Chapter 1

UNDERSTANDING COLOR

"In my mind's eye, I visualize how a particular . . . sight and feeling will appear on a print. If it excites me, there is a good chance it will make a good photograph. It is an intuitive sense, an ability that comes from a lot of practice." — Ansel Adams

We've all heard about a hundred different definitions of color as it pertains to digital images and computer monitors, and what's not needed is another chapter to rehash all the stuff you already know. But just in case we aren't in sync with our definitions, let's talk a little about some of the more important aspects of color in images and a little about general color management that we should clearly understand together. Beginning with creating the best color correction environment to some basic understanding of digital images, let's move forward to get a handle on a few basic principles. Pull up a chair next to the fireplace, grab a latte, and let's sit down and agree on some understanding of color and how to manage color in Photoshop.

Understanding What You Need for Good Color Handling

Without getting into the technical aspects of viewing color, looking at reflective versus subtractive color, examining the anatomy of your eye and all the other scientific rules and axioms related to color viewing, there are some essential ingredients you need to become familiar with when it comes to color viewing, color correction, and printing correct color.

Quite simply, the most important of these ingredients include

- **Controlled lighting.** One of the most commonly overlooked areas related to good color viewing conditions is carefully setting up your viewing environment (see Figure 1-1). If you work on a super professional color monitor, have your monitor tweaked with a $5,000 color calibrator, and use the most sophisticated color profiles, you're only halfway to color correction. If light coming through your window and your overhead lights results in a colorcast on your monitor, you're not working in an optimum viewing environment. The first consideration you need to make is controlling the lighting of your workplace.
- **Monitor calibration.** You've heard it all before, and we repeat it here — you need to be certain your viewing device reflects the best possible brightness and gray balance that you can get. On the low end, you can purchase some inexpensive calibration equipment; on the high end, you can purchase some very sophisticated calibration tools. At some point, you need to use a device to get your monitor to display the best you can get in terms of brightness and gray balance, as we explain in Chapter 2.
- **Color profiles.** You have options for using source color profiles, viewing profiles, and output profiles. Getting your color translated from one device to another is always an important consideration when getting color right.

Pixels and Resizing Images

Since you've been around pixels for a long time, you pretty much have an understanding that those tiny little squares all bunched together ultimately comprise the makeup of a digital photograph. You know that the number of pixels in one way or another relate to image quality. Furthermore, you're certain that no matter how many pixels you have in an image, the quantity of those tiny little dots doesn't have a darn thing to do with improving color. We have to manipulate, finesse, and mess around with those pixels to balance the color.

Pixels and Dots

Wouldn't it be a great world if an input dot, a viewing dot, and an output dot were all at a 1:1 ratio? In other words, you see a bright red pixel, you shoot a photograph and capture the hues precisely, you see the same bright red color on your monitor, and you print the photo resulting in a print that shows that red pixel exactly as you saw it before taking the picture.

1-1

Unfortunately, digital life is not so easy, and a caveat is always thrown into the mix. The imbalance of dots related to different devices is one of many factors that confuse us when it comes to image color correction and preparing files for various output devices.

You might have a color printer capable of rendering 1440 pixels per inch (ppi) of resolution. Your input image (obtained from a scanner or digital camera) might be a 300-pixel-per-inch image file. When it comes time to open your image in Photoshop, you're working on a 72-pixel-per-inch display. What's more confusing is that the output resolution on your printer is really a lie. Take an Epson color printer, for example, that renders a 1440 ppi resolution. Does that mean you need 1440 pixels in your image to take full advantage of your printer? The answer is definitely NO. The reason being is because the printer fires off microscopic droplets of ink in at least four colors (Cyan, Magenta, Yellow, and Black) or more to give you the illusion of continuous-tone color. These many droplets define each pixel in terms of color and brightness.

If you prepare images for commercial printing on film setters and plate setters, resolutions of the equipment can exceed 2500 pixels per inch. Again, your image file at 300 ppi is plotted in dots, and each dot is formed by many smaller dots to create all the gray tones needed to reproduce the file at a specified halftone frequency.

X-REF

For a little more understanding of what we mean by gray tones in color images, see the section later in this chapter "RGB Color."

Pixels and Image Sizes

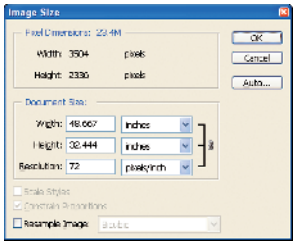
Digital cameras are marketed, with among many other features, the total number of pixels the camera's sensor is capable of capturing. You hear numbers such as 6.3 megapixels, 7.2 megapixels, 11 megapixels, and so on. These figures describe images captured with the total number of pixels per image. When you first open a digital camera image, the resolution of the image may be 72 ppi. As a result, you need to resize the image to the correct proportions for your desired output; when you do, the image resolution increases proportionately.

NOTE

Some digital cameras saving in *JPEG* format default to 72 ppi at dimensions producing the total pixels captured by the camera sensor. Cameras capable of saving files in Camera Raw format typically save with higher resolutions also at the dimensions that produce the total pixels captured by the camera sensor.

As an example, follow these steps to resize an image without affecting the resolution:

1. Open an image taken with a digital camera in Photoshop CS2.
2. Choose Image ➪ Image Size or press Command/Ctrl+Option/Alt+I to open the Image Size dialog box (see Figure 1-2).



