

## Lighting Methods for RNL

*Creating scenes that look rather like photographs asks for special lighting schemes, the Bryce sun alone is not adequate. We are looking at IBL, HDRI in TA Gel and Obscure Lighting.*

### Introduction

In order to be able to assess whether a render looks photo realistic, a controlled environment has to be set up. A real scene has to be photographed and this scene must be recreated artificially, rendered and then compared to the photograph. Natural light can be created by capturing the light — colour and intensity — around the scene; this is called a Light Probe. The light ought not to change while acquiring the light probe and photographing the reference scene.

### *The Light Probe*

The light probe was assembled from 35 photographs, using exposure times from 4 seconds to 1/60 second at f-8 and 100 ISO. These photographs were taken within 7 minutes in a room with partly artificial light and partly daylight but without direct sunlight. The dynamic range is 1,470:1 and maximum radiosity 28.



In the zenith is a lamp with a reflector bulb that directs the light to the ceiling. It is 90 cm (~3 ft) from the lens; the lens is 115 cm (~3.8 ft) above the floor. The brightest light comes through the window ahead. Its brightness (blue) is around double as bright as the bulb above (reddish). The other light sources only contribute to the ambient light.

### *The Scene*

The scene was set up exactly below the light bulb. Removing the gear to acquire the light probe and setting up the scene took 11 minutes, and photographing the scene from four angles took another 9 minutes. The light probe and the four photographs were acquired within a total of 26 minutes, in which time the sun moved by 6.5° over the house towards the brightest window. The overall light did not change perceptibly.

### *Bryce 7.1 Pro — Lighting Methods for Rendering with Natural Light*

Below the scene as seen from all four angles is shown. In each pair, the left picture is the Bryce scene and at right the photograph of the real scene. Care has been taken to get approximately same horizontal field of view for the photograph and the render. The models are to scale with the real objects.



The Bryce camera was set to a FoV of  $120^\circ$ , which would be in the diagonal of a 4:3 aspect ratio document. Here, we have an aspect ratio of 2:3 to match the real camera. This gives a horizontal FoV of around  $100^\circ$ , a vertical one of  $130^\circ$  and a diagonal one of  $140^\circ$ . The Bryce camera starts to stretch the lines because it has no distortion correction like the camera lens.

On second thought, it might have been a better idea to photograph the scene with a fisheye lens and attach the fisheye lens to the Bryce camera. However, this does not affect the result as far as light is concerned.

In Bryce, the tone-mapped HDRI backdrop is on a sphere with an infinite diameter and it cannot be scaled. Placing the scene becomes extremely difficult, if not impossible, because of the parallax errors. If a backdrop is used where the nearest objects are far away, this would not much matter.

More serious is that the light sources, one of which is quite near, are treated as if at infinite distance. The real sun in an outdoor scene can be considered to be at infinite distance like in the light probe. Unfortunately, there is no controlled environment available outdoors. Cloud movement and wind are hardly controllable.

With these limitations in mind, the following tests were performed, using three different lighting schemes.

## Render Examples

The scene above was rendered using *IBL*, *HDRI in TA Gel*, a True Ambiance variant brought forward by David Brinnen, and — also one of David's ideas — *Obscure Light*. With each method, the scene was rendered from four viewpoints. The material properties were not changed.

The missing shadows from the object on the floor should be ignored. It was not intended to make that part looking natural. Only the light on the objects and the shadows cast onto the objects is of interest for this investigation.

### **IBL**

Image based light would seem to be the ideal candidate for rendering with natural light. After all, the movie industry has been doing this for years. For pure image based light, we have to consider the disadvantage that the light sources are near to the object in the real world, but at infinite distance in Bryce.



**IBL settings:** Quality 256, Saturation 50%, Intensity 7, Specularity 1000, HDRI Effect 40, Shadow Intensity 75%, Tone-mapped as backdrop added to sky, probe diameter 3840 pixels. All sky effects disabled, no visible sun, Ambient full white, Sky Dome full black, Sun/Moon Shadows 100%.

**Discussion:** apart from the banding, the shadows look pretty good, perhaps still a bit dark. Specular on the upside down metallic ashtray is a bit wide but that could be corrected for. There is too much dynamic in the light. Where the light from the window (providing the main shadows) hits the sidewall of the table it gets too bright but those parts which point away from the window are too dark. This can only be corrected with a lower dynamic range HDRI.

