BEYOND THE FRINGE

David Kilpatrick looks at the issues of lens bokeh and colour correction

ぼけ

Bokeh is an abused word. As I write this, a Pentax user forum on Facebook is holding a 'bokeh photo' contest. The very concept of a 'bokeh photo' is evidence of how much the meaning of an subtle Japanese word has deteriorated. Bokeh or *boke* (written on the right using the characters *bo* and *ke*) is a lens *quality* – like colour transmission, micro-contrast, vignetting, or field flatness. It is present whether you use a lens at *f*2 or at *f*22. It doesn't mean out-of-focusness. It means the fingerprint which any given lens imposes on the way the focus of an image looks including the transition from sharp to defocused planes. At any aperture!

The root of the word means something like 'fuzziness' so it's always related to how the image goes out of focus. You can't talk about the bokeh of a perfectly sharp image from a perfect lens, something like a copy of a painting made on a repro stand. Such an image just doesn't have any.

Bokeh is affected by the other qualities of a lens, including its field flatness and degree of correction for aberrations. Residual astigmatism, for example, will tend to smear the image radially (spreading out from the axis) or tangentially (following a circle round the axis) behind and in front of the focus plane. Longitudinal chromatic and spherical aberrations will tend to make the out of focus image look *green* behind the focus plane, *magenta* in front of it.

This is difficult to remove by post-processing so one solution is to work in black and white. Monochrome conversion always removes colour aberration and fringes, including the subtle effects of colour bokeh problems. It's important to keep files in RGB colour form when converting them to monochrome. If you want perfect neutrality, simply move the Saturation control maximum left when converting a capture in *Adobe Camera Raw*; some adjustment of the tone curve, contrast and clarity may also be needed to produce a natural black and white film simulation. The Desaturate menu command in *Photoshop*, used on any RGB image, has a similar effect and again is best used along with careful contrast curve adjustment to avoid a flat dull look.

Because the factors affecting bokeh and depth of field itself are very complex, it's almost impossible to predict how the image from any lens will look. Simpler lens designs intended for larger formats tend to have 'better' bokeh and complex designs for smaller formats are handicapped by their entry and exit pupil positions and degrees of asymmetry. There's a good reason to prefer lens designs which have generous glass diameters rather than shoehorning superzoom specifications into the smallest possible barrel. In my experience the cost of the lens is not relevant. You can get busy, wiry unattractive defocused detail from high end lenses and smooth blur from

Above: rough bokeh and smooth bokeh, but you might not guess the lenses – expensive Canon 70-200mm f2.8L on the left at f3.5 (edge of image), right 18-200mm Canon EF-S at 200mm and f8, centre of frame. It is hard to predict which lenses will produce attractive defocused detail. The Lensbaby 3G is designed for curvature of field and strong spherical aberration, below – note the defocus discs.

consumer designs depending on the settings and conditions.

Often the best bokeh, at the expense of critical sharpness for the subject, is achieved by working wide open. Most lenses have a perectly circular iris at maximum aperture and some even have a Waterhouse-type stop a little smaller than the maximum diameter of the elements at that point.

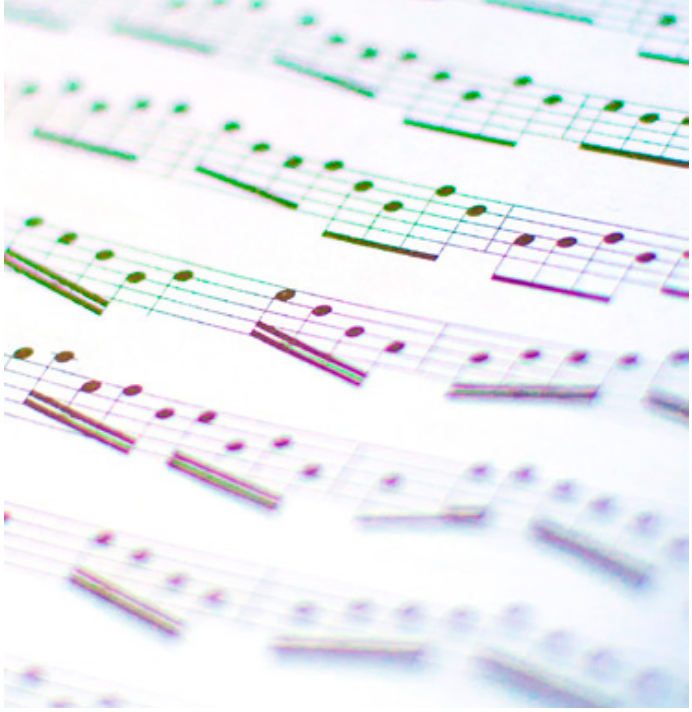
Towards the edges of the image with angles much over 45° the sensor no longer 'sees' a circular aperture, but an more elliptical shape, actually a lens in geometric terms because it is formed by two arcs. The out of focus circles of confusion become ellipses of confusion, and the long side of these shapes is aligned tangentially round the lens axis. This tends to show up in blurred detail closer than the focus plane, and not in the background, because of the way other aberrations interact.

You check any lens for its likely wide-open bokeh quality across the frame by looking at it from the rear and turning it from straight-on to a 20-25° angle. You will see the circular aperture gradually change shape and if you go beyond 25° (beyond the edge of the image circle for a lens with normal back focus distance) it will eventually disappear, you won't see even a slit of light.

