

Color Management, Profiles, and Spot Colors

Not Everything There is to Know, but
Enough to Get You Started



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Introduction

Color on computers has been, since the dawn of desktop publishing in the mid-1980s, a hot topic of controversy. Publishers and graphic artists needed a way to get the color they would see on their screen to look as close as possible to what they'd see on the printed page. When things first started out, the two were not very close at all.

Additive vs. Subtractive Color

One of the issues involved in the color problem are the differences between the additive (computer display) and subtractive (printed page) color models used. Computers use different percentages of red, green, and blue light to display images as pixels on the screen. This is called *additive color*, because the lights “add up” to white. Of course, white on my computer may not look the same as “white” on your computer. This is a matter of calibration, which we'll address later.

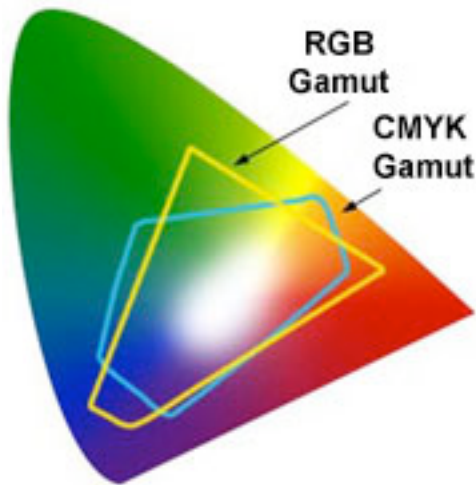
Printing presses, but also today's photo-desktop inkjet printers, are based on a subtractive color model. Take colors away, and you get white. Add color together, and you get black. The model used for subtractive color is CMYK, or Cyan, Magenta, Yellow, and Black. Since variations and quality of inks of CMY differ, it's difficult to get a “true” black from the mixture of equal parts of cyan, magenta, and yellow ink. So, black is added as a fourth color, to standardize the need for “true” black instead of a “muddy” black.

Two reasons color on the computer screen doesn't look the same as what we see on the printed page are (1) because the computer must translate RGB values for CMYK values on the press, or for the printer, and, the (2) gamuts of both color models are not the same.

Gamut is the range of different colors that can be produced by a color model. Your computer, for instance, cannot create every color your eye is capable of seeing with its screen. Your eyes have the “widest” gamut. The RGB model is capable of producing about 16.7 million colors when 24-bits of memory space are used to name the color. Super high-end monitors and scanners can display/read higher-bit color files, extending this range further. CMYK on the other hand, can only display around

10,000 different colors. One website describes the differences in gamut this way (<http://www.techcolor.com/help/rgb.html>):

The result is this: The gamut, or range of colors we humans can SEE is huge. The range of colors that an RGB monitor can reproduce is LARGE, and the range of colors that CMYK printing can reproduce is PATHETIC.



In this diagram, the full range of color available is what the human eye can see. We can also see that RGB physically can't represent all of these colors, and that CMYK is worse. Yet, CMYK can produce colors impossible to see in RGB!

It's no wonder, then, that graphics and layouts we design on our computer screens don't turn-out exactly the way we see them in printed materials. Today, professional software (Photoshop, Illustrator) does a good job at the translation problem between CMYK and RGB. But the differences between the two gamuts are still with us, but there's help.

From Pathetic to Amazing

While CMYK has its limitations, printers, for many years, weren't restricted to these colors for use in their work. They could create a wide range of colors outside cyan, magenta, and yellow chemically—metallic inks, florescent inks, and ink colors that match a variety of nuances just as we enjoy in the variety of wall paint we can buy at the local hardware store. Welcome to the world of **spot colors**.

Spot colors are single-inks that already have the color we're looking for, without any mixing. **Process colors** are those resulting from the mixture of two or more inks, such as CMYK. Some designers also try mixing two or more spot colors for some interesting effects, but that goes beyond our discussion.

