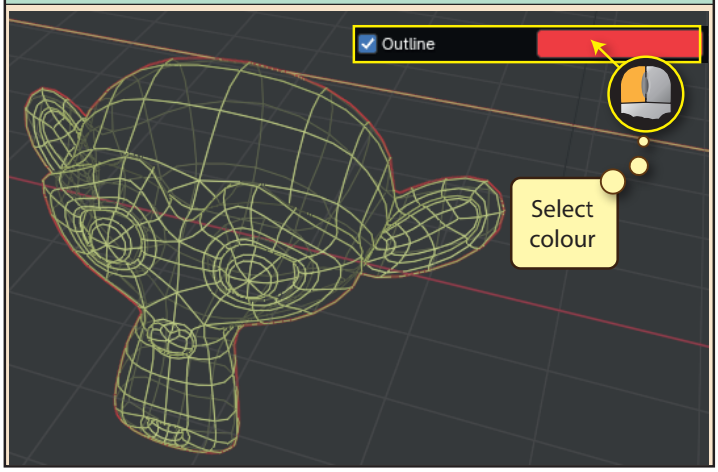
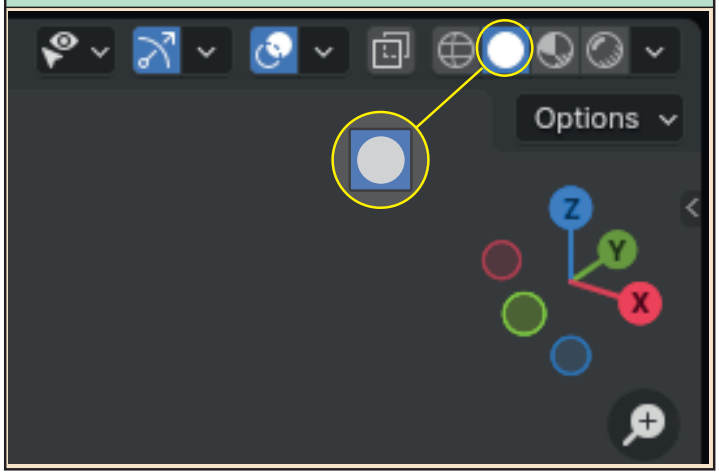
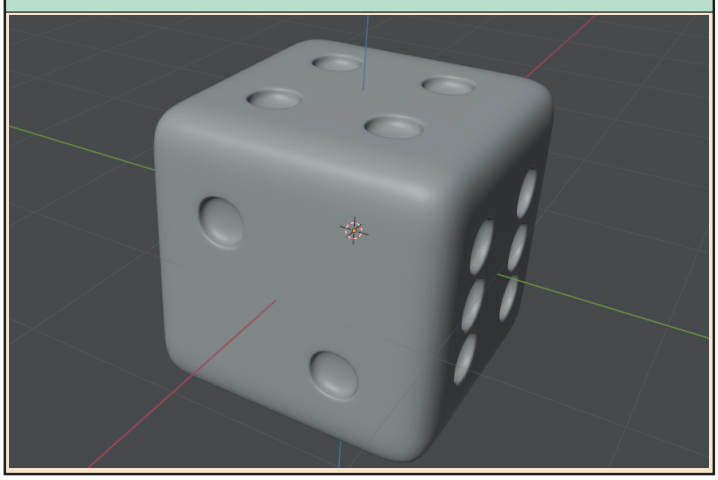
Outline is the final entry in our panel. This sets the outline colour of all meshes. The outline is defined as the set of edges on the border of a mesh as seen from our viewpoint. Here we can see the red outline on the monkey.



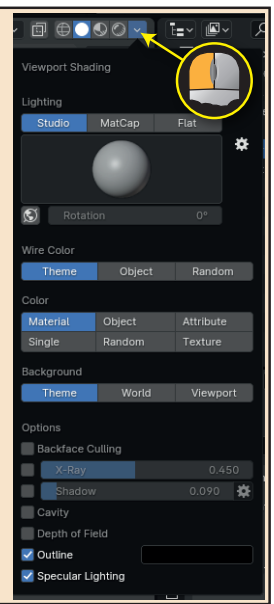
Solid Shading is the next of our ***Viewport*** shaders. This is the default shader used when we start a new project.



If we've not set up any other options in the ***Properties Editor***, the meshes in our scene will appear in shades of grey.

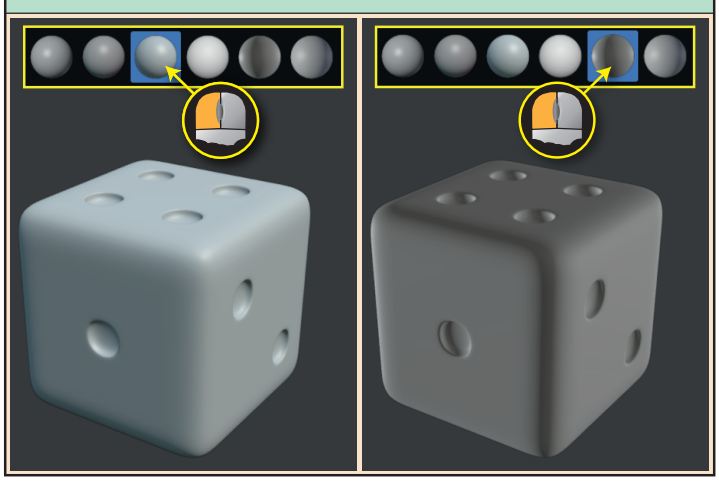


This time, the **Shader Settings** button creates a panel with many more options than we saw in the ***Wireframe's*** panel.

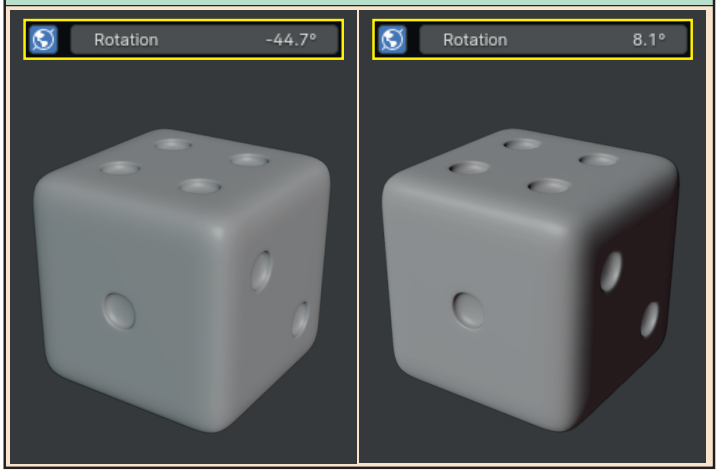


Lighting gives three options. ***Studio*** lighting has, itself, six options, the selected one being represented by the sphere beneath. If we click on this sphere, we'll see all six options in the shape of more spheres.

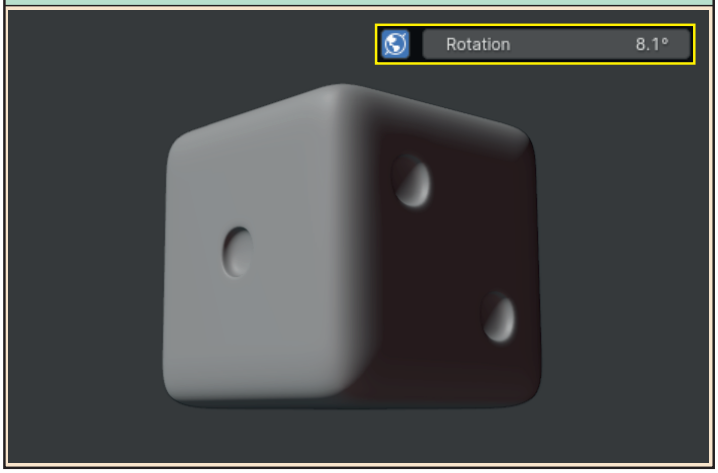
Clicking on one of the spheres will change the lighting on our die. Two examples are shown below.



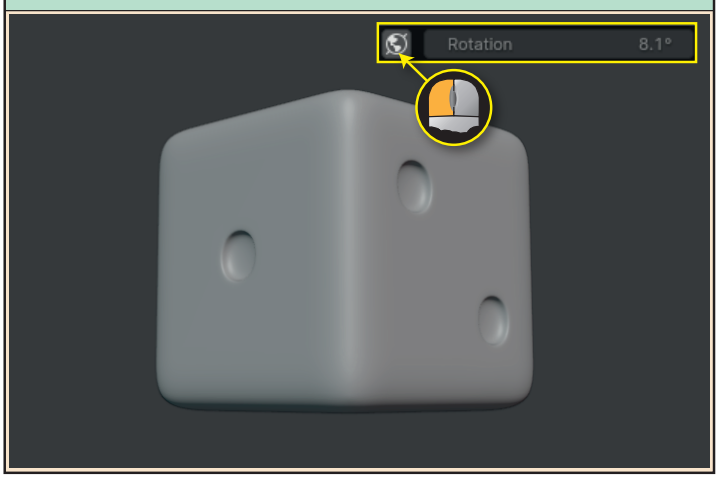
Rotation is a value field beneath the sphere. Adjusting the value here will change the direction of the light and hence the shadows displayed on the objects. Below we can see the effects of different ***Rotation*** values (using second-from-left sphere)



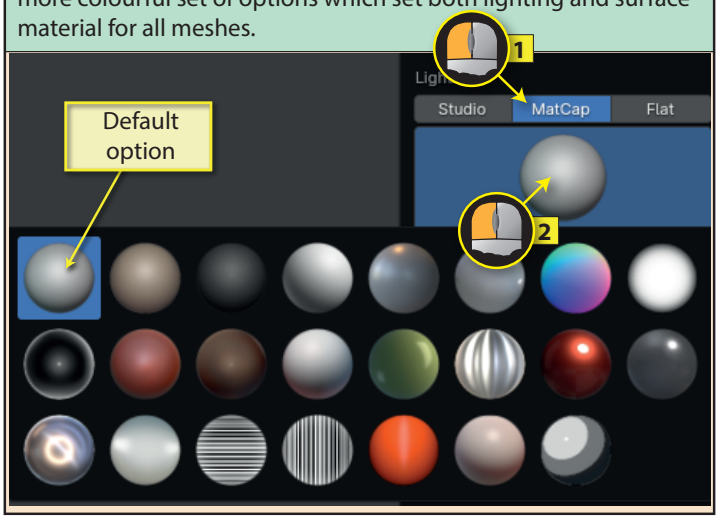
As we move our viewpoint, the light remains consistent and the shadows remain fixed. The example below uses the same 8.1° value as in the last image and the 2 remains in deep shadow as our position is moved.



