Device Independence at Last!

Color Without Devices

Two of Five

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There is something to be said about having fewer choices. When we have too many choices, we either relish or realize later it was the wrong choice, or they will ponder endlessly about a selection. Device-independent color-space makes color management a lot easier, by effectively giving us fewer choices.

Last time (Article 1: Color Space Cadets) we talked about why color is different from device to device. Since no two devices are the same, they reproduce the same image file differently. Even two devices of the same model can differ from each other. This translates into millions of RGB and CMYK color spaces. These color spaces are referred to as device-dependent color spaces, because the color you get depends on the device.

Since the resulting color for a specific RGB or CMYK value depends on the monitor or printer, predicting color is difficult. This means what you see on your monitor, doesn't match what you get on you printer, let alone on proofs or the final product.

So what about a color-space that we could specify only one value to a color? This color-space could not be dependent on devices; it would have to be based on something else. Such a color space would be called device-independent.

Many of you probably have heard of Lab Color. Lab Color appears under PhotoShop's Image:Mode menu, along with RGB Color, and CMYK Color and others. Actually Lab is a device independent color space.

Lab is more accurately referred to as CIE L*a*b*. Lab is a three-channel space, like RGB, but the similarity ends there. L* is lightness, a* is redness or greenness, and b* is yellowness or blueness. The a* and b* channels can have a negative or positive number, making it rather unique.

I'm not going to get into a whole lot of technogeekspeak about what the asterisks mean, or showing you the typical CIE L*a*b* model in 3D space. It's not important for this article. The important thing you need to know about Lab is that it is device-independent. If you would like more technical information, or technogeekspeak, please send me e-mail.

The CIE, just in case you're curious, stands for the International Commission on Illumination, the main international organization concerned with color. One of the CIE's main functions is to generate standards for those who work with color, such as the CIE L*a*b* color space.

What all of this really means, is that Lab is based on a mathematical model instead of a monitor, printer, or scanner. That's it. That's the big difference! This means there is only one CIE Lab space, compared to millions, or more, different RGB and CMYK color spaces.

The benefit of a device-independent space, such as Lab, becomes clear. A color is a specific Lab value. To reproduce the color of your shirt on five monitors and five presses will require five different RGB values for those monitors, and five different CMYK values for the presses, in order to match the color of your shirt. As we've discussed before, it is because devices are different from each other.

I can define Pantone 185 as a single, specific Lab value. However, to get the same color in RGB or CMYK, we need to know a lot about a specific monitor or printer, before it can be reproduced adequately. Remember in the first article when we talked about purity of color, also known as saturation. This is one of the important things we need to know about a monitor or printer before we could effectively reproduce a specific color, such as Pantone 185.

Lab is also very large. The Lab color space contains all colors the human eye can see (and then some), so it's effectively "gamutless" since there aren't any colors outside of Lab space. Lab can define them all., from the most expensive RGB scanner, to an eight-color press and paper system.

The reason Lab is so large is that it contains perfectly pure colors. We also discussed in the first article that color purity, or saturation, is what determines the size of a color space. The more saturated the primary colors, the bigger the color space "balloon." Therefore, Lab is one of the biggest balloons of them all!

There are other device-independent spaces, in case you are curious. There's CIE XYZ, which was defined in 1931. Lab was defined in 1976! So this device independence stuff isn't exactly new. Some of you may be familiar with LCH, and this is a device independent space. This space uses Lightness, Chroma and Hue coordinates.

What's the catch? Well, just like there is no such thing as a CMYK monitor, there is no such thing as a Lab monitor. Also, there aren't any Lab inks, so are no Lab presses or printers. Not to mention that working with Lab files is, well, not exactly intuitive for most people.

Wouldn't it be great, if we could somehow describe our RGB and CMYK devices in relation to Lab? Like a sort of look-up table. Then we could work in RGB or CMYK for our benefit, and because our devices require it, yet get the benefit of Lab! We could work in RGB, have it "translated" into Lab, and then translate it again for CMYK, for example. Result? The color we selected on our monitor reproduced in print!

Of course, there are other combinations. Maybe you already have a CMYK image, but you want to preview it on your RGB monitor correctly. CMYK would be translated into Lab, then translated from Lab to RGB. Bam! The correct color!

OK, now you are excited to death, and wondering how do we do this. Do we do this translation ourselves? First, the good news. The conversion is performed automatically with color management software. The bad news? We will have to wait until next time to talk about these color look-up tables. I'll bet you just can't wait!

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