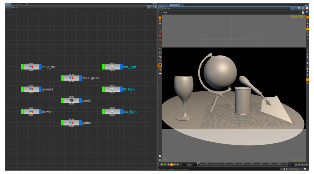
TEXTURING & RENDER PASS SETUP

Open **globe_scene_begin.hipnc**. This scene contains some simple objects, a camera and a three point lighting setup. This scene will be utilised for demonstrating Material Palette based texturing and a simple render pass setup.

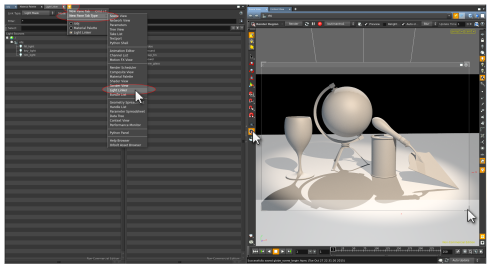


CREATING A MANTRA OUPUT DRIVER

From the **Render Menu**, select **Create Render Node > Mantra - PBR**. This will create a **Mantra ROP** for **Physical Based Rendering** at the **Outputs** Level of Houdini.

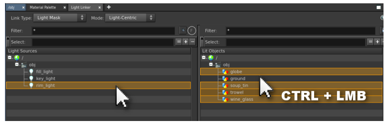
LIGHT AND SHADOW LINKING

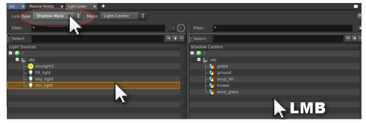
When a **Render Region Preview** is drawn **over** the **Scene View**, the three-point lighting setup is currently creating a **messy mix of shadow and lighting** information. This can be calmed down through **Light and Shadow Linking**.



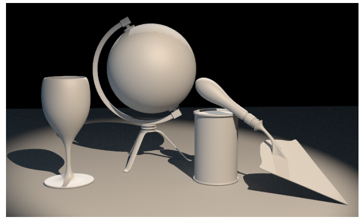
Over the **Network Editor** activate a **Light Linker** as a **New Pane Tab Type**.

Un-stow the **Light Sources** and **Lit Objects listings**, **select** the **rim_light** and **CTRL + LMB** the **ground object**. This will stop the key_light from illuminating the ground.





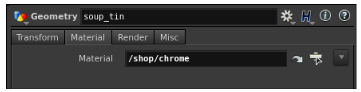
Activate the **Shadow Mask**, and **select** the **Rim Light**. **LMB off** the **Shadow Casters** listing will **deselect all the scene objects** and **stop** the **rim light from casting shadows**.



NOTE: The **Light Linker Pane** can also be used for **Reflection Linking**.

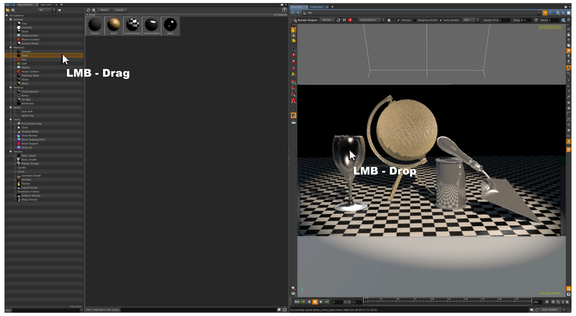
THE MATERIAL PALETTE

In the **Network Editor**, activate the **Material Palette Tab**. From the **All Galleries** list, **LMB DRAG** a **Chrome Material** directly onto the **soup_tin object** in the **Viewer**. This will automatically create a Chrome Material node at the **SHOP Level** of Houdini and will assign each material to an object through its **Object Level Material parameter**.



The **Render Region Preview** will also **update** due to assigning this material to an object.

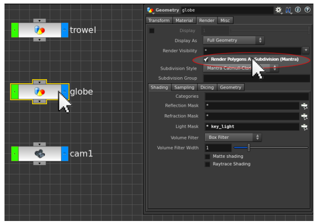
Repeat this operation again, this time assigning a **Glass Material** to the **wine_glass object**, and a **Stainless Steel Material** onto the **trowel object**, a **Checkerboard Material** onto the **ground object**, and a **Wood Material** onto the **globe object**.

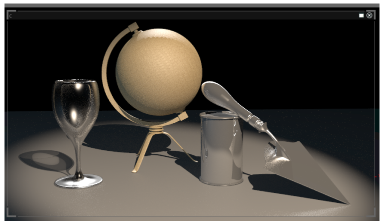


The **Render Region Preview** reveals the Material assignment done so far, as well as **highlighting** some **jagged shadows** on the **globe object**.

FIXING THE GLOBE SHADOWS

The globe model is currently conflicting with the wood material. Currently Houdini does not quite know how this object should be rendered. A **quick fix** is to activate the **Render Polygons As Subdivision (Mantra) option** found under the **Render** tab of the **globe** object's **parameters**. This will correct the overall rendering of the globe.

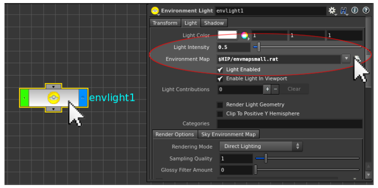




ADDING AN ENVIRONMENT LIGHT

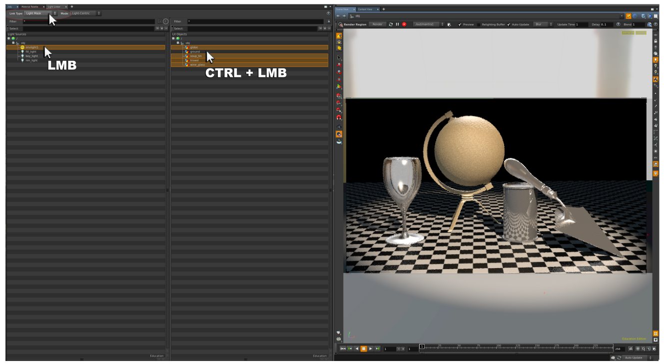
Return to **Object Level**, and in the **Network Editor**, create an **Environment Light**. In the **Light** section of its **parameters** specify:

Light Intensity	**0.5**
Environment Map	**$HIP/envmapsmall.rat**



NOTE: A Background Plate could also be used instead of a polar environment image.

The **influence** of the **Environment Light** on the **ground object** can also be **deactivated** using the **Light Mask** of the **Light Linker**. Now the Render Region preview reveals refractions and reflections taking place in the ground and metal objects.

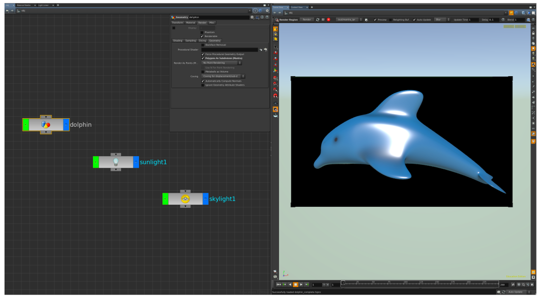


IMPORTANT NOTE: Some legacy Materials have their own Environment Map parameters that can be found on the material node itself. DO NOT USE THESE PARAMETERS. USE AN ENVIRONMENT LIGHT INSTEAD.

