Transparency in Bryce

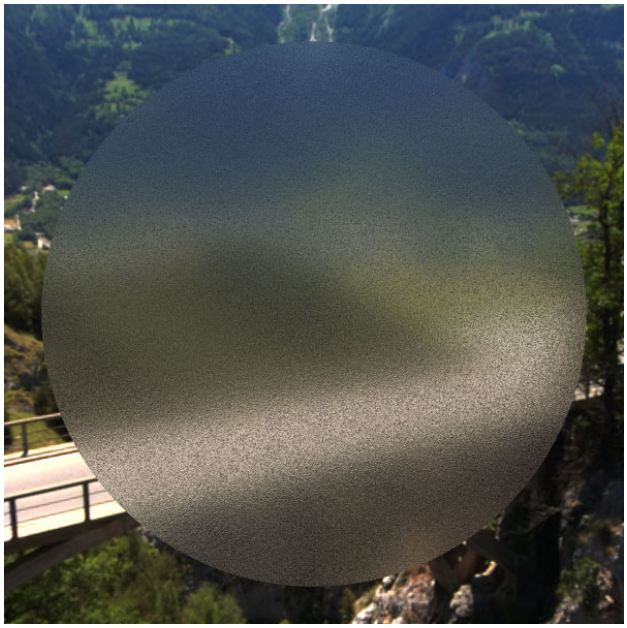
Transparency is the quality of how much light passes through a surface, an opaque surface has zero transparency. Bryce has three means to control the transparency of an object.

Transparency, Translucency and Refraction

For Bryce, transparency and translucency is essentially the same. A window glass is transparent, when looking through it we can see an image of what is on the other side of the glass.

A frosted glass is translucent, it also lets the light pass through but we cannot discern what is on the other side. Skin has some translucency, a strong light behind the head of a person makes the ears shine reddish, for example, and also foliage is translucent to some degree, light shines through leaves if the sun is behind a tree.

80% Transparent



80% Translucent

Translucency can be faked in Bryce by using some fine bump and Refraction set a bit higher than air. Transparent materials have a refraction index and in Bryce Refraction = 100 corresponds to a refractive index of 1.00, i.e. air. From Refraction 0 to 100, transparency does not change but it does from 100 to 300.

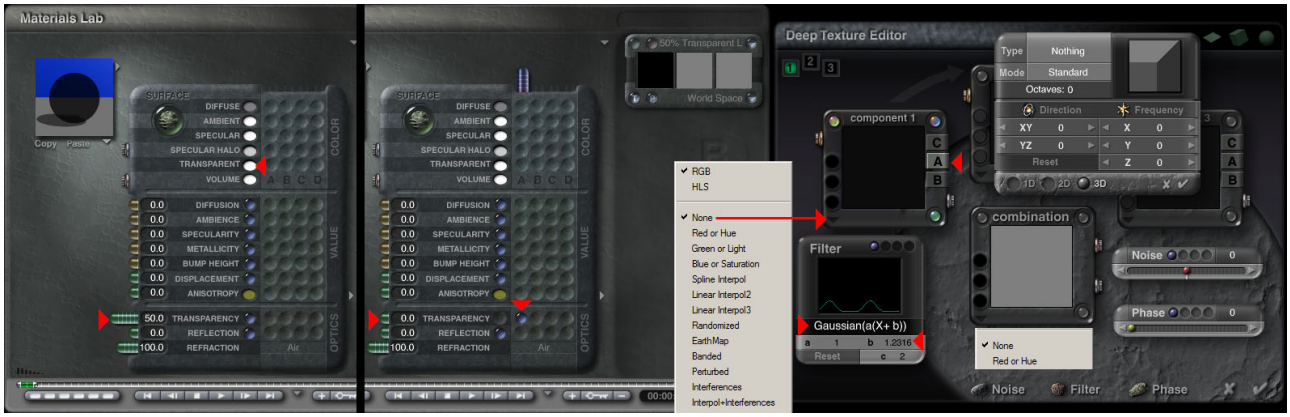
Transparency

There are two ways to look at transparency. One is to have the camera look at a surface through a partly transparent sheet, like the example above. The surface emits light that is dimmed through the sheet that is between the surface and the camera like a filter lens. Transparency behaves linear. We call it ***one-way*** transparency here.

The other way to look at transparency is to have a white surface lit by a light behind the camera. The light that hits the surface through the partly transparent sheet is dimmed. The camera looks through the partly transparent sheet onto the white sheet and the already dimmed light reflected from that sheet is again dimmed before it reaches the camera. The light travels twice through the partly transparent surface and in this case, transparency behaves square. This, we call ***two-way*** transparency in this document.

Transparency Controls

There are three means to control the transparency of a 2D sheet: *Transparency* control, *Transparent* colour and by a texture made in the *DTE*. All three controls add up. 3D objects behave differently and instead of *Transparent* colour there is *Volume* colour.



Transparency control, above left, lower red arrow. The setting can be considered as percentage (%) of permeability for one-way: 0 is opaque, 50 are half transparent and 100 fully transparent. For two-way the permeability in percent it is the *Transparency* setting squared and divided by 100; for a *Transparency* setting of 50, this will be 50 x 50 / 100 = 25%.

A 3D object has two 2D faces opposite each other (cylinder, cube) and therefore the light has to pass through two filters. It behaves like two-way and the permeability is the *Transparency* setting squared divided by 100 in percent.

Transparent colour, above left, upper red arrow. Assumed all three colours red, green and blue (RGB) are the same (grey), black (RGB 0) is opaque, middle grey (RGB 127) semi-transparent and white (RGB 255) fully transparent. If the individual colours are set differently, the permeability for each colour is also different. In this way, coloured filters can be created.

