Samples** which can be found in the **Arnold Renderer** tab in the Render Setup dialog box.


Render Setup: Arnold
Target:
Production Rendering Mode
Render
Preset:
No preset selected
Renderer:
Arnold
Save File
View to Render:
Quad 4 - Views: From Yard
Diagnostics
Archive
Denoiser
Common
Arnold Renderer
System
AOVs
MAXtoA Version
Currently installed version:
2.1.949
Sampling and Ray Depth
General
Min
Max
Total Rays Per Pixel (no lights)
207
288
Samples
Ray Depth
Preview (AA):
-3
Camera (AA):
3
9
Diffuse:
3
2
81
90
Specular:
3
2
81
90
Transmission:
2
8
36
99
SSS:
2
Volume Indirect:
2
0
Adaptive and Progressive
Adaptive Sampli
AA Samples Max:
8
daptive Threshold:
0.05
Progressive Render
Depth Limits
Ray Limit Total:
10
Transparency Depth:
10
Low Light Threshold:
0.001
Advanced
Lock Sampling Pattern
Use Autobump in SSS

The amount of samples is the quality and Ray Depth is the amount of light bounces. Adaptive Sampling will help a lot to get rid of the noise. But be care full don't go crazy with these parameters.

If you have issues with jagged reflections in glass for instance you have to place an Arnold Skydome light which can be found in the **Arnold lights** category in the **3ds Max Create panel**. If you're using an HDR for the environment you should disconnect it in the Environment and Effects dialog box and connect it to the **Texture** option of the Arnold Skydome light.



There are many Arnold tutorials available on the developer website and are highly recommended when making the next step in 3ds Max.

https://docs.arnoldrenderer.com/display/A5AF3DSUG/Tutorials

To finalize this handout I would like to share a couple of small things which are going to be wrong when you import or link your Revit files and how to fix them.

- Imported Revit photometric lights do convert to a black filter color. This should be set to white and can be done in the 3ds Max modify panel when selecting the light in the 3ds Max viewport or the Scene Explorer
- Imported textures from Revit are too dark. The RGB level of the Bitmap (Texture) should be set to 1 and can be done in the Output rollout of the Bitmap in the 3ds Max Slate Material Editor

When starting to build your 3ds Max asset libraries you might want to use free of charge samples provides by many suppliers. A best practice would also be to use the 3D Warehouse. 3ds Max is capable of importing native SketchUp files if they are in the 2015 file format. Don't forget to set the right System Units before importing a SketchUp file into 3ds Max.

https://3dwarehouse.sketchup.com/

There's also a nice set of free vegetation available on the Xfrog website. The only thing you have to do is scene convert them into Physical materials so that they can be rendered with the ART and Arnold renderer.

http://xfrog.com/category/samples.html

Besides samples there's also a lot high quality commercially based content available. Most of those 3D assets are created with V-Ray materials. You have to manually convert a V-Ray material to a Physical material or use a commercial script. To be able to convert from V-Ray to a Physical material you need to have V-Ray installed but an trial version of V-Ray (may be expired) will do the job.

https://evermotion.org/downloads/category/3d-models/5/