**HDRI on TA Gel** (David's video HDRI\_in\_TA\_gels)

This is a True Ambience render, not a classic one, but one that uses Boost Light. The tone-mapped HDRI does not provide any light. Four TA Optimized radials surrounding the scene have the tone-mapped spherical projected LDRI wrapped around them, these provide the light. This image controls the ambient colour for the radials material and Ambience is set to 100. The radials are at the same origin but have slightly different diameters. A fifth, black, TA optimised radial surrounds everything and functions as firewall.



**IBL settings:** Quality 16, Saturation 50%, Intensity 7, Specularity 1000, HDRI Effect 0, TA optimization enabled, Shadow Intensity 75%, Tone-mapped as backdrop added to sky, probe diameter 3840 pixels. All sky effects disabled, no visible sun, Ambient full white, Sky Dome full black, Sun/Moon Shadows 100%.

**Discussion:** the shadows are very diffuse and short but are in the expected general direction. The objects are evenly lit; I particularly like how the top of the white box is lit by a pale yellow light from the lamp above it. All objects are nicely lit. The parts in the direct light from the window are not over bright, what is not hit by direct light not dark. This is so because the TA feelers gather the light from the LDRI on the radials. What I miss is the specular on the metal, though this could be added with an additional radial or the Bryce sun with a moderately high specular setting.

This is a very nice setup for a still life but fails in several aspects to match the photograph. On the other hand, if we had no photograph to compare this render with, we might consider it natural looking. At least as far as the light on and around the table is concerned, it looks quite realistic.

**Obscure Light** (David's video Create\_Obscure\_Lighting)

This lighting scheme also uses an HDRI and True Ambience. However, the main light is produced by the HDRI from inside. In a standard HDRI from Inside render, the scene has to be built around the Bryce world centre, in which the tiny light producing HDRI is located. However, this works completely different if rendered in the TA mode. The scene can be everywhere, even obscuring the world centre. A single TA optimised radial encompassing the scene is needed. Its material can be default grey, if more light is needed, the Diffuse colour can be set to white instead of grey.



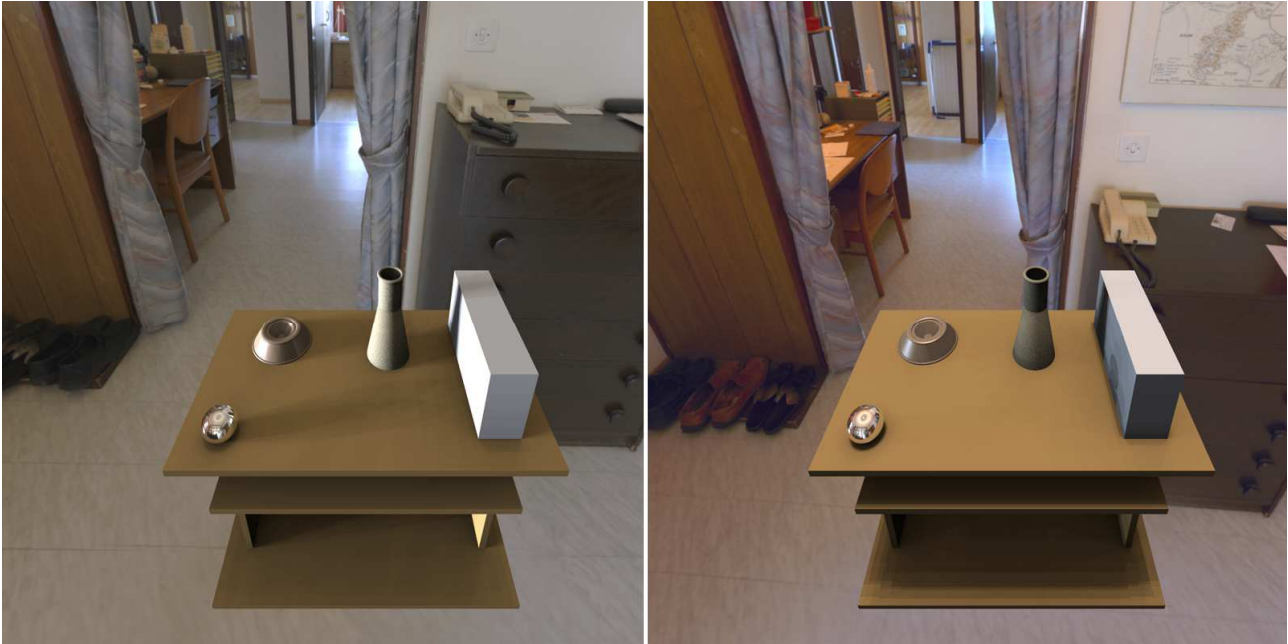
**IBL settings:** Quality 16, Saturation 50%, Intensity 7, Specularity 1000, HDRI Effect 50, TA optimization disabled, no shadows, HDRI from Inside, Tone-mapped as backdrop added to sky, probe diameter 3840 pixels. All sky effects disabled, no visible sun, Ambient full white, Sky Dome full black, Sun/Moon Shadows 100%.