A 3D object has two surfaces and therefore the colour setting influences permeability by the square law: 127 are 50% of 255 and a 2D sheet will be 50% transparent, a 3D object only 25%. *Transparent* colour works like *Transparency* on 2D faces and 3D objects.

Volume colour, above left, below upper red arrow. Has no effect on a 2D sheet and works for a 3D object (cylinder, cube) like *Transparent* colour for a 2D sheet. To set the permeability of a 3D object by colour, use *Volume* colour instead of *Transparent* colour because it behaves linear and grey 127 are indeed 50%, not 25%.

Texture, above centre and right. Set a dot in either channel A, B C or D for *Transparency* and set *Transparency* to 0 (see red arrows in centre image). A random texture will appear.

Alpha from the *Deep Texture Editor* (DTE) will control how transparent the object will become. In the DTE (above at right) set the *Noise Type* to *Nothing* and *Mode* to *Standard*, 0 *Octaves*, *Frequency* and *Orientation* to 0 and 3D. *Phase* is not used, keep it at 0.

Only alpha [A] of *component 1* is used. The colour (or rather shade of grey) displayed in the *combination* window is the colour that controls the permeability exactly like *Transparent* colour does, just inverse. This grey value can be adjusted with almost any *Filter* but *Gaussian* is the least awkward to use. *Reset* the filter to get a=1, b=0 and c=2.

Adjust *b* between about 1 and 2. Nearer to 1 the *combination* window shows a darker grey and towards 2 it brightens to white. While white is transparent and black opaque for the *Transparent* colour, here it is the inverse: black is fully transparent and white opaque. Therefore, to get 30% transparency by the *Transparency* colour you calculate 0.3 x 255 = 77.

For the *combination* in the DTE however: (1 – 0.3) x 255 = 0.7 x 255 = 179. There are no fractions for the colour values, only integers; therefore the result 178.5 is noted as 179.

Combining: keep in mind that all control settings add up to the final permeability. Set *Transparent* colour for a 2D face to middle grey 127 and *Transparency* to 50, you will end up with 25%.

Best practice is to either use white *Transparent* and *Volume* colours and adjust *Transparency*; or set *Transparency* to 0 and use a texture for it. Alternatively, set *Transparency* to 100 and adjust the *Transparent* and/or *Volume* colour.

Refraction

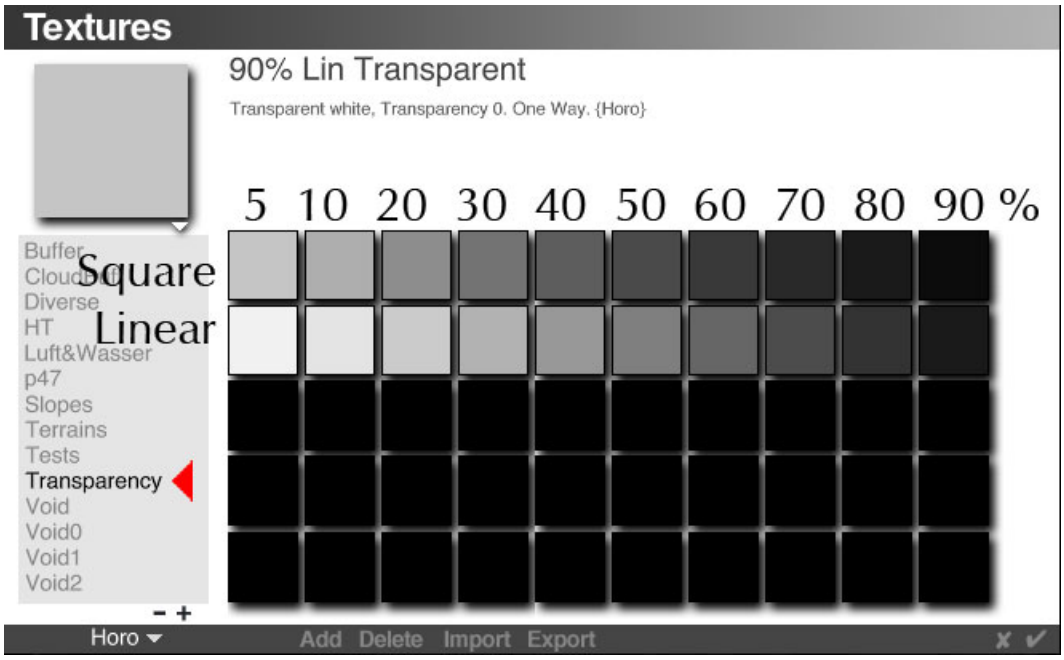
The *Refraction* setting also modifies the permeability of a partly or fully transparent object. The range is 0 to 300 corresponding to a refractive index of 0 to 3. Air has a refractive index of 1, in Bryce that is 100. From 0 to 100, there is no attenuation in the permeability; but there is between 100 and 300.

Refraction is the phenomenon that changes the phase velocity of a light wave when it passes through a medium and it depends on the angle of incidence and reflection how much light arrives at a certain location. It is possible to calculate the loss of light at a certain point as the angle changes.

For a 3D scene in Bryce where many sources emit light from different locations, where different FOV settings of the camera can be used, there are many incident and reflecting angles to consider. It does not make much sense to start trigonometric calculations. Either use Bryce or have fun with the calculator.

Texture Library

This document includes the texture library *Transparency.brt*. You can use it or delete it. If you keep it, copy it to: `<drive>:\<bryce>\Presets\Textures\<folder>`.



The percentages are the permeability or how transparent the object will be. Square textures are for two-way objects and Linear for one-way sheets.

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