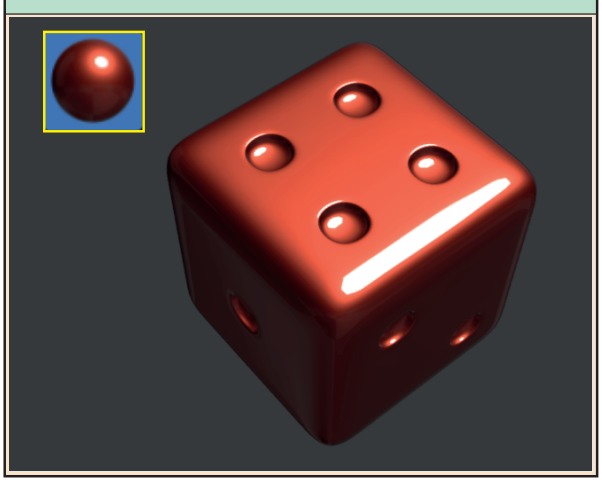
However, if we click on the **Globe** icon to the left of ***Rotation***, to disable it, the shadow moves as our viewpoint changes and the ***Rotation value*** is no longer used.



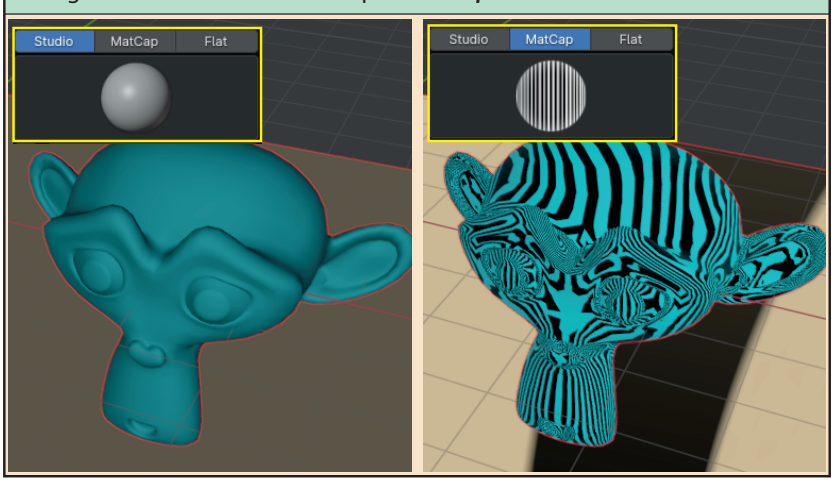
MatCap (short for ***Material Captures***) is the next ***Lighting*** option. Again, the sphere beneath, when clicked displays a larger and more colourful set of options which set both lighting and surface material for all meshes.



If we pick a more dramatic option, we can see how this affects the die.

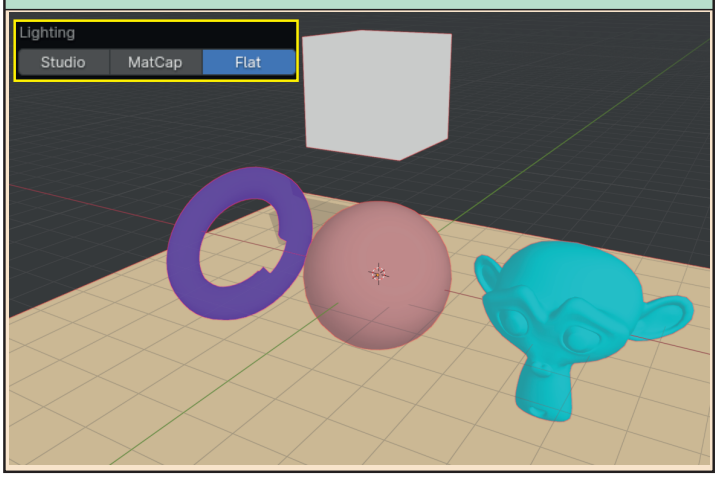


Note that if we've assigned other ***Viewport*** colours to a mesh (we can do that in various pages of the ***Properties Editor***), the ***MatCap*** selection is added to that colour. In the example below, the monkey head has been assigned a blue colour and a striped ***MatCap***.

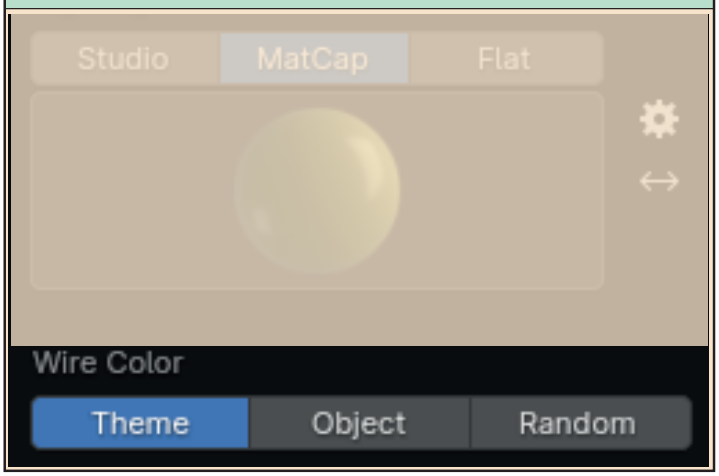


Although we can't rotate a ***MatCap*** light in the same way as we can with ***Studio*** lighting, the doubled arrowed line to the right, when clicked mirrors the effect created as shown on the monkey head below.

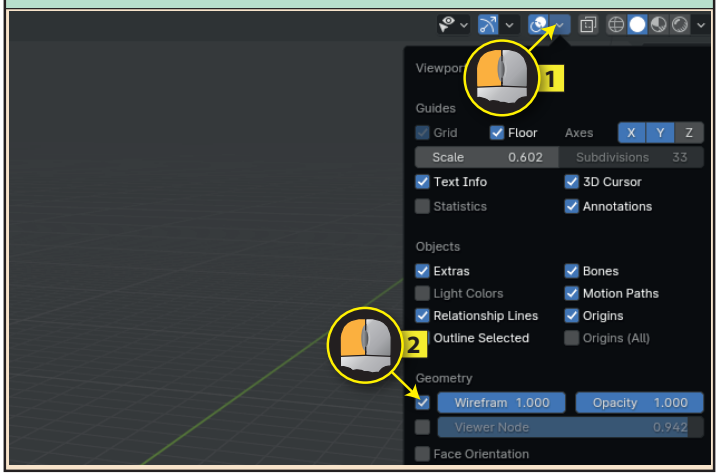
Flat is the final ***Lighting*** option. When selected, no lighting is added and we get a flat, ambient light effect.



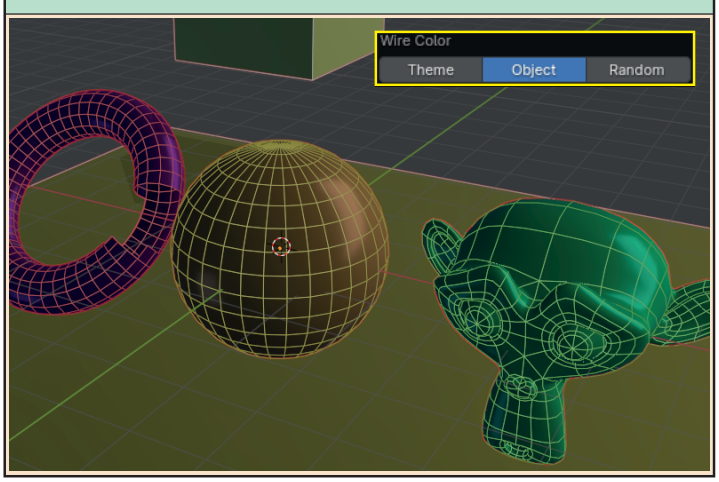
Wire Color, the next heading in the panel, is the same parameter we saw earlier in ***Wireframe Mode***. However...



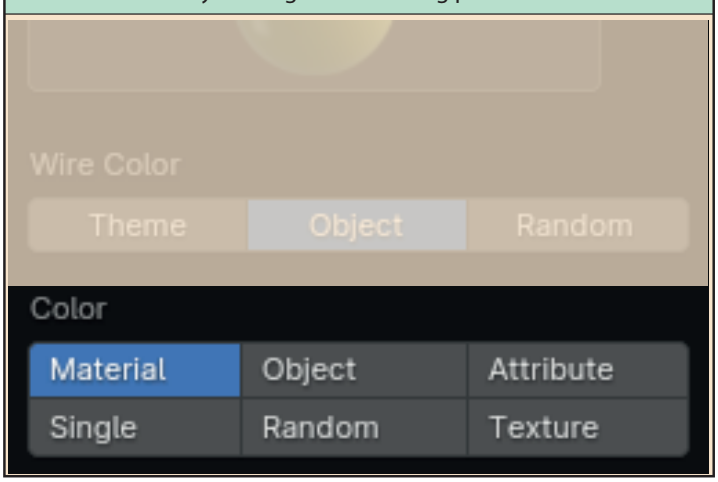
...it is only relevant in ***Solid Mode*** if we have selected ***Geometry>Wirefram*** in the ***Viewport Overlays*** panel...