**Discussion:** again, almost no shadows, the bit of them points in the expected direction. The objects are evenly lit as we expect from a TA render but we see more dynamic in the light. The side of the table lit by the main light from the window is quite bright but not overly so as in the IBL render. The quality of the light approaches the one in the photograph, except that the shadows are mostly missing. There is some specular on the metallic ashtray, but not a lot. This could be remedied with an additional light providing only specular. If we have no photograph to compare the render with, we would probably say this is a very realistic looking render.

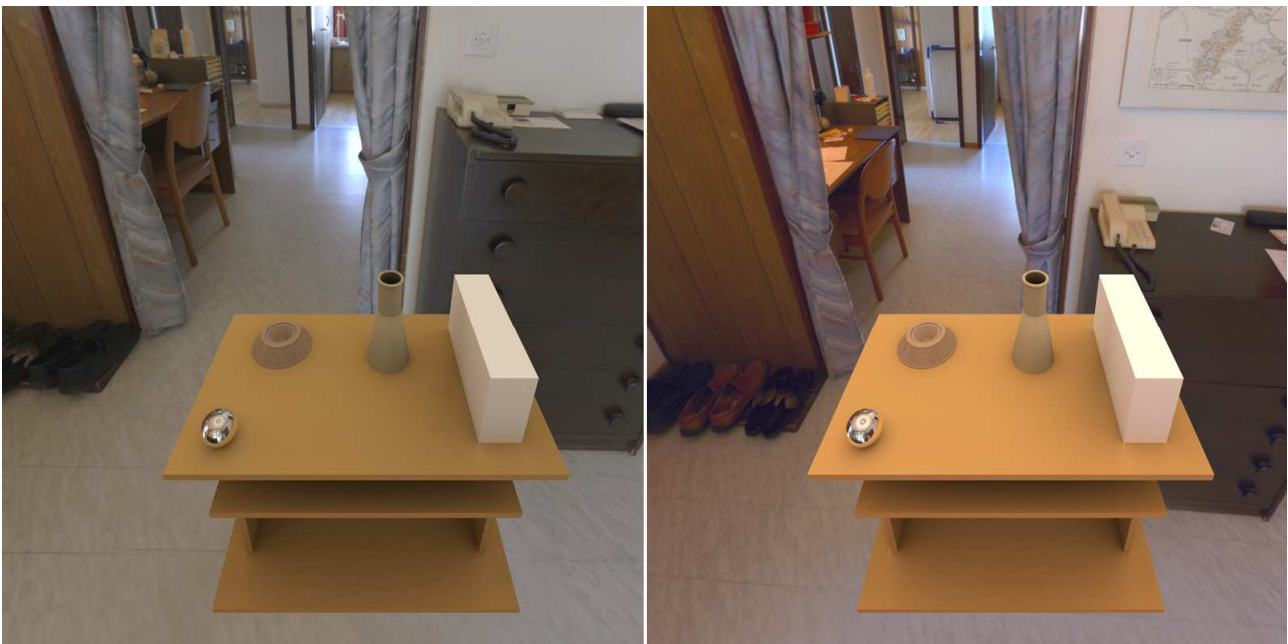
## The Role of the HDRI

The HDRI plays an important role for these lighting techniques, least for *HDRI in TA Gel*. A light probe was made about a year ago in the same environment, though the lens did not exactly point at the light at the ceiling and the lens was nearer, about 60 cm (~2 ft) and higher up the floor at 151 cm (~5 ft). There was less light coming from the window, approximately the same amount as from the lamp above.