ENVIRONMENT & TEXTURE MAP FORMATS

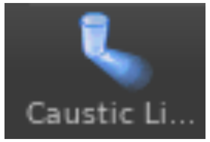
Houdini will accept a number of image formats; however for optimum rendering efficiency the Houdini native **.rat file** format should be used. Ordinary image files can be converted into .rat files, by opening them in **IMG Level** of **Houdini** and re-saving them using the **.rat** extension.

PLEASE GO THROUGH THE DOLPHIN TEXTURING HOMEWORK ASSOCIATED WITH THIS LECTURE TO LEARN HOW TO CONVERT TEXTURES INTO .RAT FILES CORRECTLY.

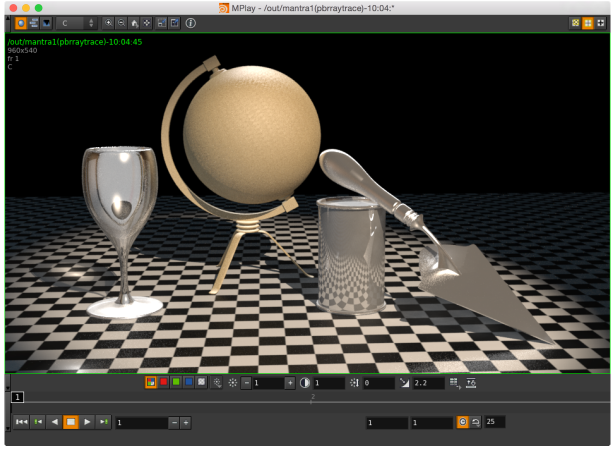


ADDING CAUSTICS TO THE SCENE

As projected light caustics for the wine glass are also required, a **Caustics Light** with a **Light Intensity** value of **0.5** can also be added to the scene using the **Lights and Camera Shelf**.



By default the **Caustics Light** will **assign caustics** to the **entire scene**, but **won't appear** in the **Render Region Preview** due to calculation times. A **formal render** of the scene to **MPlay** reveals the caustics.



NOTE: When creating formal renders, the **Override Camera Resolution** option can be activated on the **Mantra PBR node** (**mantra1**) found at **Outputs Level**. This can for example, half or third the HD size of the output for fast rendering.

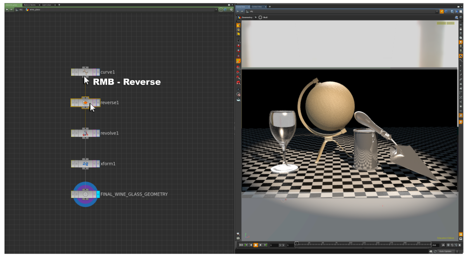
The **parameters** of the Caustics Light can be modified further when all the texturing of the scene is complete; and Light Linking can be used to control which objects create caustics.

NOTE: PBR Rendering automatically generates **bounce light** (Global Illumination). The **GI Light button** found on the **Lights and Cameras Shelf** will either add bounce light to a non-PBR render engine; or can be used to **amplify the effect of** GI for PBR Renders.

See file globe_scene_stage1.hipnc

REFINING THE SCENE AESTHETIC – FIXING THE GLASS

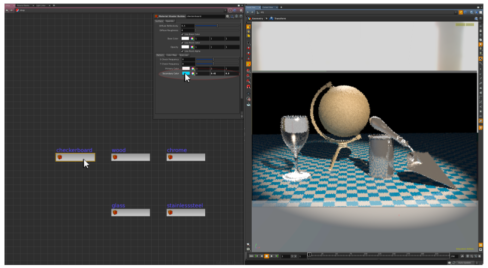
At present the **Glass Material** assigned to the **wine_glass object** is creating a **thick glass aesthetic**.



A **naturalised aesthetic** can be achieved **either** by **reversing the curve** creating the wine_glass (by inserting a **Reverse SOP** after the Curve SOP in the wine_glass geometry network); **or** by **swapping** over the **values** of the **Inside and Outside Index of Refraction parameters** found in the **Glass Material**. **Either solution will work**.

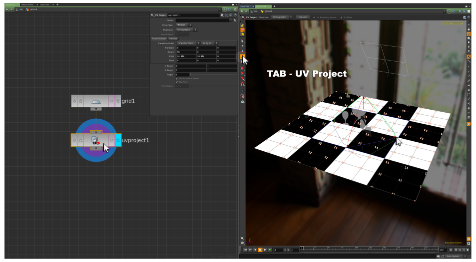
REFINING THE GROUND

At **SHOP Level**, locate the **Checkerboard Material**, and in its **parameters** adjust the **Secondary Color parameter** to a light blue.



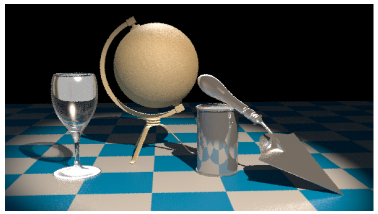
In order to gain full control over the placement of the checker pattern itself, the ground geometry can be projected into UV Space.

Locate the **Grid SOP inside** the **ground object**, and with the mouse over the **Context View**, press **TAB** and type **UV Project**.



This will append a UV Project SOP to the Grid SOP and activate interactive handles to control the placement of the UV Square over the grid geometry. The **hotkey e** (**with the mouse over the Viewer**) can be used to activate the **Scale Handle** of the UV Project SOP. **Interactively scale down** the size of the Blue Edge UV Square so that it just encompasses the main geometry of the scene.

NOTE: If a **UV Project** is **invoked through** the **Viewer**, the **UV Square** (**represented** in the Viewer by the **blue edge**) will be **automatically set to cover the entire grid** and will project as **Vertices** rather than **Points**.



The **Render Region Preview** of the **Scene View** can be used to check the resulting aesthetic.

REFINING THE TROWEL

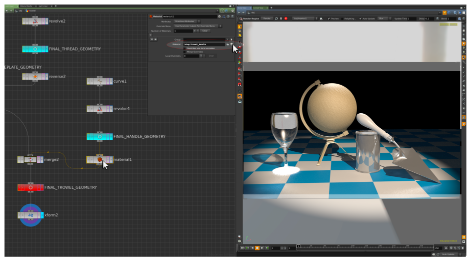
At present the trowel object is entirely textured with the stainless_steel material. The handle however should be a different material. Switch once more to the **Material Palette** and **LMB drag** and **drop** a **Mantra Surface Material** into the **/shop palette area**. A Mantra Surface Material can be configured to represent a wide number of surfaces and aesthetics.

Switch back to a **Network Editor**, and at **SHOP Level** and rename the **Mantra Surface Material** to **trowel_handle**.

ASSIGNING TEXTURES TO SPECIFIC GEOMETRY

Inside the **trowel object**, locate the **FINAL_HANDLE_GEOMETRY Null SOP**. Append to this node a **Material SOP**. In its **parameters** specify:

Material **/shop/trowel_handle**



The effect of both the **stainlesssteel material** and the **trowel_handle material** can now be seen.