1-2

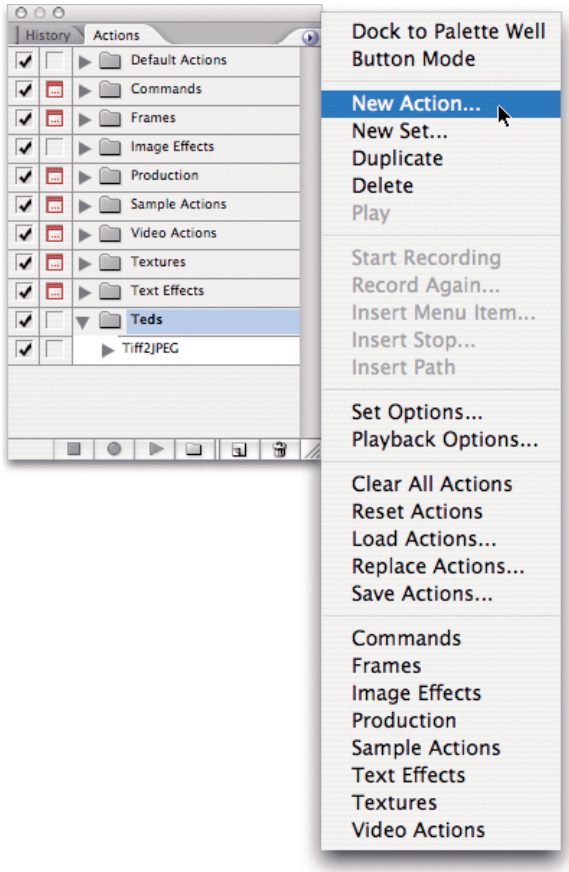
3. Type a new number in the Resolution box to change the resolution. Leave the Resample Image checkbox deselected when changing the image size. As you increase the amount in the Resolution text box, the values change proportionately in the Width and Height text boxes. The more resolution you add to the Resolution text box, the lower the values appear in the Width and Height text boxes.

Individually resizing images works well when color correcting a single image or maybe just a handful. However, if you've filled up your memory card and need to size many files, it's best to use an automated *Action* when files need to be the same size.

Create an Action for Resizing Images

To create an Action for resizing images, follow these steps:

1. Open an image taken with a digital camera in Photoshop CS2. Start with one image open in Photoshop to create the action.
2. Choose Window ➪ Actions if the Actions palette is not currently open.
3. Click the right-pointing arrow to open the Actions palette menu and select New Action (see Figure 1-3).
4. Choose Image ➪ Image Size or press Command/Ctrl+Option/Alt+I to open the Image Size dialog box.
5. Type the resolution value you want for a batch of images and then click OK in the Image Size dialog box.
6. Choose File ➪ Save As and select the format you want to use for the file from the Format drop-down menu. Click Save to save the file.
7. Close the file by clicking on the Close box or choosing File ➪ Close.
8. Click the Stop playing/recording button in the Actions palette. At the bottom of the Actions palette you see a row of tools. The first tool in the palette, represented as a square, is the Stop playing/recording button.



1-3

PRO TIP

You can create a new group and nest all your own custom actions in the group. First, select New Set from the palette menu and the Name dialog box appears. Type a name for your new group and click OK. The new group appears as a folder in the Actions palette. To nest a new action below the folder name, click the new group folder to select it. Open the palette menu and choose New Action when you want to create an action. All your actions can then be grouped together in your new folder apart from the default actions Photoshop provides you.

After you click the Stop playing/recording button the Action is listed in the palette and ready to use on a folder of files. Be certain to copy all your files from your memory card to your hard drive and place them in a single folder.

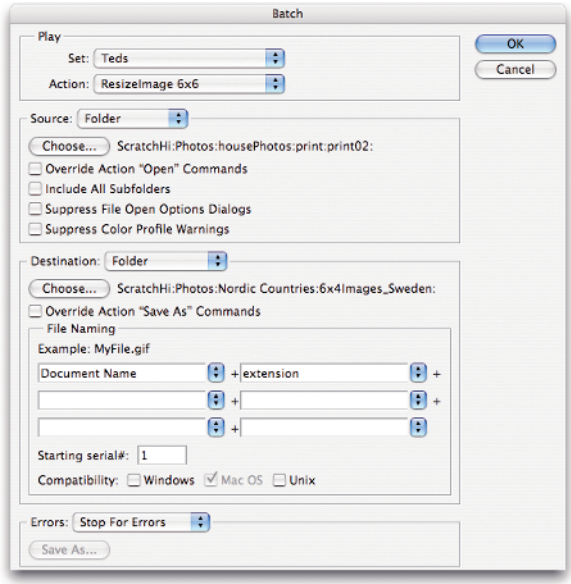
NOTE

Try to avoid resaving files as JPEG if you happen to open JPEG images. Each time you save a file as JPEG, you lose more image data. Use a lossless compression format such as Photoshop (PSD) format or TIFF when saving your files. If your files need to be saved in JPEG format, perhaps because JPEG is the preferred format for your photo lab or service center, save as JPEG with the Quality setting at the maximum (12) when saving the final file.

PLAY AN ACTION

When it comes time to use your action, follow these steps:

1. Choose File ➪ Automate ➪ Batch to open the Batch dialog box shown in Figure 1-4.



1-4

2. From the Set and Actions drop-down menus, select your Set (if you created one) and select the new action you created to resize images.
3. Click Choose under the Source item in the Batch dialog box to open the Choose a folder dialog box.

4. Navigate your hard drive in the Choose a batch folder dialog box to locate the folder where you saved the images from your media card. Select the folder and click Choose to return to the Batch dialog box.

5. Click Choose in the Destination area. Follow the procedures in step 4 to specify the folder where you want to save the resized images.

   If you need to create a new folder for your saved images, you can click Choose and click New Folder in the Choose a batch folder dialog box.

6. Click OK.

   Photoshop automatically opens files in the source folder, resizes images according to settings you supplied when you created the action, saves the results to the destination folder, and closes each file after saving.

