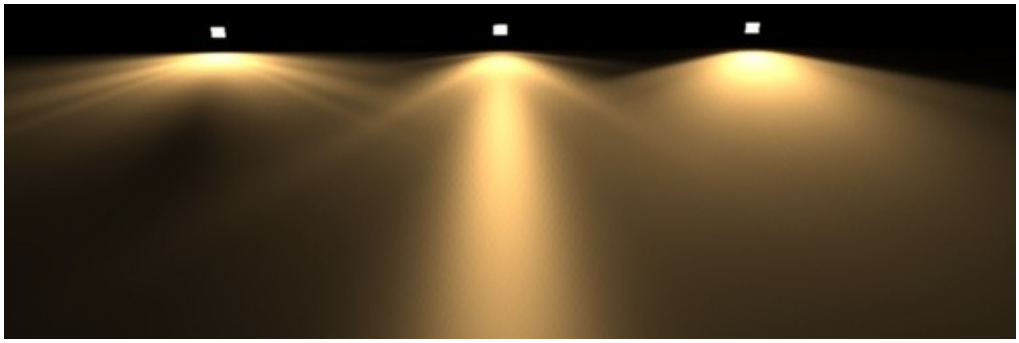
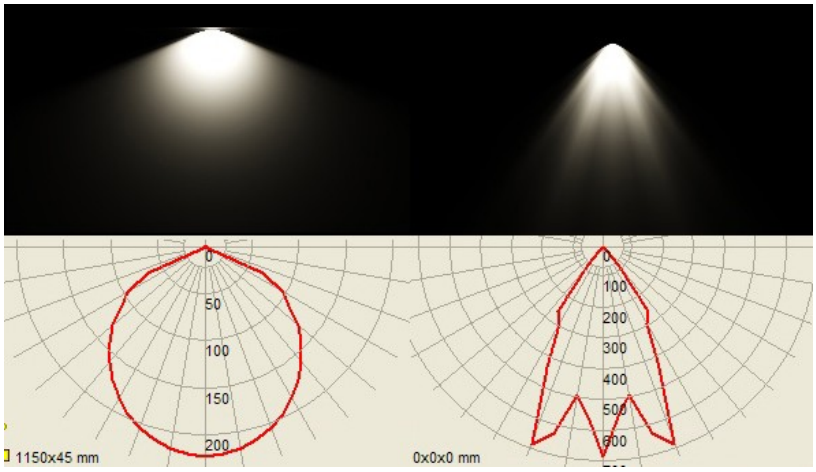
IES



IES stands for Illuminating Engineering Society. IES is a standard file format that holds information on the distribution of light intensity from a light source. You can think of it as a digital profile of a real world light. In 3D software like 3Ds max it can be used for creating lights with shapes and a physically accurate form. By default, Indigo emits a basic light shape. While Indigo is capable of creating real refractions of an accurately modelled light fixture to create this effect, it is far easier to use an IES profile, and the result is much the same. Many manufactures provide IES files for their lights, and it is a great way to add realism to your scene.

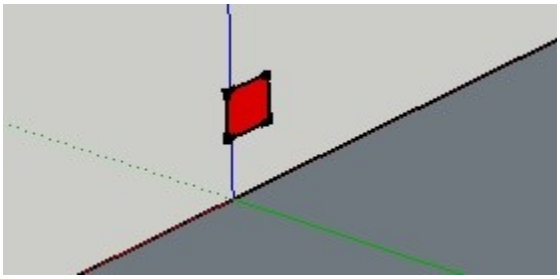


Digital Photometric data. With the basic Indigo profile Left, and an IES profile Right.

You can use an IES viewer to preview these profiles. There is a very good viewing program made by Andrey Legotin that can be found here: http://www.photometricviewer.com/

Setting up the scene

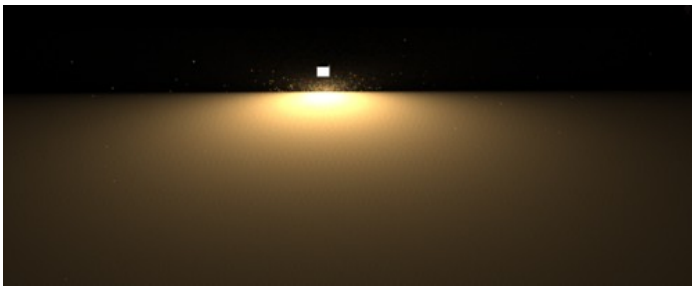
Firstly, we will set up a simple scene to show off the light effects. For this I have made a flat ground plane, to catch the light, and a small, single plane mesh above and perpendicular to it.