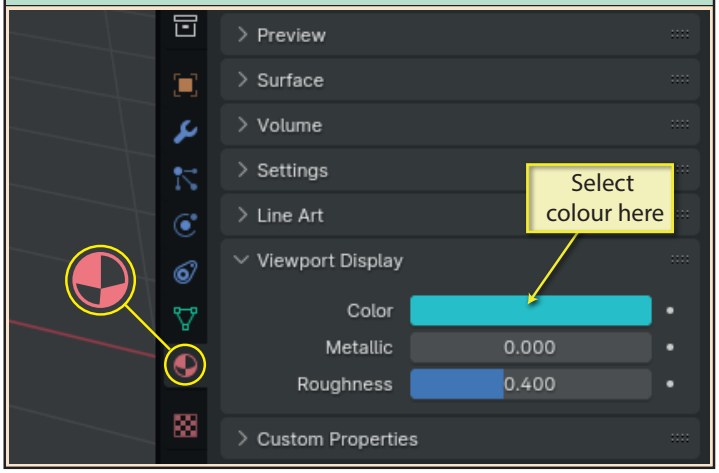
...in which case, the edge will be made visible in the specified colour.



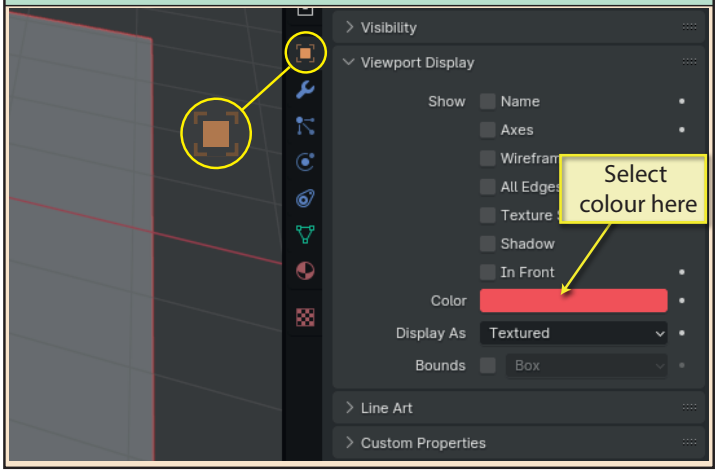
Color, the next heading in the panel, is used to specify which colour the surface of our objects is to display. Although these colours are not designed to appear in the final render they may be useful in other ways during the modelling process.



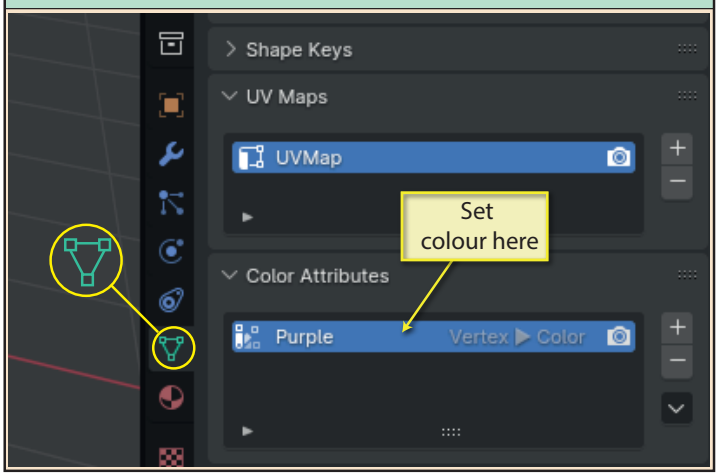
Material, sets the colour of an object to that specified in the ***Materials page*** of the ***Properties Editor***. It can be found under the heading ***Viewport Display>Color***. Below we can see the settings for the monkey head.



Object, when selected causes each object to display the colour defined for it in the ***Object Properties page***, ***Viewport Display>Color***. Below, we see the setting for the torus.



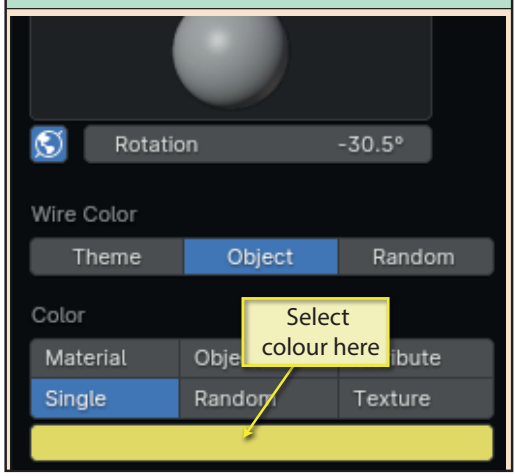
Attribute, sets an object's colour to that defined in the ***Data Properties page, Color Attributes***. How this colour is set up is a little different from the previous two and will be discussed in a later chapter. Below is the setting for the UVSphere.



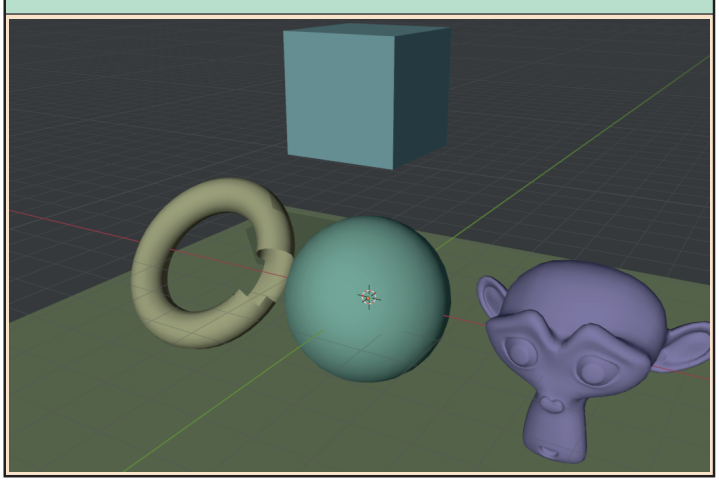
NOTE

If no colour is set in the *Data Properties page*, the colour defined in the *Object Properties page* is shown.

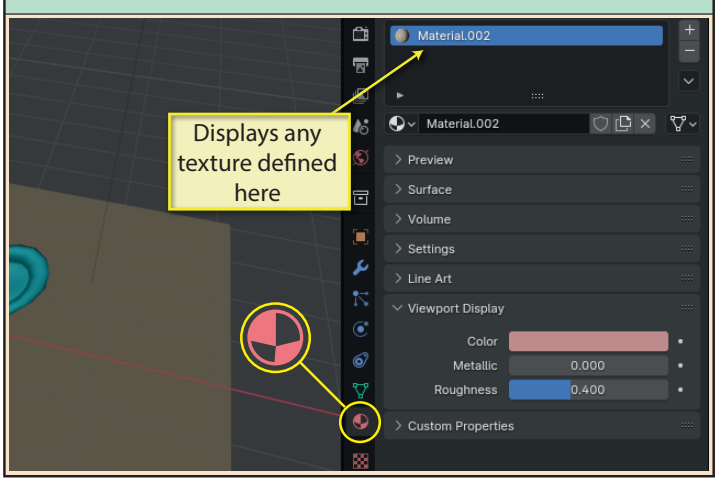
Single shows every object in the same colour. The colour is selected in the colour bar that appears below the six ***Color*** options.



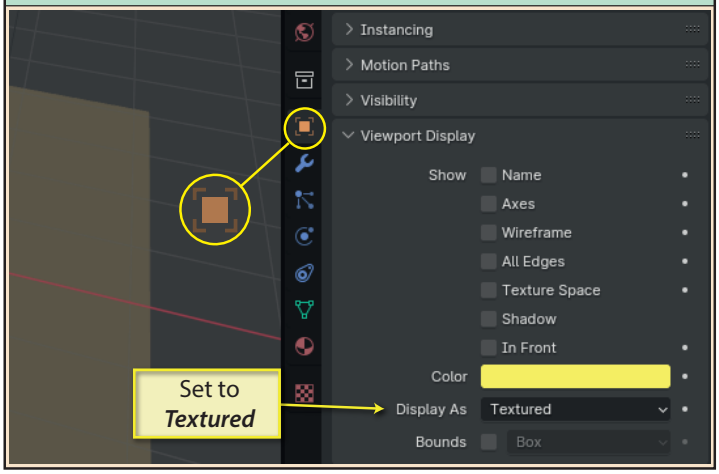
Random shows each object in a different, pale colour.



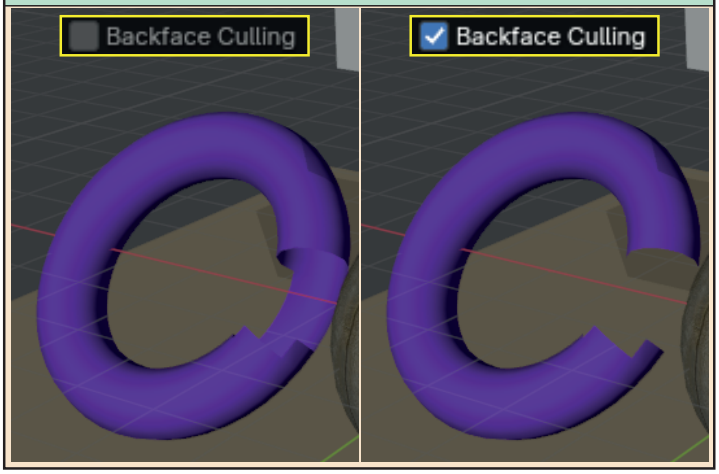
Texture sets the object to display any true texture it has been assigned in the ***Materials page***. If none has been defined it will show the colour defined in the ***Object Properties page***. But...



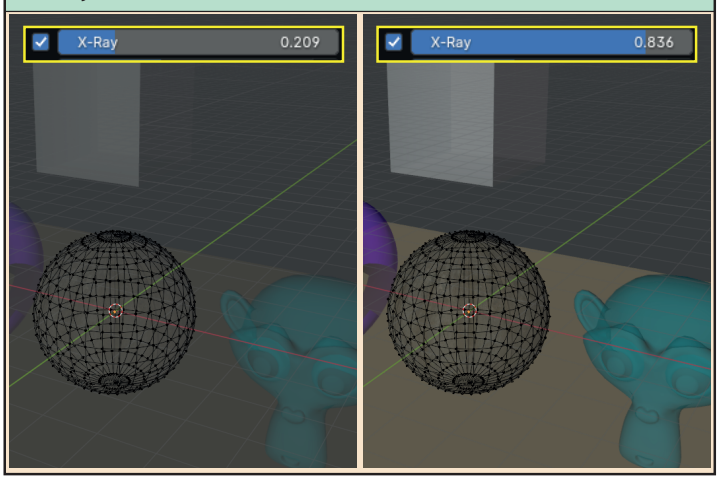
... there is an additional requirement needed before the texture is successfully displayed. The ***Object Properties*** page must have its ***Viewport Display>Display As*** set to ***Textured***.