Resampling Images

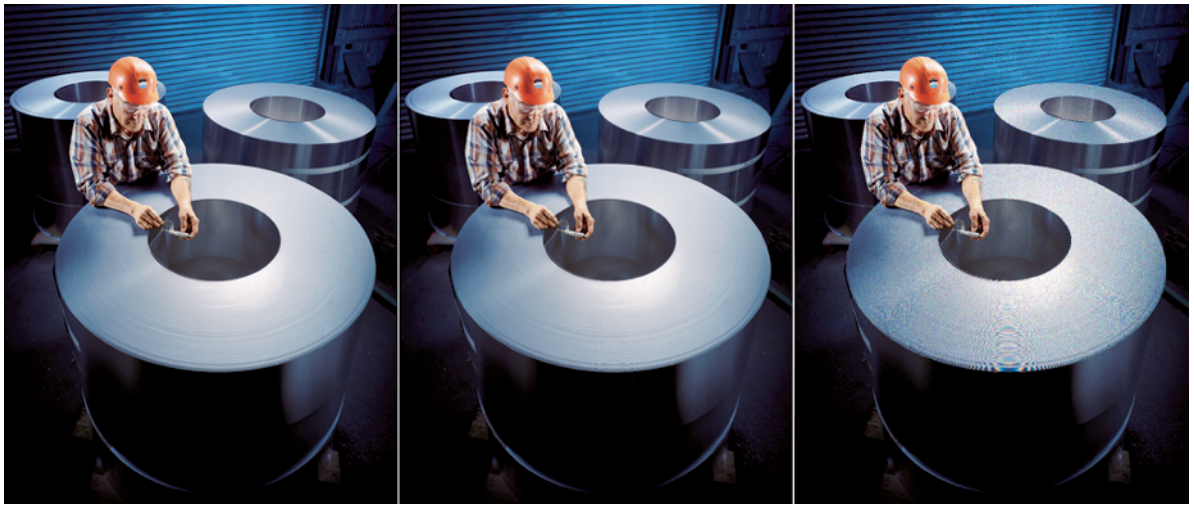
Going back to the Image Size dialog box, if you select the Resample Image check box you change the number of pixels in an image to a value higher or lower than the total pixels you started with depending on what values you type in the Resolution box. For example, if you size an image at 6 x 4 inches with the Resample Image check box deselected, the resolution may increase to 600 pixels per inch. At this point, the total pixels in your image remain the same. Check the Resample Image check box and change the resolution to 300 ppi. When you click OK, half the pixels in the file are tossed away and the image is said to be *downsampled*, which means the resolution is lowered.

Ideally, plan on downsampling images to the optimum resolution of your output device. In terms of color printing on continuous-tone devices, 300 ppi can generally be applied to most color printers.

Quite often you'll need to downsample digital photo images. When you select the Resample Image check box in the Image Size dialog box, the drop-down menu adjacent to the check box offers five resampling modes. The default is Bicubic, and for most of your continuous tone images, this is the mode to choose. In Figure 1-5 you can see the results of using the Bicubic method compared to using Bilinear and Nearest Neighbor.

X-REF

For more information on working with moiré patterns, see Chapter 8.



Bicubic Bilinear Nearest Neighbor

1-5

The other two options, Bicubic Smoother and Bicubic Sharper, are helpful when sampling images such as portraits or photos that need some sharp detail. Use Bicubic Smoother when downsampling portraits where facial features are rendered a little smoother. Use Bicubic Sharper when you want sharper detail like when shooting aerials or architecture.

PRO TIP

When in doubt, however, use Bicubic and be done with it. Other modes use different algorithms to calculate new pixel values, but none works better overall as a default than the Bicubic method. Bicubic is always superior to Nearest Neighbor or Bilinear for general use with photographic images

Upsizing Images

As a general rule, upsizing images by adding more resolution to a file often produces undesirable results. Too much upsampling can make your image look like mush. Photoshop uses an algorithm to calculate new pixels based on the values of the original pixels and at best produces a guess at what those pixel values should be. Sometimes the result of the guesswork is a less-than-desirable image.

There are some circumstances, however, where upsizing images can be helpful. The results may or may not be desirable, so you have to run tests and print samples to see if your resampling efforts are satisfactory. A good example might be a digital camera image that needs to be printed as a large poster. If the output of the original file is pixelated, you can try to upsample the image and print a small area of the photo to test the results.

NOTE

Photoshop's algorithm for resampling images has improved over the years and offers you some impressive results. In Photoshop CS2, the Bicubic method of resampling is more impressive than found in earlier versions of the program.

For a more sophisticated approach to resampling, you can acquire a Photoshop plug-in designed to resample images. Genuine Fractals is a product developed by onOne Software (`www.ononesoftware.com`) designed exclusively for the purpose of upsampling images. In Figure 1-6, you can see the results of upsampling an image 400 percent using Genuine Fractals. The original image appears in the center

GF PRINT PRO UPSAMPLED 400%

P.S. BICUBIC SHARPER 400%

1-6

inset. On the right is a close-up of the file upsampled in Photoshop using Bicubic resampling, and Genuine Fractals upsampling on the left.

Whether you use Photoshop or a plug-in like Genuine Fractals, don't expect to take a wallet size image at 72 ppi from your Web page and upsample the image. You need to start with a file that is at least a 4 x 6 inches at 300 ppi or greater for best results and keep the resizing of the image to within certain sizing limitations such as 800 percent or less.

Understanding Color Modes

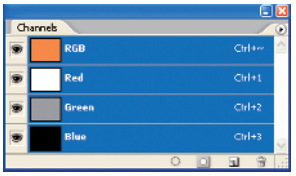
Photoshop supports working in, converting to, and saving files in a number of different color modes. For digital photographers, the default and most popular color mode is RGB. In addition to RGB, you can convert to other color modes for editing images or submitting files to clients for various types of output.

You don't need to be concerned with every color mode Photoshop can handle. Most often you'll work with one of four color modes that include RGB, CMYK, Lab, or Grayscale.

RGB color

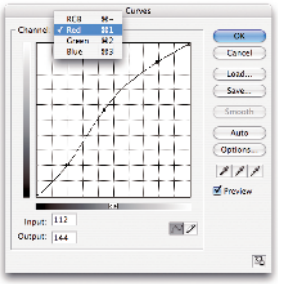
You're probably familiar with the standard RGB color mode that you see when viewing color images on your monitor, take color photos with your digital camera, or scan pictures with your scanner. RGB is the default color mode for working on color images and correcting color.

Color in Photoshop is represented in channels. In an RGB color image, you have three channels — one for red, one for green, and one for blue. When you open the Channels palette and look at each of the three RGB channels, you see various levels of gray. The RGB composite channel is seen as color, but the three individual channels are seen as white, gray, or black depending on the color represented in the composite channel (see Figure 1-7).



1-7

Each of these three channels can be changed for color value and brightness. Whatever change is made on the individual channels is reflected in the composite image. If you use Photoshop tools for correcting color and brightness, most of your correction tools offer options for selecting the composite image where you make changes to all three channels simultaneously, or you can make changes to a selected channel. In Figure 1-8, a curves adjustment is made on the Red channel.



