IBL Advanced: Backdrop Sharpness, DOF and Saturation

IBL is about Light, not Backdrop; after all, it is IBL and not IBB. This scene is lit exclusively by IBL.

Render time
1 min 17 sec.

The pizza, cutlery and bread are from Pizzeria Italia by *mclean*, the candle is by *David Brinnen*, the flowers are some Gazania from *Lisa's Botanicals*, and the vase is from DAZ, I do not remember the details; the Utah Teapot is a classic and the mirror ball a Bryce sphere.

Again, this scene is exclusively lit by IBL but somehow it looks unfinished. Since the advent of shadow capturing techniques, mixing objects with an HDRI backdrop became a new playground in Bryce. This video is not about shadow capture, this has been covered in videos already and there are products by David that deal in depth with that technique.

Bryce IBL is in the adulthood but it has not yet fully matured. There are still a couple of features that are missing, particularly as far as the backdrop is concerned, and we have to resort to workarounds.

We will work with the panorama at right as HDRI for light and backdrop.

A few words about the colour: the left panorama has the colour right, but if we are in this room, we will perceive it rather than the right one, which has been white balanced. The fluorescent lamp is actually greenish and the bulbs yellow-red. The colours in the right panorama are too blue – nevertheless they look more natural.

The camera was at the height of an average person standing on the floor and put in the middle of the table. The main light comes from the bulb at 78° elevation, 12° off the zenith. The fluorescent lamp is higher up and contributes about half of the light. The other lights do contribute, but less than 10%.

We will start with spatial resolution of the HDRI used as backdrop. How large must a backdrop be to render sharp? It depends on the FOV (field of view) of the Bryce camera and the size of the final render. The size of the render is obvious; a 400 pixel wide render does not need such a large backdrop panorama than a 2000 pixel wide one.

FOV might be a bit trickier to understand. First, FOV in Bryce is not AOF – angle of view, and it depends on the Scale set. In the following examples, the camera FOV is set to 90° at Scale 100 and this corresponds to a horizontal angle of view of 72° (or a lens with a focal length of 30 mm). 72° is a fifth of a full circle of 360°. The width of a panorama in the spherical projection needs to be at least five times wider than the width of the final render.

Render time
5 min 09 sec.

The HDRI used here has a width of 8260 pixels and the render is 1000 pixels wide. 8260 divided by 5 is 1652 and we have about 160% of the pixels needed – which is good. However, if we look carefully, we notice that the left and right sides appear to be less sharp than the centre part. There are slight distortions and if we look closely at the flowers to the right, this becomes more obvious.

Render time
2 min 00 sec.

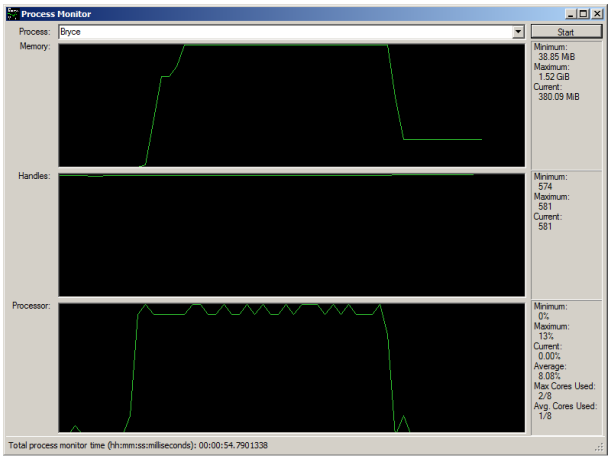
A bit of blurriness comes from stitching the individual photographs to an HDRI. Then, we do not exactly know how Bryce treats the HDRI loaded. It stands to reason that it also introduces a bit of distortions that show as a slight blur. I suspect that we would need at least twice as many pixels as are rendered to get a fully sharp backdrop. In our case, the spherical HDRI should be at least five times 1000 pixels, which are 10,000 pixels wide for two pixels per rendered pixel.

