Houdini 16 Mantra Renderer

Renders

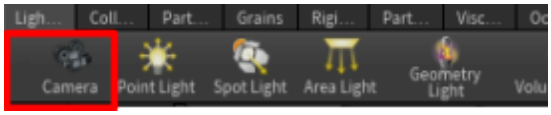
The renderer that comes with Houdini is called Mantra. It seems very similar to Maya's Arnold renderer, but not as popular. Although Arnold does have a Houdini plugin, I think Houdini people prefer to avoid it when doing their FX work.

Setup

To setup the a render using Mantra, you need to create a render camera and add a Mantra render node in the /out context.

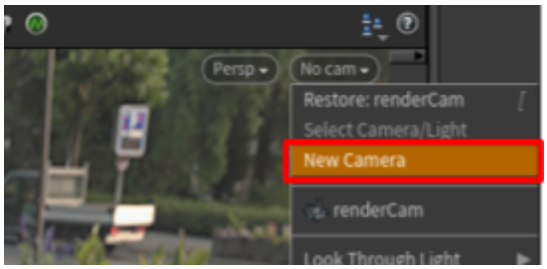
Create a Render Camera

Before you can render, you need to create a camera. To create a camera, you can either use the Camera item in the Lighting shelf…



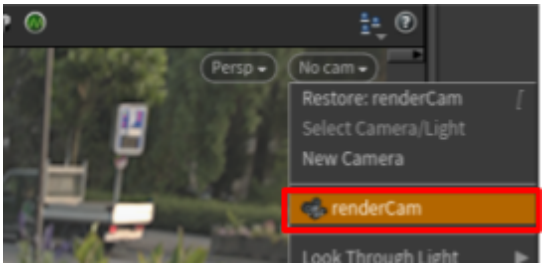
> **NOTE**: Remember that if you hold Ctrl and click it'll dump it at (0,0,0) and select it upon creation.

Or, you can orient your scene to where you want your camera to be and in the upper right-most dropdown (just below the toolbar) in the scene view, choose New Camera…

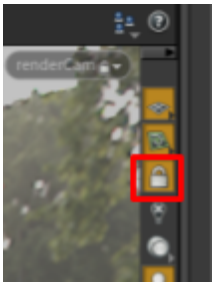


Once the camera is created, you can do a Maya "look-through object"-style orientation by…

1. Selecting it in that same dropdown (doesn't matter how you created it -- it'll exist in the dropdown)



2. Locking your view to the camera using the right toolbar



3. Orienting your view using the normal pan/tumble/zoom controls

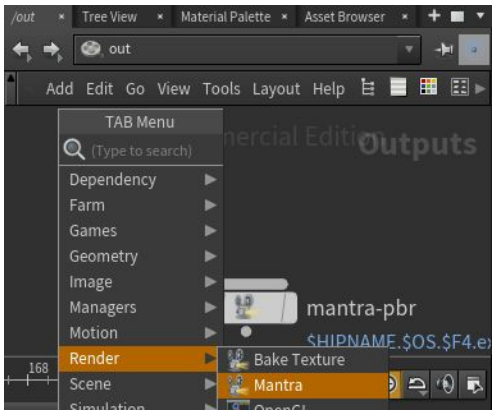
NOTE: Remember to unlock your view once you're finished orienting your camera.

NOTE: You can set things like aperture and f-stop directly on the camera you created. All those options will be in the properties pane.

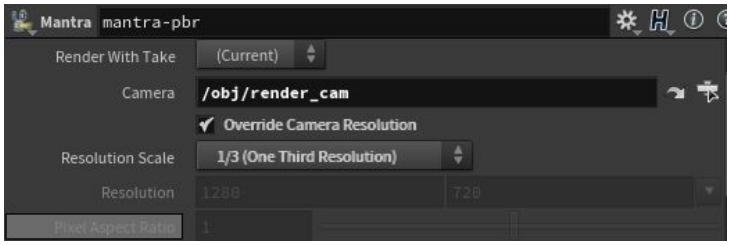
Create a Render Node

You can create render nodes in the /out context. Usually having 1 is fine, but you can create different render nodes if you want to have multiple different render setups (e.g. quick render vs production-quality render).

You can add a Mantra node by going to the network view, switching context to out, and inserting a Mantra node from the Tab menu…



After you set down the node, YOU MUST SET A CAMERA in the properties pane. That means your scene NEEDS to have at least 1 camera node in it...

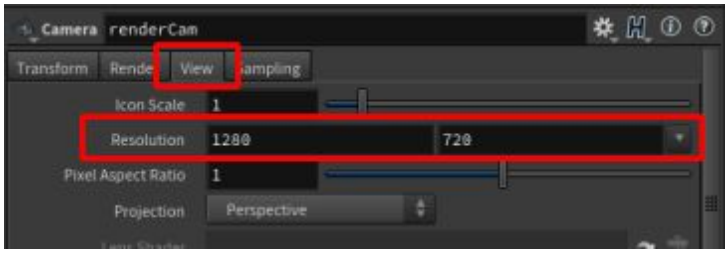


NOTE: See the above section on how to create cameras if you don't have one created yet.