1-8

You have options for adjusting individual channels in other dialog boxes, too, such as Levels and Channel Mixer.

CMYK color

CMYK color is process color using mixes of Cyan, Magenta, Yellow, and Black. If your digital photography is limited to output for photo prints and Web graphics, you don't need to be concerned about CMYK. However, if you prepare files for commercial printing at print shops, CMYK is something you need to understand.

Whereas RGB encompasses a large color *gamut* representing more that 16 million colors on your color

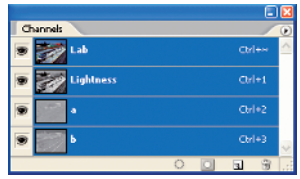
monitor, the CMYK model offers you fewer colors that can be seen on your monitor and reproduced on a printed piece. Regardless of whether you output RGB or CMYK files, your working environment stays in RGB color and all your color correction is performed on RGB images.

What is important when editing images for CMYK output is to be certain you see the color as closely as possible to what will be rendered in CMYK. While editing in RGB mode, choose View ➪ Proof Setup ➪ Working CMYK. Your monitor then displays colors more closely to the CMYK color gamut.

Lab color

Lab color, like RGB color, represents color images in three channels. These channels are L or Lightness channel, and the *a* channel and the *b* channel. The L (Lightness) channel represents all the brightness in your image while the a and b channels represent all the color. The entire color spectrum is split in half with each of these two channels taking one-half of the full color spectrum.

When it comes to editing Photoshop images for color and brightness, you can use Lab color when you want to make changes without affecting the color in the image. For example, you might convert an RGB image to Lab color and select the L (Lightness) channel in the Channels palette (see Figure 1-9) or press Command/Ctrl+1. After selecting the Lightness channel, you might sharpen an image using the Unsharp Mask filter. Doing so sharpens the image without changing color.



1-9

Grayscale

Grayscale images are single-channel files with only a Gray channel. Grayscale images have no color, and in order to add a color tint to an image, such as a

Color Correction in Photoshop versus Photoshop Elements

Throughout this book are screen shots and references to Adobe Photoshop with little mention of Adobe Photoshop Elements 4. Elements is a truly great image-editing tool that provides an abundant number of features for editing and printing your digital photographs. Many cameras ship with Elements on a CD-ROM so you may get the program free with the purchase of your camera.

Unfortunately, Photoshop Elements doesn't have some critical editing tools for correcting color and brightness that are available in Photoshop. Among other features, Elements does not provide you a Channels palette where you can edit individual channels. The channels are there and visible when you open a dialog box like the Levels dialog, but you can't edit individual channels with other editing tools. Nor does Elements support a Curves dialog box that provides you with more brightness control than you get with the Levels dialog box.

In addition to the lack of editing features for channels and curves, Elements does not support much in the area of color profiling. You only have two choices when managing color using either the Adobe RGB (1998) color space or sRGB. Custom profiling is not part of the program.

Due to the lack of these critical tools, we recommend that all serious digital photographers who want the most out of color correction avoid using Elements and stick to Photoshop.

sepia tone, you need to convert the grayscale image to RGB color.

If you are printing a black-and-white photo, you may get better results on some equipment by first converting the grayscale image to RGB color. On some other printers, you might be best leaving the image in Grayscale mode.

X-REF

For information on working with grayscale images, see Chapter 8. For information on printing grayscale images, see Chapter 11.

Understanding Bit Depth

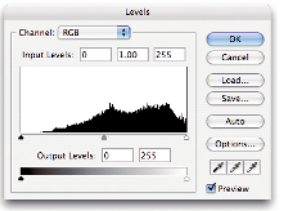
As we previously explained, your color images are represented in three channels. Each of these channels contains a level of gray to express any given color. Essentially, the gray values block out or hold back light. A level of 0 in each channel means no light passes through each channel resulting in a black image. Conversely, a level of 255 is wide open and lets all light pass through resulting in a pure white image.

NOTE

The number 255 is a figure you want to remember. Because 0 (zero) is a number, too, there are a total of 256 levels of gray in an image.

When you work with 256 levels of gray for each channel, you are working on an 8-bit image. If you take 256^3 (256 x 256 x 256), the result is a number in excess of 16 million, which is the total number of colors in the RGB color gamut. When it comes time to reproduce your images on a printer, the printer outputs your file from 8-bit images in an effort to reproduce as many of those possible 16.7 million colors as it can.

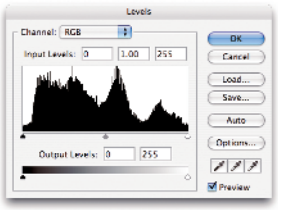
If you use a digital camera capable of capturing *Camera Raw* images, your camera sensors are likely to capture 12-bit or higher images — the most common higher bit being 16-bit. A 16-bit image has 4096 levels of gray per channel. This extra data permits you to decide which 256 levels of gray ultimately are used on your final printed piece. In Figure 1-10, for example, the Levels dialog box is opened on an 8-bit image. The left side of the histogram reports no data showing on this side, which means there is no detail in the darker areas of the image.



1-10

Because your printer can only print 8-bit images, the extra image data is tossed during printing. However, when you edit an image for brightness and color correction, you want to perform as much of your editing as you can while in a higher bit mode. Having the extra data in an image lets you decide which 256 levels of gray from the 4096 levels will be used when printing the image.

Figure 1-11 shows the Levels dialog box for a 16-bit image with data across all 256 levels of gray. You can skew the input sliders on this image to the left or right to pick up a little more detail in either the highlights or shadows. In essence, you are telling Photoshop which levels of gray you want to reproduce.



1-11

X-REF

For more information on using the Levels dialog box to adjust brightness and contrast, see Chapter 4.

Understanding Dynamic Range

Dynamic range is the measure of capturing data in the highlights and shadows. If your images are clipped (showing no data on either end of a histogram), the dynamic range is much less than a photo captured where you see a histogram containing data at both ends and all through the midtone areas.

Input devices such as cameras and scanners are categorized in terms of dynamic range as well as output devices. Looking at a digital camera, you can find many point-and-shoot models that boast more than 7 or 8 megapixels that cost less than $500. You can also find digital cameras in the 4- to 6-megapixel area that cost more than $2000. One of the primary differences between the cameras is the dynamic range of the sensors. Obviously, the more costly cameras provide you a greater dynamic range, which means you see much more detail in the shadows and highlights.