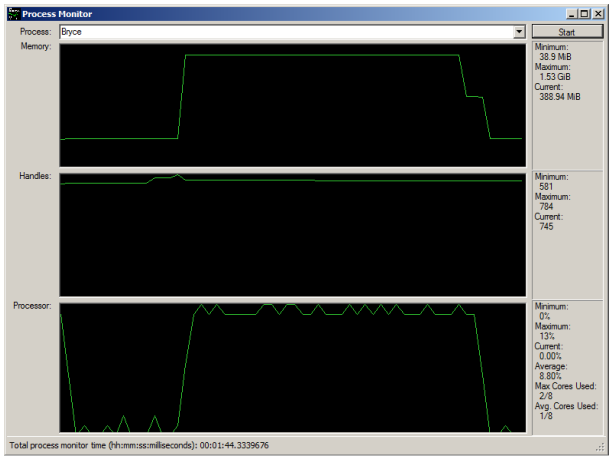
Bryce is still a 32-bit application and can normally only handle 2 GB of memory. Though a 10,000 x 5000 pixel spherical HDRI panorama would only need 0.6 GB of memory once loaded and tone-mapped. However, the HDRI is compressed and decompressing is done in memory. Tone-mapping is done in memory as well. This asks a lot of memory until the HDRI is loaded and tone-mapped.

And by the way, saving a scene with an HDRI is also very memory intensive, because the compression of the HDRI and the scene is done in memory.

At left below memory usage to load the scene above with the 8260 x 4130 HDRI and at right when the scene was saved. The compressed source file only needs 118.5 MB so do not ever get fooled by the file sizes of a saved Bryce file. The scene uses 390 MB but to load it, 1.5 GB was used.

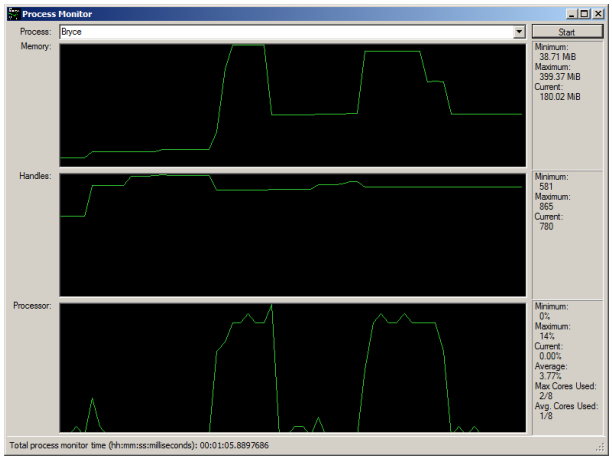
If you are on a 32-bit machine with 2 GB of memory, you would not be able to load this scene because your operating system may already need 600 to 700 MB of the available memory and the remaining 1.3 to 1.4 GB will just not suffice.





I could use such a large HDRI and measure the memory used because my computer sports 8 GB of memory and I made Bryce large address aware. With this trick, Bryce can use up to about 3.3 GB until it runs out of memory. But this is not the rule, so we will have to find ways to work with a smaller HDRI as backdrop.

Using **DOF** (depth of field) and a smaller, more blurred HDRI is one of the possibilities we will now investigate. The HDRI used before had an uncompressed size of 410 MB; the one we use now has an uncompressed size of 62 MB, its diameter as a probe is 2560 pixels.



The scene uses only 180 MB, while loading and tone-mapping, memory usage hit 400 MB and with this, we are on the safe side as far as memory usage is concerned. The scene loads and saves much swifter as well.

Render time 28 min 31 sec, Quality 512.

Render time 6 min 59 sec, Quality 512.

To set DOF, I selected all objects except the vase with the flowers. The Focal Length in the Render Options was determined as 248 Bryce Units. The Lens Radius is set to 0.09. The Lens Radius has its photographic equivalent in the f-stop or diaphragm setting. We would like to have the f-stop numbers instead of the rather arbitrary dimension-less number. The higher the Lens Radius is set, the less the Depth of Field will be – this means the narrower the range depicted well focused.

The HDRI backdrop can also be given DOF, but it has to be set to zero. We already have a blurred backdrop and we want to make the vase as much blurred that it matches the fuzzy backdrop. The scene was rendered with DOF and only 16 rays per pixel.

What we did here was trading memory for render time.

What else can we do to get a sharp backdrop without wasting too much of memory? We can load a high resolution HDRI into an empty scene, tone-map it and export it from Bryce as a 24-bit bitmap BMP or TIFF in the Spherical projection, then quit Bryce. Make sure the HDRI is not rotated. Yaw and Roll should be at 0° and Pitch at 90°. This gua rantees that the exported spherical panorama is aligned with the original HDRI. This makes aligning the HDRI and the picture on the sphere much easier.

