ImageXpress UnTechnical Bulletin

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DIGITAL IMAGING ISSUES

Deep-Bit Scans

A Bit About Bits

When mere mortals use the word "bit," it is usually in the context of:

1. A small portion, degree, or amount.
2. A brief amount of time; a moment.
3. A short scene in a theatrical performance.
4. An entertainment routine given by a performer.
5. A pointed and threaded tool for drilling
6. The metal mouthpiece of a bridle, serving to control, curb, and direct an animal.

So much for being mortal! When the computer guys (technical term is "geeks") use the word "bit," they mean something *entirely* different. To them, a bit is:

1. A single character of a language having just two characters (binary digits), 0 or 1.
2. A unit of information storage capacity.

There you have it, in plain, simple, techno-babble.

As far as digital imaging goes, line art (black and white) is referred to as a "one-bit" image. A "two-bit" image would contain four shades of a single color (black, dark gray, light gray, and white). Every time you add a bit, you double the number of color increments. Thus a three-bit image would contain eight shades (2x2x2), a four-bit would have sixteen, etc.

The Numbers Game

Continue on with the math and you arrive at 8-bits, which consist of 256 shades, including solid color and no color. There are three primary colors, red, green, and blue that are the basic color building blocks of the human visual system. Each of these three colors contains 8-bits (or 256 shades) of information. When these three primary colors, and all their shades are combined, we end up with a 24-bit (8x8x8) image that contains up to 16,777,216 distinct colors.

Every (24-bit) picture you see on your monitor is a composite of a red channel (containing 256 shades of red), a green channel (containing 256 shades of green), and a blue channel (containing 256 shades of blue).

Since 24-bit scans are the accepted norm in the desktop world, images that contain more than 24-bit are called "deep-bit" or "high-bit." Seems they couldn't agree on a single term. One could deduce from this that a 24-bit scan is considered either *shallow* or *low.* We will refer to 24-bit image captures as *lowly 8-bit scans.*

Grayscale vs Color

Understand this… grayscale scans differ from color scans inasmuch as they use only one channel for their information… the grayscale channel. Your computer deals offers three basic image modes… color, grayscale, and black and white. Color takes up the most real estate because of the three-channels worth of bit depth; Grayscale takes up only one-third of the space of color because it is only one channel's worth of bit depth, and black-and-white takes up the least room because it is only one channel and one bit.

Nearly all grayscale scans are performed in (RGB) color and converted to grayscale *after* the scan is complete, but *before* you see it on the monitor.

Even though grayscale scans use only one channel for their information, they still capture the same bit-depth within that channel as color scans. Thus, if a scanner can capture 16,384 shades per (RGB) channel, it can capture the same number of shades of gray.

Remember, a given scanner that captures (for example) 12 bits per channel in color may be referred to as a 36-bit scanner simply because the three combined 12-bit channels adds up to 36-bit. That same scanner will can only produce a 12-bit grayscale.

Too Much is Never Enough

There are those that would argue that *lowly 8-bit scans* don't contain enough color information to achieve "high-end" results, since most high-end drum scanners can capture up to 14-bits of data per channel. These scanners are referred to as 42-bit scanners.

42-bit images contain *a lot* more information than 24-bit. Each channel can contain 16,384 shades of color (or gray). When the RGB channels are combined, they produce over 4,000,000,000 colors. Four BILLION!

Impressed? Before you start casting aspersions (or anything else) at your lowly 8-bit flatbed scanner, consider this. *No matter what* scanner you use, black is always black and white is always white. The black captured by a 42-bit scanner is no darker than the black captured by an 24-bit flatbed. Red is always red, green is always green, blue is always blue, and white is always white. So what's the big deal? What makes *deep-bit* scans so much better?

The big deal is the number of shades that are *in between* solid colors and white. Like a great sandwich, it's the amount of good stuff in the middle that really counts. While most scanners can identify over a hundred shades between black and medium gray (50%), deep-bit scanners can discern thousands of shades.

The most difficult range for any scanner to capture is shadows. Those tones located between black and middle gray. It is here that deep-bit scans excel, simply because they can identify small differences in dark tones.

The human eye seems to have the very same visual limitation. Seeing in the dark is not easy for us humans. We tend to bump into things we can't see. Animals, on the other hand, see great detail in low-light conditions. I guess we could say they have "deep-bit" eyes.

So What's the Advantage of Deep-Bit Images?

Photographic transparency originals many times contain significant detail in the darkest areas of the image. This detail is nearly to low-bit scanners, which usually yield scans that appear muddy and lacking in detail in the darker areas.

Scanning such an original with a deep-bit scanner allows even the darkest areas to reproduce detail. Although deep-bit scans don't always display their superiority on the monitor (even the best monitors can only display 24-bit), the adjustment of deep-bit images using a custom "curve" will evidence shadow detail simply unattainable from a low-bit scanner.

Most of the advantage of deep-bit scans is limited to the scanning of transparencies, since photographic print paper rarely possesses enough *dynamic range to warrant the use of a deep-bit scan.

Most Deep Bits Eventually Get Shallow

Regardless of the bit-depth of the scan, all digital images (except for those destined for film recorder) revert to 8-bit per channel for output. All imagesetters and desktop printers output a maximum of 256 levels per channel.

What To Do

When scanning in deep-bit mode and capturing more than 8-bits of image data, always apply any range enhancing curve first. After the application of the desired curve, you may either continue processing the image in the deep-bit mode, or convert the image back to 8-bit for further processing.

An argument can be made for converting the image back to 8-bit only at output, so that all adjustments are made in the large, safe expanse of deep-bit mode, though there is a price to be paid in time and disk space.

Deep-Bit Advantage for Low-Bit Scanners

Only have an 8-bit scanner? You can still gain advantage from deep-bit processing by using a technique used by many professionals. Here's the procedure…

Process the image as usual but before sharpening the image (usually the last step), switch Photoshop 5 to 16-bit mode, sharpen with ImageXpress' Deep-Bit Unsharp Mask filter (shameless plug), then switch back to 8-bit mode before saving the file. The advantage is quite obvious, especially with digital camera images.

ImagesXpress' Deep-Bit Filters

ImageXpress has developed the industry's first, and to this date *only*, Photoshop production filters for deep-bit image workflows. The filter set is appropriately named **Deep-Bit Filters**, and includes:

- Despeckle
- Dust and Scratches
- Gausian Blur
- High-Pass
- Median, and
- Unsharp Mask

The filter set is available on-line for download as a free 7-day trial.

*photographic term for bit-depth, which is a computer term for how many tones exist between the darkest part and the lightest part of an image

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