Adding More Image Data

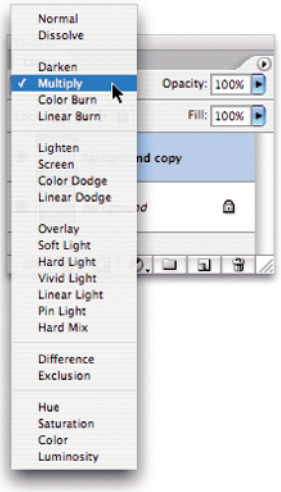
If you use a digital camera capable of capturing images at higher bit depths with a dynamic range sufficient for capturing details in shadows and highlights, you can't always get all the necessary data you need to produce a good quality print. You have to consider lighting conditions and the amount of available light you have to work with. At times, there won't be enough light to get all the detail you want in shadow areas, and the light may be too much to get any detail in highlights.

If you do photo reproduction and copy work, you're stuck with the dynamic range as it exists on your source material. Old photographs that may be washed out don't provide you with a good quality image to obtain a quality copy no matter how good your camera may be.

Photoshop has a few tricks that can help you improve dynamic range and add more data to a file. In the case with photocopy work, take an antique or aged photo that appears washed out and shoot the print with your digital camera. To add more data, follow these steps:

1. Open an image that appears washed out in Photoshop.
2. Open the Layers palette and drag the Background layer to the New Layer icon to duplicate the layer.
3. Open the Layers palette mode menu and select Multiply (Figure 1-12).

   The top layer appears darker as the Multiply mode takes all the black on one layer and adds it to all the black on the second layer. Note that you can change the Opacity on the top layer to control the amount of darkening you want in the composite image by dragging the Opacity slider left and right.



1-12

PRO TIP

Using the AutoContrast adjustment when working with 16-bit images can accomplish similar results as described in these steps. If you have 8-bit images, follow the steps outlined here.

4. Open the palette pop-up menu and select Flatten to flatten the layers.

5. Adjust Levels and Curves to optimize the brightness.

6. Compare the results of the edited image to the raw image you opened in Photoshop.

   In Figure 1-13, you can see a comparison of the image before and after following the steps outlined here.

1-13

X-REF

For information on using Levels and Curves, see Chapter 4.

PRO TIP

If you have a portion of an image that needs to be darkened, use the Lasso tool and create a selection where you want to improve contrast. Choose Select ➪ Feather to open the Feather dialog box. Type a value to add a large feather to the selection. The amount of the feather depends on your image size and resolution so you may need to test it a few times. Start with at least 20 pixels for your feather radius. Click OK and press Command/Ctrl+J to duplicate the selection as a new layer. Select Multiply from the Mode pop-up menu and only the selection is darkened.

Improving Captured Dynamic Range

In a controlled shooting environment, you have another option for adding more data that will improve the dynamic range in your photos. This method requires you to use a tripod, and your subject matter should be still with no visible motion such as people walking, automobiles passing, or sporting events action shots.

A super-wide captured dynamic range cannot be reproduced on any known hardcopy output device, but this option retains all the captured tonal data, allowing the user to manipulate it later in the editing process to fit the output device, without clipping shadows or highlights.

To improve dynamic range where the lighting conditions may not be optimum to capture sufficient detail in shadows and highlights, you need to take three to five photos of the exact same image at different exposures then merge them together in Photoshop. Follow these steps to see how to do it:

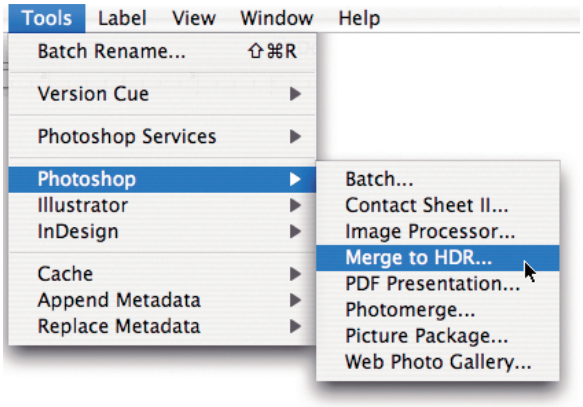
1. Take a photo using your tripod, then change the Exposure Value (EV) one to two stops to over- or underexpose the image and take a second photo. Repeat the process of changing EV to one to two stops again in the opposite direction producing at least one underexposed and one overexposed photo along with your original photo.

   The photos you use can be either 8-bit or 16-bit images. The Merge to HDR command ultimately creates a 32-bit image after you run the command. If you reduce the image bit depth after converting to 32-bit, some clipping is likely to occur and you lose a little tonal range when dropping the bit depth.

2. Add your photos to Adobe Bridge so you can clearly see the thumbnails of each photo.

3. In Adobe Bridge, choose Tools ➪ Photoshop ➪ Merge to HDR (see Figure 1-14).

   You can also use the Merge to HDR command in Photoshop if you don't have the files displayed in Adobe Bridge. Choose File ➪ Automate ➪ Merge to HDR.



1-14

4. Wait a few minutes for Photoshop to process your image and view the results in a new Photoshop document window. Photoshop merges all the data from the individual images and effectively increases the dynamic range. If you expose for shooting shadows, shoot for properly exposing highlights, and the third shot for the midtone ranges, the Merge to HDR command combines the dynamic range from the images to provide you with ample data in the shadows, highlights, and midtone areas. In Figure 1-15, you can see the five images we started with and the end result after merging the photos.

1 second@F-22 | 1/4 second@F-22 | 1/15 second@F-22 | 1/60 second@F-22 | 1/250 second@F-22

1-15

Don captured the river scene in Figure 1-15 with a 12 f-stop range from bright sun to deepest shadows. This type of capture is near impossible with negative film, but Photoshop's Merge to HDR ultimately creates a composite image with a rich tonal range. The overall image sharpness suffers a little because a slight breeze moved the trees a bit. Printed at 5 x 7, it's hardly noticeable, but larger prints show a slight lack of crispness in the trees.

