Pacific New Media

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## Digital Color Management for Print and Web

Fundamentals

Strive for 90% rule. All screen images, and all images between individual monitors and print stage, should be 90% similar. All proofs, press proofs and monitor images should not vary more than 10% in color and density – for the entire workflow if possible.

1. Basics

What is gamma? Gamma is a measurement of the luminosity or brightness of the image file on the monitor. A higher gamma makes an image lighter; a lower gamma, darker. The default gamma for Windows operating systems is 2.2. The default gamma for older Mac operating systems, Leopard and earlier, is 1.8. The default gamma for Snow Leopard or Lion is now 2.2, to coincide with Windows systems. The default gamma of digital printers is 2.2. This means if you prepare images for the web or print on an older mac, you must manually adjust your monitor and image-editing software to a 2.2 gamma if you do not want your images to be viewed too dark.

What is color space? A color space is the color gamut, how many colors a device will "see." Different devices, such as film, scanners, cameras, monitors, and printing devices can perceive and reproduce colors in completely different ways. Additive RGB color is what the monitor "sees," and Subtractive CMYK color is what the print "sees". Each device then, is said to have it's own color gamut. To further complicate matters, there are different RGB color spaces, that render a greater or lesser color gamut.
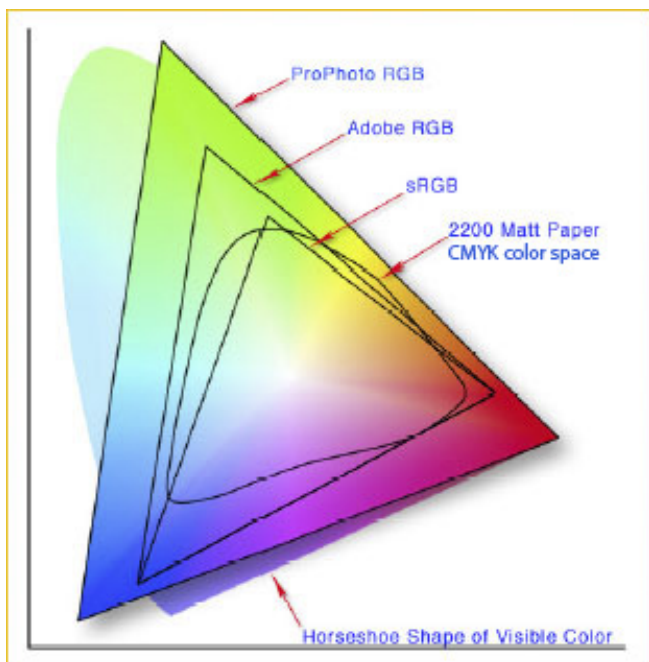
ALL monitors, cameras, projectors—anything with light shining through it, use Additive color or RGB color space, with the three primary colors, red, green, and blue combining together to make white light.

ALL printing devices, where the light is reflected off of a surface to form the color gamut, use Subtractive color, CMYK color space, with 4 primary colors, cyan, magenta, yellow and black, which, when combined make pure black.

RGB color gamut is considerably larger than the CMYK color gamut.

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RGB Color spaces

Pro Photo: Largest color gamut available. Exceeds what a print can "see" at this stage in printing evolution. Available only in RAW format.

Adobe RGB: Standard color space for photography. Color gamut most similar to high-quality printers and monitors.

sRGB: Smallest RGB color gamut. Designed for office equipment (color laser printers.) Microsoft standard. Default for web and most digital devices.

2. Workflow Procedures

For image editing, the best rule of thumb is to stay in the largest color space and pixel depth that is possible for most of your workflow, such as 16 bit color and Adobe RGB, or ProPhoto RGB. This gives you maximum editing capability, with the greatest dynamic range and color space. And only reduce the color space or pixel dimension as needed for output, AFTER your corrections have been made.