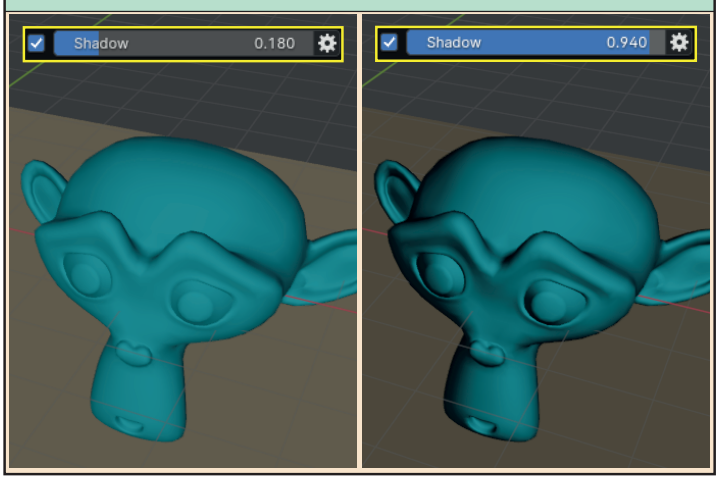
Backface Culling is the next new entry in the panel. When selected this hides all the back faces currently visible. In the scene below, only the internal part of the torus is affected.



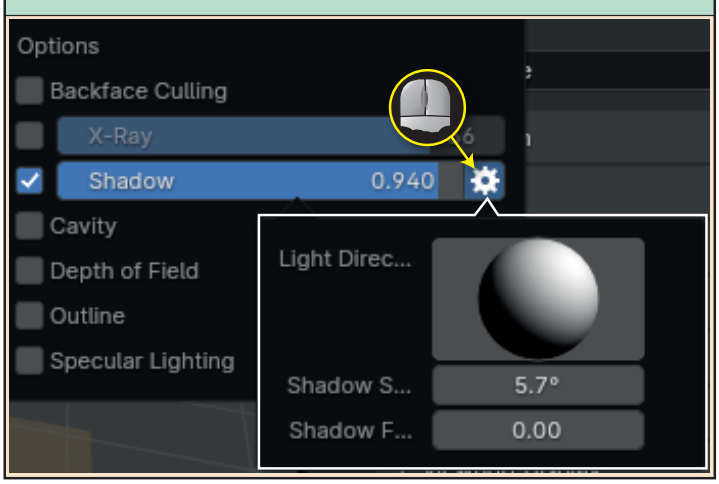
X-Ray, as we've seen before, is best suited for use in ***Edit Mode*** where we can gain access to elements normally hidden from our current viewpoint. The associated value adjusts the visibility of the object's surface.



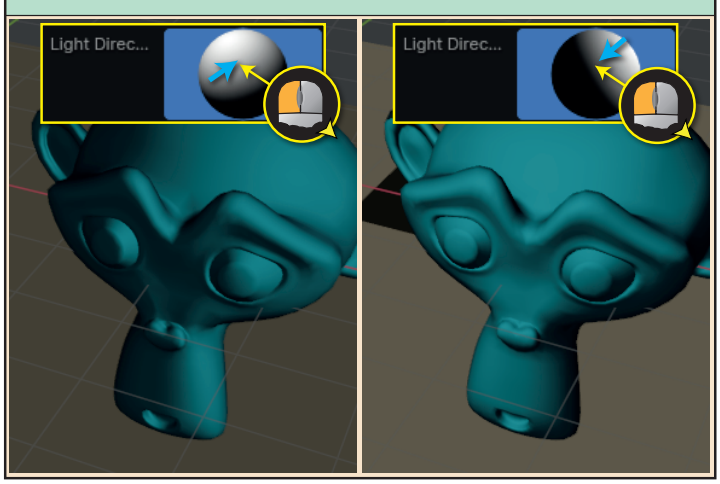
Shadow, when selected, creates a shadow on the surface of each object with the associated value controlling the intensity of the shadow.



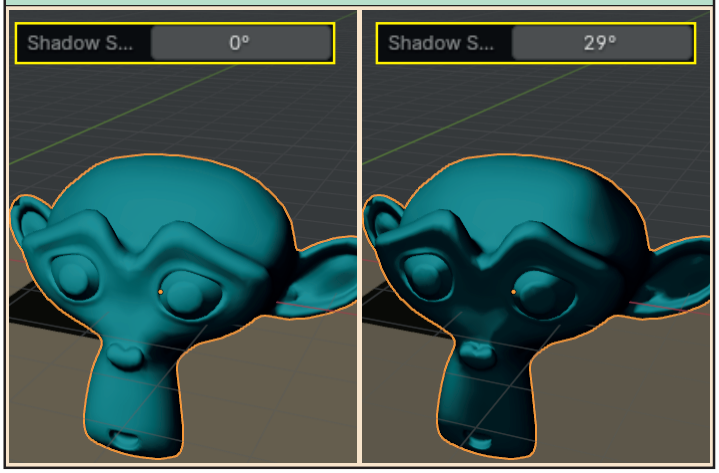
Moving the mouse pointer over the cogwheel creates a small panel offering three more adjustments to the shadow.



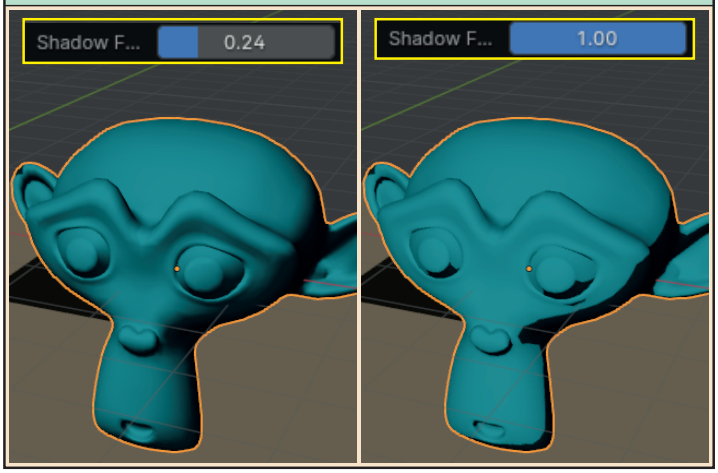
Dragging over the **Shadow Direction** sphere adjusts the direction of the light creating the shadow.



Shadow S[hift] shifts the shadow along the surface of each object.

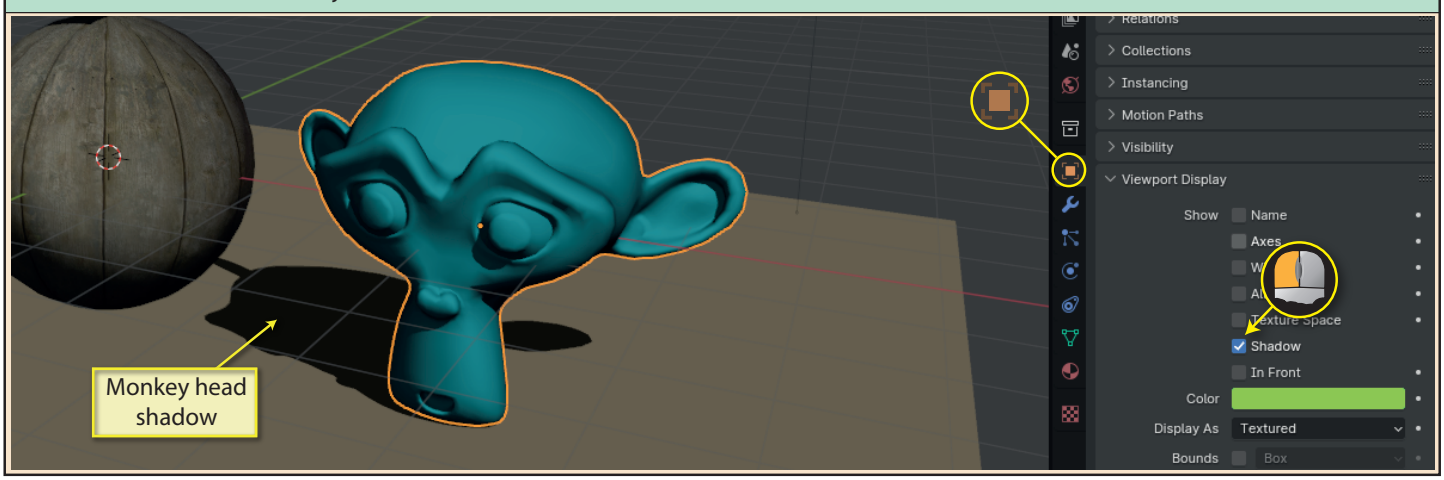


Shadow F[ocus] adjusts the focus of the shadow terminator.

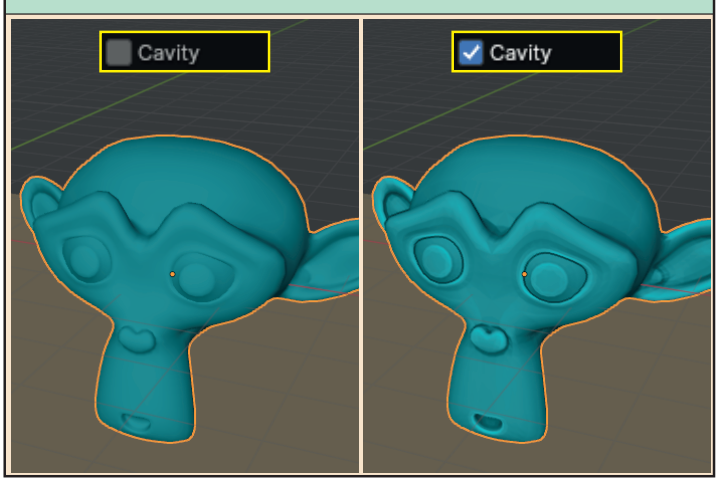


Although we've created shadow on the surface of each object, if we want an object to cast shadows onto other objects within the ***3D Viewport***, then we need to select the object then go to the ***Object Properties*** page and check the box ***Viewport Display>Shadow***.