In any graphics application, we can apply a sharpen filter in the hope this will improve things a bit. We can then apply this 24-bit picture on a sphere surrounding the scene. Because it will be mapped on the inside of the sphere, the picture will have to be flipped horizontally, make a mirrored copy of it.

The sphere has to be placed into the world centre and encompasses the whole scene. The image should be mapped Parametric. The picture is offset by 90° clockwise in the Parametric mapping mode. We have it here at Y = 0° and the HDRI Yaw is at 270°, which means it is offset by 90° counter clockwise and HDRI and the picture on the sphere are aligned.

We are not always confronted with such a nice arrangement and the sphere has to be rotated. It is therefore a good idea to load a low or medium resolution HDRI so the sphere can be aligned with the HDRI backdrop. Remove all shadow options for the sphere.

A radial light has to be set approximately into the centre of this sphere to light up the picture. Here, it was set to Diffuse 7, no falloff – in case the size of the sphere has to be adjusted, no adjustment for the radial is needed – and no shadow casting. Only the sphere is included to receive light, all other objects do not get any light from this radial.

Render time 14 min 2 sec, Quality 512.

Render time 14 min 27 sec, Quality 512.

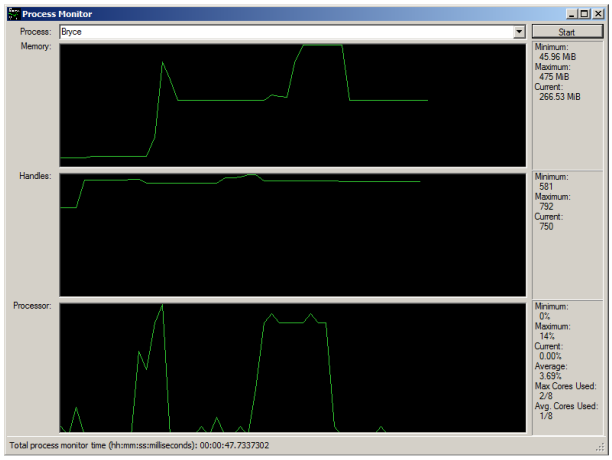
The sphere with the mirrored picture applied has a size of 1024 Bryce Units (at left). There is no match at all. The picture is much wider than the HDRI – it appears as if the camera had a FOV of almost 180°. What is going on here?

The HDRI backdrop is at «infinite» distance. The sphere with the picture must be larger; the largest it can get is 1,024,000 Bryce Units. This is done at right and the pictures are almost correctly aligned. There is a bit of a blurred upper edge on the newspaper at right and at left there is a tiny bit more space after the bench ends.

As far as the light is concerned, the HDRI and the picture on the sphere are aligned.

The HDRI can now be exchanged by a very low resolution one. HDRI and sphere are aligned, as far as light is concerned, the size of the HDRI does not matter. In fact, we can use a specular map and get yet another advantage. The HDRI used has a diameter of 800 pixels and needs just 6 MB of RAM, the picture on the sphere is a 8260 x 4130 pixel panorama and needs 34 MB; in total light and backdrop take 40 MB.

Render time 15 min 10 sec with Quality 512.



The scene needs 267 MB and to save it, 475 MB are used. This is a bit more than the 400 MB for the medium resolution HDRI but we have a well-focused backdrop. Render time is quite high. Since we use a specular map for lighting the scene, the light sources are more diffuse and we can reduce the quality and still have no noticeable banding. The HDRI is not used as backdrop.

Render time 2 min and 9 sec, Quality 64.

Render time 35 sec, Quality 64.

Each step of quality increase doubles the render time. Back from 512 to 64 this is eight-fold (512 to 256 = 2 x, 256 to 128 = 2 x, 128 to 64 = 2 x; 2 x 2 x 2 = 8). There is no need to use DOF if the backdrop image on the sphere is of adequate resolution.

Render time 2 min 3 sec, Quality 64.

Render time 2 min 6 sec, Quality 64.

Now, what happens if the specular convolved HDRI is used as backdrop to some extent?

The left one above uses the tone-mapped HDRI as backdrop and the sphere is 25% transparent. The colours are less saturated. To increase saturation, use the HDRI without tone-mapping it, as the right render shows.