1.) Calibrate monitor. Preferably with a hardware device (Color Eyes, Gretag-Macbeth). This is the most important step for consistent results throughout the workflow. The monitor calibrator actually adjusts the luminosity and color projection of the monitor to an objective standard. Make certain gamma and brightness are consistent with your output or preferred monitors for web display. Generally, gamma is set at 2.2. Color temperature is generally set at 6000 - 6500 degrees Kelvin.

2.) Set color space and print/web defaults for all software and capture devices. Adobe RGB preferred. Most cameras and software default to sRGB. Most digital SLR cameras and some point-and-shoots can be calibrated to Adobe RGB in the camera menu.

Even Photoshop defaults to sRGB surprisingly enough. In Photoshop, go to Edit>Color settings, use North American prepress 2. which maps the gamut to Adobe RGB. If you do not set PS for Adobe RGB, the color space will be reduced immediately upon opening an image in PS to sRGB and the additional colors of Adobe RGB are lost forever.

In InDesign, go to Edit>color settings. If you want all programs in the Adobe Creative Suite to default to Adobe RGB, change your color settings from Bridge.

Set scanners for Adobe RGB or no color correction, allowing you to set the color space in PS. For scanning in 16 bit mode, use 48 bit color or 16 bit grayscale.

3.) Edit image in Photoshop in RGB color space (not CMYK): for artistic purposes, for content, for communication and meaning, for color and tonal correction, and for subjective enhancements. Use nondestructive editing procedures (Camera RAW, Lightroom 3, or Adjustment layers in PS) to preserve pixel depth and quality, and when possible, use 16-bit mode.

In PS, you can adjust color and clear color casts with Color Balance adjustment layer, Hue and Saturation, or the most flexible of all color and tonal correction tools, Curves Adjustment layer.

Using Curves for color adjustments

The image of the young ballerina is too red/magenta in the middle tones and too blue in the shadows (on the edges), either due to a color cast from the camera or from light reflected off of the red wall. Shadows are often very blue in general.

With curves, you can target the value areas that you want to change, and either lighten/darken the entire image, or selected areas. Alernatively, you can use any of the three color channels, RGB, and perform highly sensitive and targeted color adjustments.

To change the lightness or darkness of the image or selected areas: Use the default RGB channel and either grab the curve in the center and raise it to make the image lighter, or lower it to make the image darker. To target particular areas: use the hand tool in the upper left of the Curves adjustment pallette, hover over the area within the image that you want to change, and click. A point will be placed on the Curve at that particular tonal or color area. Raise or lower the Curve as needed.

To perform color adjustments with Curves: Choose the channel that you want to adjust, in this case the Red channel. With the hand tool, select the broad tonal/color areas that need adjusting, in this case the lower/middle values that are too red. Then, adjust the point as needed. In this case, we lowered the point on the red channel, thus removing the excess red from the middle values.
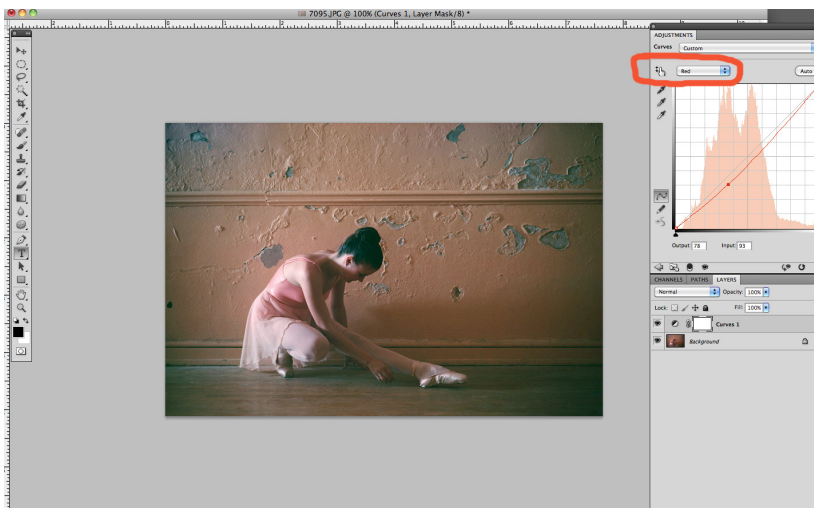

You can perform multiple channel adjustments, or on the entire RBG channel, on the same Curves adjustment. You do not need to make separate layers for each adjustment.

