Lighting for Digital

Dave Montizambert searches for optimum digital exposure

We've heard it a million times and here it is one more time: Ansel Adam's golden rule for optimum capture in his B&W Zone System is, "Expose for the shadows and develop for the highlights". This makes sense for B&W film where all contrast control can be applied in the darkroom after the exposure. However it makes no sense with digital capture, if you expose for the shadow you run the risk of pushing the highlight tones over the edge into white without detail. Now once all detail is lost in the highlight, and I mean really lost – 255 levels in all three channels – there is nothing to work with, no chance of rescue with Lightroom or Adobe Camera RAW's highlight recovery slider, and since it is digital no resurrecting silver halide crystals hiding deep in the emulsion. Furthermore, there is less chance of these fixit methods turning out with images processed "in camera" (ie JPEGs) than there is with RAW images processed after the fact in your favourite RAW processing software – in camera processed JPEGs contain less data than RAW files and so highlight recovery is more unlikely.


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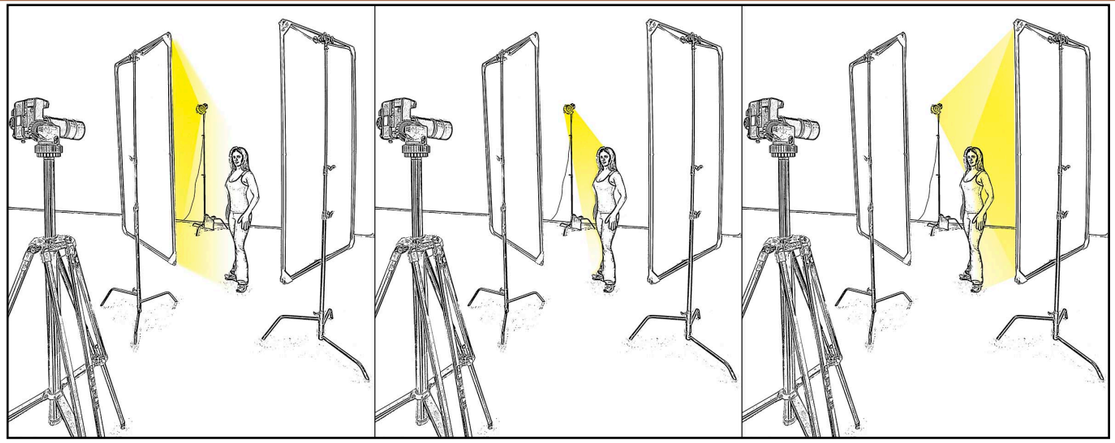
With RAW digital files the number of stops from middle grey to pure white is less than the number of stops from middle grey to pure black. In fact where detail in the shadow ends is a matter of some debate, it really comes down to how much noise and banding of tonal gradation you are willing to risk. In addition to this, digital favours the highlight, it assigns more bits to describe the highlight than it does to describe the shadow. Don't know what a bit is? See side bar entitled "Bits, Bitmap, and Bits Per Channel".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Dramatic backlit lighting: Look at Image 01 of model Sarah Madro. She is illuminated by light reflecting off a 1.3 x 2 metre white nylon fabric stretched over a panel frame placed in front of her on the camera left side of the image frame - see lighting diagram Image 02. The origin of the light energy for this main light source comes from a strobe/flash mono-block place behind her on the camera left side of the image frame. This light origin also provides heavy dramatic back lighting for Sarah giving her separation from the dark background. I often use this one light dramatic backlit technique indoors on rainy days to simulate outdoor sunlight. To fill in the shadows a second reflector panel was placed to the camera right side of Sarah, this fill light source caught stray light from the backlight and redirected it onto her dark side. This fill reflector was placed further away than usual to create darker shadows.

Most professional D-SLR cameras today create 12-bit encoded data. 12-bits describe or breakdown the greyscale into 4,096 discreet steps or levels of brightness. An increase of one digit in bit depth, say from 12-bit to 13-bit, will double the possible levels of brightness. Very recently Canon announced their new 1Ds Mk III that they claim to be 14-bit. If this new Canon is a true 14-bit camera, its captures should have in the neighbourhood of four times more levels of brightness to play with than does a 12-bit camera! See Bit Depth/Tone correlation in **Image 05**.