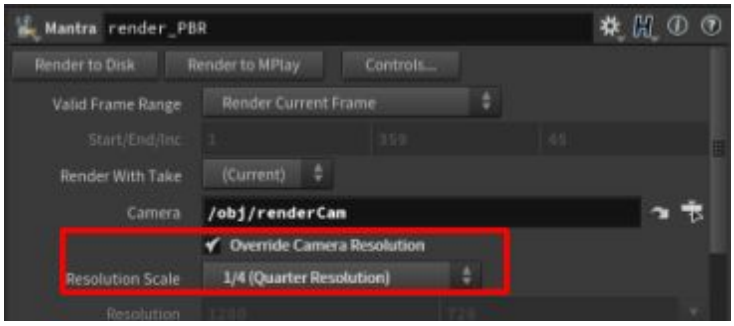
It's recommended by Houding to set the Rendering Engine to Physically Based Rendering. According to the lesson, this isn't the default but the other methods are legacy and PBR gives you a lot of features out-of-the-box for free without manual tuning.

Render Resolution

You can set the render resolution on the camera that your Mantra node is linked to. In the camera properties, under the View tab there should be a Resolution property…

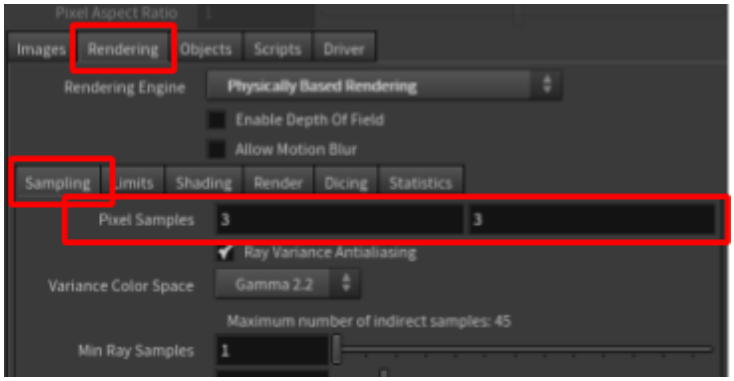


You can scale down the rendering resolution of the camera in the Mantra node via the Resolution Scale in the property. To enable it, you need to check Override Camera Resolution property…



Render Quality

You can set the samples for the render (just like you do with Arnold). You can do so under Rendering -> Sampling in the properties pane of the Mantra node...

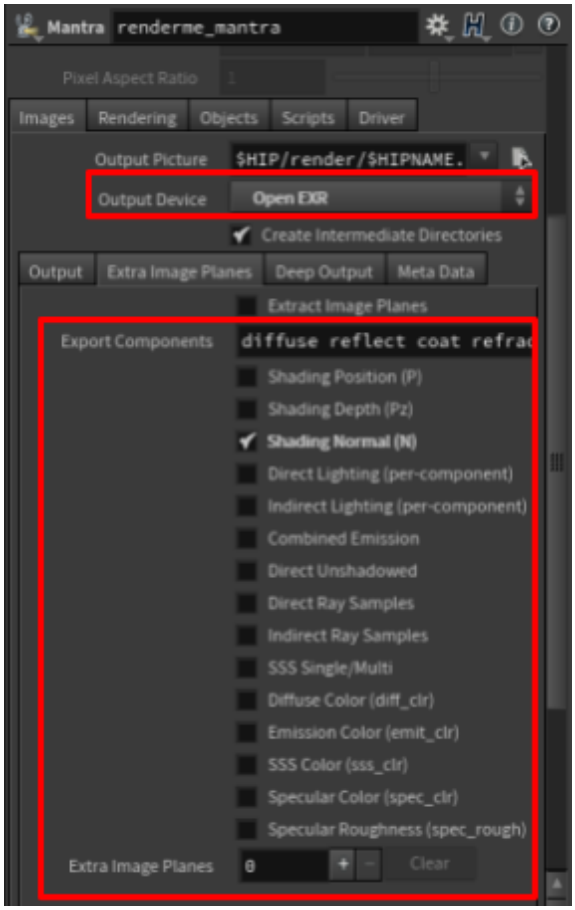


Pixel Samples seems to be the most important option here. For things like subsurface scattering, if you don't want a lot of noise you need to jack this value high. I set it to around 20 or 30 to get a okay quality subsurface scattering. There are also individual "quality" sliders below Pixel Samples for things like SSS and specular.

Image Planes (AOVs)

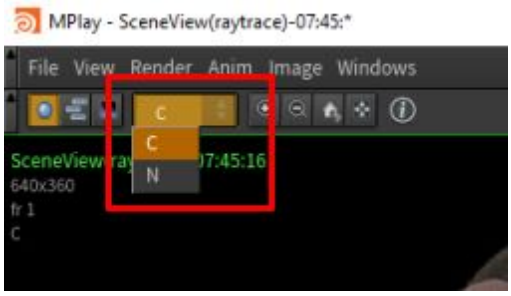
Mantra's equivalent of Arnold's AOVs is called image planes. You can define image planes in the Mantra node by selecting what you want via the properties under Images -> Extra Image Planes…

> **NOTE**: Make sure you set your Output Device to OpenEXR.