Many printing jobs today might include 6 inks: CMYK, plus two spot colors. Varnishes (clear coatings, to make things shiny, for instance) can also be used, and 'count' as a color in your printing project. The problem with spot colors is that your computer, in RGB or CMYK can't really display what that ink looks like: it can only approximate the look. When choosing spot colors, designers will typically use a swatch book—something printed with all the actual inks—to choose the color. What appears in your program is only an approximation of what the color really looks like on the printed page.

Several standards exist for spot colors. By far the most popular in the U.S. is PMS, the Pantone color Management System. Pantone colors are listed by both coated and uncoated papers, as the look will change. Coated papers have a finish on them that can affect how ink is absorbed, and how color looks to the eye. In addition to their swatch books, Pantone also sells digital meters that can be placed on a variety of surfaces and "read" the color. The following tells you a bit more about Pantone, and comes from their website (<http://www.pantone.com>):

Whether you are creating a logo, a product, packaging, an ad, the latest fashion trend or a vision, we have the tools and solutions for keeping your colors accurate and consistent cross-media, around the world. The PANTONE Color language is the most universally understood standard available.

The webopedia (<http://www.webopedia.com/>) describes Pantone with less marketing-speak:

A popular color matching system used by the printing industry to print spot colors. Most applications that support color printing allow you to specify colors by indicating the Pantone name or number. This assures that you get the right color when the file is printed, even though the color may not look right when displayed on your monitor.

That's right! Know the number, and you can access the Pantone library in Photoshop, Illustrator, and InDesign. If you proof your work by printing your document on a local printer, these colors will only be "guesses" by the software and printer. There's no need to use spot colors when your work will only be printed on a desktop printer, or with the CMYK process.

The benefit of spot colors is multi-faceted:

- Spot colors fill in areas of the gamut left-behind by CMYK
- Spot colors add visual interest and effects impossible to see with RGB or CMYK
- Spot colors can be combined to produce an almost endless variety of colors and effects on the printed page

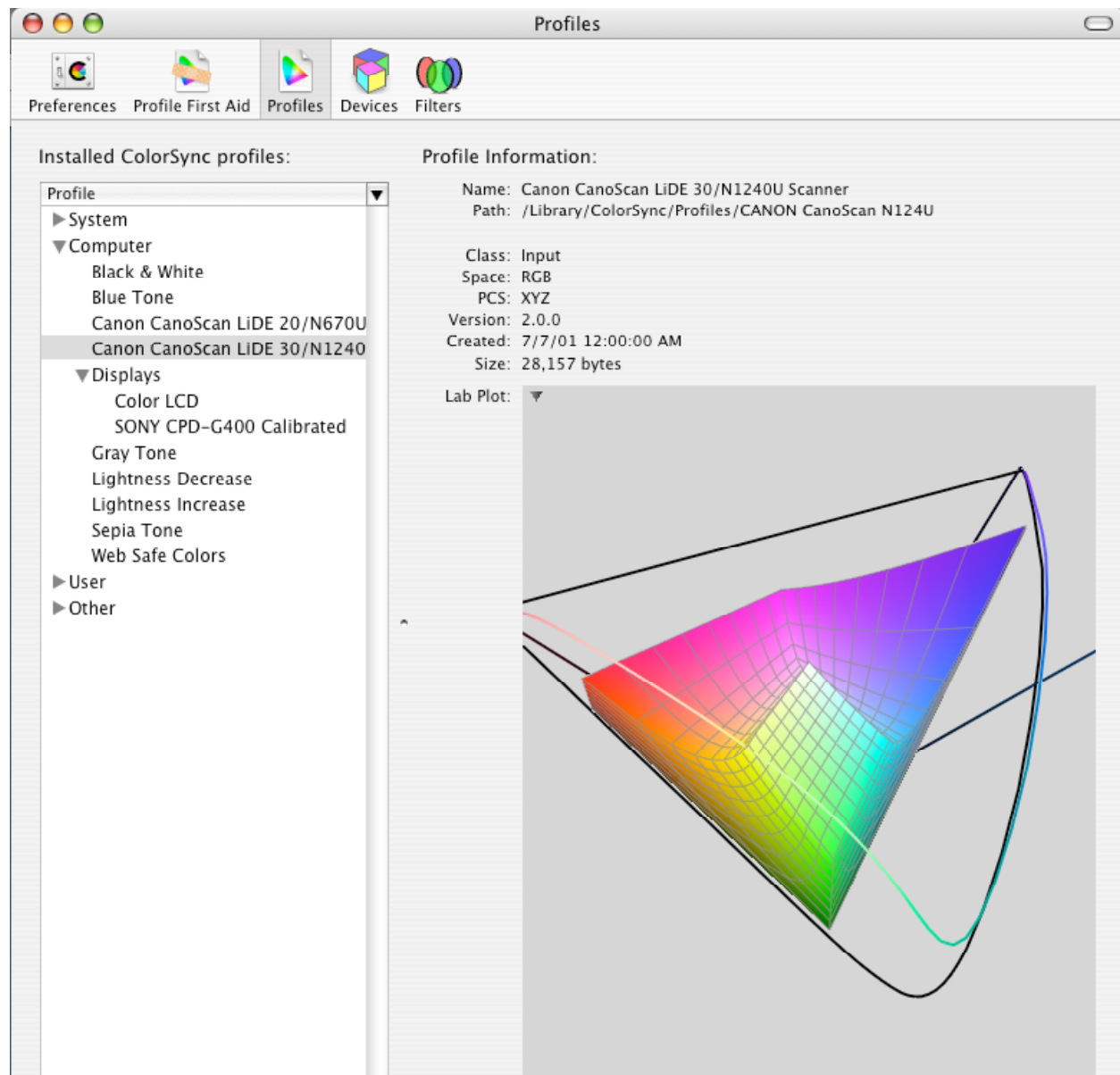
The drawbacks, however, are numerous too:

- More inks in a printing job mean it will cost more
- Some spot colors are difficult to work with
- Some individual inks are pricey, compared with others
- Your computer can't accurately reproduce these inks on screen

Color Profiles

The diagram used earlier to show gamut was only an approximation: what if I told you that each piece of equipment in a room full of computers and peripherals, had different gamuts? Scanners, printers, cameras, and monitors do—but they can also have individual **color profiles**. A profile is a description (in a computer file) that says "this is how this device displays, or reads color..." A **color management system**, such as ColorSync on Macintoshes, bridges the gap left between these different devices, based on their profiles. Macs have been a mainstay in the publishing industry for a long time due to Apple's integration of color management in the operating system.

In OS X, I can use the ColorSync Utility to manage the profiles for my different peripherals:

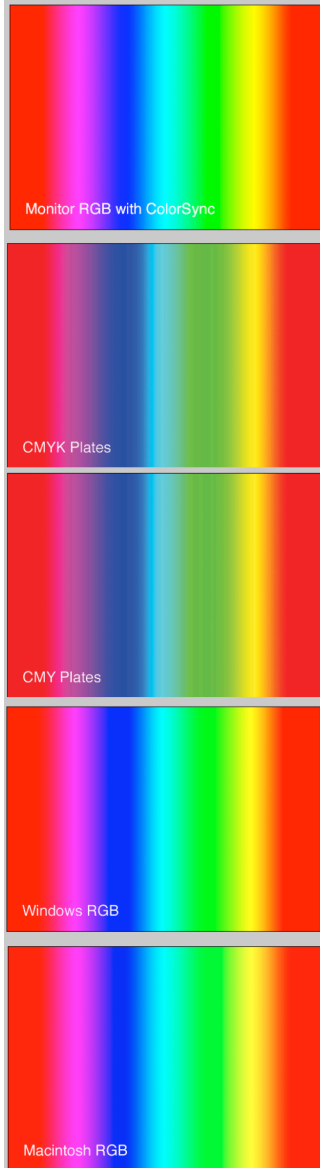


Different manufacturers will provide these profiles with their products. Others, such as the one seen above for the Sony display, I created myself. Photoshop can save profiles, too, with files, so that when files are moved, the color profile used to create the file “moves” with it.