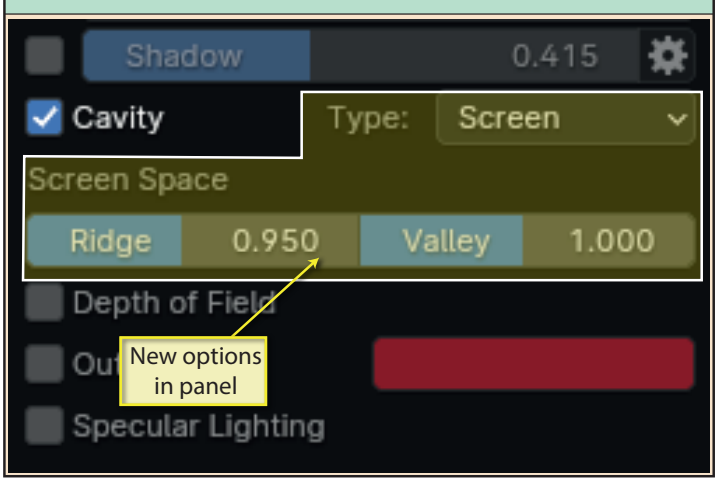
We need to do this for each object that we want to cast a shadow.



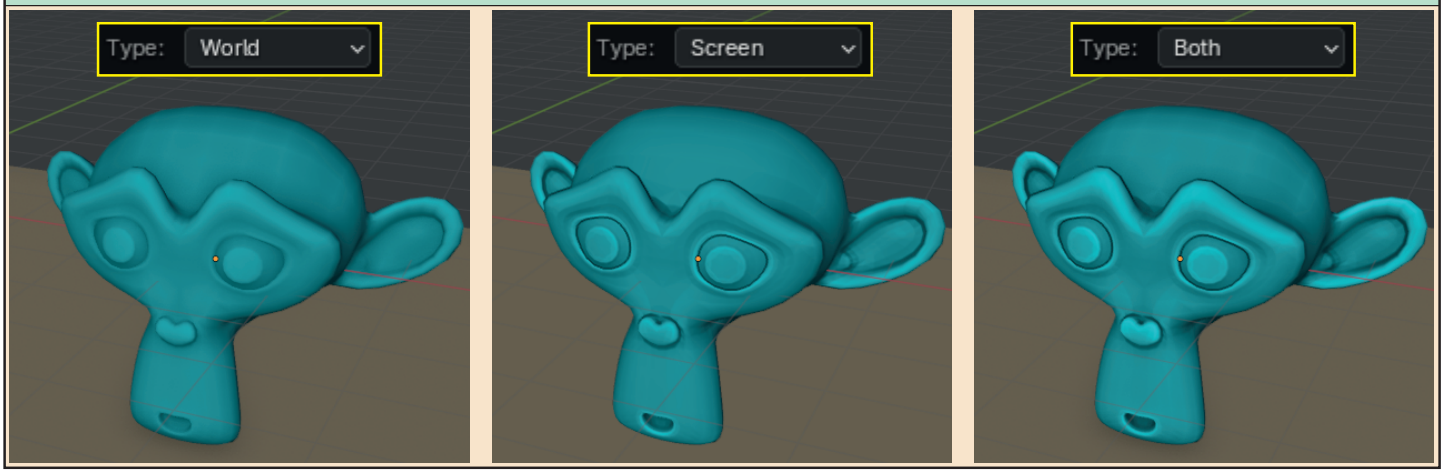
Cavity is the next entry in the ***Solid Shading's*** panel. This option adds shadows and highlights on the surface of an object to emphasise valleys and ridges in all the meshes in the scene.



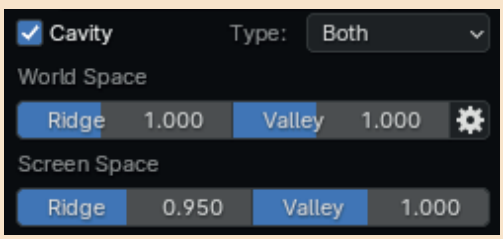
By checking ***Cavity*** we add a few extra parameters to the panel as shown below.



Type offers three options in its dropdown list:
World takes into account the size of the ridges and valleys in the mesh and is the more complex of the two options, taking longer to calculate.
Screen is less accurate but faster. ***Both***, uses both methods at the same time.

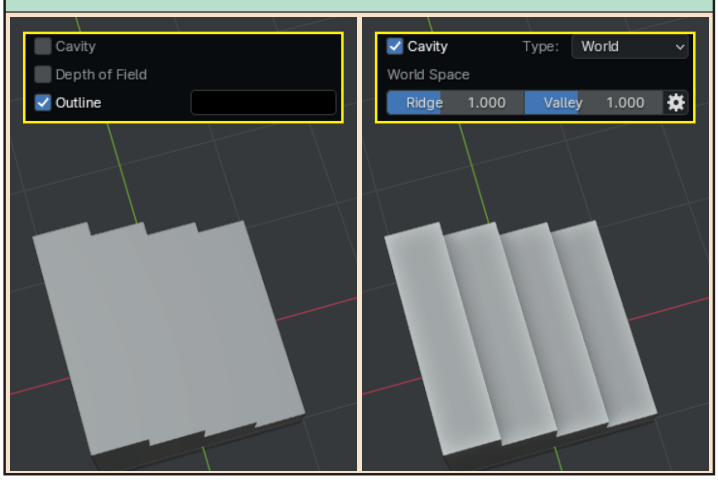


In addition, we have **Ridge** and **Valley** fields to adjust the highlights and shadows created by the ***Cavity*** effect. If we've chosen the ***Both*** option, there are separate adjustments for ***World*** and ***Screen***.

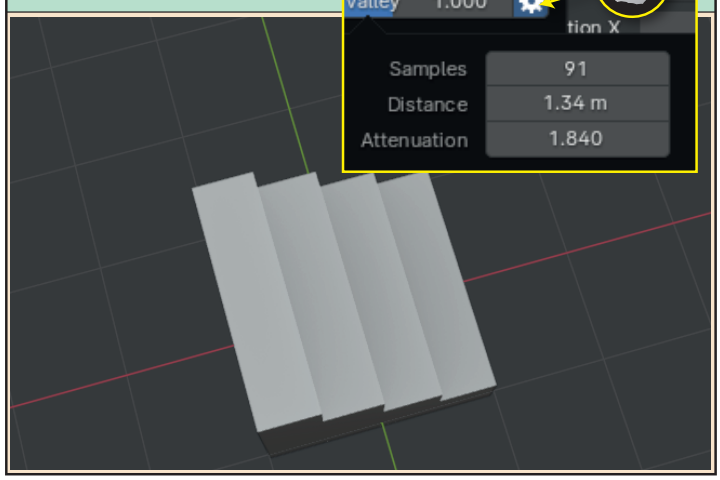


Below we can see the effects created for different ***Ridge*** and ***Valley*** settings when using the ***Screen*** type only.

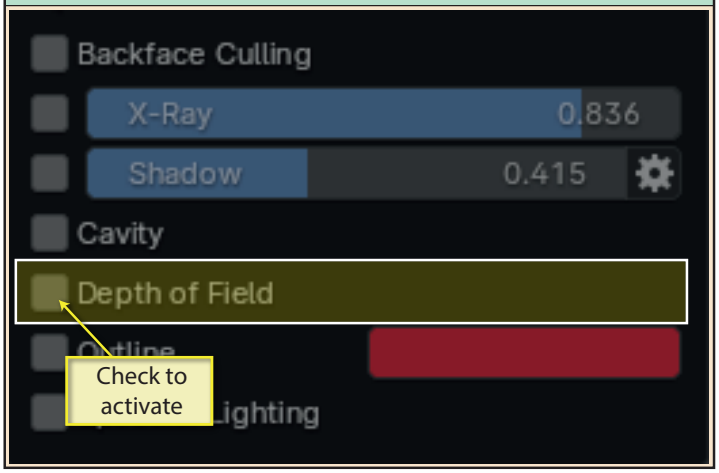
There is a practical use for the ***Cavity*** effect. Below we can see the difference between a set of steps as viewed without and with ***World Cavity***.



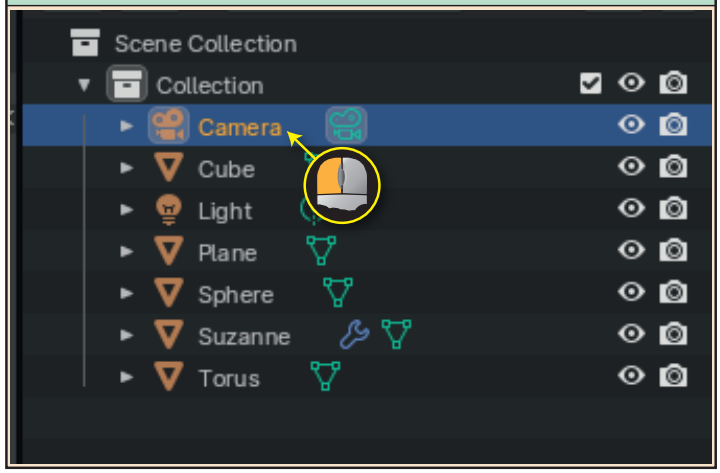
When using the **World** option we get an added cogwheel. Moving the mouse over this produces another small panel where we can add subtle adjustments to the ***Cavity*** effect.



