# Understanding RAW and RAW Workflow

Taking Back Control of Your Photos
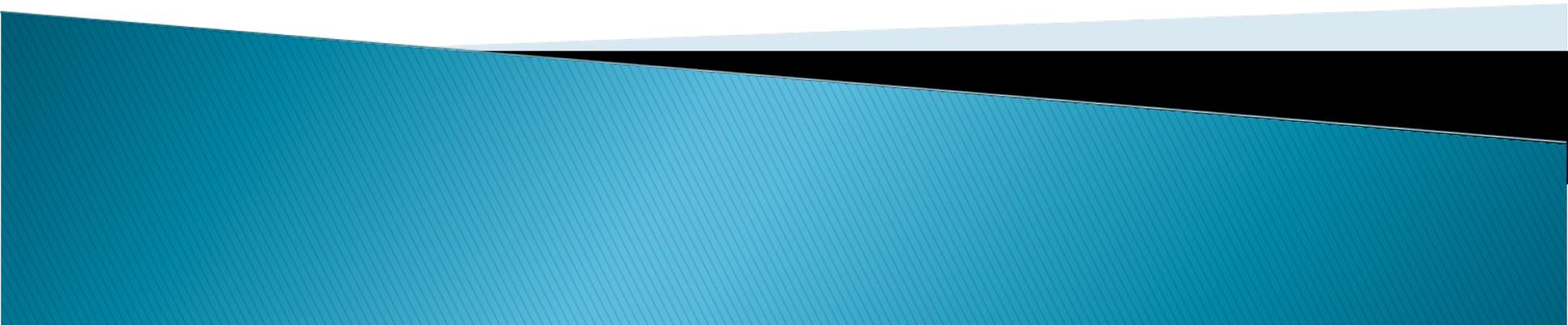
The Ol' Pump Operator

- Dispelling the FUD

Hey…What Exactly is Going on Inside My Camera?
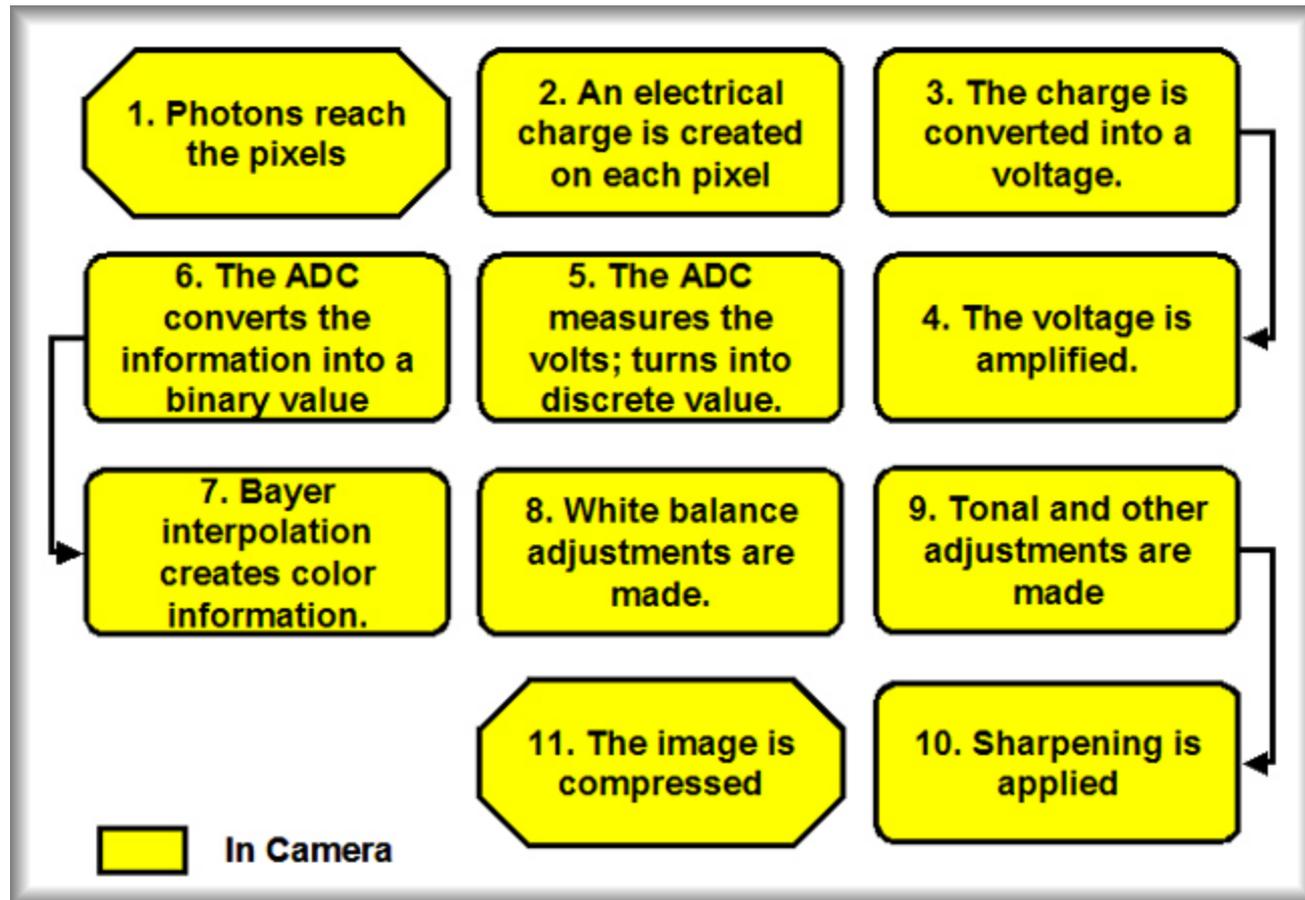
What are RAW Images?