Once selected, YOU MUST RENDER TO MPLAY to see the AOVs… You can select which AOV is being shown via the dropdown in the toolbar.

> **NOTE**: C is the beauty render… To figure out what the rest of the codes are, look at the names of the checkboxes you selected for extra image planes.

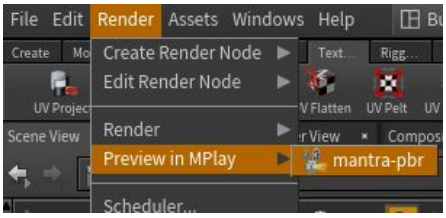


Standalone Render

There are many ways to trigger a render…

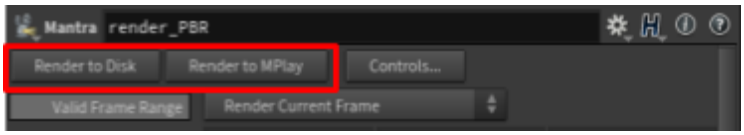
1. In the main menu… Render -> Render -> (mantra node name)

2. In the main menu… Render -> Preview in MPlay -> (mantra node name)

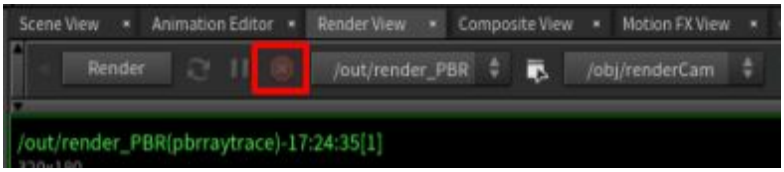


3. In the left toolbar of scene view… click the movie reel (last button in the toolbar) and choose the render node name

4. In the Mantra node itself, there are the following options available at the very top of the properties pane…



If you choose Render to Disk, you can kill the Render by going to the Render View panel and choosing the Stop button…



NOTE: MPlay is Houdini's version of Maya's fcheck? Fcheck is the Maya image playback viewer checker thing. You need to render to MPlay if you have extra image planes being output (image planes are the equivalent of Arnold AOVs) -- this is detailed in further sections

NOTE: It turns out as your render's happening, you can tell MPlay/Mantra to focus on a particular part first by clicking on it during the render. The tiles should start to focus on

that area. This may only work if progressive rendering is turned OFF (double check this when you have a chance)

Interactive Render

Remember that IPR stands for Interactive Photorealistic Render. It's used to get feedback on how the render looks in real-time. It's works like downloading old school progressive scan JPEGs from the Internet back in the days of 56k modems.

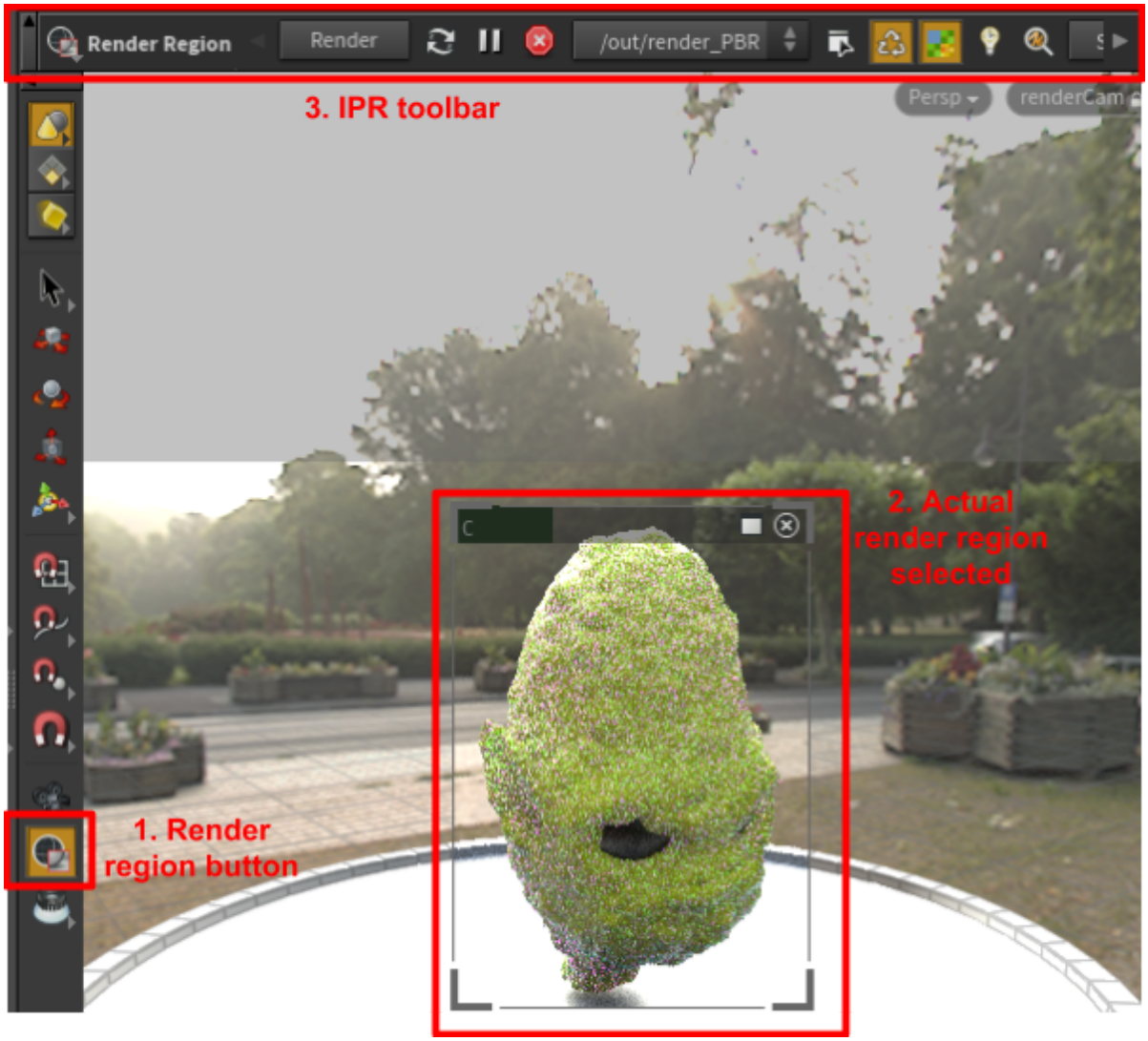
There are 2 ways to do IPR rendering: directly in the Scene View or via the Render View.