A grey scale has pure white at one end and pure black at the other end. In between these two extreme tones we have 4,094 levels of brightness with 12-bit, that is to say that the intermediate tones of the greyscale are broken down into 4,094 separate steps or levels of tone. We are using slight variations in brightness to simulate a continuous tone greyscale and if the steps of that progression are fine enough, we can fool the eye into believing that it is seeing a continuous tone progression.

In fact we don't really even need this many levels to create the illusion, it can be done with considerably less. Your printer dumbs down bit depth to about 6-bits for printing and when you work on your image in Photoshop at 8-bits or when you create a JPEG image, you are only using 256 levels of brightness to describe the whole greyscale. 8-bit is considered low-bit and 10-bit and above is considered high-bit, at any rate more bits equal more levels of brightness which equals more editing head-room – an important factor when processing images as well as correcting, or manipulating, files in Photoshop.

As I mentioned earlier, digital assigns significantly more bits to the highlight than the shadow. Expressed in brightness levels, digital applies 2,048 levels to the first stop down from pure white at the highlight end of the greyscale (see top graphic in Image 06). This is half of the available 4,096 levels possible from the 12-bit encoded data. The second stop down uses half again of the available levels, 1024. The next stop 512, the next 256, the next 128, leaving only 64 levels to describe the sixth stop in the shadow.

Sixtyfour levels sounds pretty bad, but it is more than enough to describe a shadow. However, at 64 levels you may run into trouble if

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you try to lighten up the shadows to show more detail. Many digital photographers play it safe, under-exposing their captures to ensure highlight detail, then in their RAW processing software or by opening their image in Photoshop, they use the appropriate controls to brighten the image to bring back the mid- and shadow-tones. This method may be a necessary evil in uncontrolled lighting situations, but be aware that if you go too far with 'playing it safe' you can wreak havoc with shadows. When you lighten a file in your image editing software, you are pushing the distribution of bits further up the greyscale, in other words if you lighten the file by one stop, where you once had 64 levels of brightness in the shadow at the sixth stop, you now have half (see bottom graphic in Image 06). In addition to this, noise, which typically resides in the darker tones, will be emphasised. If you wish to maximise the available bits your camera has to offer, it makes more sense whenever possible, to place the brightest significant highlight as close to burnout as possible and then during processing place the shadow, quarter, mid, and threequarter tones to taste.

In Image 01 of model, Sarah Madro, the shadows are intended to create a dramatic look and so are quite dark. If you had a change of heart after the fact and decided to lighten the shadows of this 12-bit capture by one stop using curves or levels, the sixth stop shadow tones would only have 32 of the original 64 levels (see bottom graphic in Image 06). In Image 07, we see a before and after close-up of where the transition from lighter shadow into darker shadow occurs in the cheek to hairline area. In the lightened version, we see this shadow gradation breaking apart (over-emphasised for teaching purposes) – the subtle gradations from one tone to the next are too far apart to create the illusion of continuous tone. This bit of ugliness is called posterising or banding and is as undesirable as cracker crumbs in bed. If you are not sure how dark you want your shadows, then I suggest a higher fill ratio during lighting and then darkening the shadows after the fact during RAW processing or in Photoshop with curves.

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Therefore, to capture the optimum exposure in digital it makes sense to reverse Ansel's rule to read, "Expose for the highlights and process for the shadows". Now that is a pretty bold black and white statement that forgets to mention the quarter-tones, mid-tones, and threequarter-tones, and it really does not fully address the extended capabilities of photographers who physically create lighting for digital capture. It's all about contrast, more specifically contrast control. Ansel Adams did it with exposure and development because he could not affect the lighting contrast before capture. Studio photographers do it with lighting since they can physically alter the lighting contrast before capture. Therefore I am compelled to make a new big bold black and white statement for those who do control contrast prior to capture, "Place the scene's tones with lighting and then set this manufactured contrast at the optimum exposure by making a hypothetical grey card read middle grey in the raw capture -113-118 levels for a 2.2 gamma colour space such as Adobe RGB or sRGB or 93-96 levels for a 1.8 gamma colour space such as Colormatch RGB. Huh, that's funny, that is pretty much how I did it with film – I lit for tones and then exposed for middle grey.

Learn more about this type of lighting and other dramatic lighting techniques at my in-depth January 20th 1-5pm Extra Plus Masterclass as well as creative Photoshop techniques at my January 17th 7:30-9:30pm Masterclass, both at the 2008 SWPP/BPPA convention.

