

What is instruction-based editing (a.k.a. metadata editing) and why should you convert your raw files to DNG?

## The power of DNG

Along with the many raw processors coming to market, there's a whole new method of image-editing as well, called either *instruction-based* or *metadata editing*. It could affect how you handle image editing.

To grasp the scope of this new method, we should compare it to the image editing tools presently in use. My Canon EOS 5D can produce a rendered 4,368x2,912-pixel

RGB image; in 16-bit RGB it is 72.8MB, or 36.4MB 8-bit RGB. Every time I wish to view, edit or print such an image, I have to open it in Photoshop. It can take awhile for any computer to process this much data, depending on how Photoshop has to numerically alter some or all of the 12,719,616 pixels it's working on.

A Canon 5D raw CR2 file takes up only

14MB; it's grayscale data that hasn't been rendered into an RGB, pixel-based image. The rendering is the job of my raw converter of choice, Adobe Photoshop Lightroom. If I decide to alter the color, tone, orientation or cropping of this raw file, I won't directly manipulate all 12 million pixels; instead, I'll build a set of instructions for *ultimately* rendering those pixels when I need direct access to them. Herein lies the power of metadata-based image editing: It can postpone the rendering of the pixels until I'm ready for it. Until then, I'm actually editing a text file, not an image file composed of RGB pixels.

When editing a pixel-based image, I have the option to stamp (or *bake*) corrections into each pixel, but then there's no turning back after I save the file. The editing process changes the numeric values of each pixel, which results in some data loss (due to inherent rounding errors).

If I want to postpone the alteration of the pixel values, I can use layers or adjustment layers in Photoshop. A standard layer accepts additional pixel edits that "float" above the background of pixels. If I change my mind while I'm cloning or compositing, I can edit the individual pixel layers without affecting the background layer. Still, this will further increase the file size and processing overhead.

Adjustment layers do not contain pixels, but specific global instructions for altering the tone and color of the underlying pixels. Adjustment layers are like instruction-based editing—they don't contain pixels; instead they describe to Photoshop how I'd like the underlying pixels to change once I flatten the image. When I flatten or print a document, all pixel-based or adjustment layers need to be calculated and applied to the file. In essence, the edits are stamped onto the underlying data, even in simply printing the file. The