Scene View

You can do IPR on a select part of your scene through the scene view via the Render Region feature.

To activate a render region…

1. Select render region button on the left-hand toolbar (it's near the bottom).
2. Once selected, you can click-and-drag on a region in your scene view -- that region will render directly in the scene view.
3. Notice how you get the exact same toolbar showing as you do in the Render View



The render region has a little progress bar on top of it that fills up as the render completes. You can click the X in the righthand side of the progress bar to kill the render region.

The toolbar will remain visible so long as the Render Region button is selected. If you want to know the particulars of the toolbar, check out the Render View section directly below (its the same toolbar).

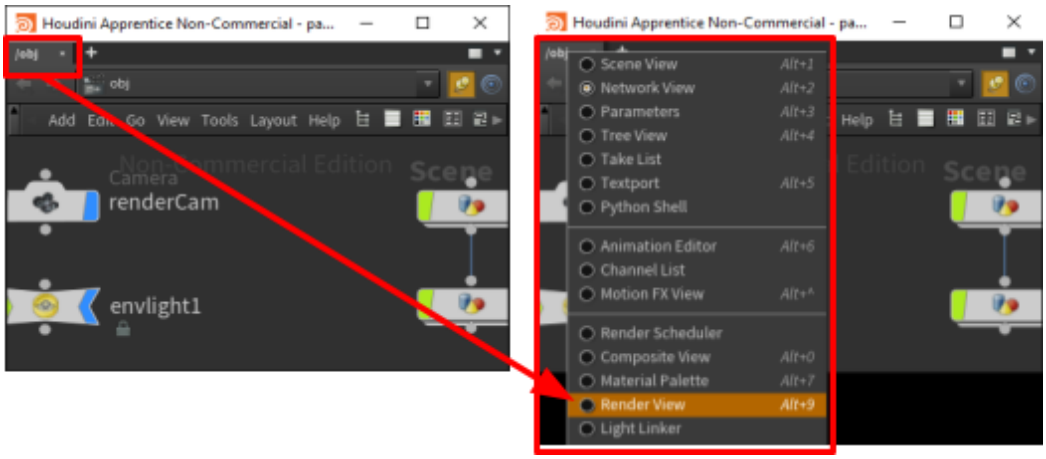
> **NOTE**: Remember that if you can still manipulate your view while the Render Region is going. Use the shortcuts -- Space+LMB/MMB/RMB to rotate/pan/zoom.

Render View

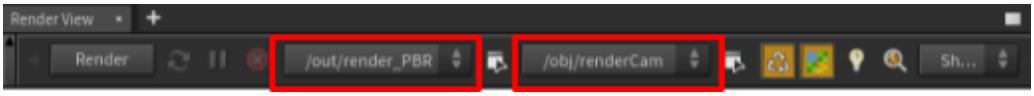
You can do IPR through the Render View. The best way to set this up is to create a new floating window and set it to be a Render View. You can do this by…

1. In the main menu, select Windows -> New Floating Panel

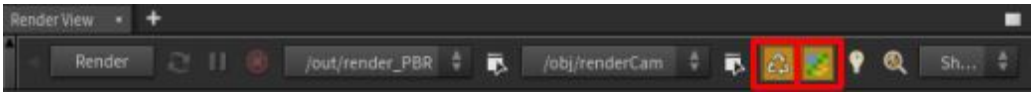
2. In the new floating panel, right-click the top-level tab (there should only be one) and set it to Render View