Switch the **Network Editor** to the **SHOP Level** of Houdini, and locate the **trowel_handle material**. Modify its **parameters** to:

Diffuse >

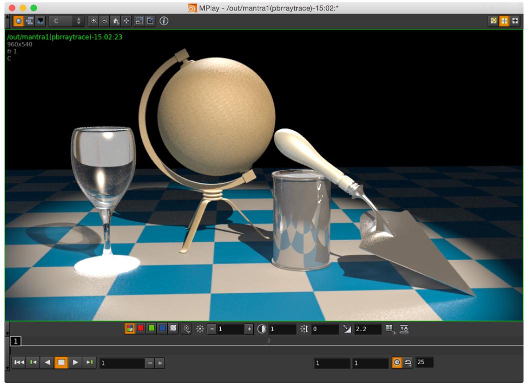
Base Color **0.9** **0.9** **0.75**

Reflect > Base >

Intensity **0.5**

Roughness Amount **0.5**

This will create a suitably shiny ivory type material for the trowel handle.

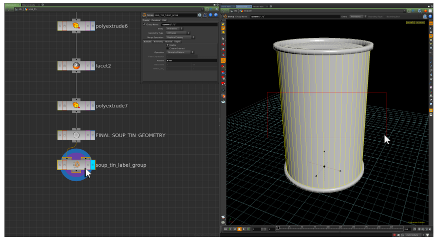


NOTE: As the trowel_handle material is a uniform procedural texture it does not require UV projection.

See file globe_scene_stage2.hip

REFINING THE SOUP TIN

Locate the **FINAL_SOUP_TIN_GEOMETRY Null SOP**, and in the **Context View** select the faces of the tin can that make the label area and activate a **Group (SOP) Operation**. **Rename** and the **Group SOP** node name to **soup_tin_label_group**.



Switch over to the **Material Palette** and **LMB** drag and drop a **Mantra Surface Material** into the **/shop palette area**.

At **SHOP Level**, locate this new material and rename it to **soup_tin_label**. In its **parameters** specify:

Diffuse >

☑ **Use Map**

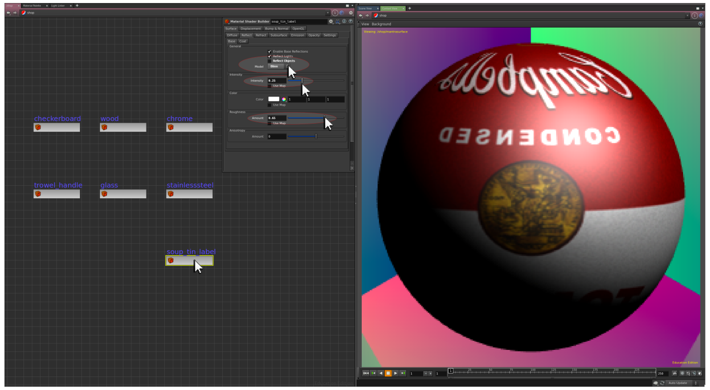
Map **$HIP/Soup_square.rat**

Reflect > Base >

■ **Reflect Objects**

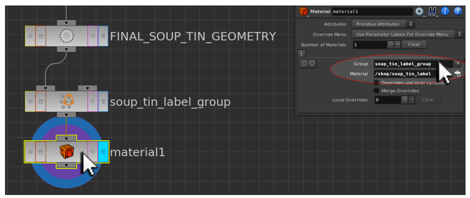
Model	**Blinn**
Intensity	**0.25**
Roughness	**0.65**

This will assign a diffuse texture to the Material and set the sheen of the material to a paper aesthetic.



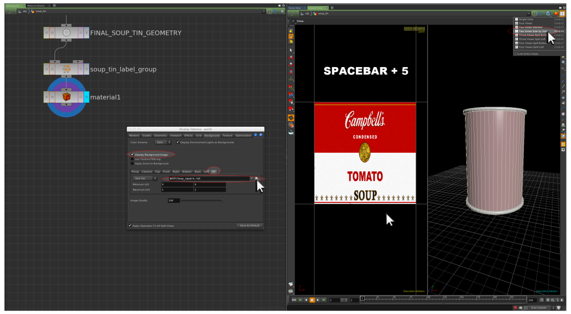
At the **soup_tin Geometry Level** append a **Material SOP** to the **Group SOP**. In its **parameters** specify:

Group	**soup_tin_label_group**
Material	**/shop/soup_tin_label**



This will assign the label material to the geometry group. A render of the soup tin reveals that each face of the soup tin label area is being textured with the soup tin label. **Projecting** the **label geometry** into **UV Space** can **rectify this**.

Using the **Viewport Layout Button**, assign **Two Views Side by Side** as the **Context Viewer display**. Activate the left hand side View to a **UV Viewport** by pressing **SPACEBAR + 5** with the mouse over the left hand side View. The left hand side view itself can be set as the **active View** by pressing **n** with the mouse over the left hand side view.

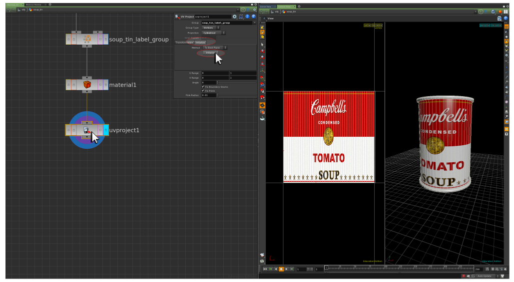


Using the **Viewer's Display Options**, the **Soup_square.rat** image can be loaded in as an image for the UV Square. Displaying the texture map within the UV Square will make creating the UVs more understandable.

To the **Material SOP** append a **UV Project SOP**. By default this will produce an Orthographic projection of the geometry into the UV Square. In the **parameters** for the UV Project SOP **specify**:

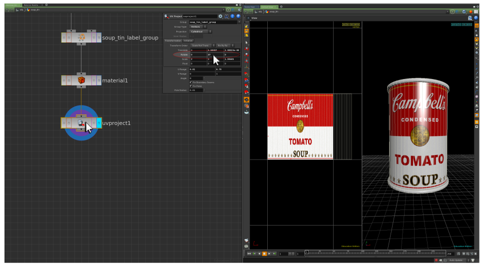
Group	**soup_tin_label_group**
Group Type	**Vertices**
Projection	**Cylindrical**

From the **Initialize** section of the **parameters LMB** the **Initialize button**. This will move the projection to where Houdini thinks it should be based upon the grouped geometry.

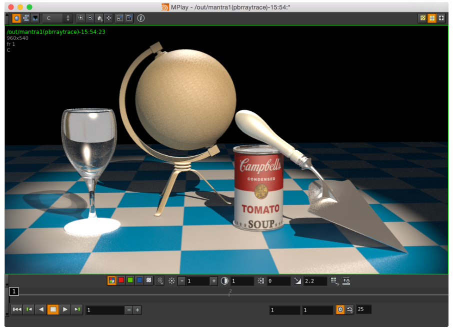


When the soup_tin geometry is examined in the Perspective View, the texturing works; however the **label** is a little **too stretched**. This can be corrected by adjusting the **U Range parameter** of the **UV Project to**:

U Range	**0.01**	**0.79**



Adjusting the upper **U Range Value** will have an effect on the geometry's projection into the UV Square. This parameter adjustment will refine the aesthetic of the label projection. When modifying this parameter **be aware of the texturing seam generated** at the back of the **soup_tin geometry**. This seam will be made invisible with the correct value assigned. The **Rotate Y** Parameter located under the **Transformation** section of the **UV Project SOP** parameters can also be adjusted to rotate the scaled label into the correct position.