It often happens that a tone-mapped HDRI looks a bit low contrast and low saturation. There are almost 50 different tone-mappers I know and have experimented with. The one we finally decided to incorporate into Bryce can be used fully automatic with the right initial settings. This tone-mapper produces very photo realistic images from an HDRI in most of the cases. Nevertheless, sometimes a backdrop could do with a bit more contrast and colour saturation. Then you can use the colours to bleed through the sphere with the backdrop picture. Though the HDRI is very much blurred, the colour hue matches if the transparency of the sphere is set diligently.

Letting a part of the non-tone-mapped HDRI illuminate the backdrop sphere is a neat idea if you need more contrast and colour saturation. So what can we do if the saturation is already too high without the HDRI lighting up the backdrop image?

We have a saturation control in the IBL lab, but it only controls the saturation of the light produced by the HDRI, not the backdrop. Well, if an image on a sphere is used as backdrop, that image can be de-saturated in a graphics application.

If we use the HDRI itself as backdrop and it is overly saturated even when tone-mapped, we can use something like a neutral density filter.

Render time 2 min 16 sec, Quality 64.

Render time 2 min 40 sec, Quality 64.

Above is again the HDRI with a diameter of 2560 pixels as backdrop. At left, the HDRI is tone-mapped and at right, it is not. Obviously, the tone-mapped one looks more natural but we want to reduce the saturation nevertheless.

We create a sphere that surrounds the scene. A size of 1024 Bryce units will nicely do. As for the material, we use a grey Diffuse colour with R/G/B each 127. We will play with the Diffusion and Transparency controls and in the IBL lab with Intensity.

The HDRI is not tone-mapped to show the effect of the filter better. At left below, Diffusion is at 50 and Transparency at 75. Intensity is 5. At right, Diffusion is at 100, Transparency at 50 and Intensity lowered to 4.

Render time 2 min 39 sec, Quality 64.

Render time 2 min 32 sec, Quality 64.

The left picture below is a third example with Diffusion and Transparency both at 100. Intensity was again lowered to 2.5.

Render time 2 min 27 sec, Quality 64.

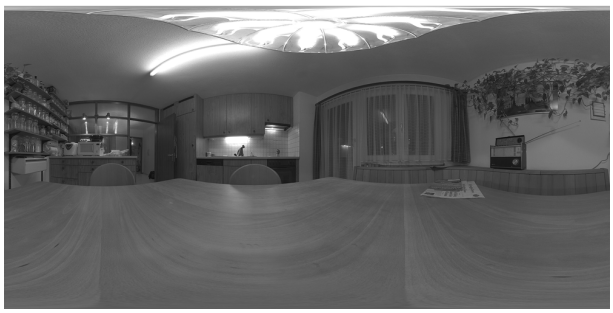
Render time 1 min 33 sec, Quality 64.

The one to the right uses yet another method to de-saturate the backdrop but it does look a bit hazy. There is no sphere used as a filter. Instead, Sky Colour is set to middle grey, the same colour as used for the filter sphere. The HDRI backdrop is set to Blend with sky with Use Sky Color enabled. The HDRI backdrop is set to 60% transparency – which means that there are 40% non-tone-mapped HDRI backdrop and 60% grey from the sky colour.

If a filter sphere is used, the camera looks through the filter onto the backdrop. If a grey sky background is used, the grey sky shines through the backdrop.

To make the backdrop still less saturated, we can use the tone-mapped variant.

We can also go the other way around. We can remove the colours on the high resolution LDRI and make it monochrome, then colour the background using the HDRI as backdrop to colourise it.



Render time 2 min 4 sec, Quality 64. -->

The HDRI was linear tone-mapped, that is just squeezed into the LDRI dynamic range, and made monochrome. The picture above at left shows it. It was mirrored and mapped on the sphere as we did earlier. The sphere is 25% transparent, a radial with no falloff and Diffuse 5 lights the sphere from the inside. For the HDRI, the specular map was used at Intensity 5, without tone-mapping. The render is shown above right.

Render time 2 min 6 sec, Quality 64.

Render time 2 min 2 sec, Quality 64.

Same setup, at left the transparency of the sphere is set to 50%, the radial has still Diffuse 5 and the HDRI intensity is also left at 5. Above right, transparency is reduced to 25%, Diffuse of the radial is reduced to 4 and HDRI Intensity doubled to 10. There is more colours bleeding through and the resulting render has a dreamy quality. The specular map is responsible for this.

