

To a color geek, Adobe Lightroom has limited color management options, but it greatly simplifies the user experience. The missing functionality is a trade-off.

## Color management in Lightroom

When Adobe set forth to build Lightroom (called Shadowland before the public beta), the team of engineers started with a clean slate to design a product for digital photographers.

The engineers have gone to lengths to create a product with a short learning curve. Just look under the Help menu and select The Five Rules. Color management in Lightroom is quite different from Photoshop in many respects. The goal in the design of Lightroom was to make color management nearly invisible. When you compare Lightroom's color management options and preferences to Photoshop's, you'll see some similarities, some differences and some omissions. Like Photoshop, Lightroom is ICC aware, meaning it requires a calibrated and profiled display. But Lightroom works only with raw files or rendered RGB images.

At its heart, Lightroom is a raw processor. Yes, there is database functionality that makes it quite different from Adobe Bridge, a simple file browser. Yes, there are Print and Web modules, and you can import existing rendered images such as TIFFs, PSDs and JPEGs to the database. I prefer to think of Lightroom as a tool primarily for organizing and converting raw data into a rendered RGB image.

The raw processing pipeline is based on the Adobe Camera Raw processing pipeline. The products share many of the same controls, and will eventually have complete interoperability with each other, as well as Bridge and Photoshop.

It's important to remember that raw images are essentially grayscale data. The role of a converter is to produce a full-color

image from this raw data. At some point, all raw processors need to produce a color image, which is encoded into some color space. Then the user can render the image using various controls to produce a desired color appearance. In the case of Lightroom and Adobe Camera Raw (ACR), the color space is partially based on ProPhoto RGB (Figure 1). This extremely wide-gamut color space is necessary with the enormous color gamut that's possible with digital capture. Since raw data is encoded linearly, the internal color space used to apply rendering edits with both products is also linearly encoded. Think of the underlying internal color space as having the RGB primaries and white point of ProPhoto RGB, but instead of 1.8 gamma encoding, this new



Figure 1. In this 2D gamut plot in ColorThink, you can see the huge gamut of ProPhoto RGB—so big that the blue primary falls outside the range of human vision, as represented by the horseshoe plot.

space uses a 1.0 gamma encoding. (See “Linearity and Gamma” in the December issue of Professional Photographer.)

All processing within Lightroom, raw or rendered, takes place in this linear encoded color space based on the ProPhoto RGB chromaticity and white point values. A histogram of linear encoded data would look quite strange, with most of the values pushed to one side. The numeric values may also be difficult to decipher due to this linear data handling. For this reason, the histogram and numeric values provided in Lightroom are based on ProPhoto RGB, using the sRGB Tone Response Curve (primarily based on a 2.2 gamma with a tweak to the tone curve in the shadows). Therefore, behind the scenes, Lightroom uses a linear encoded ProPhoto RGB space, but the numbers (represented in percentages in Lightroom) and histogram reflect a gamma-corrected version of ProPhoto RGB matching the Tone Response Curve of sRGB.

The color space used for these numbers and the histogram is known within Adobe as Melissa RGB, a.k.a. Love Child RGB. No matter which encoding color space the user selects upon export, Lightroom will provide numbers and a histogram based on Melissa RGB. Adobe Camera Raw updates the numbers and histogram when the user selects the output color space.

Sadly, Lightroom's Develop and Print modules lack a true soft proof that's based on an output device. You cannot select an output profile and produce an on-screen simulation as you can in Photoshop. I suspect this was done for two reasons: It would add greatly to the complexity of the product, and greatly delay the release of what is unquestionably a 1.0 product. I hope to see full soft proofing capabilities in future versions of Lightroom. Editing images for output without this capability is a leap of faith.

Lightroom offers three options for encoding color space for export: sRGB; Adobe RGB; and ProPhoto RGB. When you export a file in ProPhoto RGB, it will be encoded as a 1.8-gamma corrected color space, as defined by Kodak and not Melissa RGB. In the application's preferences, you can select the color space, bit depth and file type to use upon export.\* Adobe recommends choosing ProPhoto RGB to preserve color details when exporting from Lightroom. Since ProPhoto RGB has such a large gamut, Adobe recommends exporting the file in 16-bit color. Lightroom automatically converts images exported from the Web module to sRGB.

If you import rendered RGB images to Lightroom and make no edits, the images will retain their original color spaces. In short, Lightroom can be used as a Digital Assist Manager for existing rendered files. If you wish to simply open the file in an external editor like Photoshop, the original color space is retained. However, if you wish to export a file edited in Lightroom, the Export dialog must be set to create a copy first. Lightroom will build the copy of the original rendered image and place it into its database with "edit" appended to the file name (Figure 2). The exported copy will then be converted into the color space you selected



Figure 2. Lightroom's Edit in External Editor command gives you the option to edit an existing rendered image, a copy of that image or, if Lightroom edits have been applied, a copy with those edits. With raw files, the last radio button is the only option\*.



Figure 3. These preferences control the color space, bit depth and file format when images are edited in an external editor. Online help provides useful guidance about the options\*.

in the application preferences (Figure 3).

Let's say you want to import a layered TIFF file in ColorMatch RGB and edit it with Lightroom controls. You must choose Edit in Adobe Photoshop CS2 > Edit a Copy. Lightroom creates a flattened copy of the file and exports it in the color space you set in the application preferences, *not* in ColorMatch RGB. Because the ACR engine applies the edits, the copy is converted from ColorMatch RGB to ProPhoto RGB (linear gamma) and back to the color space set in your preferences.

If you use Lightroom to edit rendered RGB images, consider which color space to select upon output. If the original file is in sRGB, Adobe RGB (1998) or ProPhoto RGB, and you want to honor the original color space, be sure that the application color space preferences for exported files matches. Otherwise, Lightroom will not preserve the original color space on edited files in any color space but these three.

The current version of Lightroom supports only RGB editing. You can import CMYK, grayscale or LAB documents into the database, but you cannot edit them.

When you enter the Lightroom Print Module, you can select any ICC printer profile loaded on your computer for output. Without a soft proof, selecting a rendering

intent is a guessing game. In addition, you have access only to the Relative Colorimetric or Perceptual rendering intents as an option for color space conversions; it's not a major issue, because you probably prefer one rendering intent over the other. I have seen rare cases in which the Saturation intent actually produces a preferable color appearance, but you can't make such a decision without soft proofing all available rendering intents. Here again, Adobe apparently intends to make Lightroom easy for the user by limiting the options. Time will tell if this approach is viable.

We didn't see much in the way of color management in Photoshop until v. 5.0, nearly 8 years after its initial release, and it was still rough around the edges. For a 1.0 product, Lightroom looks promising with respect to color management, but it's a delicate balancing act.

I can live without LAB or CMYK support, but hope to see true soft proofing in a future version. The lack of multiple working spaces isn't a serious limitation for me. In fact, if you only work with raw files, all you really have to do is set Lightroom to always export in 16-bit ProPhoto RGB. It will be interesting to see how the market reacts to Lightroom, and how the product will evolve in response to wide user feedback. ■

*\*The screen captures and options discussed in this article may not necessarily be included in the public release.*