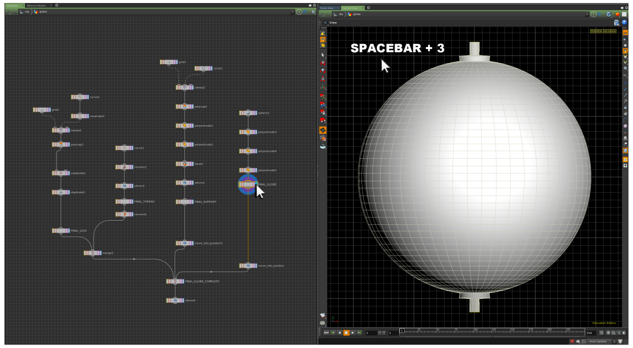


As before, a render of the scene can be generated to check the final aesthetic.

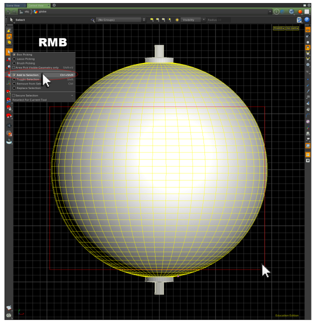
See globe_scene_stage3.hip

REFINING THE GLOBE

Go inside the globe object, and locate the **FINAL_GLOBE Null SOP**. Activate the **Display/Render flag** to this node. Set the **Context View** to **Hide Other Objects**, so that the geometry is clearly visible. With the mouse over the Viewer, press **SPACEBAR + 3** to set the View to a **Front Orthographic View**.

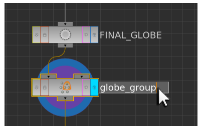


In this view, interactively drag select and group all of the faces of the globe itself (excluding the parts which fix the globe to the stand). If any faces have been missed when creating this new group, the **Select button** has the **RMB** option to **reselect the geometry for the current operation**. Also, these **RMB select options** can control for example if a **selection is added to**, **replaced** or **subtracted** from the original selection.



Pressing **SPACEBAR + 3 again**, will set the **Viewer** to a **Back Orthographic View**, allowing all of the **back faces** of the **globe** to also be **selected**.

NOTE: By **default**, **Houdini** now **only selects visible geometry**. This behaviour can be changed by **RMB** on the **Geometry Type Selection button** and **deactivating** the **Area Select Visible Geometry Only option**.



With the faces of the globe selected, activate a **Group SOP** in the **Viewer**. **Rename** the resulting **Group SOP node** in the Network Editor to **globe_group**

CREATING THE GLOBE MATERIAL

Switch over to the Material Palette and **LMB** drag and drop a **Mantra Surface Material** into the **/shop** palette area.

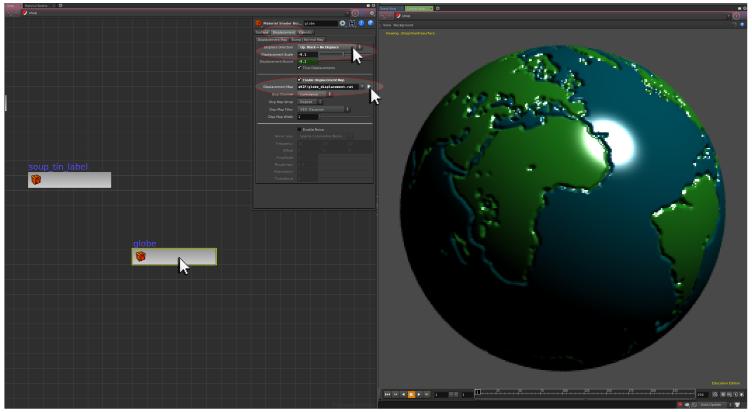
The Mantra Surface Material can be utilised for both surface and displacement shading. In the files for this lesson are two texture maps which can be assigned to the globe. One returns colour information for shading purposes, the other contains black and white information for displacement purposes.

globe_colour.rat

globe_displacement.rat

Locate this new **Mantra Surface Material** node in the **SHOP Level** of Houdini and rename it to **globe**. Under the **Diffuse section** of the **parameters**, activate the **Use Color Map** toggle option, and using the **File Chooser** button read in the **globe_colour.rat** image.

Under the **Displacement section** of the **parameters** activate the **Map-Based Displacement** option, and load into the Displacement Map parameter the **globe_displacement.rat** image file.

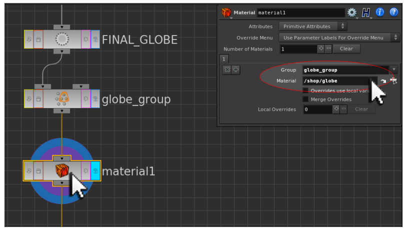


Specify a Displace Direction of up: **black = no displace**, and specify an **Overall Scale** for the displacement of **-0.1**.

The configured material can be examined in the Material Ball View to see the effect of combining both surface and displacement shading. Return back to the **Geometry Level** of the **globe object**. Here append to the **globe Group SOP** a **Material SOP**. In the **parameters** for the Material SOP specify:

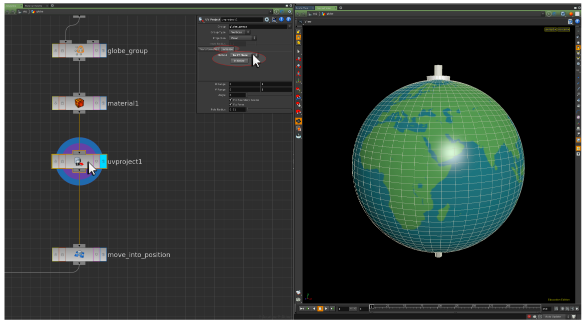
Group	**globe_group**
Material	**/shop/globe**

Use the **Operator Chooser button** to set the Material parameter to point to the globe material.



The globe_group geometry can now be projected into UV Space so that the material can be seen and rendered correctly. To the **Material SOP** append a **UV Project SOP**. In the **parameters** specify:

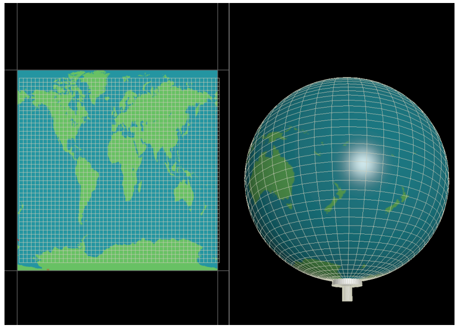
Group	**globe_group**
Group Type	**Vertices**
Projection	**Polar**



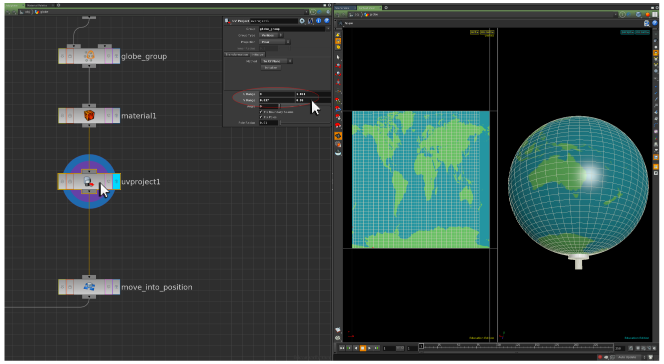
Under the **Initialize** section of the **parameters** specify:

Method	**To XY Plane**

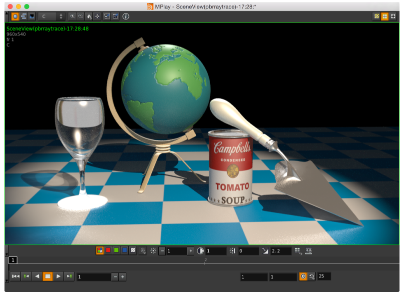
Finally press the **Initialize** button to map the projection onto the geometry.