A single plane mesh raised off the ground

The plane will be our light-source, so select the it and assign it an **emitting material** in your Indigo plugin. Since we are working with artificial lighting, go to your **environment settings** and disable the sun and set a ***black background.***

Hit render and you will get the standard Indigo light render like so:



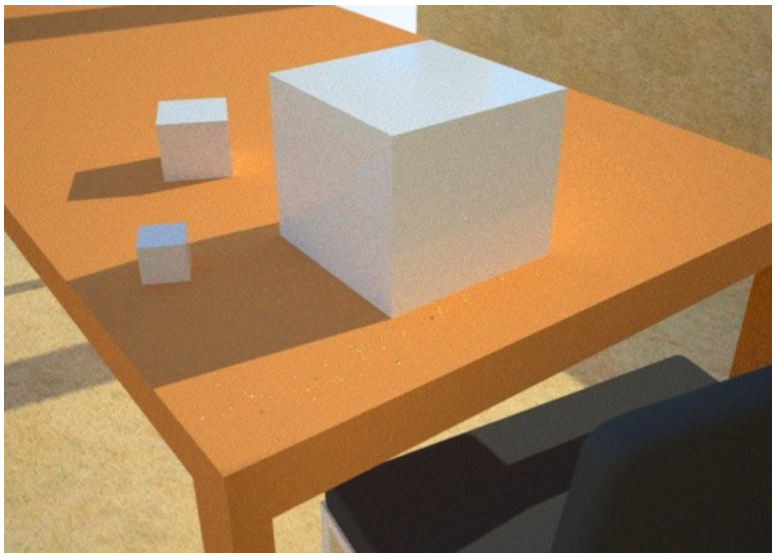
Render with no IES profile

Adding an IES profile

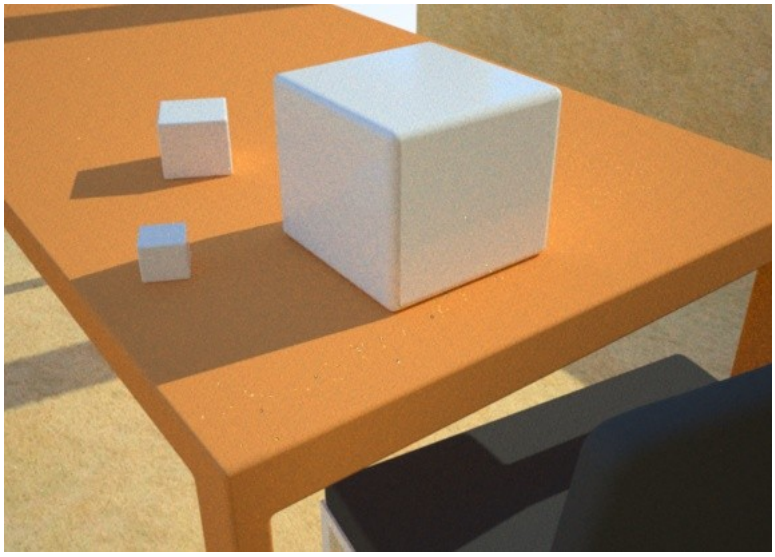
Open the **material editor** of your Indigo Plugin, under **Emitter Attributes** you will find the **IES path.** Download the zip of IES files here http://www.indigorenderer.com/dist/ies-profiles.zip and link to one. Hit render to view the new IES profile in your scene.

Bevel your edges

In the real world, nothing is completely perfect. The computer environment on the other hand, is perfectly precise by design. This can lead to sharp edges and reflections in your renders. A quick and easy way to remedy this is to bevel, or round, your edges.



Scary cube monsters



Friendly boxicles

Notice the reflections curve around the edges of the cubes, and the edges them selves pick up a more defined specular highlight.

Texture levels

There are many things that you can do on a computer that are mostly impossible in real life. On a computer, you can make an object with a completely red surface, with an RGB of 256,0,0, which is practically impossible in the real world. While you can still put that material into Indigo and render it with realistic lighting, it will still look out of place. Therefore, there are a couple of rules-of-thumb that you should follow to avoid surreal scenes. These suggestions are most obvious when used on a diffuse material, and even though a reflective material such as a phong will light the surface and subdue the color levels, any surface shadows will still appear a bit funny.

Image by Prof4D

Saturation

Saturation is the level of colors in an image or texture: the higher the saturation, the more vivid the colors are. As in the example with the pure red, it is mostly impossible to get such a saturated color, it is usually blended with other colors. Here is an example of wood texture saturations:

A range of saturations, middle being optimal.