Using Color Profiles

You have two major issues to deal with when it comes to managing color. One is your eye and how you see color, and the other is your hardware and how color is seen and interpreted by all your devices. When it comes to you seeing color, you need to be concerned with controlling light and setting up your monitor for the best viewing conditions. With respect to devices, you need to be concerned with the capture device — in this case, your digital camera — and the output device.

X-REF

For viewing color and setting up your color-viewing environment, see Chapter 2.

Color is managed on devices through the use of *color profiles*. Color profiles are data files used by your devices, and color profiles in your Photoshop images are lines of code added to the image files. One of the most important uses of color profiles is for translating colors from one device to another so that you are assured of, as closely as possible, colors ultimately appear the same across all your equipment. The operative here is translation, and it's important to know that quite often you need to convert color from one source to another.

Monitor Color Profiles

You've probably read much about the fact that color viewing and management is not an exact science and you can't expect to get color precisely the same between your monitor and your output. This is true, but what we expect is to get things pretty darn close where the anomalies between various sources handling color are very subtle and have little effect on how you properly view and manage color.

When it comes to viewing color, the viewing device needs to be calibrated, and the result of your calibration efforts is creating a monitor profile. Essentially, this means quite simply that when you turn your computer on, your operating system loads the monitor color profile with all the settings used to calibrate your monitor into memory so you see the same monitor brightness each time you start working in Photoshop.

A monitor color profile doesn't have a direct impact on your Photoshop image and printing the file. Monitor profiles are simply used to be certain that your monitor has the correct brightness, absence of colorcasts and color tints, and displays your photos on-screen with colors as true as possible.

X-REF

To learn how to create a monitor color profile, see Chapter 2.

CRT versus LCD Monitors

LCD (liquid crystal display) monitors are the rage today and with prices continually dropping, more people are discarding their traditional CRT (cathode-ray tube or television-type) monitors in favor of the much smaller footprint of the LCD monitors.

If you want the best viewing conditions for correcting color in Photoshop, resist the temptation to purchase an LCD monitor. The color clarity of CRTs cannot be matched by any LCD screen produced today. Among

other things, you have a number of different adjustments you can make on CRT monitors for changing contrast, brightness, and hues. The end result is that CRT monitors are better able to represent actual document colors. In many cases you can purchase a super-quality CRT monitor at much less cost than an average-priced LCD monitor.

If you're a color professional, stay away from the LCDs (see Figure 1-16) and buy a good-quality CRT display. It's the tool of choice for color specialists.

X-REF

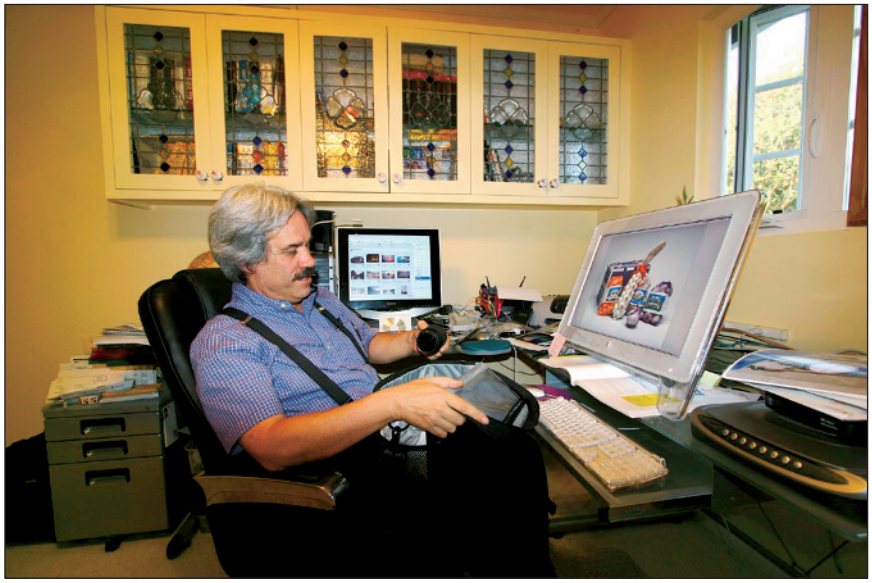
For more on CRT monitors, see Chapter 2.

Color Workspaces

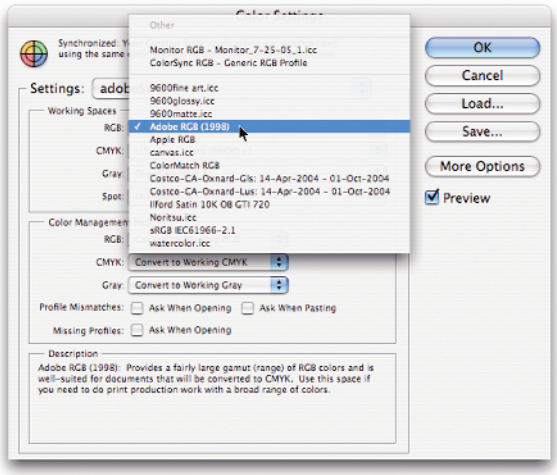
If there's a monkey wrench in the color-management process, it's the confusing idea of knowing that you have a monitor color profile and a color working profile. Color working profiles define your color workspace that impacts how your image color is translated between different color monitors and viewing conditions. If, for example, you want to exchange a file with another user, you embed (or save your profile) with the color workspace you use. The recipient of your file may use another color workspace, in which case the user might convert your image from your color workspace to his or her workspace. Through this conversion, the color is translated as near as possible to maintain as much of the same color from your original workspace to the converted color workspace.

Photoshop provides you with two primary color workspaces when you install the program. In Photoshop, choose Edit ➪ Color Settings. The Color Settings dialog box appears. Click the RGB item in the Working Spaces area of the dialog box, and you see preinstalled color profiles as well as any custom profiles you create or import (see Figure 1-17).

- **Adobe RGB (1998).** The first of the two primary workspaces used by most photographers and artists is Adobe RGB (1998). This workspace is popular with anyone who prepares images for some form of print output. This workspace provides a wide range of RGB colors that theoretically can be reproduced on a printing device.