This is a highly flexible method for sensitive color correction and can do everything that the Color Balance adjustment layer can do . . . and more.

Color Correction Primer

It helps to understand the color wheel, and to know that the additive primary colors, RGB, and the Subtractive primary colors, CMYK, are opposite each other. If one color is in excess, remove it or add its opposite. For example, if Red is in excess, either remove red or add cyan.

If Blue is in excess, either reduce blue or add yellow.
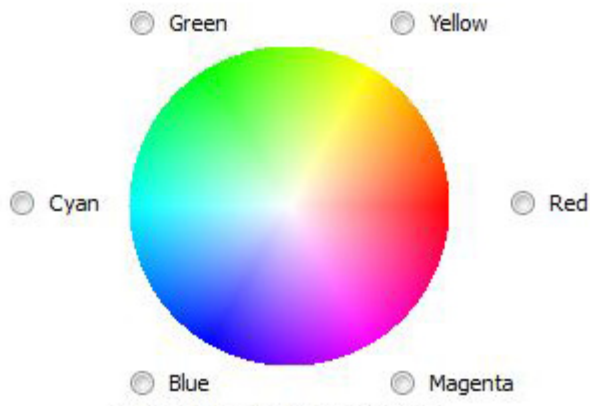
Here is an illustration of the color wheel, with the Additive Primaries opposite the Subtractive primaries. It's important to know this, since all color correction tools in Photoshop employ some version of working with these primary colors.

The art of photography encourages a sensitive awareness of color, both for clearing/correcting color casts and for employing color as a creative, expressive element in your images. Over time, and with attention and work, your awareness of color will grow, hopefully in ways that will engender a deeper relationship to its power, its emotional undertones, and its expressive potential.

In any workflow, generally it is a good idea to clear/correct any color cast that comes from the camera or the processing lab *first*, and then move on to your subjective, expressive intent through the creative use of color. And remember, less is more, just because you can doesn't mean that you should. Every image does not need to be highly oversaturated or falsely impactful.

When finished with your color correction, save image in PSD or TIFF format with the Adjustment layers intact. Do not flatten your image, or do not resize or change pixel dimensions (resample). This is your integral image, that you may change in different ways for particular output or web purposes.

3. Output and ICC Profiles

1.) Each device has an ICC profile that "maps" its color gamut and accounts for its idiosyncacies— your scanner, monitor, digital camera, and printer should each have a specific profile. Sometimes manufacturers provide a profile, and sometimes you'll have to create your own. Newer ink jet printers, flatbed and 35mm scanners, and so forth will generally ship with an accompanying profile, and some include multiple profiles to account for different media (on both input and output devices.) Higher-end digital cameras also use profiles, but can also capture into a specific color space. Note that most consumer-oriented digital cameras use sRGB as their working space.

Every printer and particular paper and ink-set has its own profile, which is either loaded on your computer, or comes with the device, or can be downloaded from the web and installed on your computer. On a Mac, go to Library>Color Sync>Color profiles.

When you calibrate your monitor, it creates its own profile which is loaded into your System Library.

Note: Most manufacturers make their device profiles available on the Web.

2.)When you save a file, Photoshop embeds a profile for that file, which consists of its color space, rendering intent, dot gain, etc. This is why it is exceedingly important to go to PS>Edit Color Settings> and set for North American Prepress 2, even if you are working for the web. You want to maintain the largest color space until you actually resize your file for the web.