Darkness

If a texture or material is too dark, it won't reflect enough light and therefore just appear pure black. Now as far as we know, the only real occurrence of pure **0,0,0 RGB** is a black hole which consumes light, literally. Even Super-Black the blackest material made by man reflects 0.4% light. So for your objects to look real, the RGB should be a minimum, of say, **20%** or **RGB 50,50,50.**
This is not to say you can't have something painted black in your scene, just remember that even black paint is visible, meaning it reflects light.

Lightness

Inversely, an over-bright surface will emit *too much* light. Only emitters should should be allowed to appear white if the light temperature is intentionally white. If there is a surface in your scene that is over **80%** brightness, or about **RGB-204,204,204**, it will reflect more light than is natural, both washing it out and possibly washing out near-by surfaces. Try to keep it below that.

Post-processing

If you find your render is still not as saturated or contrasted as you would like, play around with the tonemapping settings to find what you are looking for. See the tonemapping section for more information.

Phong

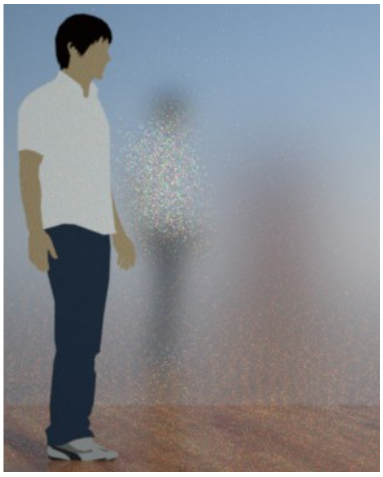
The majority of surfaces around us have some shine on them, just some more than others. If you look around, nearly every object you see has some sort of reflection or a highlight. If your render is looking like a bunch of cardboard cut-outs, it's time to make things shiny!

The most common way of doing this is using the **Phong** material type because it adds reflections and highlights to a surface. There are two important controls when using Phong: **Exponent** and **IOR (Index of refraction).** The **exponent** controls how rough a surface is (or how sharp the reflection is, if you want to look at it that way): a mirror is very smooth with a sharp reflection so has a very high exponent, and a painted wood door is quite rough with a very blurred reflection so has a low exponent.

The **IOR** controls how much light is reflected by the surface, so again a mirror reflects a lot of light and so has a high IOR, while the door is quite low.

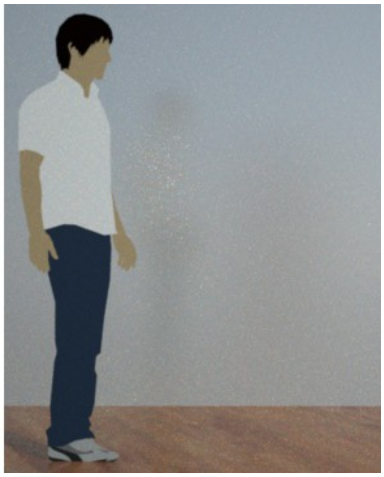
Here are 4 examples modelled on the wall behind John.

Exp: 100,000 IOR: 20



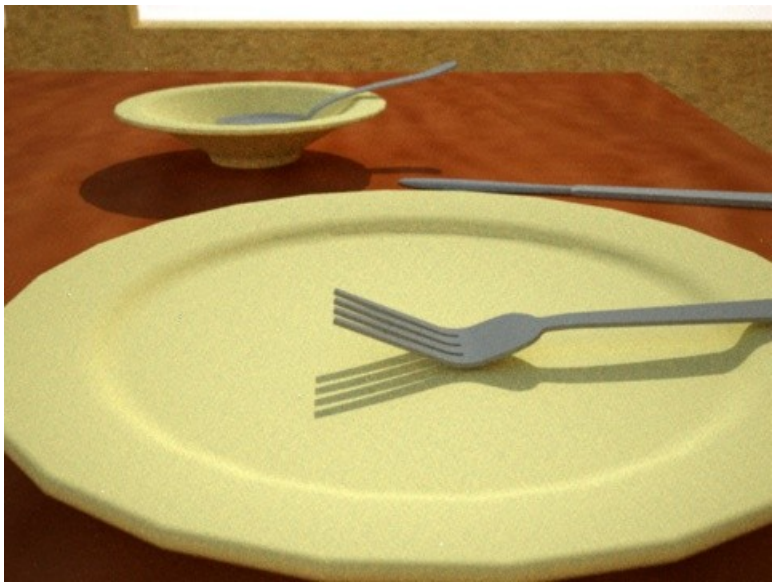
Exp: 500 IOR: 20

Exp: 100,000 IOR: 3



Exp: 500 IOR: 3

Now to put that into practical terms, here is an example:



All materials are default diffuse.

