

## Fixing White Balance and Color Errors in Photoshop

By Ron Carran  
August 17, 2007

After shooting with your digital camera (or after scanning a piece of film), you will want to use Photoshop to fine-tune the colors and mood of the photos you took. Often, especially when shooting in raw format, your pictures will look a bit dull and washed out compared to the way they looked on the camera's small LCD. This is entirely normal, for the camera is applying some fixes of its own to make the picture look "punchy" on the LCD, but the raw data awaits your manipulation to show its true "colors."

Photoshop offers you all the tools you need to accomplish your vision, but it requires a good deal of setting up before you can start adjusting, correcting and tweaking. Let's start with that.

### Setting up your computer

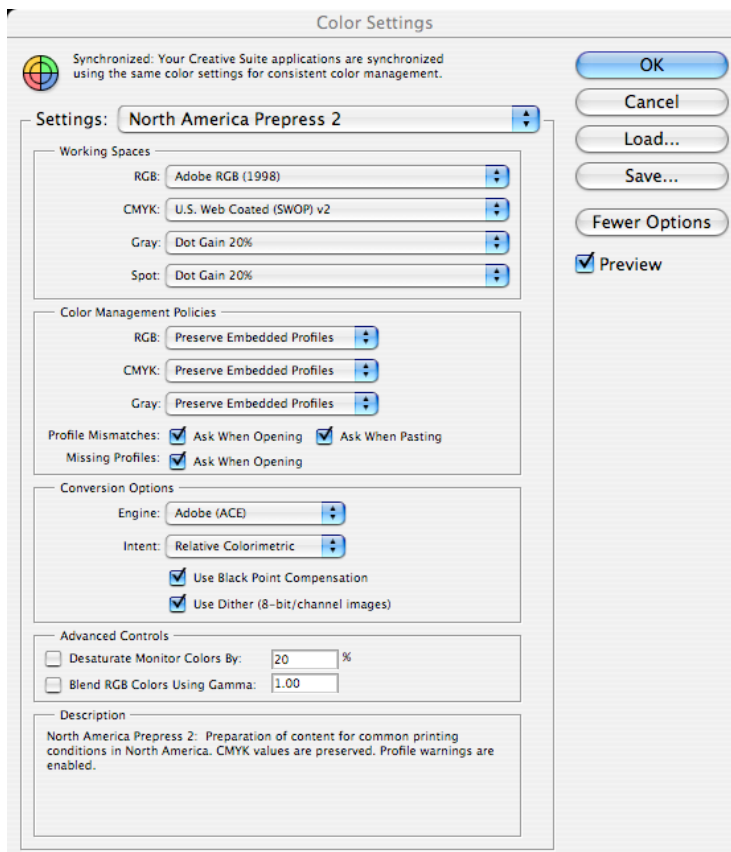
In order to be able to assess the color quality picture you are seeing on your computer screen, and make decisions about correcting its color, you need to make sure what you are looking at is actually what will print or display when you produce the final presentation copy of the image. We need to start by setting up your computer to a set of known calibration values, so that we can accurately judge what it is displaying. First, we will tell Photoshop which parameters to use in displaying color, then calibrate your monitor to display those colors, then finally move on to adjusting your printer match what you see on the monitor.

### Photoshop Color Settings

You need first to tell Photoshop how to interpret colors, and what parameters to use when displaying those colors. The following steps will set up what I consider to be the most desirable settings for color rendition. There are many parameters you can change, but most of them can be set correctly by accepting the defaults.

Use this procedure.

1. From the Edit menu, select Color Settings. The following window opens. (Make sure **More Options** has been clicked. (When it has, the button will say **Fewer Options**.)

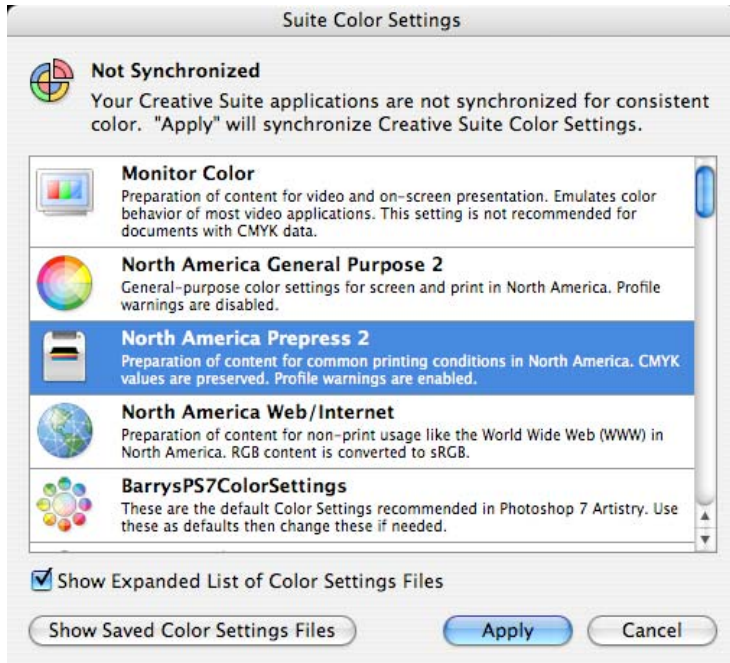


2. Choose **North America Prepress 2** for the most widely used group of settings.

Notice that the RGB Working Space is set automatically to **Adobe RGB (1998)**. This is fine for most applications. Adobe RGB (1998) has become a standard in the prepress and imaging industry. However, if you have a newer printer (Epson, HP or Canon) and wish to print a larger gamut of colors, change this setting to **Pro Photo RGB**. Gamut refers to the set of colors displayable on a monitor (or printable from a printer). These newer printers are capable of accurately printing these colors, so you can take advantage of them by selecting this larger gamut working space. Many less expensive digital cameras use sRGB as their working space. This is a smaller gamut than Adobe RGB (1998), and is used widely for web graphics. So, if your intention is to use your photos mainly on the Internet, sRGB will give you a more realistic idea of how they will look in a browser. But for printing, Adobe RGB or Pro Photo is the better choice.

Note: If you own the entire CS3 suite of programs (Photoshop, Illustrator, InDesign, etc.), you should synchronize the settings among all of these programs.

3. Select **Creative Suite Color Settings** from the Edit menu in Adobe Bridge.
4. Pick the color settings you want to synchronize and click **Apply**.



## Monitor Calibration

Adobe provides software to do a manual monitor calibration for Windows called Adobe Gamma. This method will get your monitor in the “ballpark” of accurate color rendition, but that’s about all. It relies on your eyes as the judge of what colors are correct, which may or may not actually be accurate. On a Mac, use the Apple Display Calibrator, which works only for Apple monitors. (Note: many LCD monitors are calibrated differently than CRTs, and may not produce as accurate colors as CRTs.)

A far better method is to use a third-party hardware calibrator to check exactly what colors the monitor is producing, and adjust them to the correct levels. These calibrators are available for prices ranging from about \$79 to a few hundred<sup>i</sup>. I won’t go into the instructions to actually run the calibrations, as each manufacturer has their own procedure.