Examination of the both the **Viewer** and the UV Editor reveals that there are **two New Zealands** and that the **projection** into UV space is not **filling the globe image.**
As with the placement of the soup_tin label, the **U and V Range parameters** of the **UV Project SOP** can be modified to correct this.

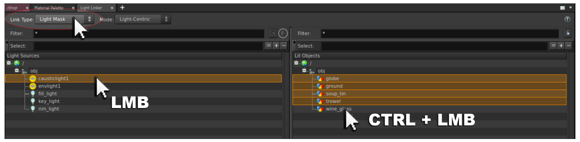


With the texturing of the globe complete, the Display and Render Flag can be reset to the end of the network, and the globe material aesthetic can be adjusted accordingly.

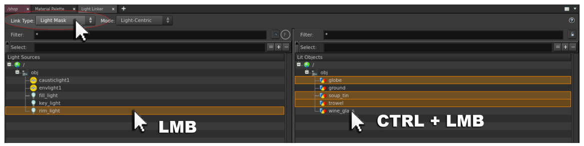


FINAL FIXES

Currently the **base** of the **wine_glass** object is **whiting out** in the **render**. There are **two factors causing this**. Firstly, **the rim_light** and secondly **the caustics_light**. **Removing** the **influence** of **both** of these lights from the wine_glass object **will create the naturalistic aesthetic** expected.



In the **Light Mask section** of the **Light Linker**, select the **caustics_light** and **CTRL+LMB** the **wine_glass object** to deactivate it from this light.



Next select the **rim_light** from the **Light Source list**, and **CTRL+LMB** the **wine_glass** object to deactivate it from this light.

NOTE: As the **Glass Material** has **Faux Caustics enabled**, the **internal caustic information** of the **wine glass** will still be present. As the **caustics_light** is still **interacting with all scene objects** but **not illuminating** the **internal structure** of the **wine glass**; the wine_glass will still be used to **calculate** the effect of caustics in the **wine_glass shadow**.

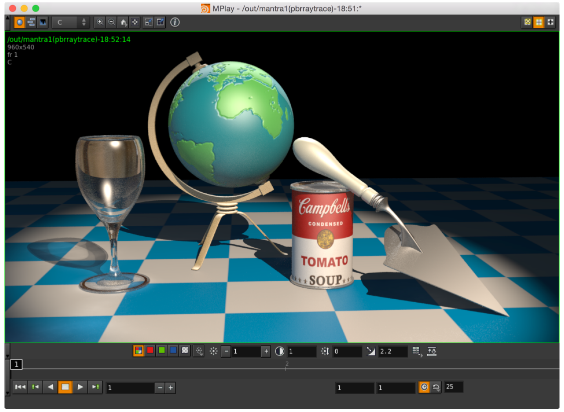
This can be **verified** in the render by **temporarily bypassing** the **Reverse SOP** used to correct the **refraction** of the **wine_glass Material**. With the **Reverse SOP in place**, the current **Intensity parameter** of the **caustics_light isn't strong enough** to **cast** a **direct caustic hot spot** on the **ground**; but caustics on the ground are still subtlety present around the base of the wine glass geometry.

OTHER FIXES

Similarly the **lights** and **materials** of the scene can also be **further adjusted** to get the best **visual result possible**.

For **example**, the **Environment Map** of the Environment Light **can be rotated** so that a **less bright region** of the Environment Map will **appear behind the wine_glass**.

Similarly, the **stainlesssteel Material** can be **naturalised**, and the **diffuse intensity** of the **soup_tin label** increased slightly.



The scene can be rendered to see the final result. **See file globe_scene_stage4.hip**

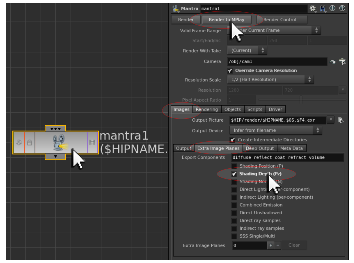
GENERATING RENDER PASSES

Materials can be **directly outputted** as **render passes as well as** the **final image**. A **Render Pass** contains the **sub-image elements** that make up the final image (for example a **Reflections Render Pass** would hold all of the **reflection information** of a scene).

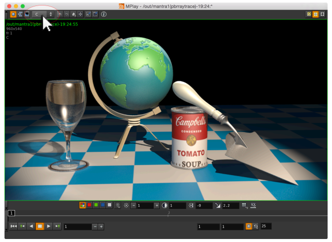
Render passes can be **recombined** in the **composite** to **rebuild the image** as per the **normal render**. The **advantage** of render passes, is that **sub-image elements** can be **adjusted individually** in the composite to really help bring the image to life.

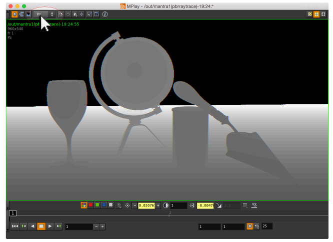
When using **Mantra PBR** (**Physical Based Rendering**), **Houdini** can output **a number of render passes**. This can be done on the **Mantra1 ROP** controlling the final output of the scene.

Under the **Images > Extra Image Planes** section of the parameters for **mantra1**, **activate** the **Shading Depth (Pz) option**.

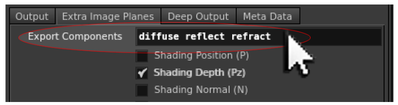


When the scene is rendered to MPlay, there are now **two images rendered** as **layers**; the **normal beauty pass**, and a **depth pass** of the scene.





The **generation** of **render passes** is also controlled by the **Export Components list**. By default, render passes will be generated for the **diffuse**, **reflect**, **coat**, **refract** and **volume components of materials**.



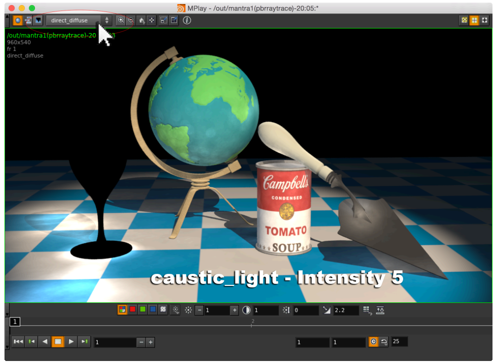
As the globe scene does not contain any **coat** or **volume** information, **these Export Components can be removed** from the list to prevent empty image planes being generated when other render passes are activated.

