Refractive Caustics using an Emissive Shader

With the correct setup, caustic effects are possible using Arnold. This short tutorial goes through how to set up a scene that contains a 'liquid' mesh with Caustics enabled in the Standard Surface shader assigned to it. The scene uses a plane that has a high Emission Scale value which produces the refractive caustic effect.

'Hard' caustics from small but bright light sources (e.g., a spot light through a cognac glass) are not currently possible.

Arnold uses simple, uni-directional path tracing. Rays start at the camera, not at the lights. Arnold does not use bi-directional path tracing (nor any other bi-directional technique, such as photon mapping, which fires rays from the lights). When using standard lights, like point lights and spot lights, which are idealized lights with zero area, i.e. point lights, it is simply impossible for Arnold's GI/reflection/refraction rays to hit the lights. Therefore, there are no caustics. However, it is possible to turn point lights and spot lights into finite-size lights by increasing their 'radius' parameter, which makes them spherical lights, which give beautiful soft shadows and soft highlights. It should then be possible for GI/reflection/refraction rays to 'see' those lights, right? Well, no. In Arnold, lights do not have a corresponding geometric object that's stored in the geometry database that rays traverse during ray-scene intersection. So, area lights are still invisible to GI/reflection/refraction rays.

Instead of using Arnold's standard lights, you can create a polygon mesh, give it a flat emissive shader, and let the GI engine 'find' that light. You will then get caustics. However, this is very inefficient, because small emissive objects are hard to hit. You would need many rays, or a very large emissive object, for this noise to be acceptable. That is why the user guide states that we can do 'soft' caustics, as coming from big emissive objects.

- Start off by opening the scene file. The scene contains a basic object to start off with. Create a polygon floor plane and position it underneath the mesh.
**Emissive Plane**

- Create another plane and position it above the mesh as indicated below.

- Assign a *Standard Surface* shader to the polygon plane above the polygon mesh. This will represent our light source. Decrease the *Base Weight* value of the *Standard Surface* shader to 0 and increase the *Emission* to around 10.

**Mesh Shading**

- Assign a *Standard Surface* shader to the polygon mesh that we want to generate the refractive caustics. We are going to make this a glass shader.

- Lower the *Diffuse* value to 0. Increase the *Specular Weight* to 1 and lower the *Specular Roughness* to 0. Increase the *Transmission Weight* to 1 and change the *IOR* to that of glass (1.5).

- Next, we will add a colored tint to the shader. Add some color to the *Transmission Color* of the glass *Standard Surface* shader.
Refractive Caustics

To view refractive caustics through our glass, we must enable them in the Standard Surface shader that is assigned to our glass mesh. Caustics can be found under Advanced. Enable it.

You can see the difference when enabling Caustics in the images below.

![Caustics: Disabled](image1) ![Caustics: Enabled](image2)

Noise

To reduce noise in the Caustics, you must increase the number of GI Diffuse Samples. The animations below show the difference between rendering Caustics with three and six GI Diffuse Samples. Be careful when using this attribute as the render times will increase dramatically when you increase this value.

![Diffuse Samples 3 (3 mins 15 secs)](image3) ![Diffuse Samples 6 (16 mins 55)](image4)

That's it. You are ready to render. Have a go at rendering some other objects. Things to consider when using this method are:

1. Fine tuning the right amount of Emission for the geometry that has the Emissive shader assigned to it, otherwise you may encounter a
lot of white noise.
2. Increase the **GI Diffuse Samples** to reduce the noise further.

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