- RAW images are uncompressed digital photos that save image data exactly the way the image was captured by camera's sensor.

- In camera settings for things like white balance, contrast and sharpening, while not applied, are stored w/ the file for your use latter..if you want them

Formats, Formats, and More Formats…Not to Mention a Non-Standard Standard

Adobe	.DNG	Digital Negative format developed by Adobe Systems; designed to be a standardized format for archiving RAW images that is supported by multiple programs.
Canon	.CR2, .CRW	CR2 format is based on the TIFF file format, CRW is based on the Camera Image File Format (CIFF); both viewable with bundled ImageBrowser and ZoomBrowser software.
Fuji	.RAF	Fuji raw format that is editable with the Fuji Hyper-Utility software included with most Fuji cameras.
Kodak	.DCR	Kodak raw format that can be edited with Kodak Custom Looks Software.
Minolta	.MRW	Minolta raw image file format that is viewable with Dalifer software.
Nikon	.NEF	Standard Nikon raw format that can be opened with Nikon View and edited with Nikon Capture.
Olympus	.ORF	Olympus raw image format that is editable with Olympus Master or Olympus Studio software.
Pentax	.PEF	RAW image format known as the "Pentax Electronic Format," which is used by Pentax cameras; can be viewed with Pentax Photo Browser software.
Sony	.SRF	RAW format used by high-end Sony cameras like the DSC-F828; editable with included Image Data Converter (IDC) software for Windows.

Benefits

- More data

  ◦ RAW files have 12 or 14 bits (4,096 or 8,192 levels of light intensity), not the gamma-compressed 8 bits (256 levels of light intensity) typically stored in processed TIFF and JPEG files; since the data is not yet rendered and clipped to a color space gamut, more precision may be available in highlights, shadows, and saturated colors.

    - Reduces posterization…a major cause of image degradation

    - All adjustments are performed w/ all the data

- Greater Control!!!!

  ◦ RAW permits :

    - The use of multiple tonal curves which increases dynamic range

    - Finer control for the settings vs. the cameras presets…full continuum vs. discrete ranges

    - Settings to be previewed and tweaked before conversion vs. burned in and un-reversable

    - The working color space can be set to match the output device vs. burned in and un-reversable

    - Different demosaicing (processing) algorithms and settings can be used, not just the one coded into the camera that is optimized for the camera's limited resources

More Data

Distribution of Shades for a Five Stop Dynamic Range

LIGHT LEVEL	JPEG	RAW	Notes
5 Stops	256	4,096	Highlights
4 Stops	128	2,048	Three quarter tones
3 Stops	64	1,024	Mid tones
2 Stops	32	512	Quarter tones
1 Stops	16	256	Shadows

Reduced Posterization

▶ Because RAW images have more shades, the differences between pixels is less stark reducing posterization

▶ It's a rounding error

  ◦ When processing and editing are performed, the camera/Photoshop runs the digital numbers through formulas to determine the new numbers.