From the Export Components options, activate **Direct lighting (per component)**. This will tell Houdini to output all the **direct lighting information** of the scene into separate image planes for the diffuse, reflect and refract components. When the **scene** is **rendered to MPlay**, the following image planes are also generated:

direct_diffuse – geometry colour; scene lighting; scene shadows
direct_reflect – geometry specular highlights
direct_refract – empty (as the scene lighting does not directly refract light)

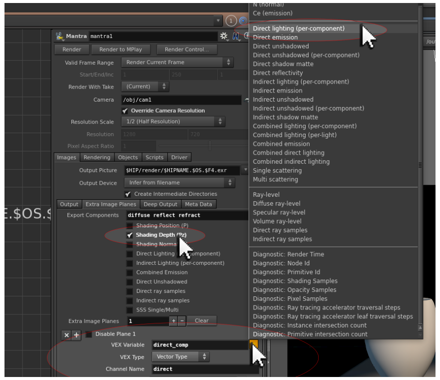
CONTROLLING CAUSTICS - ACTIVATING PER LIGHT RENDER PASSES

As the **globe scene** contains **caustics**, it is a good idea to **separate out all caustics information** in a **separate render pass**. **Currently** the **direct_diffuse** image plane also **contains** the **scene caustics hard-baked** into its render. This can be **verified** by **increasing** the **Intensity parameter** of the **caustics_light** to **5**.

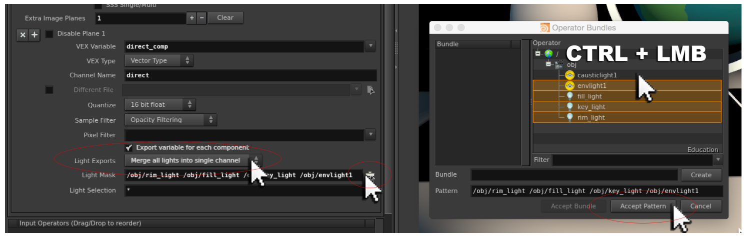


In order to ensure that the **caustic_light** is **not contributing** to these render passes, Direct Lighting image plane need to be **called individually** rather than by using the **Export Component Options list**. This will allow for individual lights to be activated for the render passes required.

In the **Export Components Options list**; **deactivate all** of the **tick-boxes apart** from **Shading Depth (Pz)**, and instead choose **Direct lighting (per component)** from the **VEX Variable parameter** associated with **Extra Image Plane 1**.

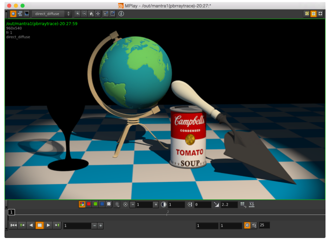


NOTE: The **VEX Variable list**, is a **full list** of **all render passes** possible, **with** the **ability** to **control** render **passes** on a **per light basis**.



In the **Extra Image Plane 1 options**, activate the **Light Exports parameter** as **Merge all lights into single channel**, and then use the **Light Mask parameter** to **CTRL + LMB deselect** the **caustics_light** from the scene lights list. This will remove any influence of the caustic light from the direct render passes.

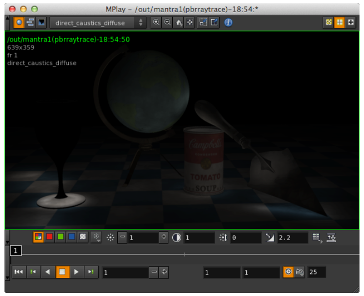
When the **scene** is **rendered again**, the **direct_diffuse render pass** no longer contains the caustic lighting of the scene.



CREATING A CAUSTICS RENDER PASS

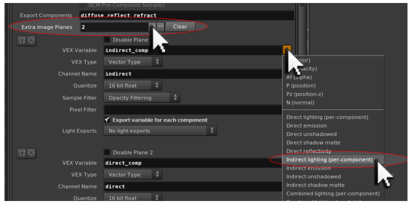
Activate a **new Extra Image Plane**, and specify a **VEX Variable** of **Combined Lighting (per light)**. This plane can be used to capture both Direct and Indirect Caustics information together. In the **Channel Name parameter** type **caustics** (this is a bespoke name to help identify this render pass).

In the **Light Exports parameter** will automatically configure itself to **Export variable for each light**; so use the **Light Mask parameter** to select only the **caustics light**. When the scene is rendered again, the **caustics** render pass is generated.



CREATING INDIRECT LIGHTING RENDER PASSES

In order to capture all of the **indirect lighting information**, activate a new **Extra Image Plane** and specify the **VEX Variable** as **Indirect lighting (per component)**.



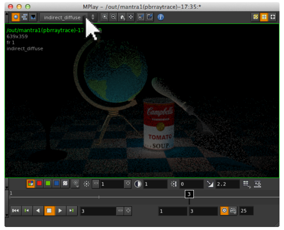
As before, activate the **Light Exports parameter** as **Merge all lights into single channel**, and then use the **Light Mask parameter** to **CTRL + LMB deselect** the **caustic_light** from the scene lights list. This will remove any influence of the caustic light from the indirect render passes.

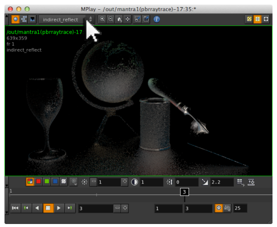
When the **scene** is **rendered again**, **alongside** the **Depth (Pz)**, **direct render passes**, and **caustics pass** the following **indirect render passes** have been generated:

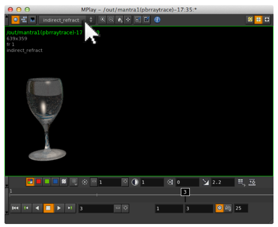
indirect_diffuse – the bounce light of the scene

indirect_reflect – the secondary reflections of the scene

indirect refract – the indirect refraction information of the scene



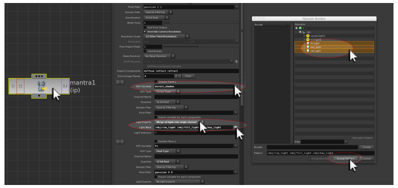


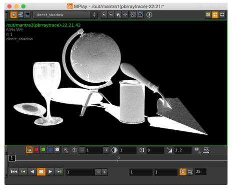


SHADOW PASSES

In order to control the scene shadows in the composite, two additional utility render passes can be activated to capture both the direct and indirect shadow information of the scene.

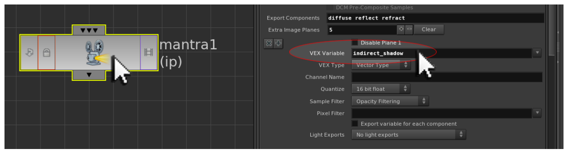
Activate a **fourth Extra Image Plane**, and specify a **VEX Variable** of **Direct shadow matte**. As before, activate the **Lights Export option** as **Merge all lights into single channel**, and then use the **Light Mask parameter** to **CTRL + LMB deselect** the **caustics_light** from the scene lights list.

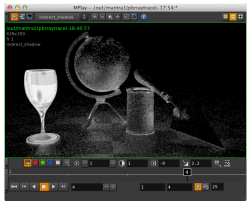




When the scene is rendered again, the shadow information of the scene is rendered alongside the other render passes.