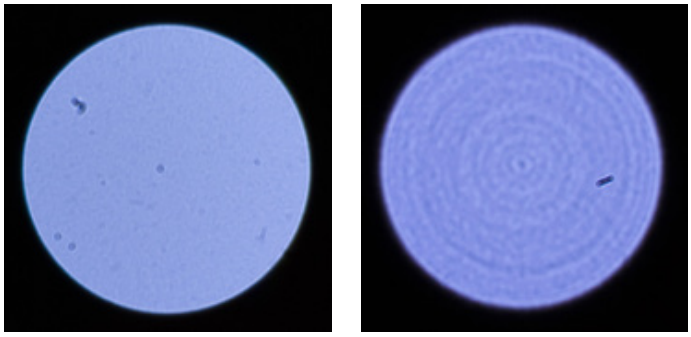
Telecentric lenses, those with a deep register keeping them as far away from the sensor as possible, may show a near perfect circle at all angles the sensor can 'see' it from.

Look at images, learn from the reputation of lenses and from others' experience. You may want a Nikon 100mm or 135mm *f*2 DC, a Sony 135mm *f*2.8 STF or a Canon 135mm *f*2 because these lenses are all designed to produce the most attractivet out of focus rendering at apertures from wide open to around *f*5.6 (from *f*8 down, there's little benefit). The Sony STF has a graduated element, darkening to its perimeter, which smooths results in a very subtle way.

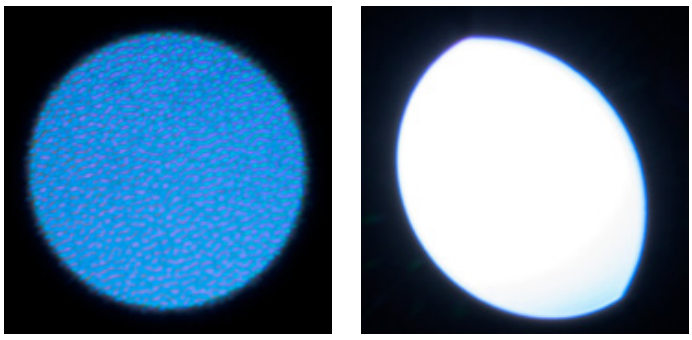
The new generation of ciné quality movie lenses for DSLRs, such as those from Samyang which are very affordable, have a multiblade circular manual iris with no clickstops. The maximum aperture is reduced a fraction to allow for light losses – the regular 85mm *f*1.4 Samyang is designated as T=1.5 in its ciné version. The aperture starts circular and stays that way, allowing a smooth continuous stop-down if you shoot video. This lens is equally appealing for portait still work.



Above: by boosting Saturation and Vibrance, the colour bokeh shift of a Voigtlander 58mm f1.4 at f2 is seen clearly.



Point source lens fingerprints created at full aperture, defocused to project a disc – top left, a Sigma 70mm f2.8 macro showing high quality final polishing but needing a clean; top right, Sigma 18-250mm zoom shows rings formed by the irregular surfaces of moulded aspheric elements, and one dust particle. Below left, the diffraction coating pattern of a Minolta Portrayer 3 soft focus filter revealed, on a 70-210mm f4 AF zoom. Below right, the lens-shaped distorted ellipse projected by a 50mm f1.4 Sony lens wide open, corner of shot.



Judging with live view

New generation full frame DSLRs offer the most scope for attractive differential focus. All of them offer Live View, and this is almost essential for judging focus effects. Optical focusing screens simply don't and can't show the real depth of field at apertures like *f*2.8, *f*2 or *f*1.4. Electronic viewfinder cameras like the Sony Alpha 99, or in a smaller format the Olympus OM-D, give a perfect preview of focus. The rear screen of a Nikon D600 or Canon 6D will do the same in Live View mode and also help ensure precision focusing at wide apertures, where depth of field may be less than the length of an eyelash.

To partner fast lenses, you may need a Neutral Density filter. I use 4X ND (two stops) which can make the difference between *f*8 and *f*4 but still allow easy SLR viewing. With Live View or EVFs, you can use 4, 6, 8 or even 10-stop ND and the brightness of the viewing system is unaffected. If you want a variable ND filter, remember it has a polarising effect and this is not always kind to skin and hair. Plain NDs are safer.

Lens fingerprints

Finally, you may sometimes notice that if a bright point source is imaged out of focus, a large 'bokeh disc' results. This disc will often have a hard bright edge – a typical result of residual spherical aberration, you can study it yourself using a magnifying glass and the sun. The bright disc may also seem to have a texture or pattern. This pattern is a cast shadow of the optical surfaces of the lens, or any attached filter.

If your lens is traditionally ground and polished, and clean-room new, you could get a clean disc. Any dirt on the lens will show up, and so will the fine texture caused by pressing or moulding aspheric elements. When you see this texture from a typical modern mass produced zoom, it becomes easy to understand why the image never looks as perfectly smooth as the result from a classic hand made design like a Zeiss Planar for Hasselblad.

This technique (a dark room, a single LED source, and the lens put out of focus) can be used to check filters and lenses and things like the 'translucent' mirror of Sony cameras or the AA filter and cover glass of your sensor – if you are very brave!