3.) Load ICC color profiles for hardware, printer, paper and inks into System Library.. If going to press, convert image to CMYK color space. If going to web, re-size and resample image for monitor display – place in sRGB color space. The standard color space for the web is sRGB. For Epson or Canon printers, stay in RGB mode and allow the printer to make the CMYK conversion.

All monitors and output devices have imaging characteristics of their own that must be taken into account to make sure that they produce the correct results. That is why an ICC profile is associated with each output device – and paper/ink combination -- to describe how the colors need to be transformed to produce accurate results.

Achieving consistent and accurate color requires that both input colors and output devices be profiled against a standard color space. ICC profiles allow you to proof images on-screen with the same color characteristics of your printer or output method.

4.) "Soft-proof" your image in PS or in various Browsers. In PS, View>Proof setup>Custom. Under Device to Simulate, choose the proper ICC profile for your output method. Choose Rendering intent of either Perceptual or Relative Colormetric. Check ON, Simulate paper color and you will see the image as the printer or output device "sees"it. From there, you can make additional adjustments on Adjustment Layers to compensate for the shift of color or tonality in printing.
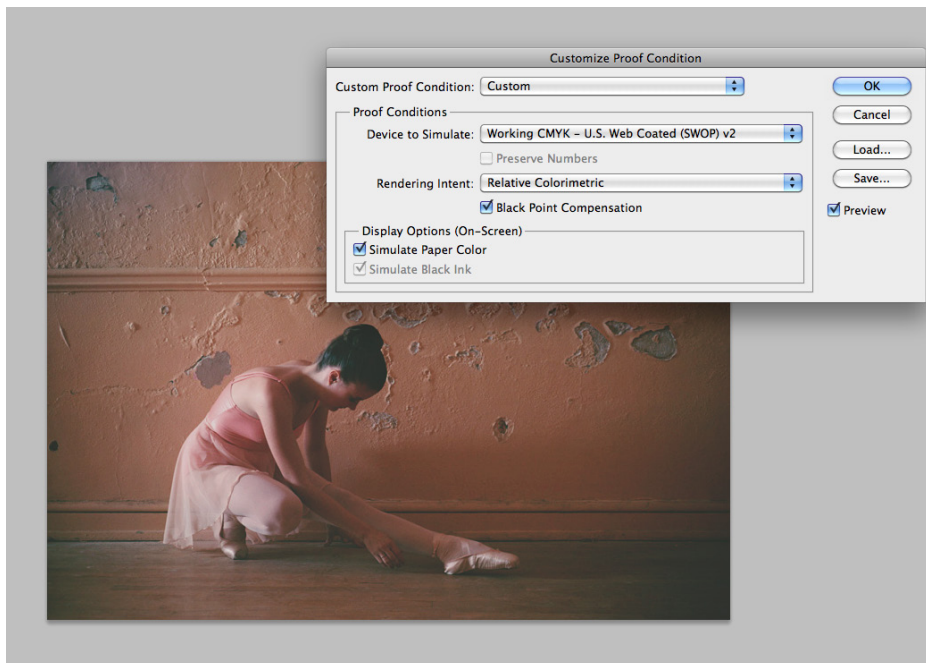
For web output, save as jpg, convert to sRGB color mode and "test" your image in various browsers. Different browsers have different color settings and treat color differently. Make sure you test in Explorer since that is the browser of choice for many PC users. Make adjustments accordingly to balance the look until it feels right in various browsers.

5.) Make test print or obtain press-proof from printer – using your file -- to verify "soft-proofing" and monitor accuracy. Make final small adjustments to color and tone from press-proofs or workprints. I use Layer groups, one for my basic, initial adjustments and a different layer group, consisting of adjustment layers that are modified for each output device. On Epson or Canon printers, and most presses, small prints are exactly the same in color and density as large prints. For economy and time, make small proof prints prior to making final print.