1-16



1-17

> **sRGB.** The official name for this profile is sRGB IEC61966-2.1, but most of us commonly refer to it as simply sRGB. This workspace is designed for use with images displayed on monitors such as Web viewing or images intended for screen previewing. The color gamut can display some colors that may not be reproduced on some printing devices.

You may hear some people recommend that you stay away from sRGB when preparing files for print. However, don't completely dismiss this workspace when sending your files off to a photo lab. Some photo-reproduction equipment that prints in RGB (not CMYK) may take advantage of the full sRGB color gamut.

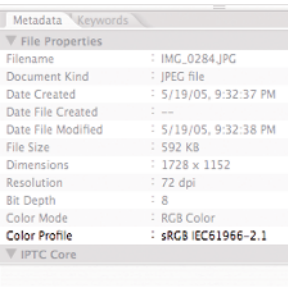
X-REF

For information on when to use sRGB for output, see Chapter 11.

Camera Color Profiles

Digital cameras can also capture your images while embedding a color profile. The Canon 20D is capable of embedding either Adobe RGB (1998) or sRGB when capturing files saved as JPEG. The Canon 20D lets you choose between the two profiles by adjusting the camera's settings.

If you want to quickly check to see if your camera saves files with a color profile, open Adobe Bridge and select a thumbnail of a photo taken with your camera. Take a look at the Metadata pane, and you should see Color Profile if your camera supports it. Figure 1-18 shows how the Metadata shows the selected image has the sRGB color profile embedded in the image.



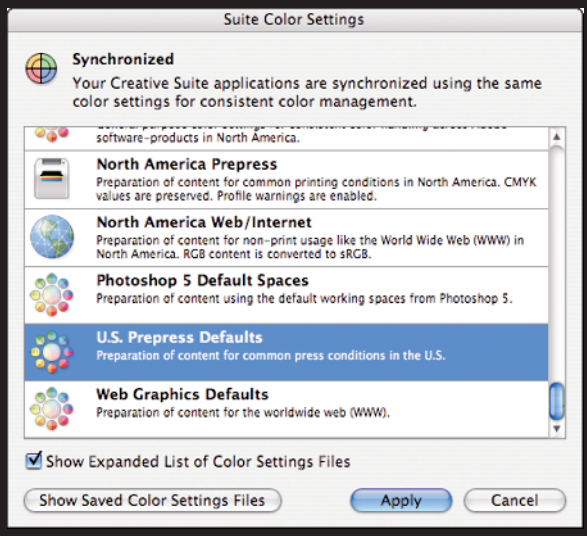
1-18

Output Profiles

Output color profiles are used by equipment to print your photographs. Assuming you have set up your working environment with the proper lighting, calibrated your monitor for the proper viewing of your images on-screen, and identified your color workspace in Photoshop's (or Adobe Bridge's) Color Settings dialog box, you are viewing colors as true as possible that can be reproduced on some device. Your color then needs to be converted properly to the output device so the entire range of colors as best as possible can be output when you print your pictures. This is where the output profile comes in. Output profiles are used to match the color you see on your monitor to the printed piece.

Color Settings Adjustments in Adobe Bridge

Users of two or more of the CS2 applications may want to open Adobe Bridge and choose Edit ➪ Creative Suite Color Settings. When the Suite Color Settings dialog box opens, you can select a Settings option that defines all your color workspaces. When you make a selection in the Suite Color Settings dialog box, colors across all your Adobe CS2 applications are synchronized, meaning you use the same workspaces when working in Photoshop, Illustrator, InDesign, and Adobe GoLive. Making your choice for color settings in Adobe Bridge eliminates the need to choose Edit ➪ Color Settings in Photoshop and all the other CS2 programs.



Output color profiles are available to you in one of three forms:

- **Developer profiles.** The printing device manufacturer may provide color profiles created specifically for your equipment or equipment used by your photo lab. You might acquire the profiles through the developer's Web site or directly from your photo lab or service center.
- **Custom profiles you create.** If you have available to you equipment capable of creating color profiles directly from test prints on your equipment, you can use your calibration equipment to create your own custom profiles. This is particularly helpful when printing to desktop printers.
- **Custom profiles developed by a service.** You can purchase color profiles for your equipment from sources that you can find on the Internet. For a small service fee, the service creates a profile for you and sends you the profile in an e-mail attachment.

X-REF

For information on creating profiles and using services to purchase custom profiles, see Chapter 2.

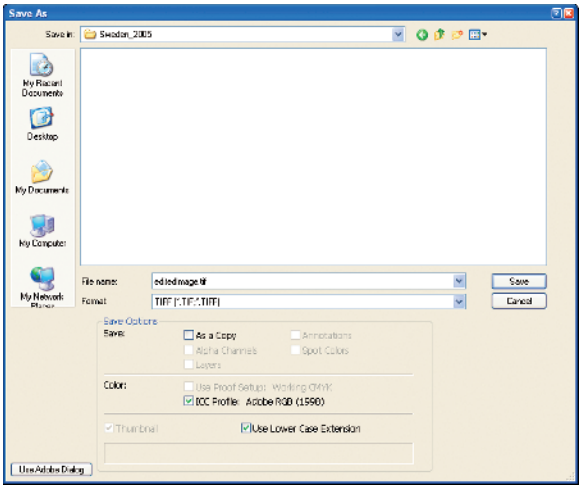
What's important for you to know before you plunge into the other chapters in this book is that you need to address all the issues here related to viewing environment and color profiling. Attempting to print your photos on any output device is a shot in the dark if you don't use color profiles and understand the need for managing color throughout your workflow.