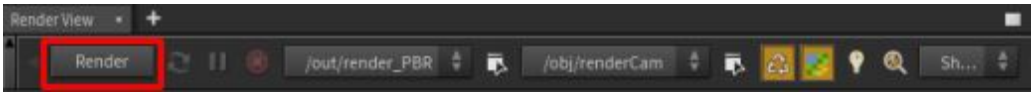
3. Make sure the proper Mantra node and Camera are selected in the toolbar



4. Make sure that Auto-Update and Progressive Rendering are select in the toolbar



5. Click the Render button

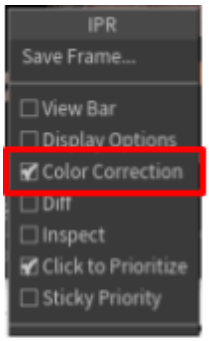


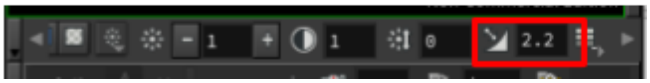
If at any point you want to STOP a render, hit the Stop button in the toolbar. Hitting this button will also stop renders from happening when something's updated.

If at any point you want to PAUSE a render, hit the Pause button in the toolbar. Pausing just pauses the render mid-stream -- you can continue it from the point it paused by hitting hte pause button again.

Gamma Correction

You can set gamma the same way both in the render view and the MPlay. Right click on the render and select Color Correction…





I don't know what's wrong with Houdini but it keeps defaulting the gamma to 1 instead of 2.2. If you click the icon it should automatically set to 2.2. It'll get reverted back the next time you render.

Materials

> **NOTE**: This section was adapted from the main document. It isn't worth adding further detail in here because most of the lessons focused on legacy shaders within Mantra/Houdini. Also, this isn't a renderer anyone uses for anything, so going in depth would be a waste of time. Much of the material stuff is pretty close to Blender/Arnold's material stuff.

Materials in Houdini 16 are handled in the /mat context (Materials) instead of the /shop context (SHader OPerations). The /shop context is still there but I'm not sure what it's used for.

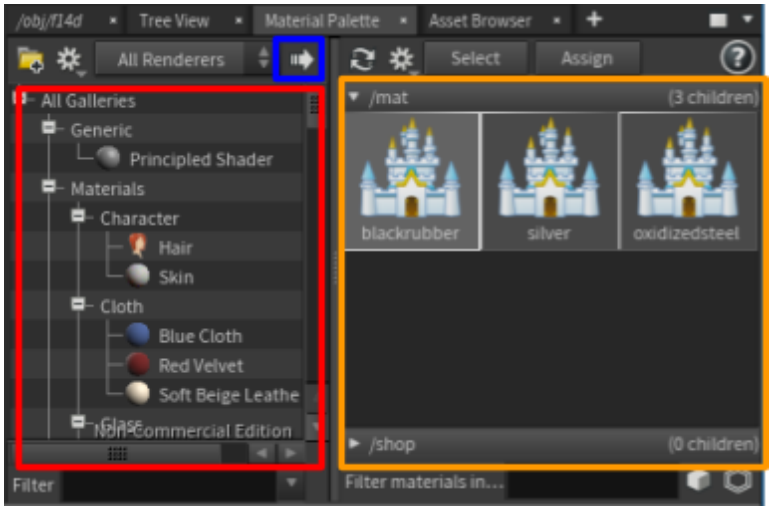
If you try to pull in any of the default materials via the Materials pane, they aren't allowed to go into a /shop context. But, if opening up legacy Houdini files all the materials are still in the /shop context.

Create Materials

You can create materials in the /mat context or via the Material's palette.

Materials Palette View

You can create materials by going to the Materials Palette view (in the same section as the network view when under the Build desktop).



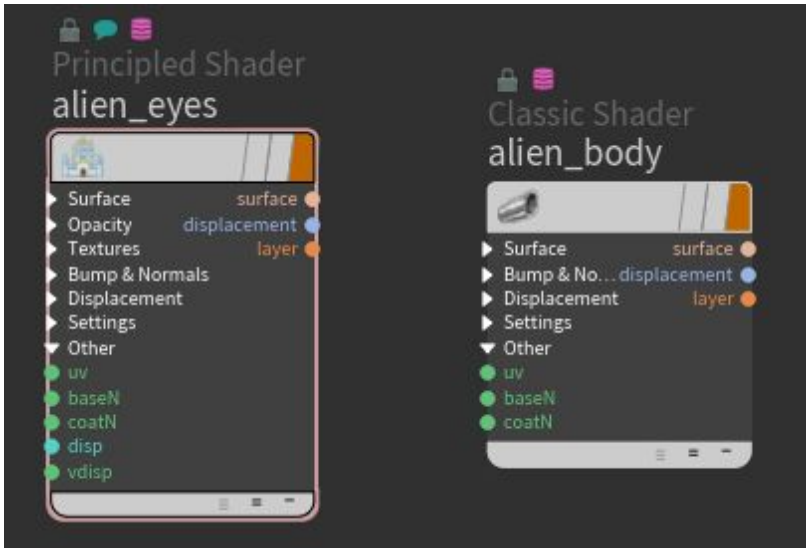
You can select from the left pane, and move over to the right pane by pressing the right arrow or by dragging-and-dropping over. These create the materials for you under the /mat namespace, which you can navigate to in the network view and tweak as you see fit.