Let’s assume that you have calibrated your monitor using one of these methods, and that you are actually seeing relatively correct colors when you look at one of your photos on screen. At least now you can make informed decisions as to how to change the color that you see, and be confident that, when displayed, your pictures will be close to what you had in mind.

## Printer Calibration

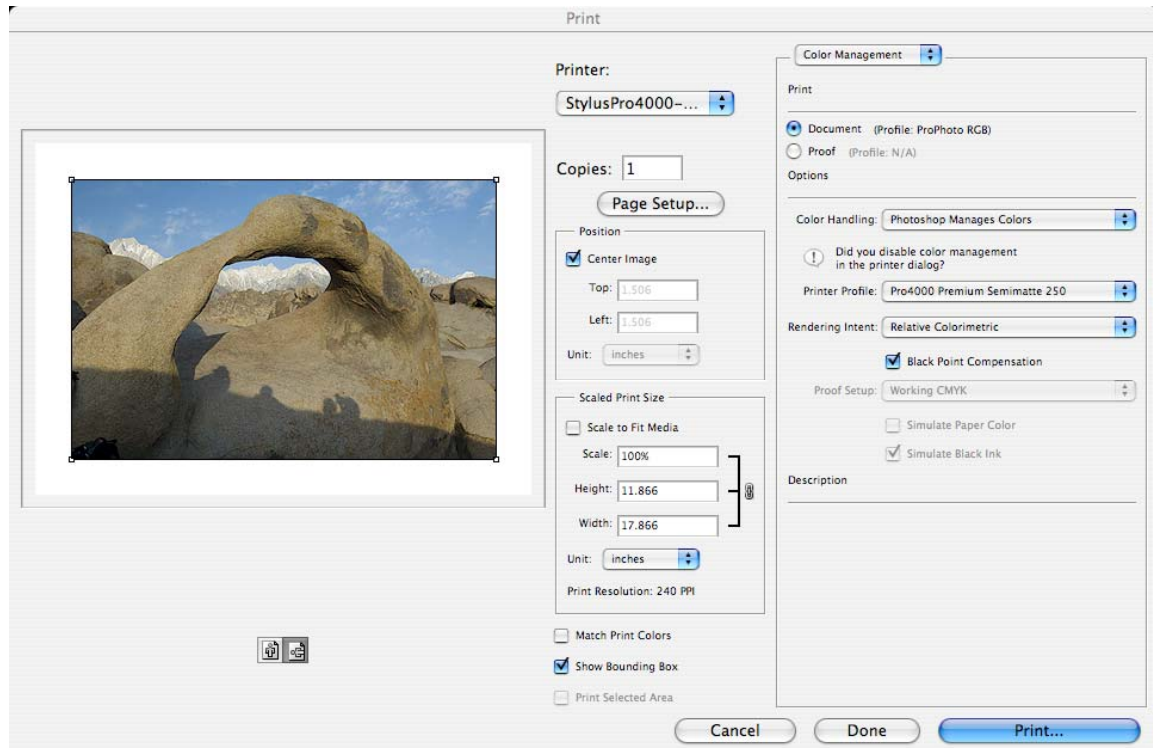
The next step is calibrating your printer so that the final print also looks like what you saw on your screen. This step is critically important, but is actually not too difficult to perform. Actually, there are a number of steps. I will use Photoshop CS3 as an example, but earlier versions of Photoshop operate in similar ways (differences will be noted).

First of all, printer calibration can only be carried out on today’s modern ink jet printers. Also, not all printers will calibrate successfully. As a general rule, any Epson, HP or Canon ink jet designated as a “photo” printer (and not an office printer), will be usable, with the higher-priced models being more successful.

The process involves using a print profile, which is actually a data file produced either by the printer company, the paper company, or yourself, that tells the printer how to put down ink on the paper to match what’s on screen. The profile must be specifically produced for a particular printer/paper combination (e.g. Epson 2200 with Epson Premium Luster Paper). Only with that exact combination will the profile work. Use another manufacturer’s luster paper, and the results will probably be disappointing (or awful).

Here's the procedure.

1. Open the Photoshop Print Dialog box using **File->Print** (in CS3). (On earlier versions of Photoshop, you *must* use **File->Print with Preview**).

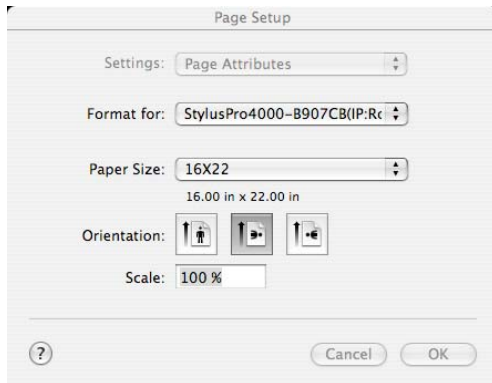


This Photoshop CS3 dialog box makes it easy to see the order of what has to be done. If you think of the window as having 3 columns (picture, Printer, Color Management), just follow these columns from the top to the bottom.

Note: Earlier versions of Photoshop have a different layout on their print dialog windows than CS3, but the functions are roughly the same.

2. Select the orientation of the photo.
3. Select your printer from the **Printer** drop-down list.

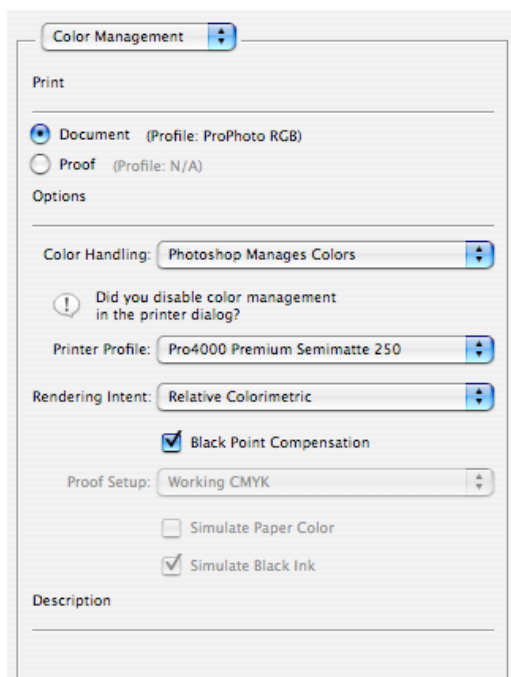
#### 4. Now click **Page Setup**.



5. Set your **Format for** Your printer and the **Paper Size** to the size sheet you want to print on.
6. Set the **Orientation** and **Scale**.
7. Click **OK**.

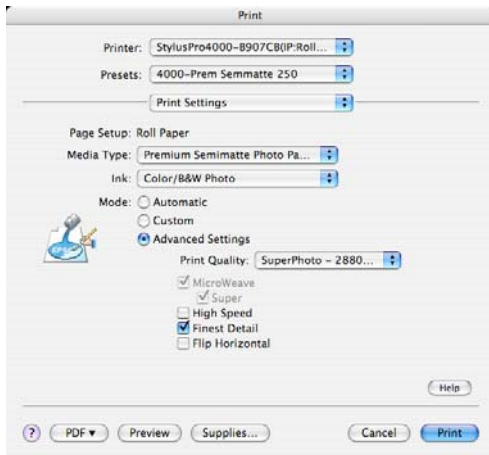
You can leave all other settings in this column set to their defaults.

