

## What's "BOKEH", Anyway?

"Bokeh" refers to the way that a lens renders out-of-focus areas in an image. Historically, lens designers have tended to concentrate on optimizing the sharpness and contrast of a lens in the plane of focus, and the result has been that some lenses which are excellent performers in this regard can still create unpleasant, even jarring images due to the way the out-of-focus backgrounds come out.

Contrary to a widely held myth, bokeh has very little, if anything at all, to do with whether the diaphragm blades form a nice round circle or a polygon when the lens stops down. Here are a series of photos showing both good and bad bokeh with both round and hexagonal apertures:



Harsh Bokeh with Hexagonal Aperture



Harsh Bokeh with Round Aperture

The upper image above was shot through a lens with a hexagonal aperture, and you can see the distinct, distracting hexagonal highlights typical of harsh bokeh. The second photo was taken with the same lens, but shooting wide open so the aperture is a perfect circle. Note that the highlights are just as harsh and unpleasant as in the first photo: the bokeh is not better, the highlights are not smoother, the only difference is their shape - and frankly that doesn't make much difference at all.

Now let's look at some better bokeh:



Smooth Bokeh with Hexagonal Aperture



Smooth Bokeh with Round Aperture

In both of these photos, the out-of-focus highlights are rendered much more smoothly and pleasantly than in the two photos above. As in the first set, however, these better examples represent both a round and a hexagonal aperture. How is that possible?

It's possible because the shape of the diaphragm has nothing to do with it. The difference between good and bad bokeh is not in the SHAPE of the aperture but in the way light is distributed across each highlight spot. Look at the details below:



Note that in the harsh image, the individual highlights look like little donuts, bright at the edges and dark in the center. In the smoother image, the reverse is the case: the light fades smoothly from bright in the center to darker at the edges. The latter type of highlight creates a smooth, natural looking background, while the donut highlights look unnatural and exaggerated and, when there are lines in the background they are rendered as double images with a sometimes dizzying effect.

So if it's not the diaphragm shape, what DOES cause good and bad bokeh?

There are multiple factors, but the overriding one is the correction of spherical aberration in the lens formula. A lens with overcorrected spherical aberration will render FOREGROUND highlights smoothly while those in the BACKGROUND will appear as donuts. In a lens with undercorrected spherical aberration the reverse is the case. Because we more often have out-of-focus backgrounds than foregrounds, in most cases this means that lenses with undercorrected spherical aberration have better bokeh.

I will admit that there are cases where the aperture shape can take on more importance: in extreme cases of an elongated “cat’s eye” aperture slit, you can get some unpleasant effects resulting from a difference in depth of field between one axis and the other - but shapes like this are seldom found except in old 8mm movie cameras where good bokeh is hardly a top priority. In the sort of cameras that people fretting over bokeh are using, it’s just not that important.

As a side note: all of the above photos, both the good and the bad bokeh, were taken with the SAME LENS: a 105mm f.2.5 Nikkor, widely considered to be an excellent lens. This lens has a slight undercorrection of spherical aberration, so the "Bad Bokeh" shots were cropped from the foreground of the images, and the "Good Bokeh" shots were cropped from the background .... of the SAME IMAGES.