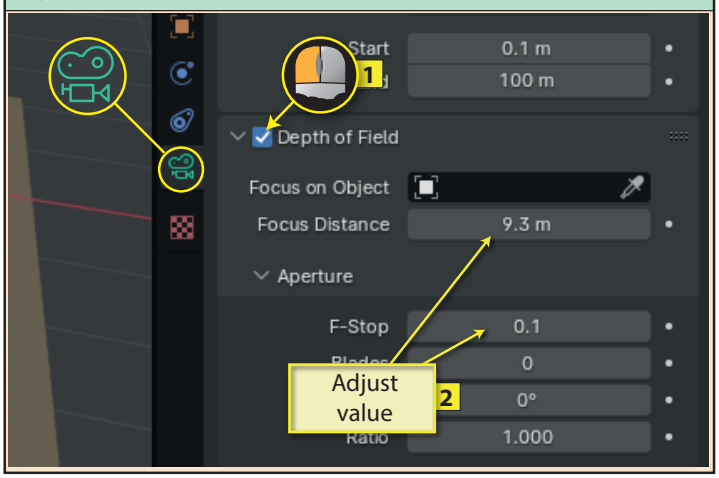
Depth of Field is the next entry in the ***Solid*** panel's settings. This is only relevant when viewing the scene through the render camera (pressing 0 on the Numpad toggles between the render and Viewport cameras).



To set up the ***Depth of Field*** we must start by selecting the render camera (click on the ***Camera*** itself in the ***3D Viewport***, or its entry in the ***Outliner Editor***).

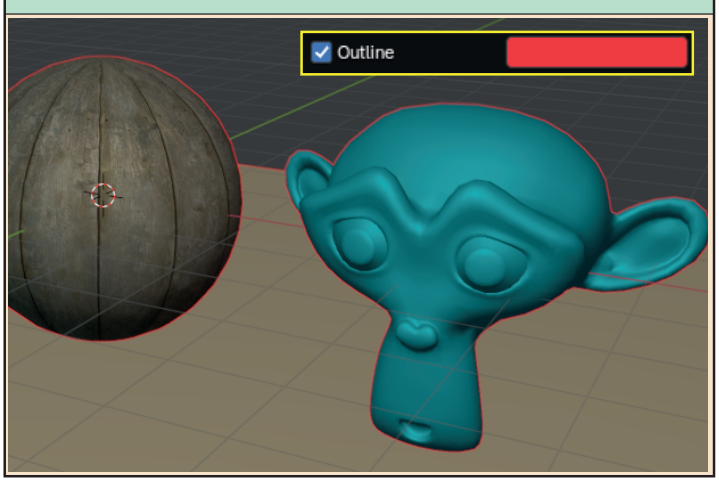


Then, in the ***Properties Editor***, we must select the ***Camera's Data Properties page***, check ***Depth of Field*** and reduce the **F-Stop** value to around 0.1 for maximum effect. We may also need to adjust the **Focus Distance**.

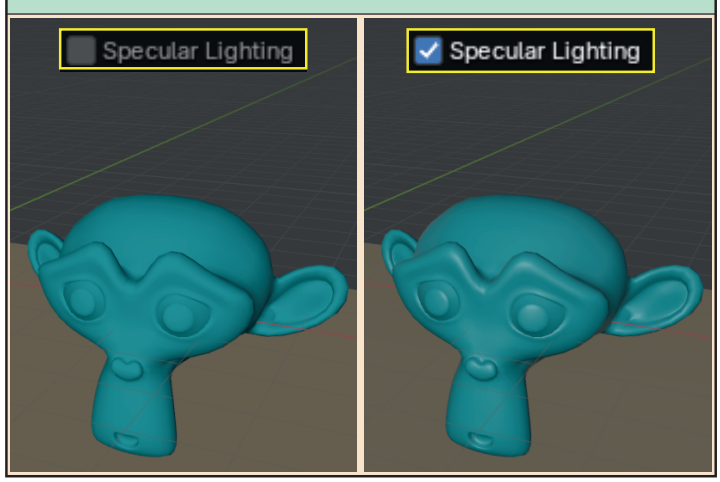


Now, when we change to the render camera view, objects away from the ***Focus Distance*** value will appear blurred.

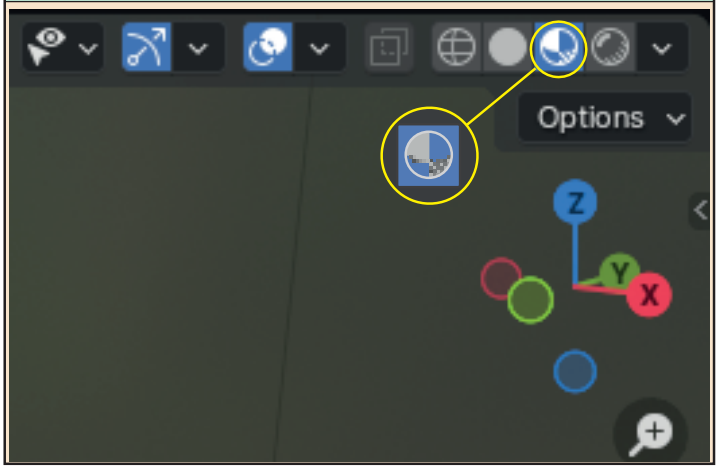
Outline, we've come across before in ***Wireframe Shading*** and this sets the outline colour for all objects.



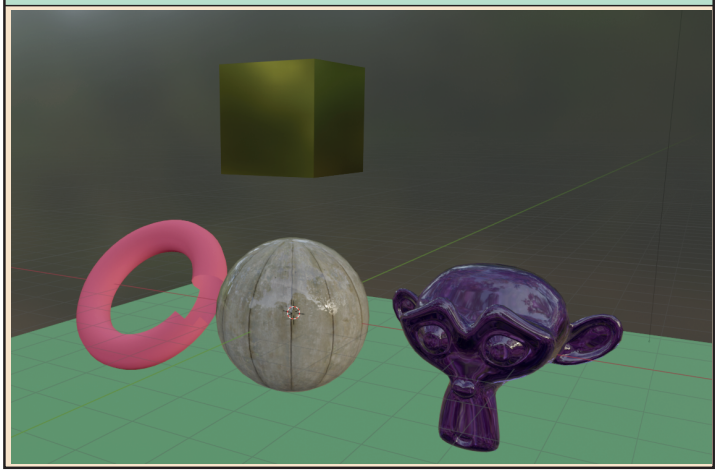
Specular Lighting is only available when ***Lighting*** is set to ***Studio***. When selected, this adds a shininess to the surface of all objects.



Material Preview is the next shading option. As the name suggests, this is the first shader to give a display closer to the final rendered image.

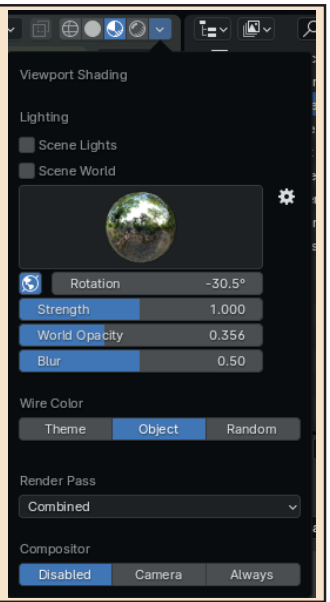


Below we can see how our scene looks after textures have been added to meshes. Blender will use the ***Eevee*** render engine to create the scene.



The adjustments panel for this shading option is shown here.

The main options control the lighting of the scene.



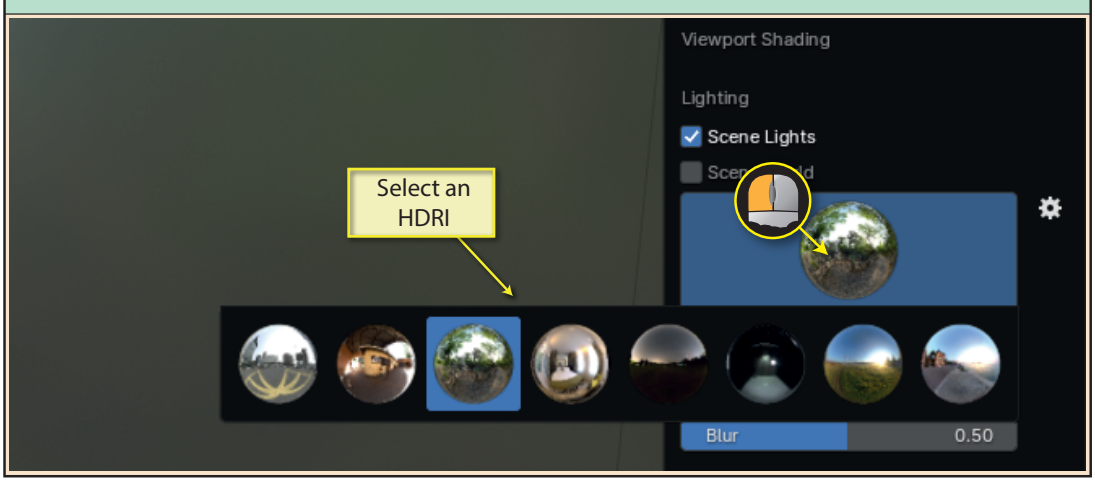
Scene Lights, when checked, include the effects of any light objects that have been placed in the scene. This includes the Point light which is created by default. If this option is unchecked the lights placed in the scene are ignored.

Scene World is the term used to denote the environment surrounding our scene.

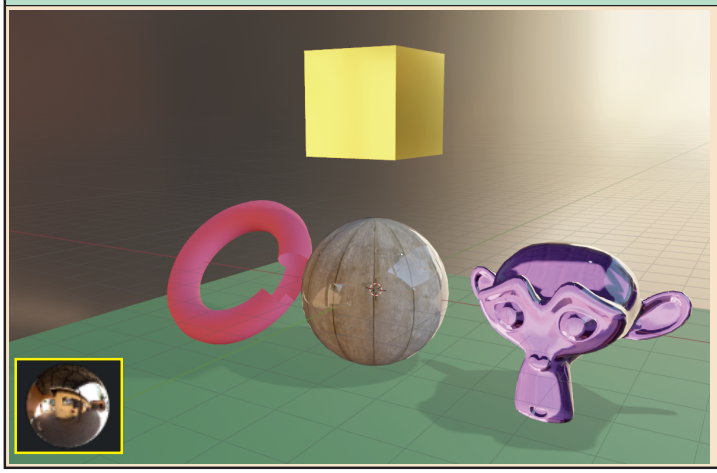
Typically, this is a 360° image referred to as ***High Dynamic Range Image*** or just ***HDRI***.