8. On the Color Management panel, you make the important decisions. Select **Color Handling** to be **Photoshop Manages Colors**.
9. Now select the **Printer Profile** for the type of paper you are using.
10. Set the **Rendering Intent** (to Relative Colorimetric or Perceptual).
11. Click on Black Point Compensation.

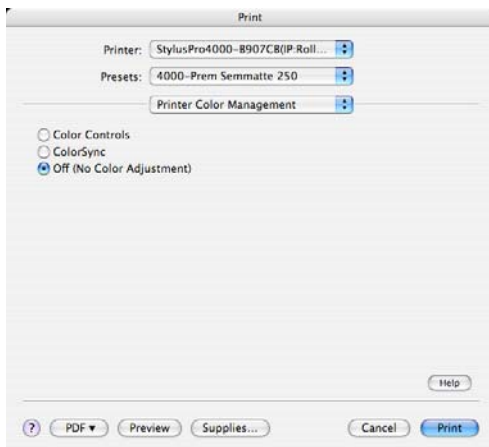


#### 12. Now click **Print**.

Set Print Settings by selecting the correct **Media Type** to your paper, **Advanced Setup Print Quality** to the desired value, and the Mode to the quality you want (**High Speed** off and **Finest Detail** on for best quality).



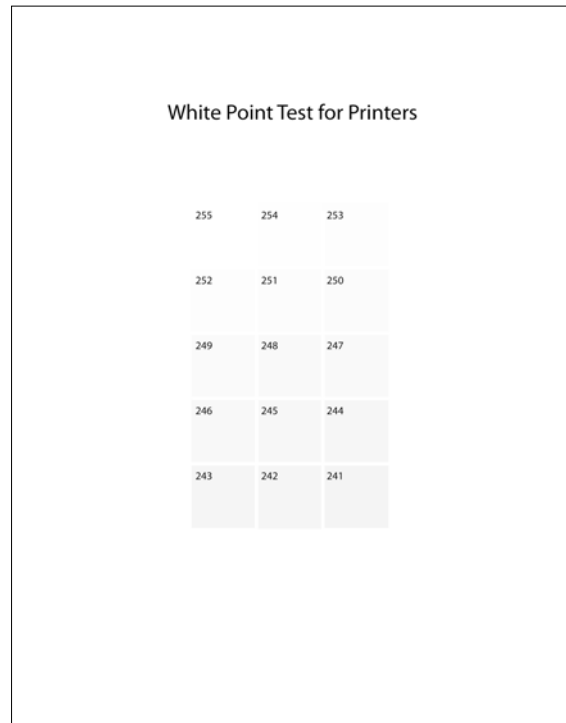
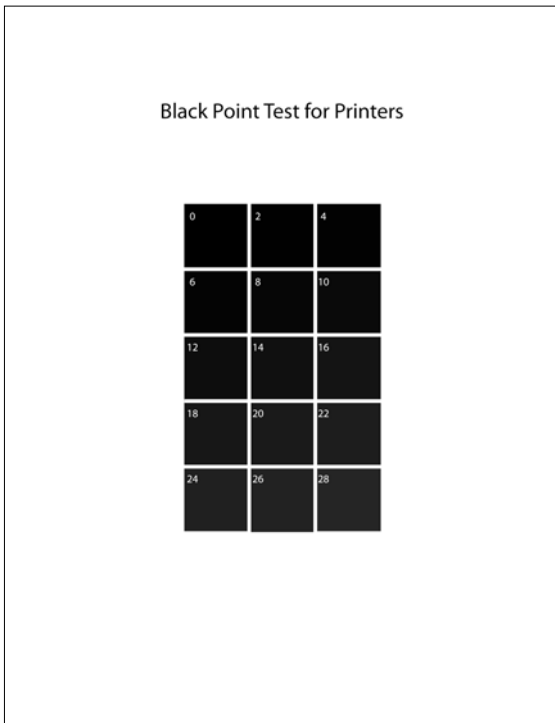
Make sure you set Printer Color Management to **Off** (No Color Adjustment). This tells the printer not to adjust anything, as the profile in Photoshop will do all the work.



13. Now **Print** your picture.

One last printer calibration that you can optionally do is to determine the tonal range of your printer. That is, how dark can your printer print without making totally black, or how light can it print where there is still dot visible. To do this, you can print these two files to give you an idea where your printer starts printing actual dots from pure white (R, G & B values of 255,255,255 don't print any dots), and where you start to see a change from pure black (R, G & B values of 0,0,0 prints full black, do visible dots). We'll use these values to set up Photoshop's White and Black limits.

14. Print these out and note the values that you begin to see dots, black and white.



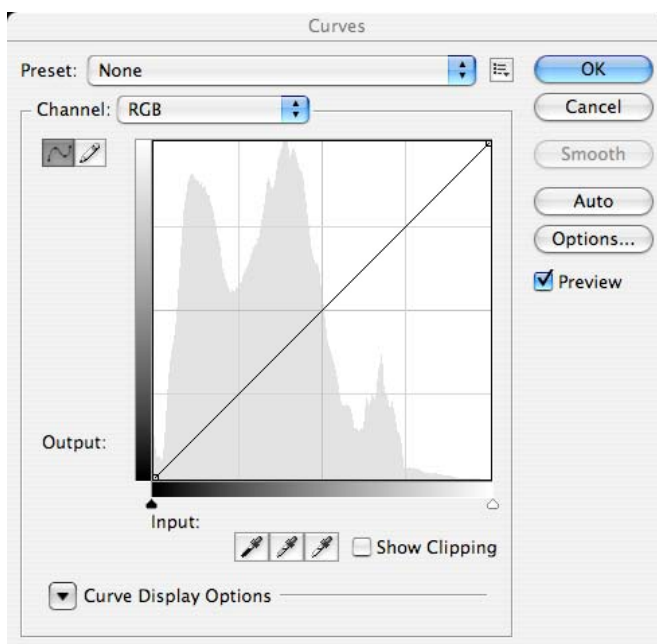
## Making Photoshop Color Adjustments

Now that we know that the displayed print will look like what we set on the screen, we can start to make artistic decisions. These decisions include portraying colors accurately (assuming that is what you want to do), having a suitable amount of contrast in the photo, removing any color cast, setting neutrals, adjusting highlights and shadows, and sharpening the finished product.