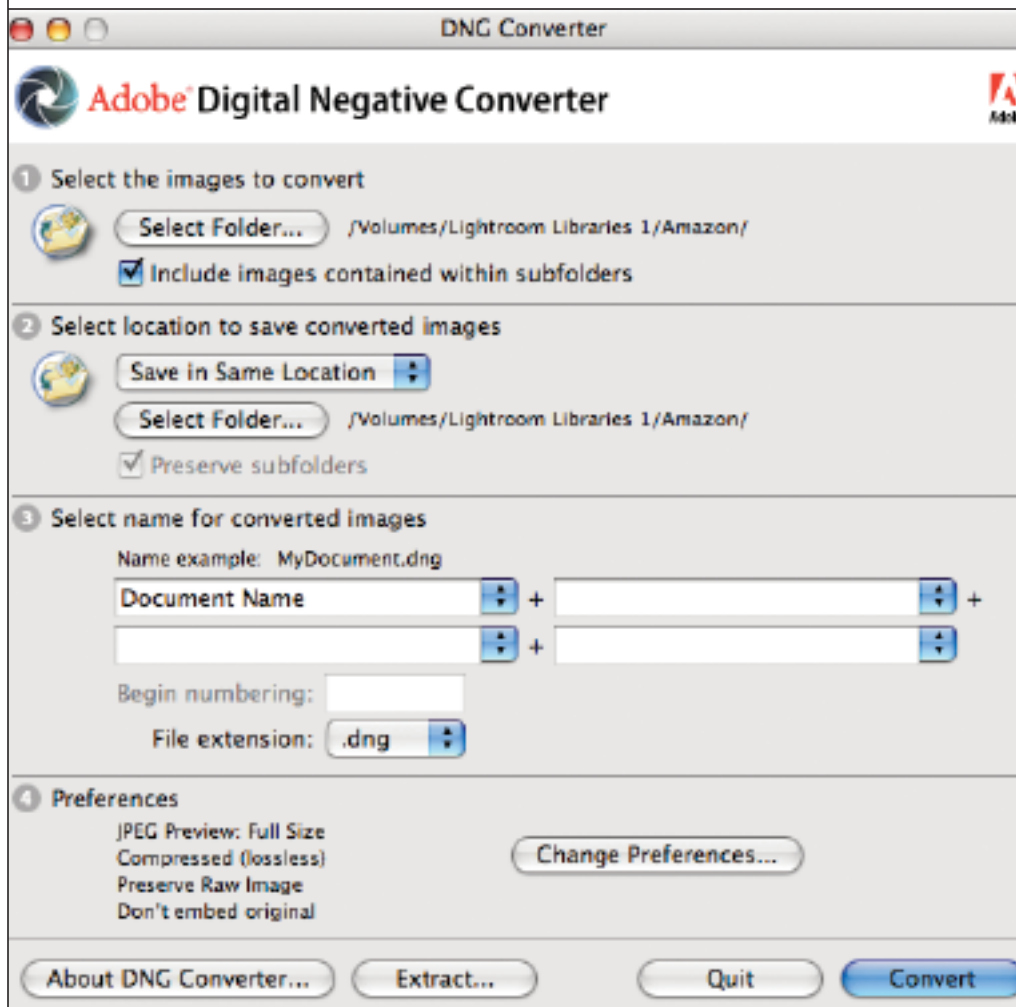


Figure 1: The DNG standalone application user interface.

new Smart Objects and Smart Filters in Photoshop act a bit differently than layers; in essence, we embed additional copies of part of a file into the Photoshop document. This adds flexibility to the editing process, but again, at the cost of increasing file size and processing overhead.

With instruction-based editing, the original raw file is simply a data source for what will eventually be a pixel-based image. When I ask Lightroom to rotate a file, alter the color or tone, crop, clone, or even print the image, the software accesses the raw data to provide a preview so I can decide how to handle the image editing. The raw data itself is never altered. What I get is a set of instructions much like a text file.

These instructions take up very little disk space and the operations are lightning fast. If I have a thousand similar images that need the same set of corrections, I can almost instantly copy and paste the metadata instructions into each image. Compare this to having to open a thousand 72MB files to apply one or a multitude of edits. The heavy lifting doesn't happen until I ask for a fully rendered pixel-based file.

It might seem like metadata editing only postpones the inevitable work of the processing, but that work can happen while you sleep. I can specify corrections to thousands of files that I may never render into pixels, which makes the process amazingly effective.

Downside? First, storing the editing instructions with the raw files: Few raw converters can or will alter the original raw data. The metadata instructions, called *sidecar files* by Adobe, are separate from the raw file and must be linked to it. Lose the sidecar file and you lose all your editing instructions.

