

Exposing to the Right - What's that all about?

The Dynamic Range

A digital SLR has a dynamic range of 5 stops (*it's usually closer to 6 stops, but most Histograms deal with a 5-stop 'spread'*). When working in RAW mode, which you really should be, most cameras record a 12- or 14-bit image.

A 12 bit image is capable of recording 4,096 (2^{12}) discrete tonal values. One would think that therefore each F/Stop of the 5 stop range would be able to record some 850 ($4096 / 5$) of these steps. But this is not the case. The way that it really works is that the first (brightest) stop's worth of data (the top, or right-most fifth) contains 2048 of these steps – ***fully half of those available.***

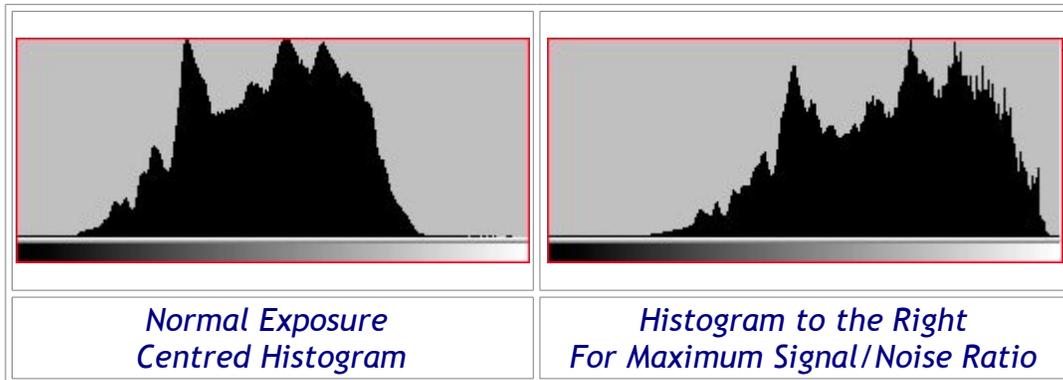
Why? Because CCD and CMOS chips are linear devices. And, of course, each F/Stop records half of the light of the previous one, and therefore half the remaining data space available. This little table tells the tale.

| | |
|---|-----------------------|
| Within the first F/Stop, which contains the Brightest Tones | 2048 levels available |
| Within the second F/Stop, which contains Bright Tones | 1024 levels available |
| Within the third F/Stop, which contains the Mid-Tones | 512 levels available |
| Within the fourth F/Stop, which contains Dark Tones | 256 levels available |
| Within the fifth F/Stop, which contains the Darkest Tones | 128 levels available |

This realization carries with it a number of important lessons, the most important of them being that if you do not use the right-hand fifth of the histogram for recording some of your image you are in fact wasting fully *half* of the available encoding levels of your camera.

But, we all know (*or at least should by now*) that the worst sin in digital imaging is to blow out the highlights – just as it was when shooting slide film. Once they're blown (*past the right-hand edge of the histogram*) it's bye-bye data.

The Lesson



The simple lesson to be learned from this is to bias your exposures so that the histogram is snugged up to the right, but not to the point that the highlights are blown. This can usually be seen by the flashing alert (the blinkies) on most camera review screens. Just back off so that the flashing stops.

When you look at the RAW file in your favourite RAW processing software, like Adobe Camera Raw, the image will probably appear to be too light. That's OK. Just use the available sliders to change the brightness level and contrast so that the data is spread out appropriately and the image looks "right". This will accomplish a number of things. The first is that it will maximize the signal to noise ratio. The second is that it will minimise the posterisation (those 'steps' you see in a gradually changing tone area, like a clear blue sky) and noise that potentially occurs in the darker regions of the image.

Be aware that by doing this you are effectively lowering the ISO used to capture the image, requiring slower shutter speeds and/or larger apertures. If you are hand-holding the camera, or shooting moving objects, the tradeoff may not be worth the reduced noise level.

A Test

This technique isn't necessarily something that you'll use every day. It requires extra work in both shooting and post-processing in the RAW converter. But, if you are interested in ensuring the best Signal/Noise ratio for a particular shot it can be worthwhile. If you find this approach to be counter-intuitive or somewhat dubious – **try it yourself**.

Set up a tripod shot; say a typical summer scene with blue sky, while puffy clouds and green grass. Meter as usual and take a shot. Review the histogram. Make sure it's what you would normally consider a good exposure. Now take another shot at +1 or so "overexposure", (use the Exposure Compensation) but not so much as to overexpose the highlights (the clouds, for example). Make sure that nothing in the frame is flashing overexposure (giving the *blinkies*), but that the histogram is skewed to the right as far as possible.

Now, load the "*properly exposed*" frame into a RAW converter, do your usual corrections and then send it into Photoshop. Next, load the "exposed-to-the-right" frame and do the same. But, make sure that you use the RAW converter's gamma, brightness and contrast controls to *normalize* it first. Now load this frame into Photoshop.

Compare the two. Look at deep shadow areas for noise and posterisation. Look into the bright areas for more or less recorded detail. See if *you* can see a difference. If not, no loss. Just continue as before. But if you do see a difference, you'll have learned a new technique that may be of use down the road.

Further Thoughts

Some people think of digital imaging as *solid state film*. This isn't the case.

For **film based photography**, the highlight end of the scale is compressed by the shoulder portion of the D/log E curve. So as brighter and brighter objects are photographed, the highlight detail gets gradually compressed more and more until eventually the film saturates. But up until that point, the highlight compression progresses in a gradual fashion.

Sensors in digital cameras behave differently. Its response is well behaved right up until the point of saturation, at which time it abruptly stops. There is no forgiveness by gradually backing off, as is the case with film.

Because of this difference, setting up the exposure using an 18% grey card (as is typically done with film) does not work so well with a digital camera. You will get better results if you set your exposure such that the whitest white in the scene comes close to, but not quite reaching, the full digital scale (255 for JPEG capture, 65535 for RAW capture).

The other point is that you need to be able to process your image in a powerful program, like Adobe Camera Raw (or your camera manufacturer's own software) to get the best out of that "to the right" exposure. Jpegs can be corrected a little in ACR, but nothing like as well as with Raw. Another reason to shoot with Raw.