Studio Setup for Product and Industrial Design

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This tutorial shows how create renders that you would typical see for studio photographs used in product and industrial design.
General Scene settings This tutorial will not cover the setup for studio lighting itself because this topic is covered very well by books about rendering and photography. A very useful book for render engine independent rendering topics like studio lighting can be found here http://www.3drender.com/.

This tutorial is based on a simple scene with two light colored rectangular lights with opposite colors. Try to to avoid pure white lights. As an alternative, use a white light and additional colored lights. A scene with colored lights will look less CG like. Also, the most physically correct solution is to use rectangular lights and disable the options: no decay and ignore light normals. The advantage of rectangular lights are: shadows, lighting, and reflections of the lightsource match perfectly.

- Image 1: Studio scene with two rectangular lights:

A basic rule for physically correct materials is to avoid pure black (RGB 0,0,0) and white (RGB 255,255,255). For renderings without Global Illumination (GI), it does not matter which white value is used. In GI mode, if the white is set at (255,255,255), too much diffuse light will be reflected and will cause an incorrect indirect lighting effect. In the real world, the maximum diffuse reflection is approximately 80%, and 80% of 255 = 204. A value of 200 is good standard value for the brightest white surfaces. This rule is especially important for interior renderings. The same rule for textures applies - a general multiplier 0.8 helps.

Image 7 below shows an example: Using the bright wood texture without correction would cause too much light to bounce between the wooden ribs. In a previous test with bright birch wood, a strong glowing effect between the ribs was visible.

- Image 2: Texture brightness correction:

The easiest way to control the quality of a rendering is to use the full adapative sampling mode Image 3. The user does not need to control the subdivs options of the lights and material. Instead, the quality is globally controlled by one parameter - the noise threshhold. For a quick preview, a threshhold of 0.05 is useful (for even less noise try 0.005). It is recommended to set the automatic subdiv range from 0 ... 100, but I often use 0 ... 50 or 0 ... 20 only. A max rate 100 is good for many cases, but the rendering may be slower.

- Image 3: Full adaptive sampling:

- Image 4: First raw preview:

The current Rhino3D rendered viewport does not show all mapping modes, therefore a quick test rendering is necessary. An easy way to render an image for texture control is to add the output of the diffuse channel in the VFB Channels option. If all lights are disabled in the Global switches section and GI is turned off, the rendering is very fast. The output channel can be found at the frame buffer. See Image 5.

- Image 5: Additional output channel at the frame buffer:

An additional Depth of Field (DOF) effect increases the realism that can be enabled on the Vray Camera options page. The focal length is set by the Rhino3D camera target (RMB on the viewport name -> show camera). Note: if the DOF effect is too strong, the objects in focus may look very small.

- Image 6: Additional DOF effect - Arperture 0.5:

Global Illumination using QMC (prim) and LC (sec)

The easiest method of controlling GI is the combination of the secondary engine Light Cache (LC) and primary engine Quasi-Monte Carlo GI (QMC GI). This method is not the fastest, but is very stable and flexible. It keeps the details of lighting simple and the user does not need many controls: only noise threshold and LC subdivs are required. An extra advantage is that the LC pass produces a quick preview of the whole scene. If the Num. Phases of the LC options is set to 1, the LC pass is not divided in sub-passes and the quality of the LC pass can be estimated. If more phases are set, less memory is used, but the user can not estimate the quality of the LC pass.

The LC pass calculates physically correct lighting for the whole scene and is used as base for the primary GI engine. The QMC GI do not need to be changed and the bounce control is inactive for the primary engine. An important parameter is the subdivs of LC. If the LC does not converge to an image with less black noise, than the subdivs should be increased - (i.e., for interior renderings at 1200 or more).

In my opinion, if the global GI color is set to a low intensity, the GI calculation seems faster. For the tutorial scene, RGB (190,174,142) and a multiplier of 0.1 are used. The background color simulates the background light of a studio environment. The GI algorithm must not sample a pure black environment.

- Image 7 Advantage of the LC pass - physical correct lighting and quick preview:

- Image 8:All effects added - quick test with high noise threshold ~0.02:

- Image 9: Rendering with GI with LC and QMC - noise threshold 0.01:

Global Illumination using IM (prim) and LC (sec)

A good way to increase the speed of the GI calculation is to jump from QMC GI to Irradiance Map mode. It's not easy to control and can produce some artifacts but if speed is necessary, than IM is the best choice. Image 11 is based on the options of Image 10.

- Image 10: Options for Irradiance Map mode:

The rectangular light option store with irradiance map is useful for blurring the noise of raytraced shadows. If too few subdivs are used, than the shadow looks blotchy. The example in Image 11 uses subdivs 6 - still a little bit blotchy. The DOF hides this a little.

- Image 11: Fast GI Rendering with LC and IM:

If GI artifacts with IM are visible, (i.e., in an interior scene), than my preference is to set the color threshhold to 0.15 and increase the samples to 64, 128, 256 or 512.

Color mapping

The human eye color mapping function is exponential - we can see details in deep shadows and in bright light. In the past, I have mostly used the "exponential" mapping for my projects. A new expontial mode is now possible - "Reinhard". The pure "exponential" color mapping function is too strong and the images look a little dull without postwork. The "Reinhard" color mapping mode allows you to choose a burn value to get the right balance between too much and too little contrast. The tutorial images show the new "Reinhard" color mapping and burn value 0.8.

The final rendering Image 12 is rendered with 8 subdivs for the shadows of the rectangular lights. The previous images are a little dark so I have set the brightness multiplier of "Reinhard" color mapping to 1.2.

- Image 12: Final Rendering:

Update: Physical correct and Gamma corrected

Here an update of the scene. The scene is setup for Gamma 2 now, my favourit Gamma value, because it is placed between Windows engine typical Gamma 2.2 and Mac engine typical Gamma 1.8. Following options are changed:

- global gamma at 2

- wood gamma at 0.45 (see TutorialG)

The scene lighting is softer with gamma 2, so I have disabled the environment light and changed a little bit the ratio between the two lights. Also I have lower the saturation of the wood texture per photo software. The noise threshold is at higher level from 0.005 at 0.012, because the new setup dosn't see a so strong threshold. Also I have set the subdivs of lights a little bit higher at 12 to avoid some IM noise. I can not direct compare the rendertimes, because a new PC is used, but the new times between the old scene and the new one are 96 s and 46 s. The gamma corrected setup calculate the scene much faster. A slight s-curve at the fame buffer curve correction enhance the contrast.

- Scene rendered in gamma corrected mode:
  Befor we have used a 0.8 multiplier for the texture. Easier is to set the global secondary GI engine multiplier at 0.8.

Attached the scene and the texture map.