For the following, I do not ask you to like what you see. I ask you to think out of the box. Bryce gives the artist freedom and is not limited to photo realistic renders.

The HDRI was subjected to a diagonal Sobel convolving filter. The way I set up the filter, it enhances lines and inverts them (dark lines get bright) without inverting the light; and the result made monochrome. Apart from the changes made for the LDRI, the setup is the same as for the examples above. There is a lot of noise in the resulting LDRI shown below at left.

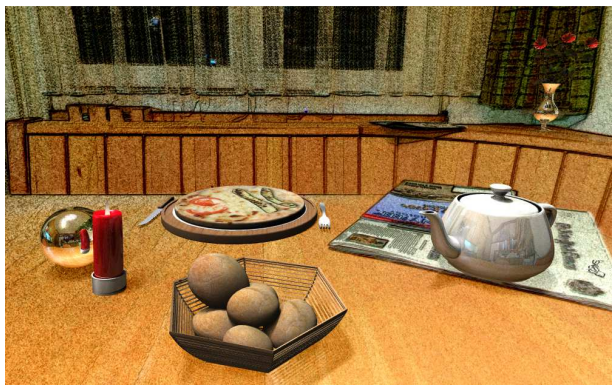
Render time 5 min 28 sec, Quality 64. -->

For the render at right, the sphere is 25% transparent, Diffuse for the radial is at 2 and the back-drop HDRI Intensity is at 10. The dark lines are enhanced and show as bright lines. Of course, this looks unnatural, but this is not the point. The point is that the artist should be given the freedom to express himself or herself through the art created.

Below at left, the transparency of the sphere is doubled to 50%, diffuse of the radial halved to 1 and HDRI Intensity is set to 5. The render looks softer with less contrast and is less saturated.

The final example below at right is a very far-out sort of render. If it were not so noisy and full of high contrast details, it could go as CEL a shaded background.

Render time 5 min 4 sec, Quality 64.



Render time 5 min 14 sec, Quality 64.

Transparency of the sphere is at 25%, the intensity of the HDRI backdrop is at 50 and it is tone-mapped. Here, a 1280 pixel diameter probe is used, not the specular map.

The radial is special. It is set to diffuse minus 7; it sucks off the light on the backdrop sphere and makes it very high contrast, it also enhances the saturation of the tone-mapped HDRI. You are not requested to like this result, just think of the possibilities. You could use just about any filter to change the LDRI on the sphere.

To wrap up what we have discussed in this video:

- using DOF for the objects in the scene if the HDRI backdrop is not sharp enough;
- export a high resolution HDRI as tone-mapped spherical LDRI panorama, use this on a huge sphere and replace the HDRI with a low resolution one to save memory;
- adjust the colour saturation of the HDRI backdrop using a sphere as neutral density filter – or the sky colour;
- use a monochrome high resolution LDRI on a huge sphere, make it partly transparent and light it with a radial, then colour it using the HDRI as backdrop;
- most importantly: think out of the box.

Hopefully, these tips will give you even more fun when using Bryce IBL.

Products used and mentioned in the video:

- The pizza, cutlery and bread are from Pizzeria Italia by *mclean* (http://www.daz3d.com/pizzeria-italia),
- the candle is from *David Brinnen*, made for the free Publishing Artists Xmas 2011 product Yuletide (http://freedownloads.daz3d.com/Yuletide_still_life1.zip),
- the flowers are some Gazania from *Lisa's Botanicals* (https://www.daz3d.com/i/shop/itemdetails/?item=3571),

Products discussing Shadow Capture:

- Bryce Mentoring DVD by *David Brinnen* and *Horo* (http://www.daz3d.com/bryce-mentoring-dvd-videos-scenes-and-resources),
- HDRI Shadow Capture by *David Brinnen* (http://www.daz3d.com/bryce-pro-hdri-shadow-capture),
- HDRI Shadow Capture 2 by *David Brinnen* (http://www.daz3d.com/bryce-pro-hdri-shadow-capture-2),
- HDRI Scene Files 2 by *Horo* (http://www.daz3d.com/hdri-scene-files-2),
- HDRI Scene Files 3 by *Horo* (http://www.daz3d.com/hdri-scene-files-3),
- HDRI Scene Files 4 by *Horo* (http://www.daz3d.com/hdri-scene-files-4),
- HDRI Scene Files 5 by *Horo* (http://www.daz3d.com/hdri-scene-files-5).

January 2012/horo