This is where a Adobe's relatively new

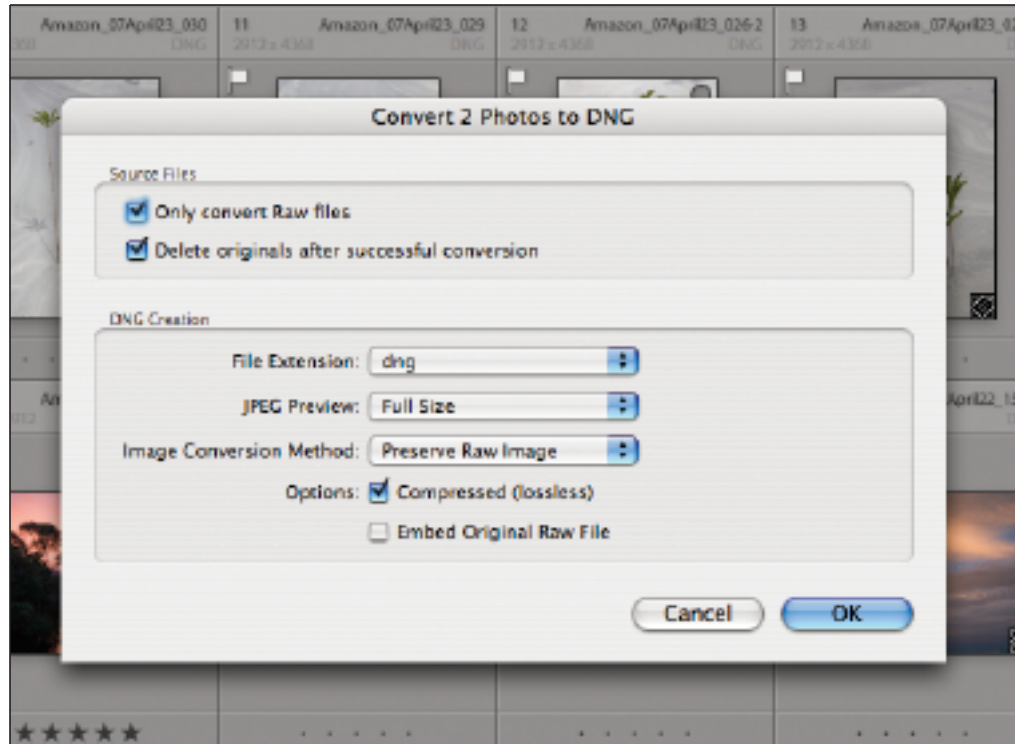


Figure 2: In the Lightroom DNG conversion dialog, the source file options are to convert only raw files and to keep or delete the originals after conversion. Under DNG Creation, the same options as in the standalone DNG converter are available.

file format, DNG (short for digital negative) comes into play. When I convert my original raw file into DNG format, the metadata instructions are embedded into the new file. The raw data and the editing instructions are always together, intact. During the conversion, I'll get an alert if the original raw file is damaged or corrupted. That's an important advantage. I never reformat my flash cards until I verify the integrity of the data by converting to DNG.

Also advantageous, DNG is an open and documented file format, not a proprietary one. The DNG specifications are open and free to anyone who wishes to build a raw converter. Once any raw file format is converted to DNG, anyone can open and process the file.

Yet another advantage of DNG is the reduced file size from the original raw file.

My 14MB CR2 files are about 11.3MB in DNG format, and they contain the *same pixels!* There are varying sizes of embedded JPEG thumbnails in a DNG that an application can use to open a preview of the image. If they're large enough, the thumbnails can be used for some printing tasks as well.

Metadata editing, at least in Lightroom, also features a history list. In Photoshop, you lose the history of the image every time you close the file or quit the application. In Lightroom, the history is stored on the disk and is accessible at any time. Hopefully this feature will be further enhanced in future versions. Imagine having a print history of each image in your Lightroom library, then simply clicking on it to reprint the image with all the parameters (e.g., crops, color rendering settings, print driver settings) that are stored as metadata or in the database.

As the DNG format becomes more robust, it might be possible to embed multiple rendering instructions with the original raw data. You could have a dozen different renderings, crops, sharpening and noise reduction settings and other instructions that would travel with the raw data within the DNG container. You could share the DNG with others who might want to append or create new rendering instructions for your review and eventual output—an efficient and cooperative workflow feature.

A disadvantage of instruction-based editing, where you're not handling pixels directly, is that you can't do precise, pixel-by-pixel image editing. For that, you need every pixel at your disposal. Here, Photoshop continues to be king. If you need to clone out a dust spot on one or 100 similar images, it can be

accomplished in a snap by a metadata editor like Lightroom. But if you're doing precise clone work, say retouching blemishes on a portrait, or any selective editing, you'll need a pixel editor like Photoshop.

It's important to understand which of the two modes of image editing is better suited for the task you need to accomplish. If you have to conduct global tone and color corrections to one or many similar raw files, use metadata to handle the task rather than opening each pixel-based file in Photoshop. If you have very precise pixel editing to do, Photoshop is the only game in town.

If you need to print a single image, Photoshop and Lightroom both work well. If you're printing multiple images—say a proof sheet—or you need to gang multiple

images on a template, a metadata editor can be far more efficient. The print module in Lightroom is so well designed for printing, that alone is worth the price of admission. Remember that to print a 12-million pixel image in Photoshop, you have to open it. With products like Lightroom, the pixels can be sent to the printer on the fly—any processing bottlenecks will occur at the printer and print driver.

Note that I've referred to metadata editing only in the context of raw files. Applications like Lightroom can handle the same workload in existing rendered file formats like JPEG and TIFF. Nearly all my existing rendered images have been edited to my liking, so I don't see a need to apply Lightroom edits as well, though the capability exists. ■