Activate a **fifth Extra Image Plane** and specify a **VEX Variable** of **Indirect shadow matte**. As before, activate the **Lights Export option** as **Merge all lights into single channel**, and then use the **Light Mask parameter** to **CTRL + LMB deselect** the **caustics_light** from the scene lights list.

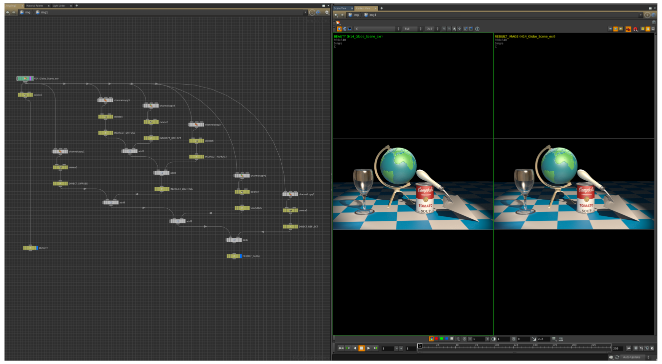




When the scene is rendered again, the indirect shadow information is captured as a utility render pass.

CHECKING THE RENDER PASSES

If a **render of the scene** is **saved** out to **disk** from **MPlay** as a **.exr file**, the **main render passes** can be used to **rebuild an exact copy** of the **main beauty render**.



See file globe_scene_stage5.hipnc

REFINING THE RENDER AESTHETIC

When all the aspects of texturing and render pass setup has been completed, the quality of the render can be improved. Improving the render quality should take place using a half of third resolution rendered image, before a full resolution image is outputted. This is so render quality improvements can be checked without excessive render times.

In the **parameters** for the **Mantra1 ROP**, specify:

Rendering > Sampling >

Min Ray Samples	**16**
Max Ray Samples	**32**

This will reduce any white speckles, and the level of render noise in the final image.

GETTING THE BEST RENDERS

Increasing values of the **Rendering Parameters** of a **Mantra PBR node** (or other **sampling parameters** found on **lights**) will inevitably result in longer render times. Therefore, **experimentation** with these **parameters** is **necessary** to find the **optimum trade off** between **render time** and **render quality**.

Some useful **parameters** to play with are:

Rendering > Sampling > Pixel Samples
• Increasing this parameter should be seen as a last resort when improving the quality of the image due to the increase in render times it produces.
• Pixel Samples will globally create over-sampling of a scene, where a giant image (the camera resolution x pixel sample value - 4 x 4, 8 x 8, or 16 x 16) is internally generated to gather as much colour information as possible, then downsized back to camera resolution to create the final image.

Rendering > Limits > Color Limit
Reducing this parameter can also **reduce white speckles** in the render.

Rendering > Limits > Reflection Limit
This parameter will control the number of times a light ray reflective bounces around a scene.

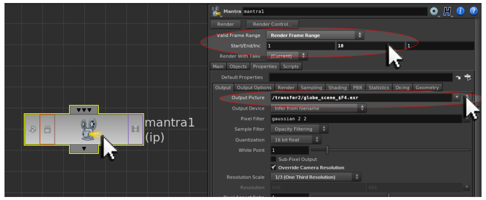
Rendering > Limits > Refraction Limit
This parameter will control the number of times a light ray refractive bounces around a scene.

Environment Light > Render Options > Sampling Quality
This parameter can help reduce noise created by environment lighting.

RENDERING PASSES AS IMAGE FILES & SEQUENCES

The final image plus its render passes can be rendered out to disk as a **.exr** file image. The **.exr format** is **similar** in many ways to the **Adobe Photoshop .psd format** where the different layers of the image remain as individual separate layers.

To activate a **Frame Range**, modify the **Valid Frame Range** parameter to **Render Frame Range**. By default, the Start and End frame parameters are **bound to the timeline** as a result of the variables **$FSTART** and **$FEND**. These **variables** can be **removed** by **RMB** on this parameter **and choosing Delete Channels**. Specific start and end frame values can then be entered.



The **Output Picture** parameter can determine a render file location on disk. For example:

/transfer2/globe_scene_$F4.exr

This will output a file called globe_scene_0001.exr where $F4 is replaced by a padded frame number (the current frame). The $F(Number) option should also be specified in any bespoke photon map generation and Shadow Depth Map generation for animated scenes and objects.

With the current frame set to 1, **$F** can be set to return the following **frame-padding options**:

$F	**1**	**$F2**	**01**
$F3	**001**	**$F4**	**0001**

AND FINALLY…

- **RENDER EVERYTHING FROM HOUDINI AS AN .EXR FILE.**

- **REMEMBER TO DEACTIVATE THE OVERRIDE CAMERA RESOLUTION MANTRA OPTION TO GET THE FINAL FULL SIZE RENDER.**

- **REMEMBER TO DEACTIVE ANY SCENE CAMERA BACKGROUND IMAGES BEFORE RENDERING BEGINS**

- **FOR PRODUCTION RENDERING OF ANIMATED SEQUENCES, ALL FILES SHOULD BE RENDERED TO /transfer2 (1TB Hard Drive).**

- **WHILE THIS EXAMPLE DEMONSTRATES RENDERING DIRECTLY THROUGH THE HOUDINI INTERFACE; RENDERING ANIMATED SEQUENCES SHOULD NOT BE DONE WITH HOUDINI OPEN, BUT INSTEAD RENDERED USING THE SHELL. THIS WILL BE DEMONSTRATED IN THE RENDER OPTIMISATION LECTURE.**

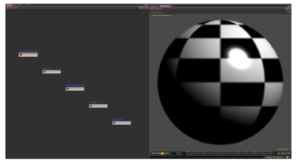
- **GENERATE A STILL FRAME COMPOSITE IN NUKE FOR TESTING YOUR COMPOSITING NETWORK BEFORE YOU RENDER YOUR FINAL SEQUENCES**

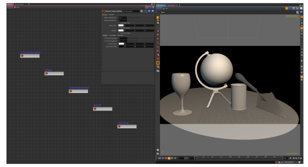
- **HOUDINI HAS FIVE RENDERING > RENDER ENGINES IN TOTAL:**
Micropolygon Rendering
Ray Tracing
Micropolygon Physically Based Rendering
Physically Based Rendering
Photon Map Generation (and non visual renderer for photon map point data)

See file globe_scene_end.hipnc

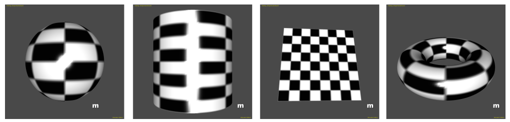
UTILITIES
$HIP – This is a **global variable** in Houdini that will **return the directory path** of the **current hip file**. If textures are saved relative to this location (ie inside the same folder or in a subdirectory) $HIP can be called in the file chooser path rather than writing the entire path location.

THE SHOP Level (**Sh**ader **Op**erators **Level**)





The **Viewer Pane** can be switched between the **Context View** (revealing the Shader View Ball), and the **Scene View** (showing the **Object Level scene** through cam1). This can make refining a scene aesthetic easier, as both the material and how it renders can be examined.