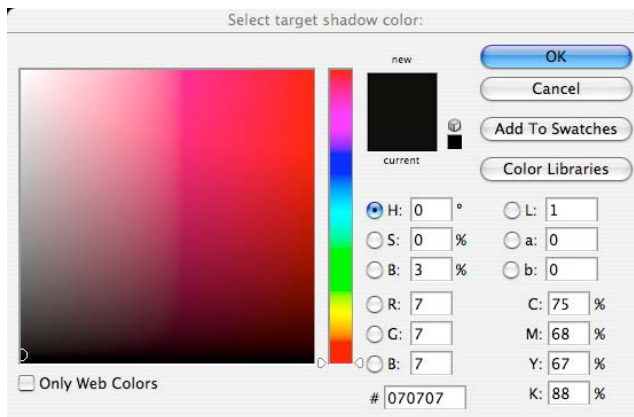
We are going to assume that all of your output will be in RGB mode, for use in ink jet printers, and not CMYK, used for commercial web press or lithographic printing. CMYK presents you with a large set of problems that we don't have to deal with for desktop printing.

Let's set up the white and black limits for Photoshop to use when determining the black and white points of a photo.

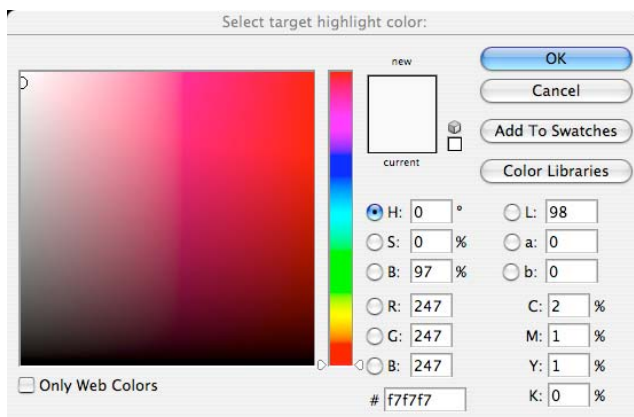
1. Open any image, even a new blank one.
2. Click **Cmd-M** (PC: **Control-M**) to open the Curves dialog box.



1. Double-click on the left (black point) eyedropper.
2. Set the R, G & B values at whatever levels you selected from the black point test print (I use 7,7,7).



3. Click **OK**.
4. Double-click on the white eyedropper and set your RGB values accordingly, either from your test print or use mine (247,247,247).



The gray-point (middle) eyedropper is fine to leave at 128,128,128.

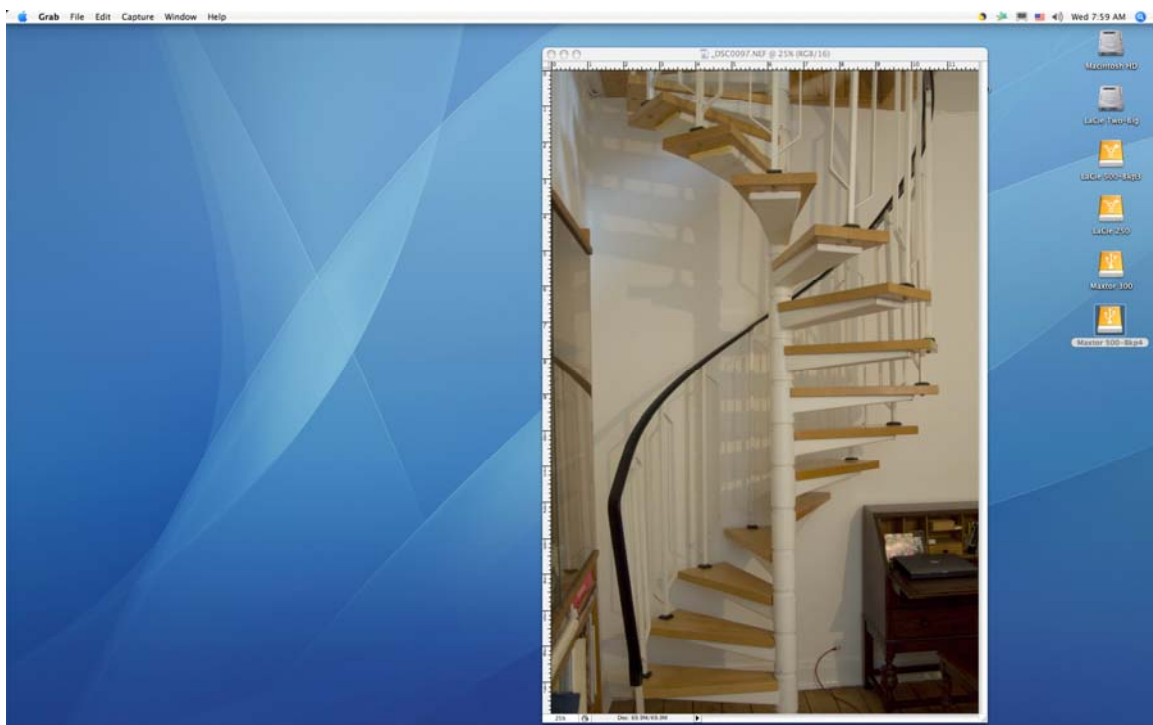
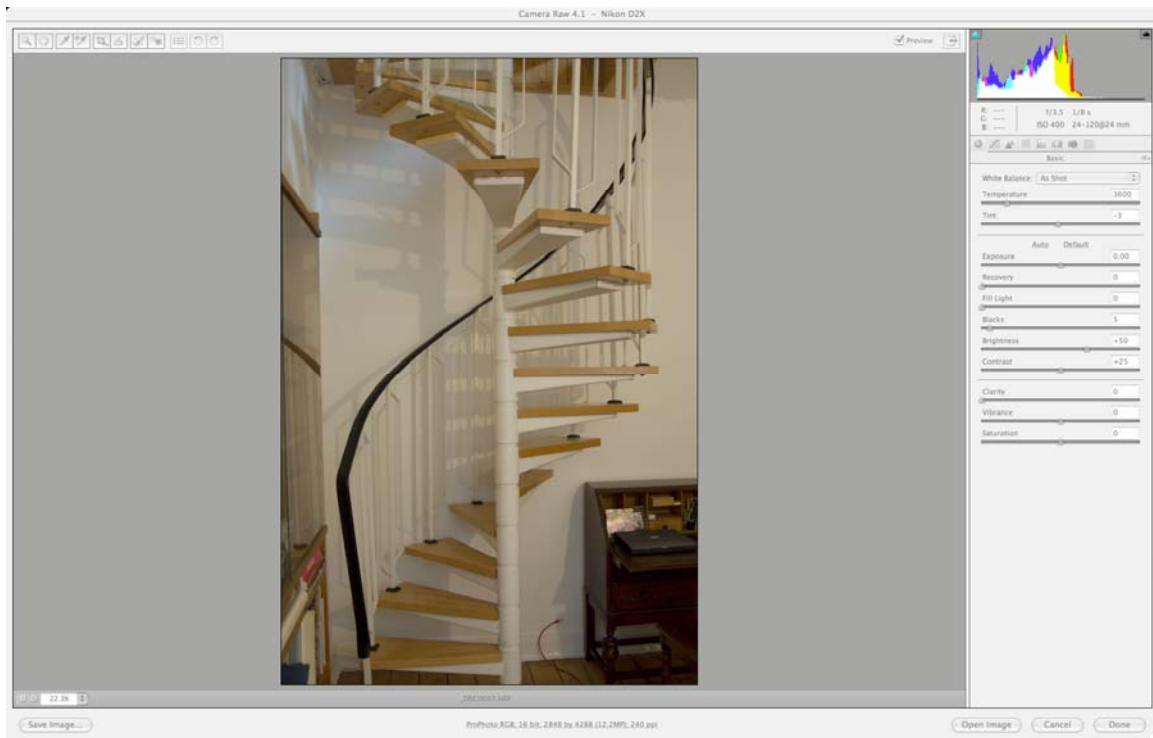
5. Click **OK**.
6. Exit the Curves dialog by clicking **OK**. When asked if you want to use these values as defaults, click **Yes**.

