

## Capture sharpening - particularly for X-Trans files

The perceived sharpness of an image depends on two things. One is the amount of contrast at edges - i.e. the difference in brightness between adjacent light and dark pixels along an edge (technically known as 'acutance'). The other is the clarity of the fine detail in areas with fine structure ('resolution'). Sharpening an image can involve both enhancing the edge contrast and improving the rendering of fine detail. (I'll say a bit more about this shortly, because it is particularly important for photographers using Fuji cameras with their new X-Trans sensors.)

Digital photographs need two sorts of sharpening: capture sharpening and output sharpening (though they may also benefit from additional 'creative sharpening' to enhance particular picture elements). This short post will only discuss capture sharpening. As a first step in processing, capture sharpening corrects the image softness caused by the camera itself (for example, by the anti-aliasing filter on digital sensors, by lens imperfections, and also as a result of the softness that naturally occurs when you convert a fine stream of photons into an array of discrete squares, i.e. pixels).

If you shoot jpegs, the camera software applies the sharpening before it saves the jpeg, so you have very little control over how that's done. But if you shoot RAW, you have more control. Programs like Adobe Camera Raw (ACR) and Lightroom apply some sharpening as they import your files, but you can change the default preset that does this to suit your pictures.

Sharpening has three aspects, controlled by three sliders in ACR / Lightroom. As I mentioned in the first paragraph, one aspect of sharpness is the amount of contrast at edges. This is controlled by the 'Amount' slider, which increases the amount of difference between lighter and darker pixels that are next to each other. But this enhancement isn't limited to a single row of brighter pixels and the adjacent single row of darker ones: the increase in contrast can be made to take effect over a range of pixels extending away from the bright/dark edge; and the number of pixels away from the edge thus affected is controlled by the 'Radius' slider.

The third slider is called 'Detail', and you would expect it just to enhance fine detail. Indeed it does, but it affects something else, too: the very way in which the sharpening is being done all round. The software does the sharpening by applying mathematical calculations ('algorithms') to the values of pixels. One algorithm implements the traditional method of the 'unsharp mask' (USM), which enhances edge contrast to produce better acutance. The other algorithm works quite differently - it tries, mathematically, to reverse, or 'undo', the blurring caused by the camera's optical system. Mathematicians call this blurring 'convolution', so the process that reverses it is called 'deconvolution'. It is, in effect, a mathematical way of increasing resolution.

Now, at low values of the 'Detail' slider, ACR / Lightroom use the USM algorithm exclusively. But as you increase the slider between 40 and 60 the software uses a mixture of USM and deconvolution, gradually shifting the balance between them till at 100 (the maximum value on the Detail slider) the software is only using deconvolution.

Images made with conventional sensors benefit from relatively low values of the 'Detail' slider for capture sharpening. But Fuji's x-trans sensor creates images that are best handled with deconvolution. So to get the best rendering of Fuji RAW files in Lightroom or ACR, it's advisable to set the Detail slider to maximum - something that is completely alien to photographers who are used to working with the RAW files produced by traditional sensors.

Roger Clark goes into the technical differences between USM and deconvolution in great detail, with practical examples, in a series of five articles starting here:

<http://www.clarkvision.com/articles/image-sharpening-intro/index.html>

Photographer and blogger Pete Bridgwood has investigated how to get good capture sharpening for the files from Fuji x-trans cameras. He offers detailed practical suggestions here:

<http://petebriidgwood.com/wp/2014/10/x-trans-sharpening/>

And there's a learned discussion of sharpening on the Luminous Landscape forum that has been carried on for the last four years, with contributions from a number of experts, including Adobe's Principal Scientist, Eric Chan, who worked on the sharpening algorithms in ACR / Lightroom. You'll find the discussion here:

<http://www.luminous-landscape.com/forum/index.php?topic=45038>

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