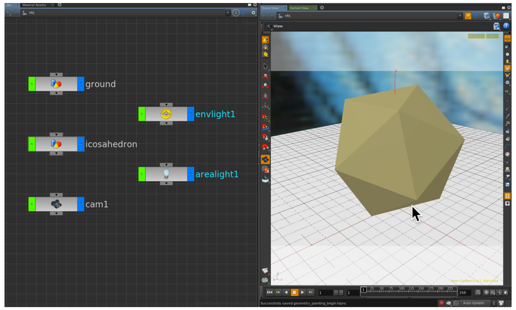


Pressing **m** on the keyboard with the mouse over the Viewer can switch the Shader View to scroll through different geometry shapes. Backgrounds can also be activated in the **Shader View** by going to the **Background menu**.

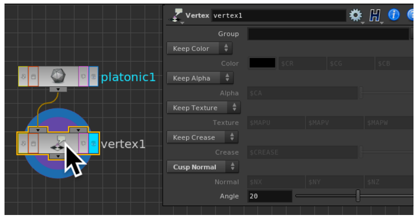
THE RENDER VIEW
As well as a **Render Region Preview**, an interactive **Render View** can be activated as part of the Viewer Tabs. This view will continually render the scene, updating with any changes to the scene parameters. The Render View allows for efficient modification of material parameters as the results can be directly seen.

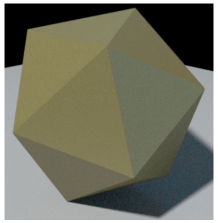
PAINTING ONTO GEOMETRY

The **Paint SOP** can be used to paint directly onto geometry. This paint information can then be used to drive material attributes such as colour, reflectivity and displacement. **Open** the scene **geometry_painting_begin.hipnc**.



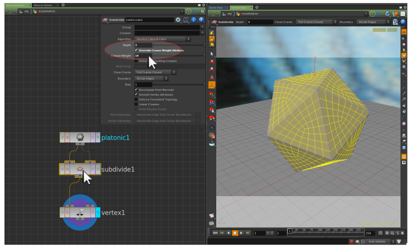
This scene contains an icosahedron with a simple lighting and camera setup. A **Mantra Surface Material** has been assigned to the icosahedron. **Inside** the **icosahedron object**, a **Vertex SOP** has been used to **cusp** the **surface normals** resulting in a hard surface render.

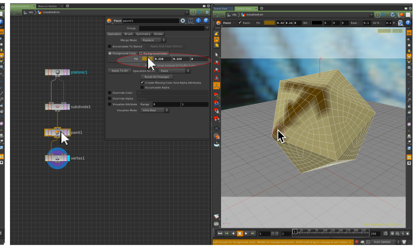




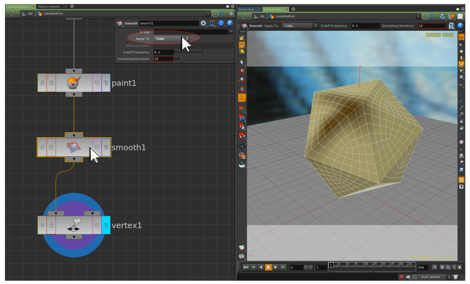
The Vertex SOP behaves in a similar way to the Facet SOP; however creates **unique vertices** rather than unique points, meaning that the faces of the geometry are still linked together.

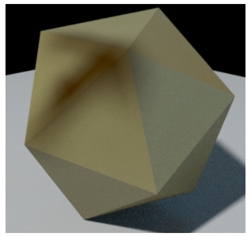
Append to the **Plantonic Solid SOP** a **Subdivide SOP**. Wire the **output** of the **Platonic Solid SOP** as the **second input**, and **override** the **Crease Weight parameter** to restore the original icosahedron shape. Setting a **Depth parameter** value of **3** will give additional topology to the faces for painting.





Append to the **Subdivide SOP** a **Paint SOP**. In its **parameters** set the **Foreground Color** to a **dark brown**, and then paint onto the icosahedron geometry. By default painted colour will be multiplied by any Material colour assigned to an object.



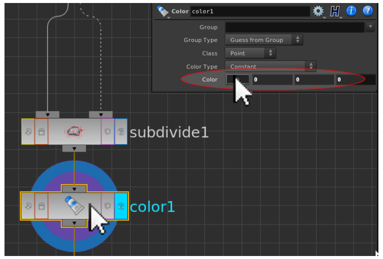


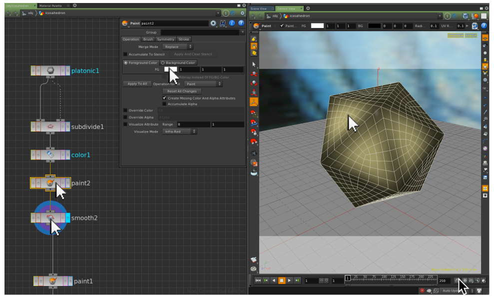
A **Smooth SOP** with **Color smoothing activated** can then be used to blur and soften this paintwork. A render of the scene will display the paintwork done.

See file geometry_painting_stage1.hipnc

USING PAINTED COLOUR TO DRIVE MATERIAL ATTRIBUTES

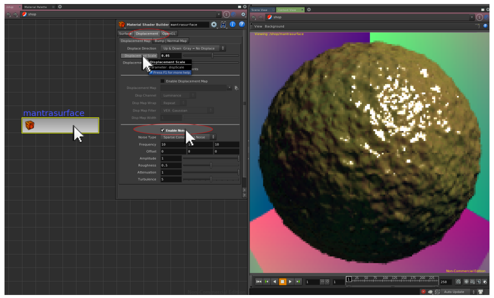
Painted colour can also be used to control other Material attributes such as reflections and displacement. Any active Material parameter can be overridden in this way. **Append** to the **Subdivide SOP** a **Color SOP**, setting a **Color value** of **0, 0, 0**.





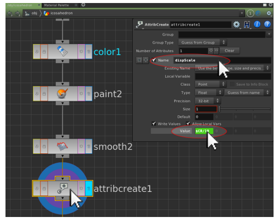
Append a **Paint SOP** to this **Color SOP**, and **paint** some **white patches** onto the icosahedron geometry. As before a **Smooth SOP** can be added to smooth the paintwork.

Switch to **SHOP Level** and **activate Enable Noise** in the Displacement Map section of the Mantra Surface Material. **Hovering** the **mouse over** the **Displacement Scale parameter** reveals the **internal name** of this parameter as **dispScale**.



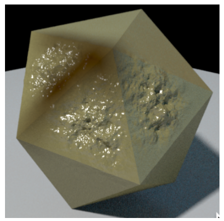
Return back to **Geometry Level**, and append to the **Smooth SOP** an **Attribute Create SOP**. In its **parameters** specify:

Name	**dispScale**
Value	**$CR / 10**



NOTE: The **Displacement Scale parameter** is a **float**, therefore only the **red value** (**$CR**) of the paintwork needs to be assigned. For **overriding Material colour parameters**, the **Type parameter** of the **Attribute Create SOP** should be set to **Vector**, with **$CR**, **$CG**, **$CB** specified as the value.

As a final step, **append** a **Color SOP** to the **Attribute Create SOP**. This will **reset** the **geometry colour** back to **white**, so that the later paintwork affecting the geometry colour will still work. When the scene is rendered, displacement now occurs on the painted white patch areas.



See file painting_geometry_end.hipnc