The dynamic range of the older light probe is almost five times at 7,060:1. The higher dynamic range does not necessarily mean the light sources are brighter, it can also mean that there are darker parts. This is the case for this light probe which was assembled from 56 photographs, using exposure times from 1/2 second to 1/125 second at f-5.6 and 200 ISO.



*IBL* render, left the new and right the earlier light probe.



*HDRI in TA Gel* render, left the new and right the earlier light probe.



*Obscure Light* render, left the new and right the earlier light probe.

What is most obvious is the pale yellow light that shines from above and casts shadows. The light from the window left of the scene is less strong and casts a shadow on the white box in the IBL render. Also obvious is the different white balancing, the examples with the older probe are warmer.

## **Photo Realism**

I set out to determine which method is the most promising to make renders appear photo realistic. None produces this quality completely but each one in part. In an environment with one or several prominent light sources that cast shadows, IBL appears to be best suited.

For indoors and still lives where we do not expect shadows which give a directional clue where a prominent source is located because there is so much reflected ambient light, I prefer the *Obscure Light* method. The colour of the light is nicely represented through the HDRI from inside; it is easier to set it up than the *HDRI in TA Gel* and gives better control over the brightness.

It would be rather nice if we could use the HDRI from inside and outside at the same time with individual controls over the light generated by each one of them. Then, we could combine the IBL and *Obscure Light* methods. *Obscure Light* with the HDRI from inside giving the environment light and the HDRI from the outside the shadows.

The tests performed are also a bit unfair because the materials on the objects were never adapted to the necessities and possibilities for the lighting method used. The eye can be easily cheated and if we do not have a direct comparison, we accept an unrealistic render as a realistic one if it is aesthetically pleasing. As far as art is concerned, this is the most important aspect.

## **Example renders optimised for an interesting result**

Below are three renders using the three lighting methods discussed. The table is from the Bryce library, the 3D-Moebius is a free model made by David Brinnen and is available from here: [http://www.bryce5.com/details.php?image\\_id=3095](http://www.bryce5.com/details.php?image_id=3095).

## ***Bryce 7.1 Pro — Lighting Methods for Rendering with Natural Light***

The Utah teapot is a classic and will eventually be available with the *Bryce 7 Content Bundle 2* from DAZ3D, and the mirror ball is a sphere. The HDRI used is the older one. Specular on the 3D-Moebius and teapot is genuine from the HDRI on the IBL render, for the other two renders, the sun was set to the same position as the lamp to provide specular.

### ***IBL***(render time 1.00)

Radials: none.  
Sun: none.  
Compat Specularity: enabled.  
Light from inside: disabled.  
Shadows: Intensity 50%, Softness 100%.  
Quality: 128.  
Saturation: 50%.  
Intensity 7, applied to light source.  
Specularity: 750.  
HDRI Effect: 150.  
Premium render: 16 Rays per pixel.  
Soft Shadows engaged.  
Maximum Ray Depth 4.



### ***HDRI in TA Gel*** (render time 2.57)

Radials: 4 with LDRI plus 1 firewall.  
Sun: Specular 100, Altitude 90°.  
Compat Specularity: disabled.  
Light from inside: disabled.  
Shadows: none.  
Quality: 16.  
Saturation: 100%.  
Intensity 7, not applied to light source.  
Specularity: 0.  
HDRI Effect: 0, TA optimization enabled.  
Premium render: 256 Rays per pixel.  
True Ambience engaged.  
Maximum Ray Depth 4.



### ***Obscure Light*** (render time 1.85)

Radials: 1 default grey.  
Sun: Specular 100, Altitude 90°.  
Compat Specularity: disabled.  
Light from inside: enabled.  
Shadows: none.  
Quality: 16.  
Saturation: 100%.  
Intensity 7, applied to light source.  
Specularity: 0.  
HDRI Effect: 500, TA optimization disabled.  
Premium render: 256 Rays per pixel.  
True Ambience engaged.  
Maximum Ray Depth 4.



Teapot and 3D-Moebius have grey Diffuse at 100 Diffusion, 75 Specularity, 75 Anisotropy and Specular Halo white 240. The teapot has additionally 15% Reflection.

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