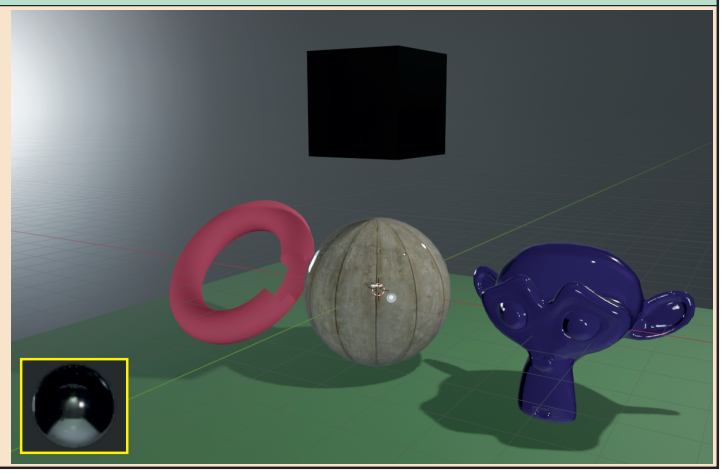
The light that would come from such an environment in the real world is added to our scene to create a more realistic effect.

With the ***Scene World*** box unchecked, the surrounding environment is assumed to be one of the HDRIs available by clicking on the sphere beneath.



The effect of two of these HDRIs on our scene is shown below.

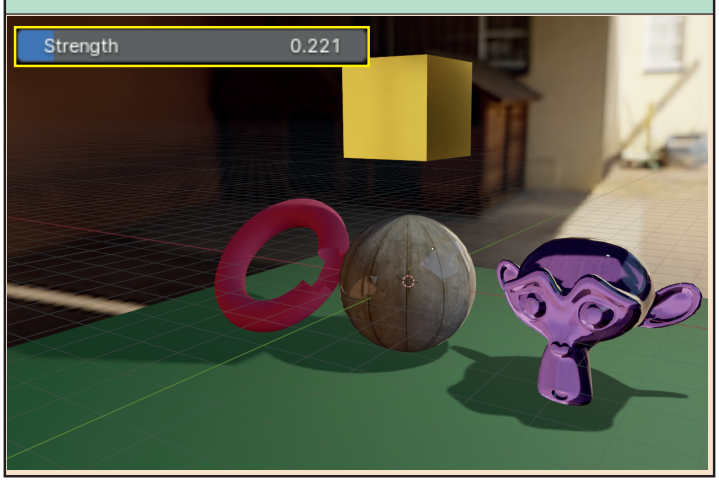




The next group of values controls various aspects of the HDRI. Skipping first to **World Opacity**, this controls the visibility of the HDRI image. If we set the value to its maximum we have a better view of the image used.

Blur adjusts the focus of the HDRI.

Strength adjusts the brightness of the HDRI and hence adjusts the strength of the light falling on our scene.

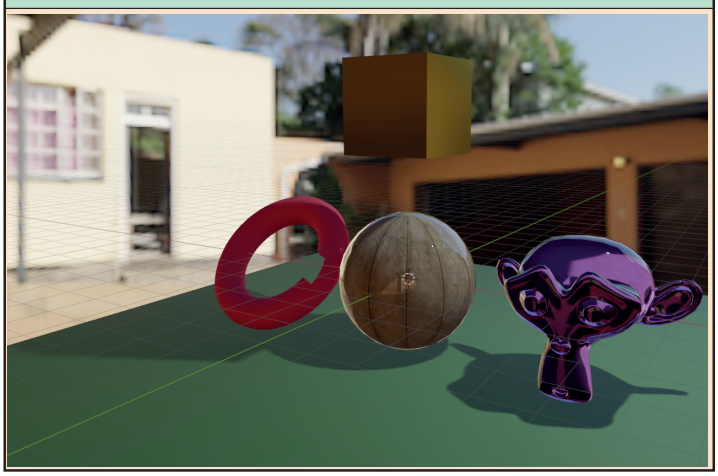


Rotation rotates the HDRI about our scene allowing us to see a different part of the image from our current viewpoint. This also affects the direction of the light coming from the HDRI.

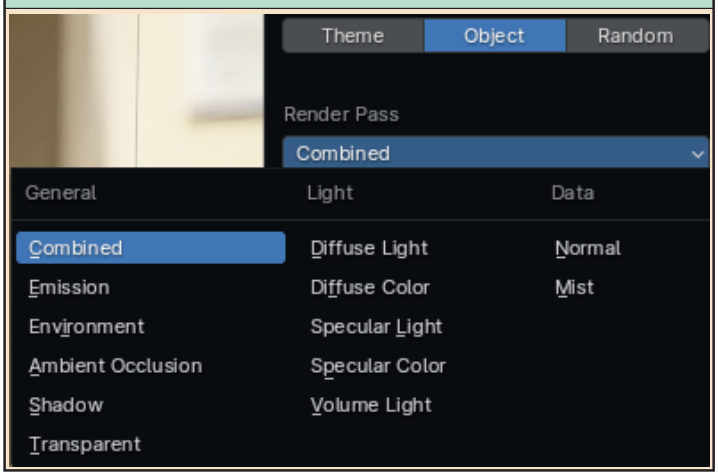
Normally, when we change viewpoint, we'll see a different part of the background image...

...but if we click on the globe to the left of ***Rotation***, the first change is that the HDRI adjusts to its default position, ignoring the rotation setting...

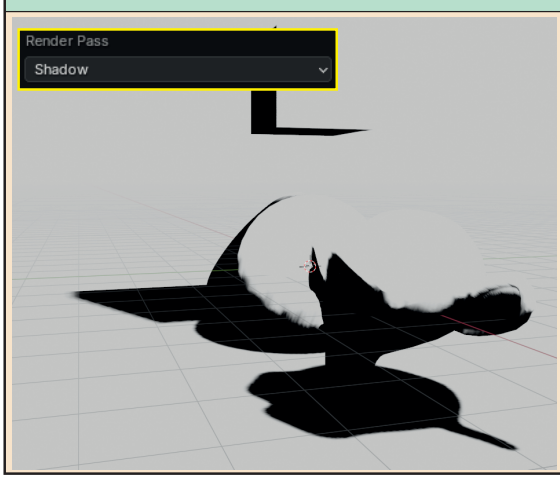
...and as we change viewpoint, the background remains unchanged.

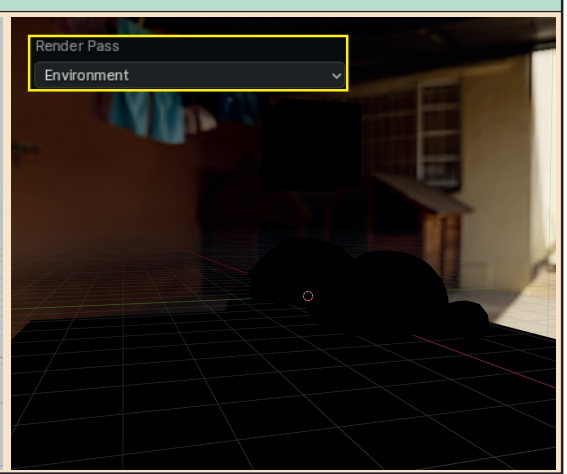


Render Path determines which part of the scene is displayed in the ***Viewport***. This gives us options to display the component parts on their own.



For example, we can use this parameter to show only the shadows created in the scene. Or to show only the HDRI.



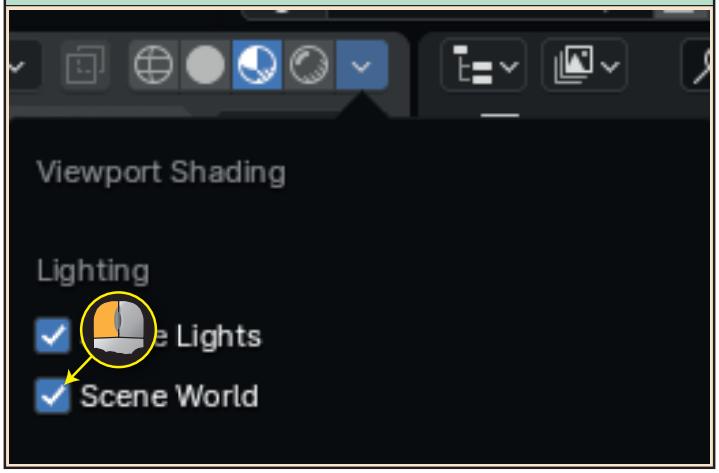


The ***Viewport Shading*** panel's last entry is **Compositor** which controls the availablity of the Blender compositor.

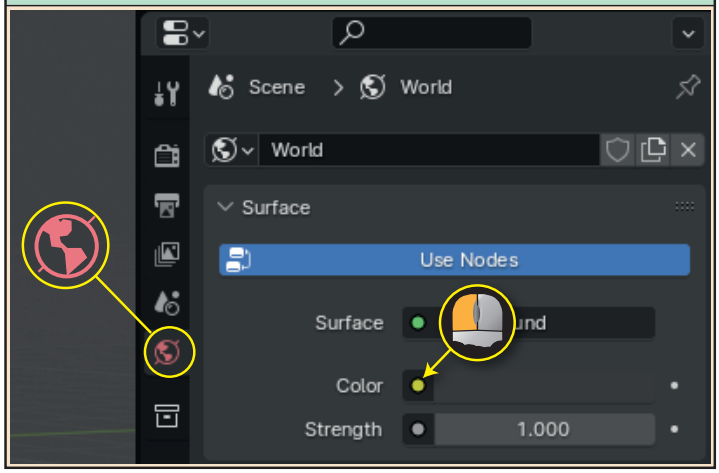
A compositor combines several images into a single image .

This is an advanced topic not covered in this text.

HDRI that we employ through this panel will not appear as background in the final renderd image. If we want the HDRI to be included, we must start by checking the **Scene World** box...