> **NOTE:** If you look at bottom left-hand side of right pane, you can see /shop. But,the Materials Palette won't let you move stuff into the /shop namespace. I think the reason for this is that can be moved over is technically a Principled Shader, which can only appear under the /mat context.

A discussion on materials is outside the scope of this document, but these are all Principled Shader (can you load in custom shaders that aren't principled shaders???). Principled shaders are similar to Maya Arnold's shaders or Blender's principled shader: sub-surface scattering, specular, reflectivity, diffuse, etc.. -- all the stuff that makes it easy for artists to make materials.

Network View (/mat Context)

In the network view, you can switch to the /mat context and drop in Principled Shader nodes. If you want, you can also use the legacy Classic Shader here (called the Mantra Surface Shader in older versions of Houdini)...



If you notice, the interface here is very similar to Maya's hypershade instead of other networks inside of Houdini (e.g. dynamics or geometry networks). You can do things here like drop in perlin noise nodes and plug the output to the diffuse or specular.

> **NOTE**: Note the 3 small buttons on the bottom of the nodes… these are exactly the same as Maya's buttons to collapse/expand nodes.

Assign Materials

The following subsections describe how to assign materials.

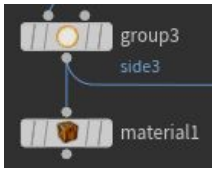
You can technically drag-and-drop the material from the Network View /mat context or the Material Palette view onto the object in the Scene view to assign a material, but that seems to not work a lot of the times.

If it does work, when you drop you'll be prompted with a dropdown that asks if you want to drop on the object or one of the groups within the object (if you dropped on a group?).

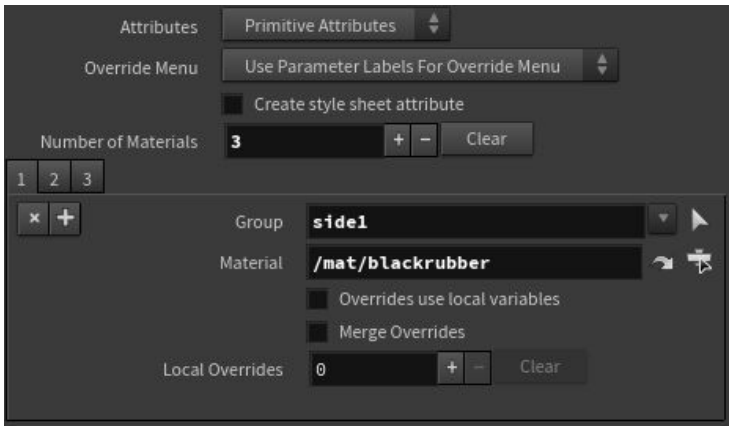
Partial Object (Groups within Object)

> **NOTE**: Need a refresher on groups? Check out the main Houdini document.

It's fairly straight-forward what to do with the Material node. Go into the Network view, into your geometry object, drop a Material node, and hook your geometry into it…



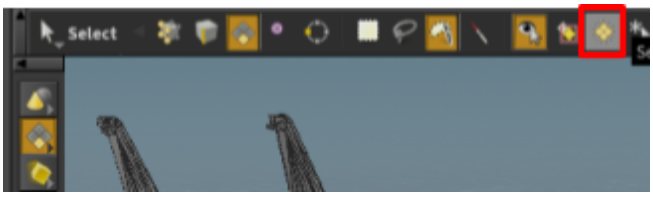
In the parameters pane, choose the components which you want the color to apply to. You can do so by clicking the arrow on the right of the Group. Once you've done that, select the material you want to use by clicking the right-most button next to Material (will open a selection menu of materials under /mat).



Note that you aren't limited to one material. You can add multiple materials for different parts of the geo. In the example above, we have 3 different materials being added to 3 different parts of the geo.

> **NOTE**: You typically would have these groups pre-defined via group nodes (especially for materials). See the Group Nodes section for more information.

> **NOTE**: If you click the arrow never to Group, it'll actually ask for a grouping rather than let you put in arbitrary components. You can turn this off by disabling the group selection toggle. You need to do this every time for Material nodes…



Full Object

In the network view (in the top-level /obj context), select the geometry object you want to apply the material to.

