# digital compass

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# What is color management?

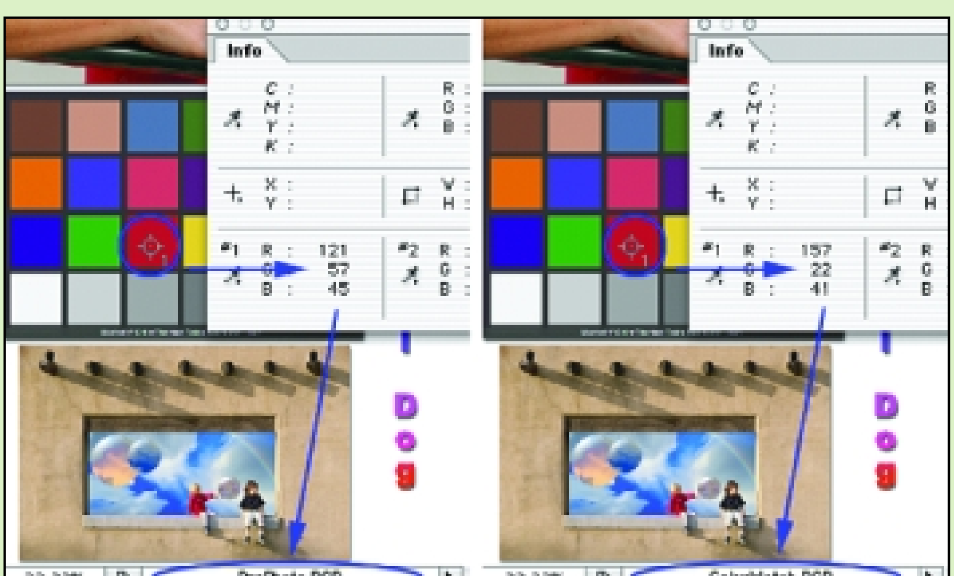
## And why on earth do we need it?

Color management has to be one of the most difficult processes to understand for the photographer embracing digital imaging.

In this series of articles I'll be writing for "Digital Compass," I'll try to make the concepts and practices of using color management as painless as possible. The goal will be to keep the "color geek" speak to a minimum while providing a good foundation in understanding the need for color management.

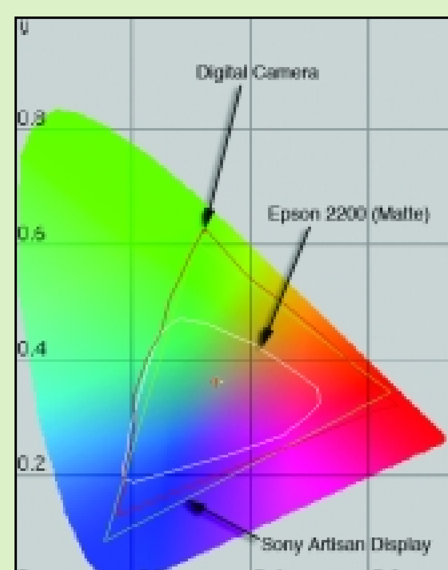
First things first: Why do we need to understand color management? For starters, computers are relatively ignorant devices that know about the world of color and images as a mere series of ones and zeros. Every image you see on your computer screen is created from nothing more than a series of ones and zeros. These numbers alone do not tell us what a color looks like, only the ingredients for color. It's like a recipe for chocolate chip cookies. The recipe provides all the instructions for making the cookies, but it doesn't deliver the taste. The two primary color files we work with are either RGB (red, green, blue) or CMYK (cyan, magenta, yellow and key, better known as black). These are known as color spaces. Scanners, digital cameras—every capture device on this planet creates RGB files. Many printers (output devices) will accept RGB data, while others will only accept CMYK data. What's important to understand is that both RGB and CMYK color spaces are known as **device-dependant**. That means that the way the output device renders the colors in our images depends on the output device itself. If we send an identical RGB file to 10 printers, we'll get 10 different results. The devices receive the same numbers but produce different colors. That's a significant problem. We need a different set of numbers for each of the 10 printers if we want to produce 10 prints that look the same.

To make matters worse, each printer has a range of colors it is and isn't capable of reproducing. (Some printers can make a more saturated red than others.) The range of colors each device can reproduce






**Here are two RGB color spaces (ColorMatch RGB and ProPhoto RGB). Though the colors appear the same, the Info palette in Photoshop shows they result from different RGB values. This illustrates the concept of device-dependant colors.**




**This gamut plot compares the color gamut of a camera, printer and monitor. Notice that the color gamut of the printer is much smaller than that of the camera or display. The printer can't produce reds or blues as saturated as those onscreen, yet it can produce a more saturated green than the display.**

is called its **color gamut**. Every digital device—be it a printer, camera or scanner—has its own color gamut. The larger the color gamut, the more saturated colors it can produce.

While we can create 16.7 million colors on our computer systems, we humans can see only about 12 million colors—we can produce 4.7 million colors we can't even see! Worse, some printers (like printing presses) can produce only about 70,000 colors.

A **gamut plot** (opposite page) illustrates the range of a color space. The entire horseshoe-shaped plot represents all the colors the average human can see. The areas inside this plot show the relative gamut of a color display, a digital camera and an ink jet printer.

So, we have files with colors represented by sets of numbers. We have devices that do not interpret the numbers in the same way, and so require vastly different numbers to produce the same color appearance. The color gamut of each device plays a significant role in what colors we can actually capture or reproduce, so we need to somehow define these numbers and then produce different sets of numbers for every device, since they all require different values. The solution is **color management**.

Color management systems (CMS) work by using device profiles, also known as ICC profiles. ICC profiles are simply data files that fingerprint how a particular device produces color. Think of each device as speaking a different language and ICC profiles are the translators that allow each device to "speak" to the others, ensuring that the numbers in our files have the correct meaning. ICC profiles also allow files to be altered (converted) so that one set of numbers can be translated into another set of numbers for our intended output device.

Over the course of the next issues, I'll discuss how ICC profiles are created and used in applications like Adobe Photoshop to ensure that what you see on your display and what you get on your printer are what you expect. This really is the primary reason to use a CMS. Professional photographers want to see, edit and produce some kind of output that meets our expectations. We want to do so as quickly as possible, without having to make multiple edits and prints, and wasting time and money. Having a CMS in place means that we can communicate to multiple users what we see onscreen, produce files with the correct numeric values to get the appearance we expect, and even control issues like color gamut. ❑