A fully-calibrated system (between cameras, scanners, software) takes time and effort to establish. This guide is too limited to help you create a fully-calibrated workflow, but is designed to make you aware of some of the issues involved in establishing a calibrated system.

Color Management with Photoshop

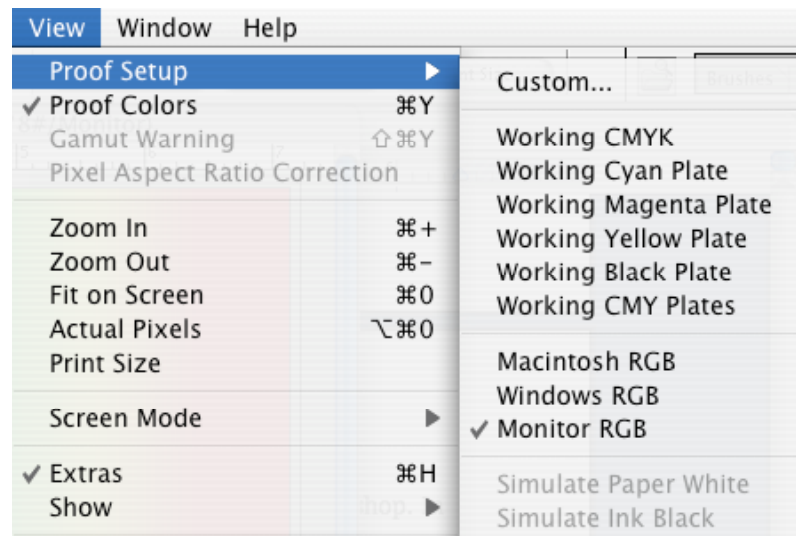
Our final section will examine the role color plays within Photoshop. In this example, I'm using Photoshop 8 (CS).



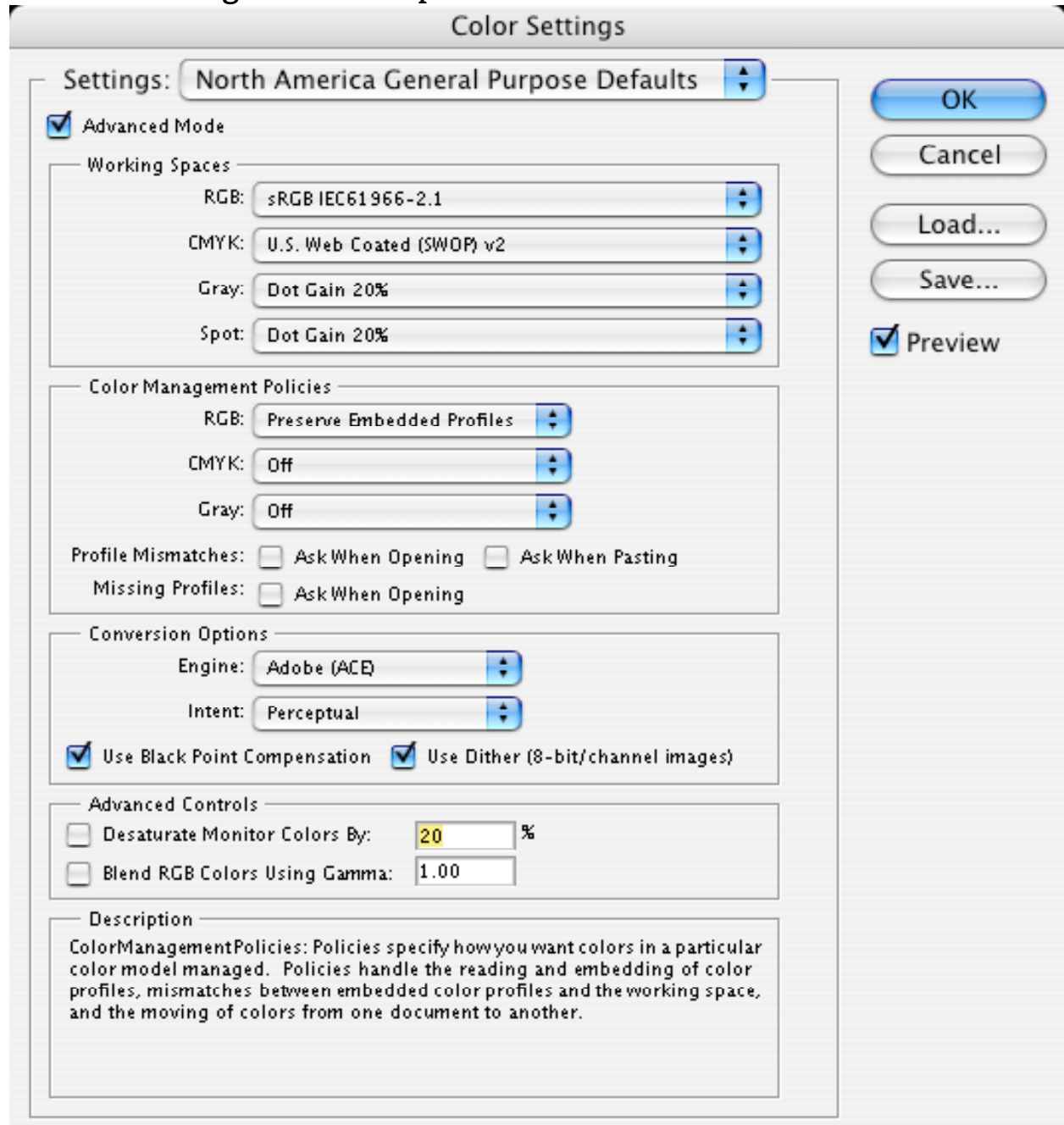
To generate the file you see on the left, I used Photoshop's ability to manipulate the display of colors with different preset color profiles. The first is color based on the profile of my monitor. The second and third, the most noticeably different, are CMYK and CMY approximations. The last two display the differences between the Mac's RGB model and that used by Microsoft's Windows OS.