## Correcting Colors

Now let's do some correction.

Many of us shoot raw format, so let's start by using Adobe Camera Raw to create a workable Photoshop file to correct. There are many adjustments that can be made in ACR, enough to fill an entire book, but let's concentrate on Photoshop's tools for now.

1. We'll start by clicking **Open** in ACR to place this picture into Photoshop, as a .PSD.



One place to start is by identifying the lightest and darkest places in this photo. We want only meaningful selections, not specular (reflections) highlights or minute dark places practically hidden from view. We also want to look for neutral areas, places we know that should be gray. Let's start with whites and blacks.

2. Click the adjustment layer icon at the bottom of the Layers palette and select Threshold.
3. Slide the pointer first to the right (A) to find the whitest points, then to the left to find the darkest.

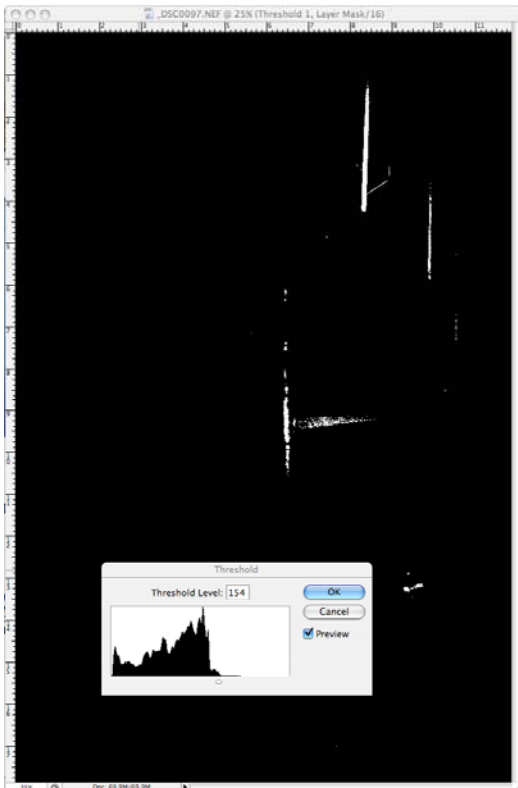


Fig. A

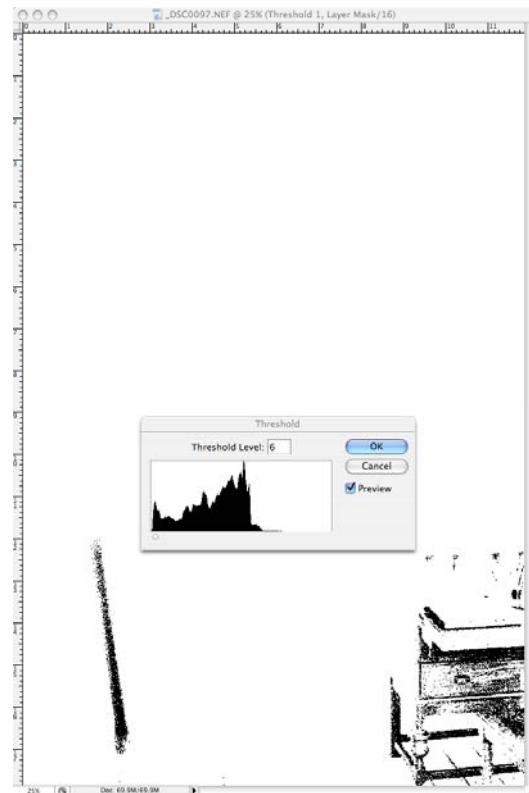


Fig. B

1. Place a white point Color Sampler by selecting the white point eyedropper from the Curves dialog box, then shift-clicking on the sampler you placed on the whitest point on the picture.
2. Do the same using the black point eyedropper to the color sampler placed at the picture's darkest area.

The results are quite dramatic. Just by adjusting what we know should be white and black, many of the colors in the photo fall right into line.



Using the gray eyedropper can also make a big difference in any colorcast present in a picture. This next photo has a definite Blue-green cast to it. But I know that the door in the photo should be gray, so if we click the gray eyedropper from the curves palette on the door, the overall colorcast of the picture should be reduced, and the other colors in the picture should be truer.