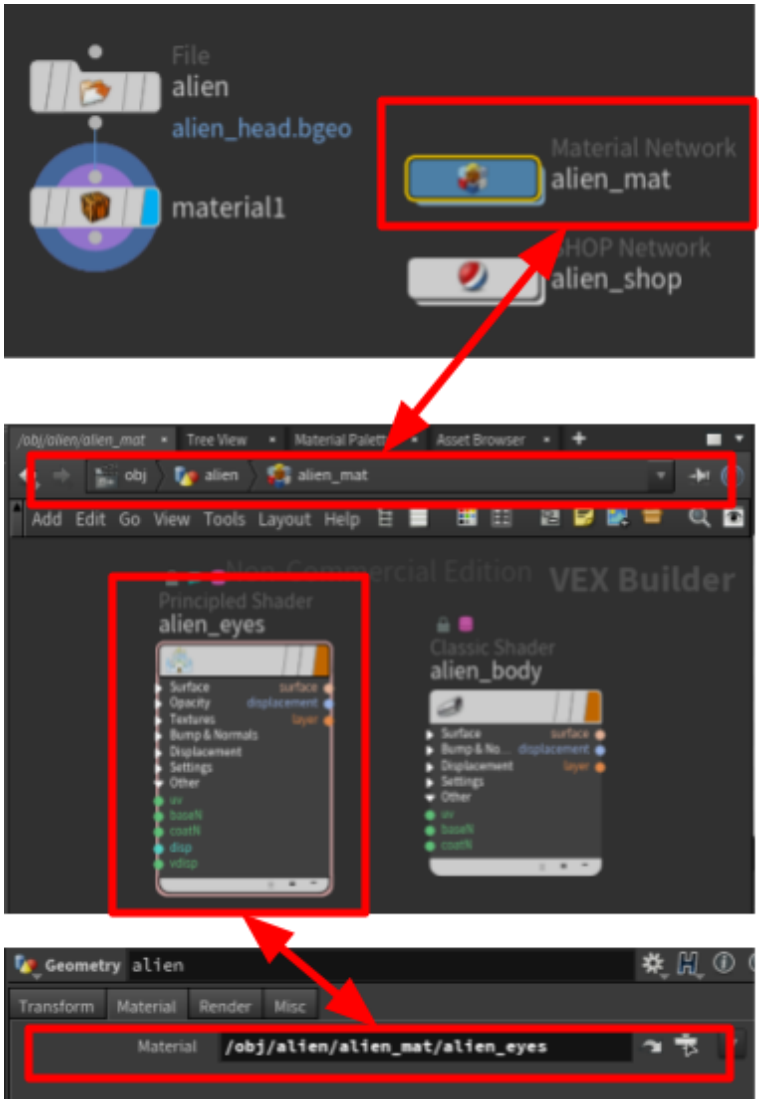
Simply go to the Material tab in the properties pane and select the material…

NOTE: Applying materials at this level will ONLY APPLY TO PARTS OF THE OBJECT THAT DON'T HAVE MATERIALS ALREADY APPLIED. That means that if you've applied materials to certain groups inside the model (via the Material node), those polygons will keep those materials.

Internal Material Networks

You can set up a /mat or /shop context INSIDE your geometry node. There are a lot of reasons why you'd want to do this, but the most important is that you want you bundle your materials and your models together if you're working within a pipeline.

To do so, simply create a Material Network node (or a Shader Network node) inside your geometry node. Once you do that, you can dive into that node and create materials, then reference those materials from your geometry…



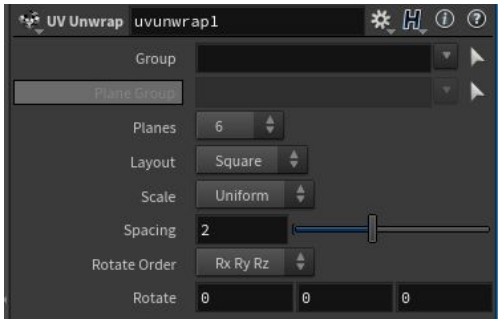
NOTE: Once you create an internal Material Network, it'll be viewable as a section along with /mat in the Material Palette view aswell.

UV Unwrap

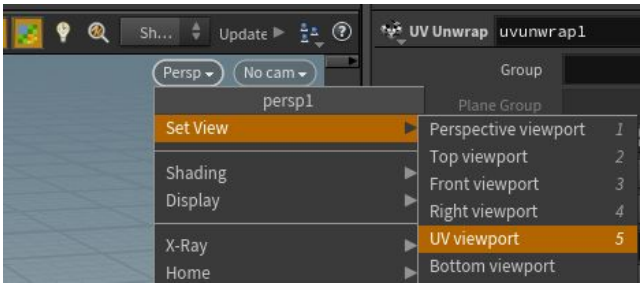
Attempts to generate UVs for the input.

You can add/fix UVs in the network view. Drop a UV unwrap node and connect whateer geometry you want to it…

You can choose how the UVs get applied…



NOTE: To actually see the generated UVs, you can use the Scene view and switch your view from perspective to UV (shortcut is Space+5)…

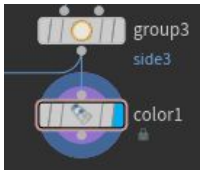


You can also switch to the geometry spreadsheet to see the UV attributes added to your points/vertices/faces/whatever.

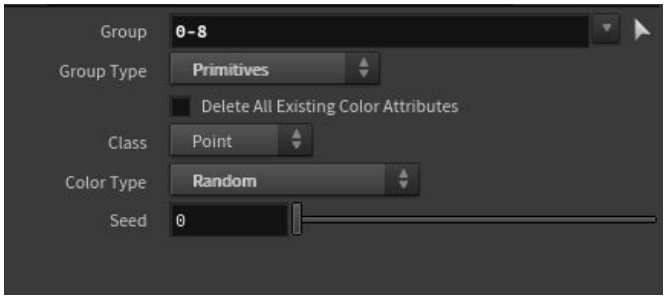
Color Nodes

You can directly apply color(s) to geometry components without going through materials or shaders. When you do this, it mixes the color you select with whatever material/shader is being applied to your geometry.