If things are calibrated (say, to my monitor), that means that the "red" I see on my laptop will match the "red" I see on my Sony monitor, when I move the file. Photoshop is "changing" the values for color on my computer to compensate for the differences between my LCD and Trinitron monitors. That particular look of "red" should be the same on any device, as long as I bring my color profile along by selecting it in Photoshop.

All the settings I change in Photoshop are available under the View menu.



Under the Photoshop menu, you can also find the Color Settings dialog, which allows you to fine-tune Photoshop for different profiles and how to convert images based on profiles:



When creating a project that requires tight control of color, it is best always to speak to your printer. They can provide you with some of the information that should be changed in the dialog box (above). The only true way to know your system is calibrated is to establish accurate

profiles for each unit in your system (camera, scanner, monitor), make changes to the color settings in Photoshop as recommended by your printer, and then hold up a finished copy of what you print next to the monitor. Will it match? No. It can't possibly match exactly, but it should be close enough so that in future projects, the results of your work you see on the screen match well with what comes-out on paper.

Your printer can also provide you (usually, for a fee) with a color proof. Many times the proof won't use any spot colors you've chosen—but their calibration with their own press is high. This sample, printed example will come close to the look you'll find on the press. Some printers also offer a "digital proof," a copy of your file with a calibration applied that matches what their press does on paper. Before printing 5000 of something, you have a final chance to make adjustments to color before printing takes place. These final changes, however, can often cost you more money... so it's in everyone's best interest (time, and money) to calibrate and use profiles to help manage the tricky world of color through your creative designs.

The following are some websites of interest on the topics discussed in this brief:

- http://www.geocities.com/pantone_color_chart/
- http://www.normankoren.com/color_management.html
- <http://www.color.org/>
- <http://www.apple.com/macosx/features/colorsync/>
- http://images.apple.com/pro/pdf/Color_Management_in_Mac_OS_X.pdf
- <http://www.photoshopsupport.com/tutorials/tt/color-management.html>
- <http://www.creativepro.com/story/feature/2440.html>
- http://www.arraich.com/ps6_tips_colormanage1.htm

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