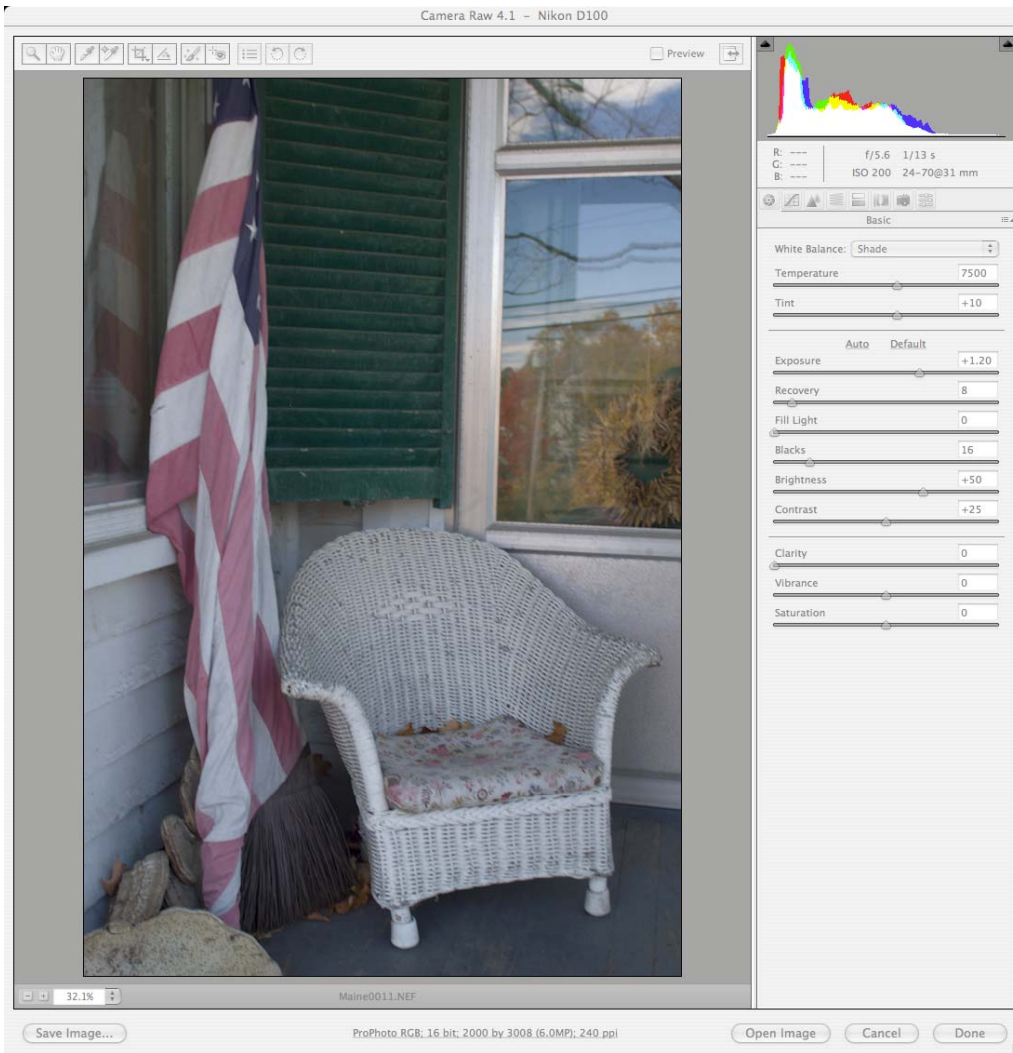


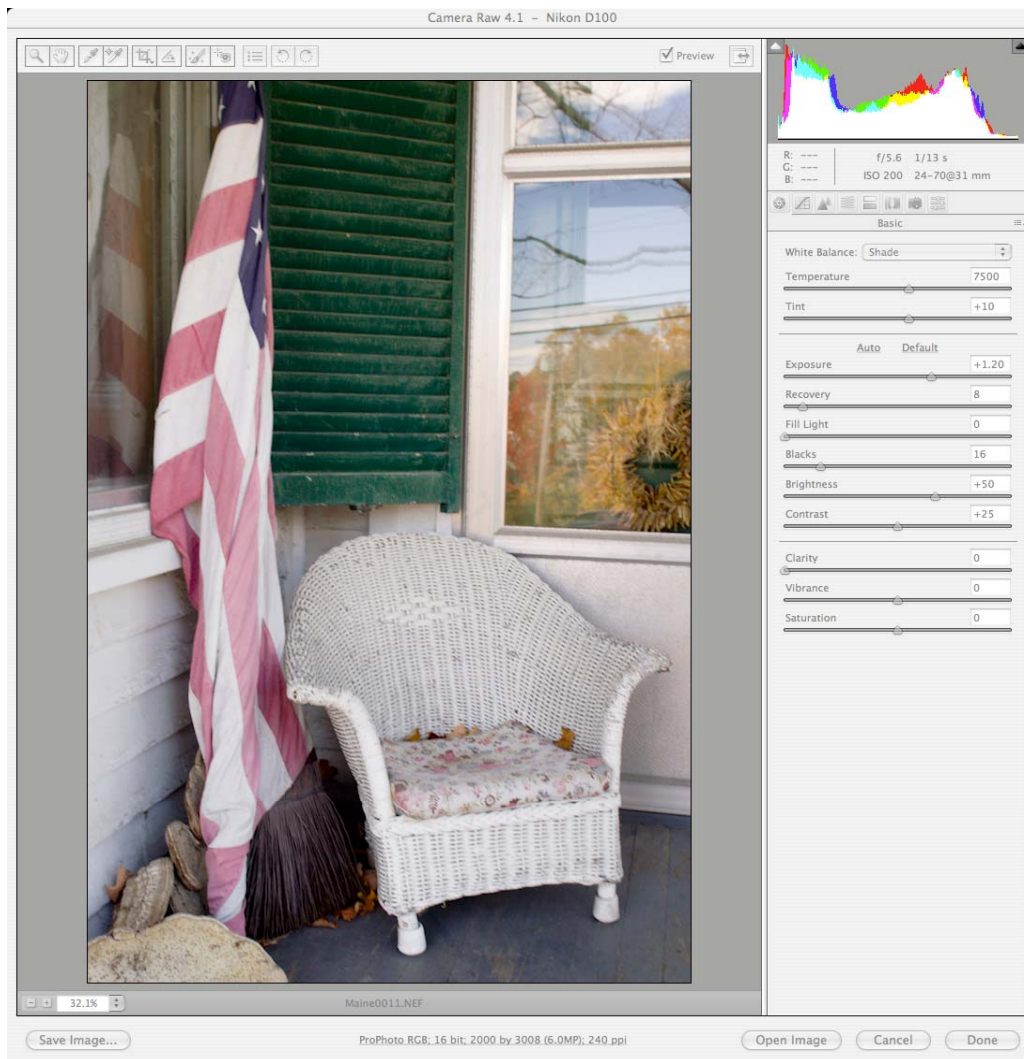
©2002 Andy Katz

And that's what happens.



Let's return to Adobe Camera Raw and see what we can do to change the white balance of a photo, before we take it into Photoshop.





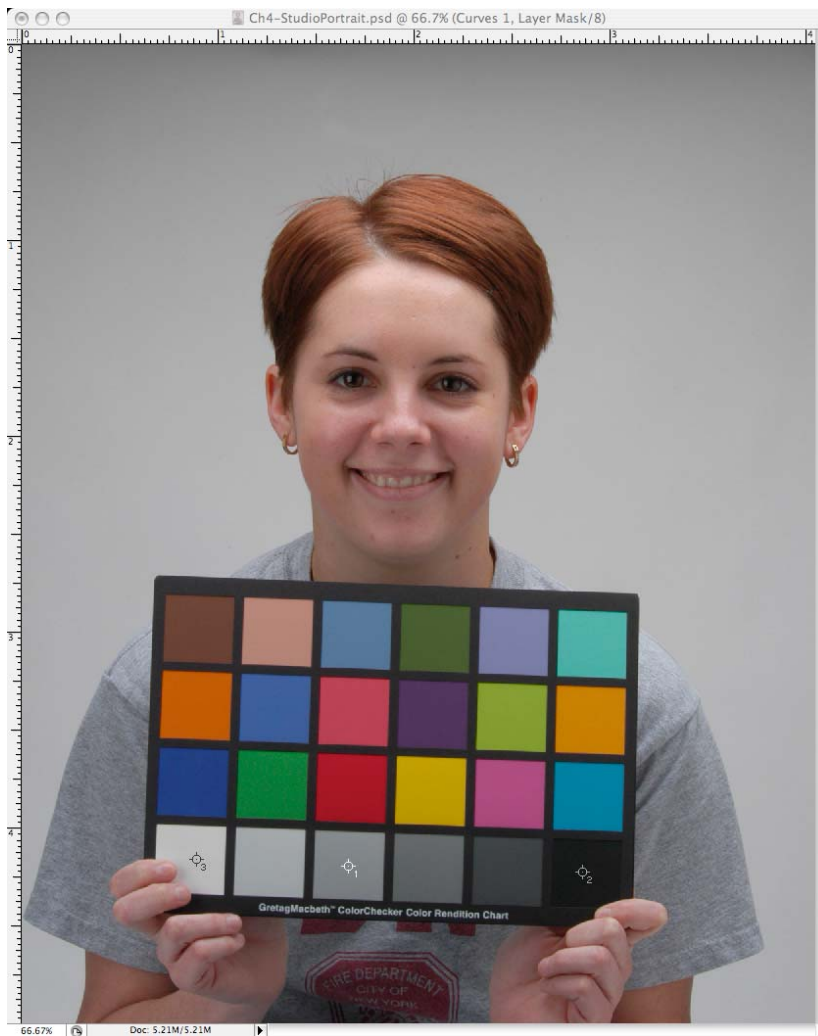
By adjusting the White Balance to Shade (7500°K<sup>1</sup>), increasing the Exposure (+1.20 stops), Recovery (from 5 to 8 to bring back the white point a little), and Blacks (up from 5 to 16 to move the blacks darker), we come up with a much more balanced picture. Now, when we move this into Photoshop, we can concentrate on the details.

