It's certainly not necessary to understand how an internal combustion engine operates in order to drive a car, but for some, it's helpful to have a basic understanding of the mechanics. With that in mind, let's discuss what's going on under the hood when it comes to profiles.

The Anatomy of ICC Profiles

First, we can say there are classes of profiles, such as input profiles, which describe how devices like scanners or digital cameras produce color, and display profiles for monitors. Some of these profiles are more complex internally than others.

Of these classes of profiles, there are two distinct types, matrix-based and lookup table (LUT) based, or simply table-based. Matrix-based profiles are simple ICC profiles used primarily to describe input, display and working spaces, although some profile packages can build the more complex table-based profiles for some devices. If you look at any of the RGB working space profiles, you'll see they are very small (about 5kb). These matrix-based profiles need only a few specifications to define them, namely a gamma value, a white point value and chromaticity or colorant values, as seen in *Figure 1*.

Simple matrix-based profiles contain a single rendering intent: Relative Colorimetric. While it's possible in Photoshop to ask for a different rendering intent (such as Perceptual, for example), the rendering intent will always be based solely on the Relative Colorimetric intent. You can see this for yourself if you convert between two working spaces in Photoshop and pick these two options. The final conversions will be identical. Because the Absolute Colorimetric intent is based on the same table as the Relative Colorimetric intent, this could be an option, but it's not recommended.

Table-based profiles are vastly more complex, and much larger in kilobytes. The lookup table is multidirectional with values that map colors throughout the entire color space, much like a cube of points that can point at any location inside that cube. Table-based profiles

are more often found with complex devices like printers because the profile needs more data to produce the results we expect. It's not at all uncommon to find table-based profiles as large as several megabytes. Table-based profiles contain every rendering intent available to the user, with a lot more data for the tables and tags, which are found inside the actual profile. Some applications, such as the Apple ColorSync Utility (*Figure 2*), allow us to see inside ICC profiles. Another useful utility, ColorThink from Chromix for Macintosh and Windows users, allows us to inspect the structures of ICC profiles. (www.chromix.com)

An area inside ICC profiles many users should know about is the **localized description string**. ICC profiles can have more than one name, as they are built to be cross-platform. The external name, the one most users are familiar with, appears when you view the profile on the desktop of your computer—it's the file name. It's usually produced when the user builds and saves a profile to disk.

The profile also has an internal name, which Photoshop (and other software) displays in various dialogs. I could, for example, have a profile named Epson2200Luster both internally and externally. If I renamed the profile on my desktop, changing it to Epson4000Matt, Photoshop (and most other ICC-aware applications) will continue to display the name Epson2200Luster in every dialog where I could select the profile.

The localized description strings entry (as in *Figure 2*) is where users set the internal name of the profile to be the one that ICC-savvy applications display. This is useful to know if for some reason you need to rename an ICC profile. You'll need some utility like the Apple ColorSync Utility to change the internal name. ColorThink also allows this kind of editing.

Figure 1, matrix-based profiles. In Photoshop's Color Settings, I pick the Custom RGB... menu option from the RGB pop-up menu, where I see the actual numeric values that make up Adobe RGB (1998), a simple matrix profile. The gamma, white point and chromaticity values are all that's necessary to define this working space.

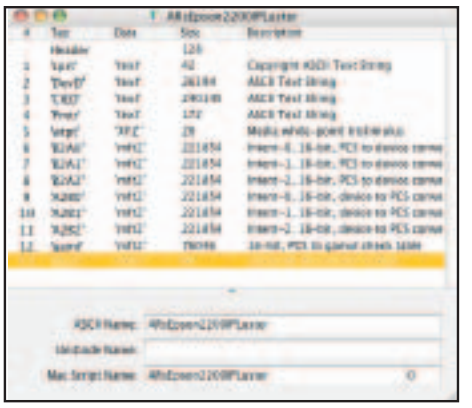

Figure 2, table-based profiles. If I double-click on an ICC profile from the desktop (in OS X), this window from the ColorSync utility appears. Clicking on various tags provides information about the internal structure of the ICC profile, such as the internal and external profile names. These names can be edited if necessary and saved into the profile.

Another useful feature of table-based ICC profiles is how they handle previewing (soft proofing) on the display and convert numbers for the output needs. There are two parts to this profiling, one that affects what we see on screen and another that affects the numbers generated by a color space conversion. For example, we could have a printer profile that produces a very accurate soft proof, yet generates a slight color cast in the print. With the preview portion of the profile table separate from the output table, it's possible to use software tools to alter only the output portion of the profile to fix the color cast, leaving the correct preview portion alone.

It's not uncommon to have the opposite problem. The print looks fine under a light box, but the soft proof looks a bit different from the print. We *never* alter the display itself after calibration and profiling! However, with a good profile editor, you can tweak and tune only the preview portion of the ICC profile and leave the output portion alone.

Some tools allow you to edit the individual rendering intents while leaving others alone. Table-based profiles are larger and more complex because they separate these tables and rendering intents for editing and control. In a future article, I'll discuss some easy-to-use but powerful profile editing applications that use this profile structure to improve the quality of many types of ICC profiles. ■

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