Dave Montizambert lectures internationally on lighting, digital photography, and Adobe Photoshop. He is also a published author having written two books on lighting and digital photography (www.montizambert.com) plus numerous magazine articles on these topics in North America, Europe, Russia and Asia. Dave also creates Photoshop tutorial CDs & DVDs for www.software-cinema.com.

Dave is available for lectures and workshops in your area and can be reached at montizambert@telus.net or www.montizambert.com.

Dave Montizambert owns and operates Montizambert Photography Inc. located in downtown Vancouver. For the past 25 years his company has created photographic images to aid various organisations and companies with their communication needs. He has created images for clients such as: McDonalds Foods, Motorola, Atlanta Scientific/ Nexus Engineering, Toyo Tires, Tri-Star Pictures, Warner Brothers, Constantine Films of Germany, Chevron Canada, Cuervo Tequila, the Canadian Broadcasting Corporation, J&B Scotch, Hong Kong Bank, Chimera Softboxes, B.C. Lottery Corp., Blackcomb & Whistler Mountains, Tsing Tao Brewery of China, B.C. Hot House, Kona Bikes, No Fear Sports Gear, Kodak, and Canada Post.

His work has won Georgie, Lotus, Hemlock, *Studio* Magazine, CAPIC, and Graphex awards.

MONTIZAMBERT

LIGHTING FOR DIGITAL

Bits, Bitmap, and Bits Per Channel

Pixel stands for picture element. Digital cameras and scanners create bitmap data. A bitmap is a representation of an image using pixels as opposed to vector data that is used to represent graphics which it does using a series of lines or curves that are stored as mathematical formulas rather than pixels. Therefore a digital camera or scanner cannot create vector data only pixel data. Pixels are made up of bits, hence the term bitmap meaning that a digitized image is a map of a series of bits.
A bit is a single binary digit – 0 for off or 1 for on. This provides a limited choice of tones, white or black. The greyscale image of model, Sarah Madro on the top left side of Image 03, confirms that an image made up of one-bit pixels cannot create any tones between pure white and pure black and so cannot create the illusion of continuous tone.

Two bit pixels are strictly that, two bit, pretty well worthless for making images. Looking at the top row centre image of Sarah in Image 03, I think you will agree that this image is better than the previous but still a long way from looking like continuous tone. A two-bit pixel can only be one of four possible tones; zero and zero for white, zero and one for light grey, one and zero for dark grey, and one and one for black. For any sort of real quality we need greater pixel depth, which means more bits per pixel. As you can see from the bit depth image progression of Image 03, increasing the pixel depth by one-bit doubles the possible tonal or brightness levels - so from 2 to 3 bits goes from 4 to 8 levels, from 3 to 4 goes from 8 to 16 levels, and so on. Jumping up in bit depth to a more usable level, we find that an image made of 8 bit pixels breaks the greyscale down into 256 brightness levels; 256 levels easily fools the eye into believing that it is seeing continuous tone as in the image of Sarah on the bottom far right side of Image 03. And so it seems that a greater pixel depth such as 8-bit and up is needed if we are to fool the eye into believing that a mosaic of square pixels is a continuous tone image.

In Image 03 we established that we need at least 8-bits to create a believable looking greyscale image, but what of colour? Creating colour digital images we need at least 8-bits for the red channel, 8-bits for the green channel, and 8-bits for the blue channel. 8+8+8 equals 24-bit colour as seen in top graphic of Image 04. You will often hear the two interchangeably, 8-bit colour means 8-bits per channel, and 24-bit means the accumulation of 8-bits per channel in red/green/blue composite colour.

With 24-bit image files we end up with 16.8 million possible colours; each channel has 256 possible levels of tone - 256x256x256=16.8 million as seen in bottom graphic of Image 04. This is a lot of colour! In fact it is more than enough to create the illusion of the full visible spectrum.

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Tones Per Bit Depth:

1 bit = 2 tones
2 bits = 4 tones
3 bits = 8 tones
4 bits = 16 tones
5 bits = 32 tones
6 bits = 64 tones
7 bits = 128 tones
8 bits = 256 tones
9 bits = 512 tones
10bits = 1024 tones
11bits = 2048 tones
12bits = 4096 tones
13bits = 8192 tones
14bits = 16384 tones
15bits = 32768 tones
16bits = 65536 tones

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