Defined Color Spaces!

Effective Device-Independence

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Don't read this article! It will make you exceptionally anxious! You want to know how in the world you define your RGB and CMYK devices. If you think calibration solves all problems, I'm truly sorry. Defining the color space of monitors and printers is important because otherwise color matching isn't possible.

First, I will discuss calibration since I started out bursting that bubble. Calibration is setting a device to a known behavior. That's it. For example, monitor calibration involves making a monitor exhibit a specific behavior. In the graphic arts, this would be a white point of 5000° Kelvin, and a gamma of 1.8. If these numbers don't mean anything to you, don't worry about it. The point is monitor calibration does nothing else. It doesn't tell our applications what color your monitor can and cannot display.

For a printing press, calibration would involve maintaining specific ink densities, contrast settings, and gray-balance, for example. This behavior, or calibration, must be maintained throughout a press run in order to ensure consistency from the first printed piece to the last. Otherwise, there would be variation among pieces coming off press.

Just as with monitor calibration, press calibration tells our applications nothing about what colors the press can and cannot reproduce. Dot gain, the whiteness of the paper, or the purity of the inks (See article 1, Color Space Cadets) is also unknown. Without this information, it's not possible to define the color space of a monitor or a printer.

I want to be clear that calibration does nothing other than provide for a means of making a device behave predictably and consistently. It is possible to have, for example, five calibrated monitors, and yet a single image displayed on them can appear different.

This applies not only to monitors, but to printers, printing presses, scanners, and digital cameras. Any device. So calibration is very important in the sense that in order to define a device's color space, its behavior can't be a moving target. Device behavior is made consistent with proper calibration.

The problem is that calibration doesn't take into account how green, for example, the maximum green your monitor can display, or the press can print. In nearly all cases the monitor can display green much better than a press can. In order to get good monitor-to-press consistency the actual color capability of both must be taken into account.

Characterization is a process where color capability is measured and recorded. For example, on a printer, or printing press, strips of various CMYK values are read with a measuring instrument. This information is saved into a file that can be used to define the color space of that printer or press.

The same applies to monitors. Usually an emissive colorimeter is used on the face of the monitor to calibrated it, and then to define its color space, or color capability. This process of defining a color space is called characterization or "profiling" since an actual text file, called a profile, is created.

Remember in [article 2] when I mentioned how nice it would be to have a sort of look-up table for our devices? The benefit would be to break away from device-dependent color such as RGB and CMYK. We would still use RGB and CMYK, but our color management system would use a device independent color space, such as Lab, to create a "bridge" between our devices. This essentially makes them device-independent from each other. The result is a "translation" between devices, so that what you scan is what you see, and what you see is what you print.

A profile generated from characterizing a device is this color look-up table. It's also known as an ICC, or ColorSync profile. These profiles define the color space, and color capability of monitors, printers, and presses. It allows us to perform accurate conversions from RGB to CMYK, and generate better CMYK previews on our RGB monitors.

ICC stands for the International Color Consortium. It's made up of companies striving for a better way to define device color spaces in an industry standard method. Today, this information is stored in an ICC specified profile. For more information on the ICC, and the members of the ICC, check out www.color.org. Apple, Adobe, Heidelberg, Kodak, Agfa, Fogra, Microsoft, Hewlett Packard and many others are members. Many of the members sell ICC profiling software and hardware as well, so you can create your own custom device profiles.

Now you have an idea of how different RGB and CMYK color spaces are defined. Essentially, generating an ICC profile makes all devices "independent" from each other. This is an open system of color that can provide predictable color with other devices that have an ICC profile. In closed-loop color, only devices inside the loop are considered predictable.

Using ICC profiles, a specific color can be converted easily and accurately from one color space to another. Imagine how much better and faster you will get the color you are expecting when you convert from one space to another, instead of unnecessary color correcting for an output device, or multiple output devices.

In Part 4, I will talk about how ICC profiles are used in some commonly used applications, and how your workflow can take advantage of this type of Color Management System.

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