<sup>1</sup> °K refers to degrees Kelvin, a way that the color of light is measured. This following definition is from Wikipedia: "Color temperature is based upon the principle that a [black body radiator](#) emits light whose color depends on the temperature of the radiator. Black bodies with temperatures below about 4000 K appear reddish whereas those above about 7500 K appear bluish. Color temperature is important in the fields of image projection and [photography](#) where a color temperature of approximately 5500 K is required to match "daylight" film emulsions." When you decrease ACR's color temperature, you are compensating for the lower (reddish) temperature of the ambient light, and it does the opposite when you increase the temperature. This is a bit counter-intuitive, since a higher °K is actually bluer (as in super-heated).

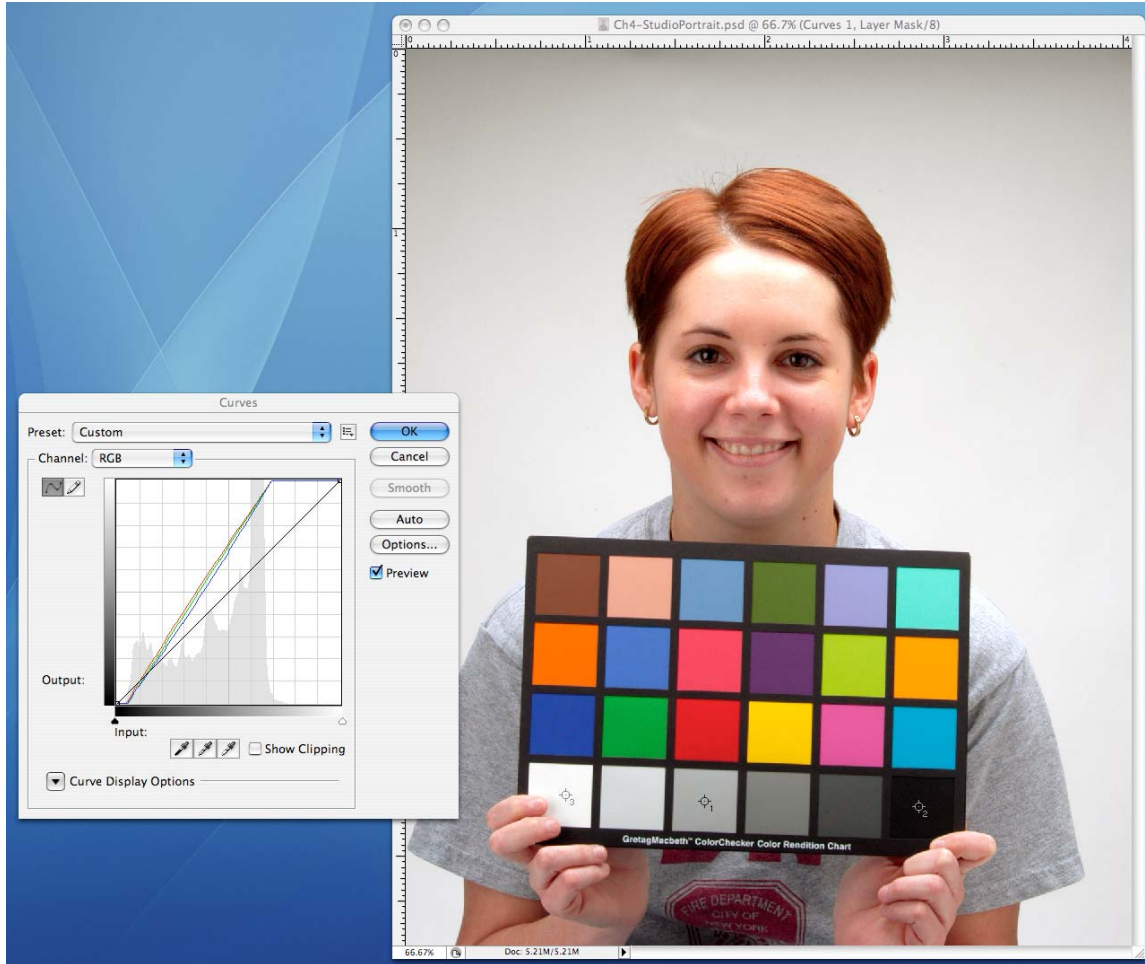
## Shooting for Balance

You can practice a technique that will make the pictures you capture in the camera easier to color correct and adjust. It works best with portraits either inside or out, but will help in any controlled situation. It involves taking a picture of a calibrated color chart, such as the GretagMacbeth ColorChecker™.

Here is a picture with a portrait subject holding the color chart. Assuming you take this picture in the same light that as another group of pictures are taken in, you can perform the major color correction tasks all in one shot, using just this photo. Then apply the same adjustment to all of the photos shot in this environment (e.g. with an action).



Notice that we have placed color samplers on the gray(1), black(2) and white(3) patches on this calibrated chart. Now all we have to do is use the gray, black and white eyedroppers in the Curves dialog to set these colors. Like magic, the picture takes on a completely different look (and a better one).



There is a lot more to talk about concerning color correction, especially when we start adjusting skin color, and photos that don't have defined white, black or gray areas in them. There are a number of books dedicated to these tasks, but a few that I recommend, and will help with the basics are noted at the end of this article.

## Adjusting Skin Tones

Skin tones are usually the hardest colors to correct, mostly because they are not uniform, and the tonal differences can be subtle. Graphic artists and photographers have been correcting skin tones for years, mostly for use in magazines and advertisements, and they have worked up a number of formulas to describe how to adjust these colors.