  ◦ However, the new numbers have to be rounded off to the nearest digital number (e.g., a new shade of 157.43 would be rounded to 157).

  ◦ The information that is rounded off is thrown away forever.

  ◦ This results in a quantization error -- which results in image degradation.

  ◦ For example, quantization error can result in a reduction in the number of shades in an image (e.g., two shades may round off to the same value; thus, two shades merge into one shade -- detail is lost). Since RAW files have many more shades than JPEG, the distance between the shades is much smaller in RAW.

So What's the Big Deal About Tonal Curves

Standard Tonal Curve

Alternate Tonal Curve

Tonal Curves Con't

Standard Tonal Curve   Alternate Tonal Curve

Lossy Compression is Avoided

- JPEG compression goes through a number of steps to reduce the file size.

  ◦ First, the file is changed from an RGB model to a luminance/chrominance model

  ◦ Second, the compression algorithm breaks the image into 8 pixel by 8 pixel squares (JPEG squares) which are individually compressed.

  ◦ Third, the algorithm throws out color and detail information to reduce the file size further increasing posterization…this time at the JPEG square level.

Sharpening is More Efective

- Sharpening is really nothing more than adding contrast

- Conventional wisdom is to only sharpen once and only as a last step in workflow

- JPEG files are sharpened once in camera (@ 8 bits) to the degree you select (but always some) and then we sharpen again after compression data loss using Photoshop

- If posterization is present, you also sharpen the JPEG squares making them even more visible
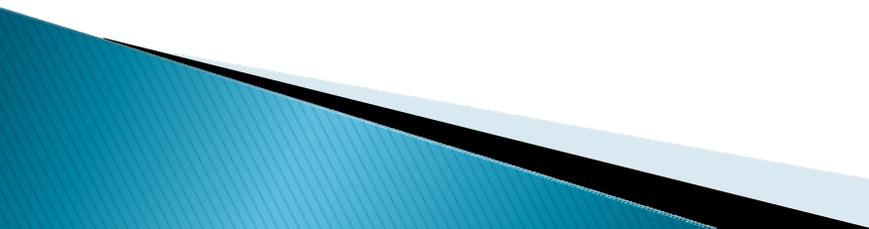
Color Space Selection

- sRGB and Adobe RGB are the most common but there are more

- RAW files do not have their color space assigned

- RAW does its color space conversion w/ the 12 or 14 bits vs. JPEG with its 8 bits

- Match the color space of your RAW editor to the output color space of your device (printer/monitor)…a mismatch degrades the image

- Buy a new printer tomorrow w/ a different color space…no big deal w/ RAW…just reprocess

The Power of the RAW Converter

Issue	In-Camera	Third Party
CPU	Small and weak	Powerful
Resources (e.g., memory)	Very limited	Few limitations
Power source	Small low voltage battery	120 volt wall power or battery
Time	Must process fast	Can take much more time

Consequently, the in camera converter must use much simpler algorithms
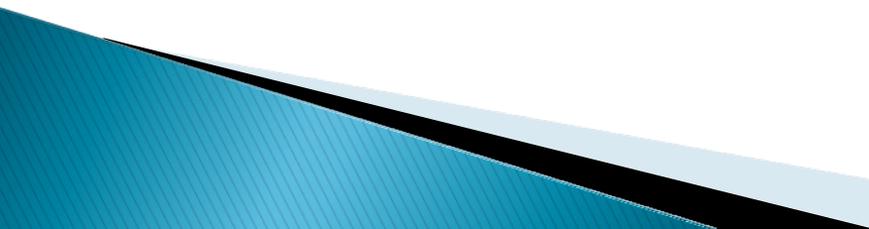
Drawbacks

- RAW files are typically 2-6 times larger than JPEG files.

- It also takes longer for the camera to write RAW images to the card, so fewer pictures can be taken in quick succession.

- There is still no widely accepted standard RAW format…it can even vary from model to model w/i the same product line

- Because of the lack of a standard RAW format, more specialized software may be required to open RAW files than for standardized formats like JPEG or TIFF.

- The time taken in the image workflow is an important factor when choosing between RAW and ready-to-use image formats.

Demo

Capture One 4.0