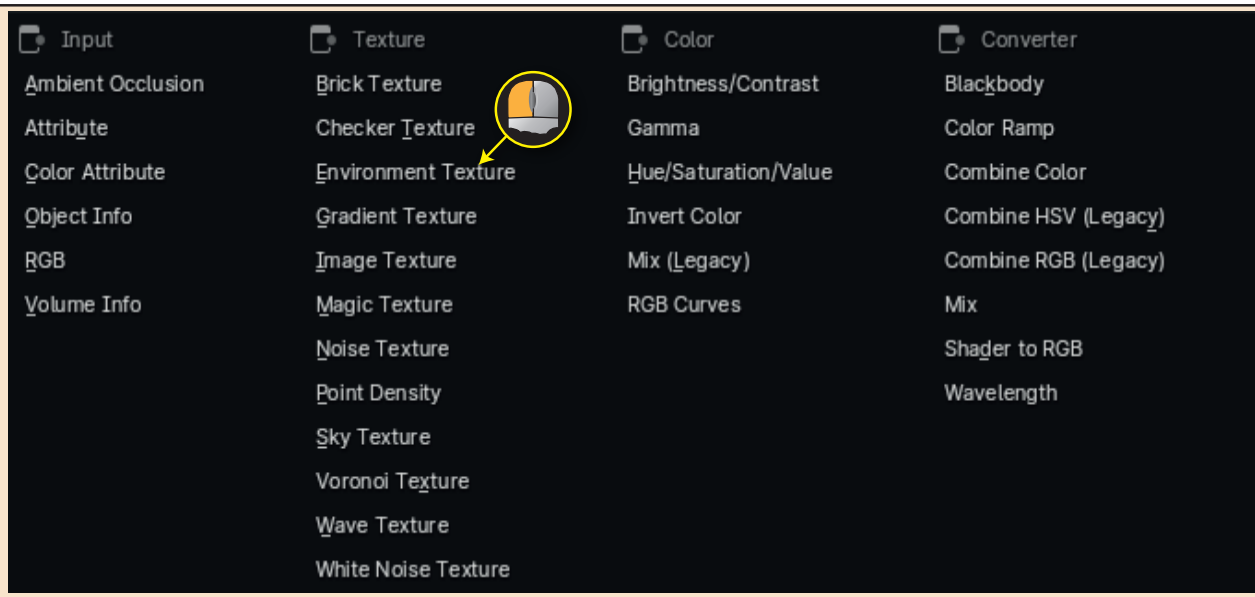


... and then move to the ***Properties Editor's World Properties*** page. There we need to click on the ***Surface>Color***.

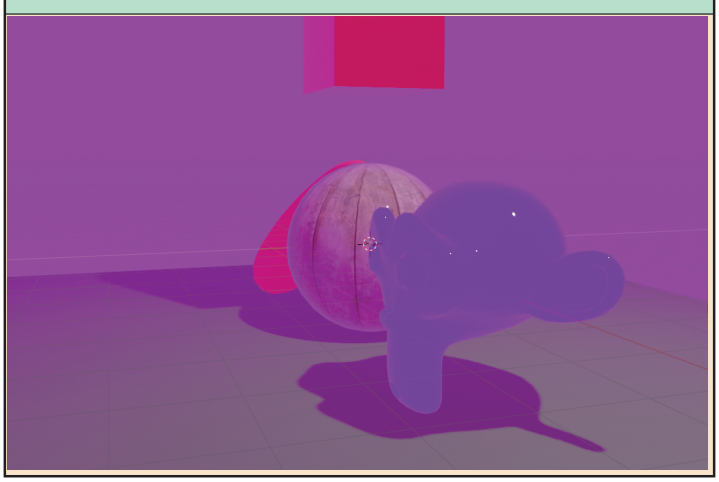


Clicking on that yellow dot produces a panel of options.

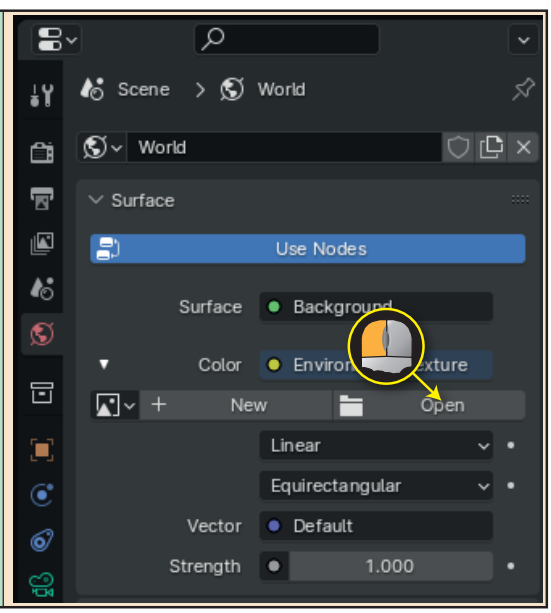
Environment Texture is the option we require in order to add an HDRI.



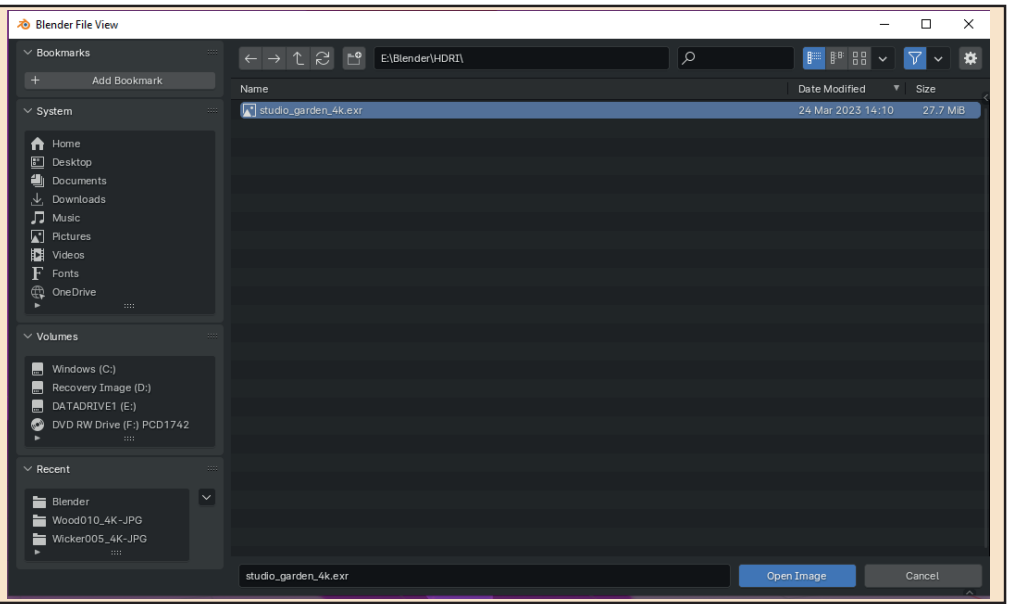
Immediately after selecting this option, the scene will take on a light purple colour. This is Blender telling us that it hasn't yet been given the name of a valid image file.



Now we need to select ***Open*** from the new options on the ***World Properties*** page.



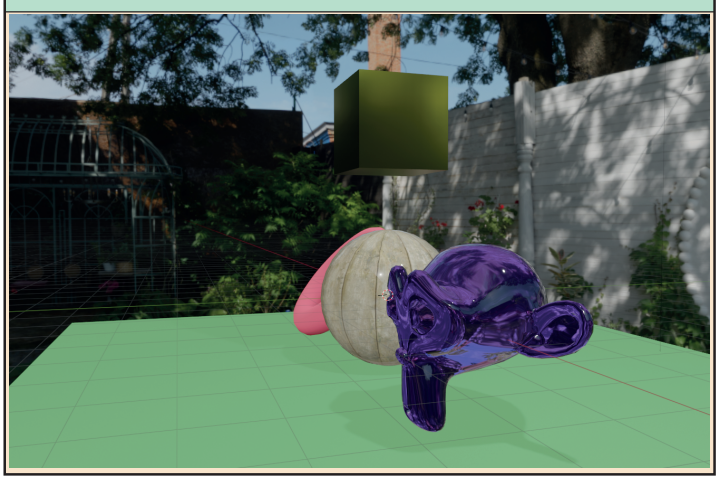
This will produce Blender's ***Open File*** dialog box where we can select the image we want to use as the background.



Note that an HDRI is not a standard image.

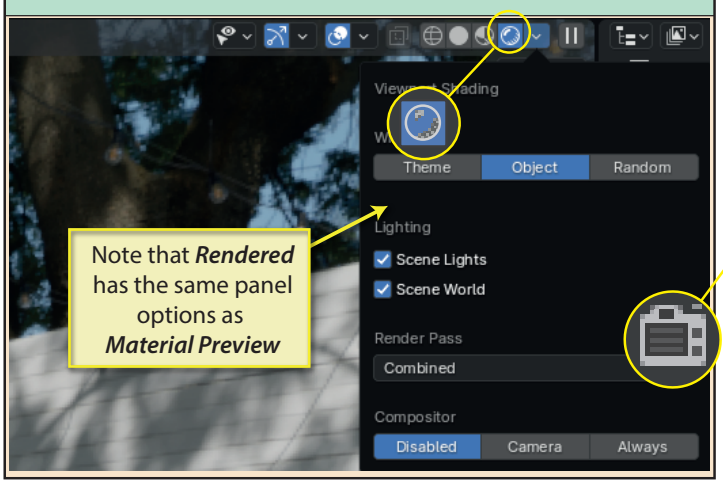
These image files have the extension **.exr** and can be downloaded for free from various websites such as ***polyhaven.com***.

Once loaded, our scene will display the new image in the background.



It will also appear in the final render.

Rendered Shading is the final option for the Viewport display. This gives us a result which is close to the final render but from the prespective of the Viewport camera.



In the **Render Properties** page of the ***Properties Editor*** we can select between **Eevee** and **Cycles**. But although ***Cycles*** gives a more accurte result it takes much longer to calculate and will be impractical on all but the fastest machine.