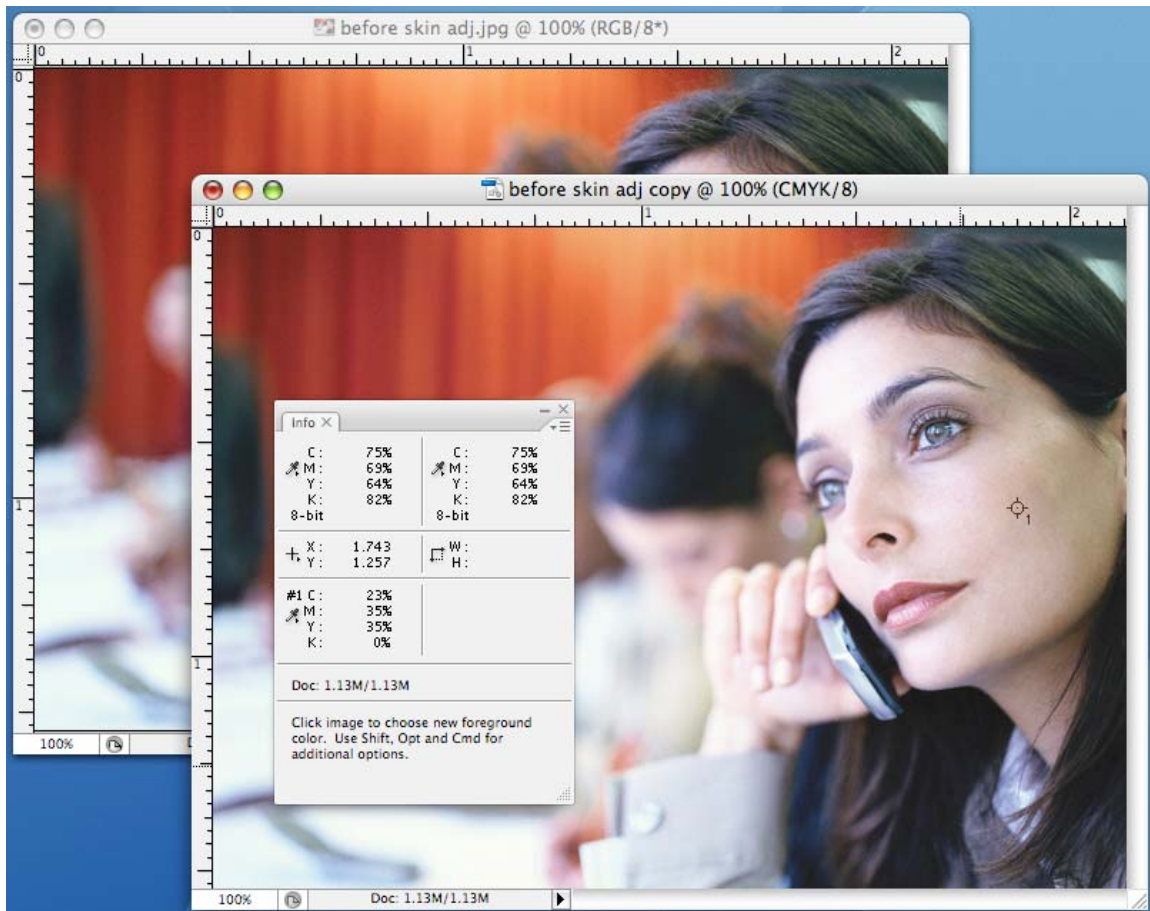
To make things slightly more complicated, they have been doing this correcting mostly in the CMYK color space, not RGB. The reason is that commercial printing uses a different process for producing images than our inkjets do. They use a collection of ink dots called a halftone. Since commercial printing ink is opaque, the 4 colors C)yan, M)agenta, Y)ellow and K)Black must be arranged near each other to give the impression of a full range of colors. Three of those inks (C,Y,M) make a dark brownish-black when placed in a halftone dot in equal amounts. Black is added for a real black. Inkjet printers, on the other hand, use a wide variety of inks that combine to produce other colors, including CMYK, although they print using your RGB files (not CMYK).

With all that said, it is probably better to correct skin tones using CMYK numbers instead of RGB. Here are some numbers and formulas you can use to correct in CMYK.

<u>Skin Types</u>	<u>CMYK Values</u>	<u>Light-skinned Babies</u>
Light Baby	C 0 M 15 Y 15 K 0	<b>Y</b> should be about = to <b>M</b>
Avg. Caucasian	C 8 M 35 Y 45 K 0	<u>Adults</u> <b>Y</b> should be 1/5 to 1/3 > <b>M</b> <b>C</b> should be 1/5 to 1/3 < <b>M</b>
Tanned Caucasian	C 15 M 49 Y 68 K 0	
Darker Skin	C 27 M 50 Y 63 K 21	Black should only appear in darker-skinned people <b>C</b> should be about 1/2 of <b>M</b>
Very Dark Skin	C 47 M 50 Y 63 K 55	

Katrin Eismann has come up with a very good way of doing CMYK correction without having to convert your photos into CMYK (which is to be avoided, if possible). Here is the technique.

1. Open the photo in Photoshop.
2. Click **Image/Duplicate** to create a copy of the image.
3. Change the mode of the duplicate to CMYK by clicking **Image/Mode/CMYK Color**.



Correct the duplicate using the formulas on page 19. Here's what I did.

4. Place a color sampler on the woman's face (by Shift-Clicking on the Eyedropper tool). This sets an area of the following values: C: 23%, M: 35%, Y: 35%, K: 0% (your values may differ slightly depending on where you clicked. I tried to click on an average part of the face, not where the highlight or dark area was).

Adjust these values by using the Curves palette in the following way:

5. Add a Curves adjustment layer by clicking on the half-circle icon at the bottom of the layers palette.
6. Change the Channel to Cyan.
7. **Command-Click** (PC: Ctrl-Click) on the place where your color sampler is, and a dot will appear on the Curves histogram where that color is.
8. Change your **Output** Level to **12**.
9. Change the channel to Magenta, and do the same but change the **Output** Level to **42**.
10. Change the channel to Yellow, and do the same but change the **Output** Level to **50**.

These numbers are between a normal Caucasian-skinned person and one with a darker tan.

11. Click **OK**.
12. Click **Layer/Flatten Image** from the menu.
13. Press **Cmd-A** (PC; Ctl-A) to select the entire image.
14. Press **Cmd-C** (PC; Ctl-C) to copy the image to the clipboard.
15. Click on the original image and press **Cmd-V** (PC: Ctl-V).
16. Send the Background layer to the trash bin at the bottom of the Layers palette.

You now have an RGB image that was corrected in CMYK, and we haven't altered any pixels in the process. Doing skin correction takes experimentation and practice, but using these formulas will help get you to a fairly acceptable result.



There is a lot more you can read up on, and I have put a list of books on the next page top consult.

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## **Hardware calibrators:**

Pantone Huey	\$89	(www.pantone.com)
ColorVision Spyder2	\$79 to \$249	(www.colorvision.com)
xRite i1Display	\$169 to \$498	(www.xrite.com)

## **Books on Color Correction**

**Photoshop Color Correction** by Michael Kiernan  
Peachpit Press ©2003 ISBN: 0-321-12401-4

**Photoshop PS2 Studio Techniques** by Ben Willmore  
Peachpit Press ©2006 ISBN: 0-321-32189-8

**Professional Photoshop: The Classic Guide to Color Correction (5th Edition)**  
By Dan Margulis Peachpit Press ©2006 ISBN-13: 978-0321440174

**Adobe Photoshop Restoration & Retouching (3rd Edition)** by Katrin Eismann  
New Riders Press; 3 edition ©2006 ISBN-13: 978-0321316271