It's fairly straight-forward what to do with a Color node. Go into your geometry node in the Network view and drop a Color node, then hook your geometry into it…

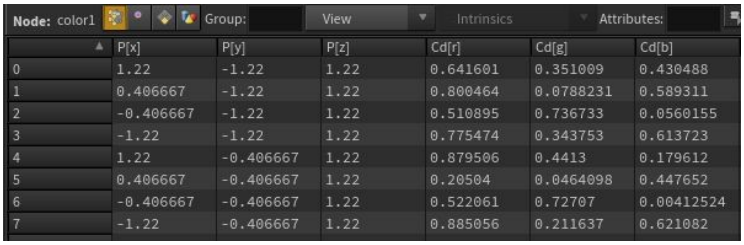


In the parameters pane, choose the components which you want the color to apply to. You can do so by clicking the arrow on the right of the Group.



The other parameters here should be straightforward. Class determines what component type to apply the geometry to (e.g. faces or points or edges or whatever). Color type can be set to Constant or Random (or a few others). Everything after that point will be dependent on what color type was set to.

> **NOTE**: If you go into the geometry spreadsheet, you can see the color show up under attributes for whatever component type you used for Class (Cd is the name of the attribute).



	P[x]	P[y]	P[z]	Cd[r]	Cd[g]	Cd[b]
0	1.22	-1.22	1.22	0.641601	0.351009	0.430488
1	0.406667	-1.22	1.22	0.800464	0.0788231	0.589311
2	-0.406667	-1.22	1.22	0.510895	0.736733	0.0560155
3	-1.22	-1.22	1.22	0.775474	0.343753	0.613723
4	1.22	-0.406667	1.22	0.879506	0.4413	0.179612
5	0.406667	-0.406667	1.22	0.20504	0.0464098	0.447652
6	-0.406667	-0.406667	1.22	0.522061	0.72707	0.00412524
7	-1.22	-0.406667	1.22	0.885056	0.211637	0.621082

Lights

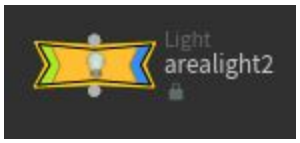
> **NOTE**: This section was copied over from the main document. There's nothing more worth adding here because this isn't a renderer anyone uses for anything.

Houdini (mantra) provides a bunch of lights that are very similar to Arnold and Maya lights…

- Point Light → emits light equally in all directions
- Area Light → a rectangle/disk/whatever that emits light
- Geometry Light → similar to having a polygon mesh in Arnold that you set to emit light

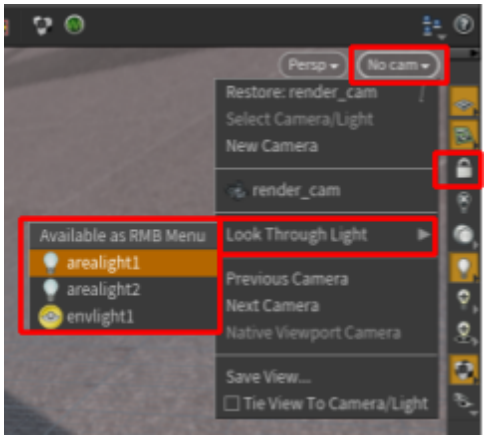
- Distant Light → parallel rays, as if the sun were shining
- Environment Light → provide an HDR image and get light emitted based on that -- similar to mentalray's image based lighting or Arnold's skydome light
- Sky Light → how is this different from the environment light above???

Add them to your scene and move them around just like any other scene node. You can find them in the Light shelf (2nd shelf set in the build desktop) or via the tab menu.



An easy to position a light is through the scene view. You can make it so as if you're looking through the light, and orient it as you move around your scene. To do this…

1. Select the light in the camera dropdown on the top-right of the scene view (just below the top toolbar)
2. Toggle the lock camera/light lock button on
3. Orient your view around, just as normally would
4. Toggle the lock camera/light lock button off



Almost all lights come with many properties that are similar to Arnold. They probably work just like Arnold does. The properties panel has sections for increasing the light sampling (if stuff comes out too grainy) and setting intensity/exposure property and a bunch of other stuff.

Intensity and exposure seem to be the main control properties here. Here's the description of it from my Arnold notes…

Intensity	Intensity of your light. This works the same way as a regular Maya light. The higher your intensity is, the more light will be given off.

Exposure	Intensity of your light. This is different from the above setting in that it's measured in f-stops (just like real photography). It's designed to help you interact with real cinematographers. For example, the cinematographer may come and ask the artist to increase something by half a stop -- you can do that directly here in this setting. This is exponential… each time you go up by 1, it doubles the intensity of your light. **NOTE**: This is linked to the intensity in that the exposure uses the current intensity value as the basis for its setup.