Phong'd up

Notice the highlights and reflections on most materials. Even the table has a soft reflection because it is varnished wood, with a low IOR and exponent. The plates on the other hand have a high exponent, giving the sharp highlight, but a low IOR because they don't give off a lot of light. The cutlery is metal which has a sharp highlight and reflects a lot of light so has a high exponent and mid IOR.

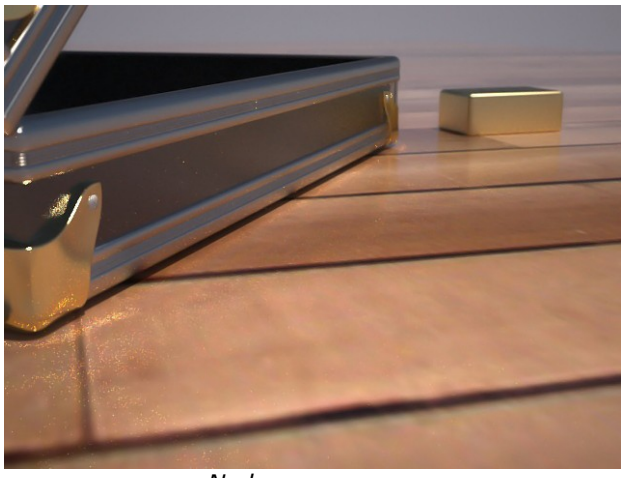
Bump maps

In addition to the texture map, there are several other 'maps' that can be added together to enhance the way the surface is rendered. Bump maps are a cheap way to create the illusion a detailed surface, without any extra modelling.

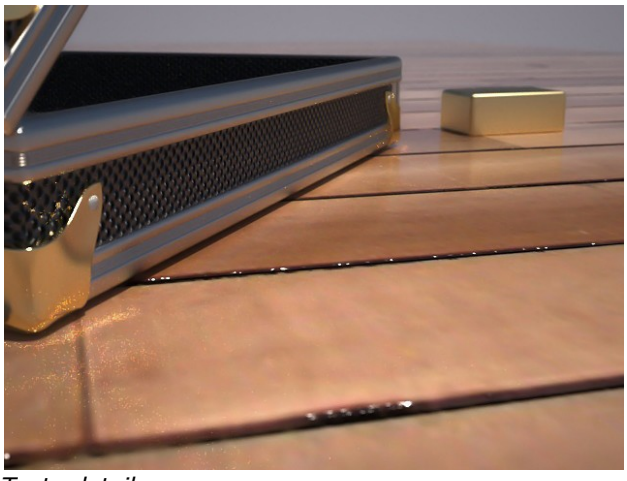
A bump map is a grey-scale image, where black is the lowest point, and white is the highest. It is important that gradients in a bump map are gradual, as a sharp edge will cause dark shadows to appear that can look like holes. A bad bump map scale will also cause this same effect.

As a side note, normal maps are not supported with Indigo.

Texture map *Bump map*



No bump maps



Tasty details

Notice how the edges on the planks catch the light in the right-hand image, giving the illusion that they are bevelled with real gaps between. The texture on the case is a plain albedo (color) with a small tiled bump map.

Correct size modelling

It doesn't take much, but if an object is more than 10% over it's real size, the scene starts to look surreal and fake. Most things have standard sizes, doorways, halls, furniture, windows and we all subconsciously know this. Look up the real sizes and make sure that your modelling conforms to them.
Some modelling packages work to their own unit of measurement so make sure yours is set up properly to use a real-world measurement.

Reasonably accurate scale

Off-scale

Model in meters

When the scale is not set properly, there will be many unexpected results so it is very important that it is correct. To be consistent, everything in Indigo is measured in meters, from focal distance and aperture, to object sizes. Here are several examples of what is affected by bad scale:

1. Sub-Surface Scattering

   Sub-Surface Scattering (SSS) is a measured distance that controls how far a beam of light goes in a medium (such as glass) before it is reflected in a different direction. A wrong scale will either cause the whole surface to light up, or appear to have no SSS at all.

2. Light absorption

   A material, such as a yellow glass, absorbs colors of light in a way that it appears yellow. Either no color will be absorbed with an incorrect scale therefore making it appear clear, or inversely, it will appear black, having absorbed all light.

3. Focus

   The aperture is a very fine measurement, which incorectly set will either cause the whole scene to be in sharp focus, or totally blurry.

Correct height

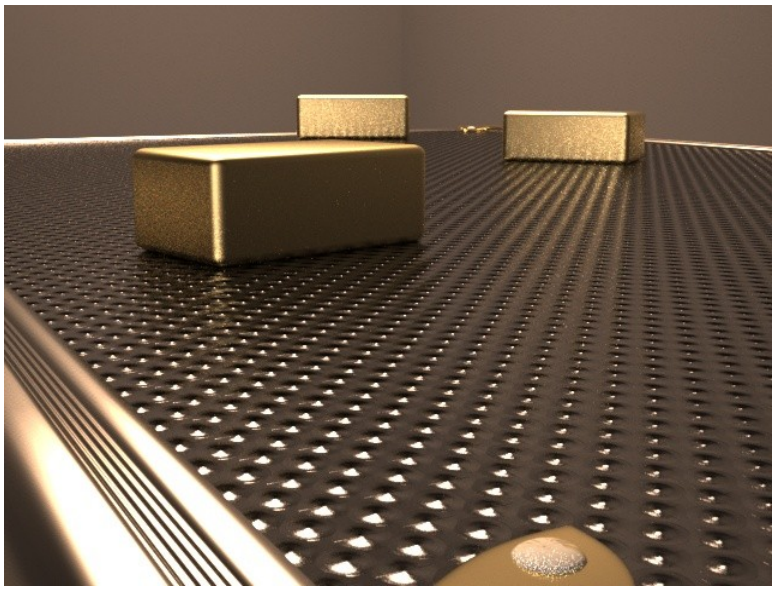
We all see from our eye level which is not often more than 1.5m. Therefore if a scene is rendered from a camera that would take a step ladder or crane to get to, it looks off. This doesn't mean that a scene will only look good at eye-level however, photographers will get into all sorts of weird spaces to get the shot they need. But as a general rule, put the camera at eye-level or lower.

Creepy web-cam

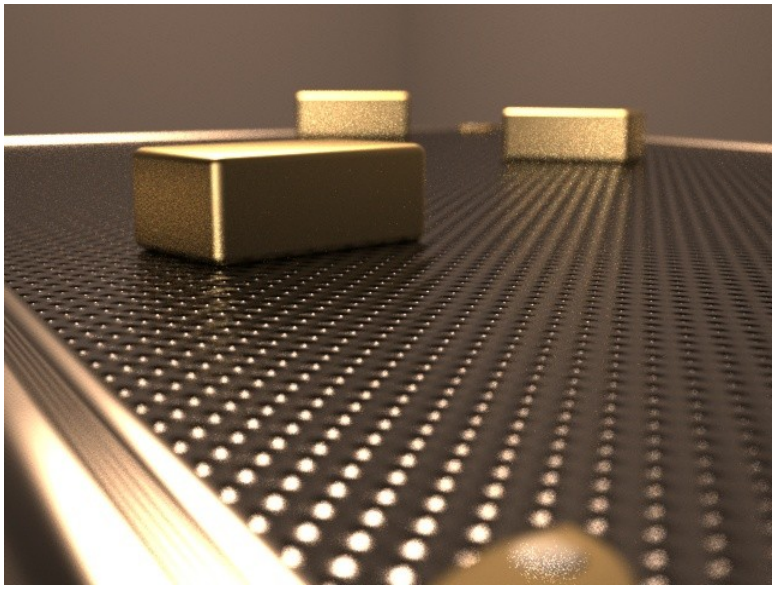
A friendly dining room scene

Depth of field

Depth of field is a phenomena that causes certain parts of an image to blur based on its distance from the camera. It is exploited as a photographic technique for a variety of reasons. A shallow depth of field can be used to accentuate certain parts of a scene, give more detailed information about a subject by exposing just a portion of it, or to remove a distracting background. A wide depth of field puts all elements in focus.
An image is always sharpest at the cameras focal distance, but the depth of field is controlled by the camera's aperture, measured in f-stop. The smaller the f-stop number, the smaller the depth of field; the larger the f-stop, the larger the depth of field.



Wide depth of field, f/22



Shallow depth of field, f/2

Film camera responses

Because Indigo acts like a real camera capturing real light, you can change the 'camera' you are rendering with. By using the **Tone Mapping** settings you can adjust the ISO, EV, and film response. What this means is that you can change the colors, brightness and contrast of the rendered scene to suit the desired feel. Because Indigo renders in HDR ,you can do this on the fly without having to re-render. Here are some examples of the same image:

Advantix-200CD, -1.0 EV, 400 ISO

Portra-400NCCD, 0.0 EV, 350 ISO

Indigo's default setting

Default setting with 40 ISO