Embedding Color Profiles

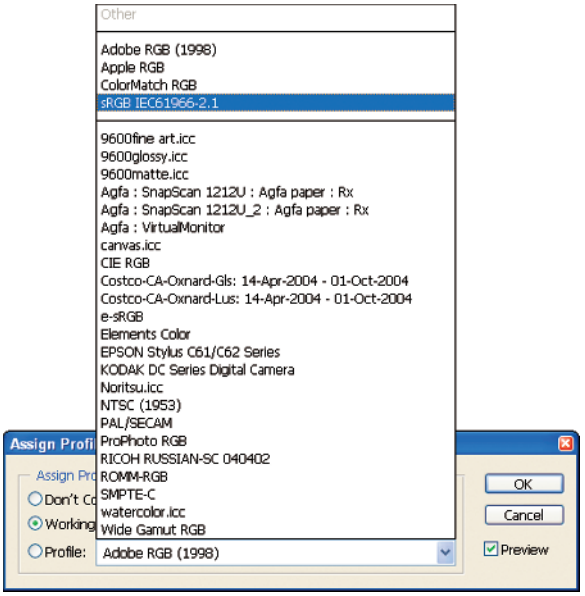
When you edit a Photoshop image using a color workspace that you established in the Color Settings dialog box, you want to embed the working-space profile in your image. Embedding a profile has several advantages. First, if you exchange files with other users or work between a Mac and a Windows machine, your images can be converted to color workspaces on other computers. Second, when outputting a photo to a printing device, your workspace color can be converted to the device profile. Finally, if you eventually upgrade to another version of Photoshop where newer profiles are introduced, you can convert your workspace in legacy files to the newer profiles.

Photoshop offers you three options for embedding a color profile in a image:

- **Use the Save As dialog box.** First, identify your color workspace in the Color Settings dialog box, then choose File ➪ Save As to open the Save As dialog box. Select the check box for Embed Color Profile: (name of color profile to embed), as shown in Figure 1-19. If you don't see the check box, you don't have a Format selected from the Format drop-down menu that supports saving your file with an embedded profile.
- **Use the Assign Profile dialog box.** With an image open in Photoshop, choose Edit ➪ Assign Profile to open the Assign Profile dialog box. The second radio button reflects your current RGB workspace. In Figure 1-20, the workspace is Adobe RGB (1998). If you want to temporarily use another color profile while working on the file, click the drop-down menu adjacent to Profile shown in Figure 1-20. A list of all profiles appears in the menu. You might use the Profile option and select a profile different than your current workspace. For example, suppose you work in Adobe RGB (1998) and you want to edit a file for Web hosting. You can select sRGB from the Profile menu and click OK.



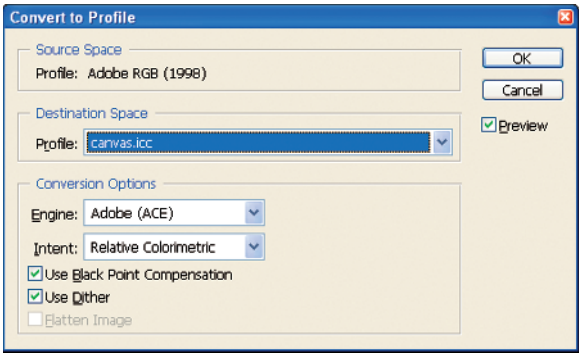
1-19



1-20

The assign profile dialog box should be used with caution. Its main purpose is to assign a profile to a color file that was saved without a profile. If you always use the Ask When Opening option in the Color Settings dialog box, you'll be aware of the lack of a color profile when you open your file. To change the color profile, use the convert option. Assigning a profile that is not correct is a sure way of ruining the color accuracy of your file.

- **Use the Convert to Profile dialog box.** Your third option is to choose Edit ➪ Convert to Profile. The Convert to Profile dialog box shown in Figure 1-21 opens where you can see the current profile assigned in Photoshop in the Source Space area, and you can choose from the Profile a destination space from the drop-down menu. Whereas Assign Profile changes the current workspace and has nothing to do with embedding the profile in your document, this option actually changes the profile in the document. You use the dialog box to actually convert the pixels in your file to the destination profile. When you choose File ➪ Save As, the destination profile appears by default in the Save As dialog box. When you click Save, the profile is embedded.



1-21

Converting Color

When you identify a color workspace and open a file where another workspace is embedded in the file, a color mismatch occurs. You have a number of different options for handling color mismatches that are established in the Color Settings dialog box (refer to Figure 1-17). In the Color Management area of the Color Settings dialog box are three drop-down menus for handling RGB color, CMYK color, and Gray conversions. Below the drop-down menus are three check boxes used to determine how color mismatches are handled by Photoshop.

For RGB color, which is our primary concern in digital photography, the drop-down menu offers three options that include:

- **Off.** This turns off all color management. Don't select this item because you'll defeat the purpose for managing color.
- **Preserve Embedded Profiles.** Select this if you know you work on images that have different profiles assigned for different purposes and don't want to mess with them.
- **Convert to Working RGB.** More often than not, this is your best choice for all your Photoshop work. Any image you open is converted to your current color workspace.

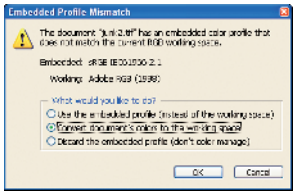
Below the drop-down menus are check boxes for how to handle the options you select in the pull-down menus. These include:

- **Ask When Opening.** If you see an annoying dialog box appear each time you open an image in Photoshop, it's because this check box is selected. You're being prompted for making a choice for converting color. If the check box is not selected and you select Convert to Working RGB, Photoshop automatically converts your color without you knowing it. To stay informed and know what's happening with your color conversions, keep this box selected.
- **Ask When Pasting.** This check box performs the same action as Ask When Opening when you copy pixels from one Photoshop file and paste them into another file. Check this box to be prompted if you copy data from a file where a mismatch occurs.

- **Ask When Opening (Missing Profiles).** This option relates to any images where no profile is embedded in the document. You might have a collection of Photos taken with your digital camera where no profile is embedded. If this is the case, selecting this check box prompts you upon opening each file. In a production environment where you need to open many files and you know you want them all converted to your current workspace, do not select this check box.

If you select Convert to Working RGB from the pull-down menu in the Color Management area of the Color Settings dialog box and you select the Ask When Opening check box, you are prompted in the Embed Profile Mismatch dialog box each time you open a file. The dialog box, shown in Figure 1-22, provides you with three choices that include:

- **Use the embedded profile (instead of the working space).** This option preserves the current embedded color profile. You can use this option if you edit a number of images you want to output for Web use while your current workspace is set up with Adobe RGB (1998).
- **Convert document's colors to the working space.** By default, this is the selection you want to use. If this selection is made, you convert the embedded profile in a document you open to your current color workspace.
- **Discard the embedded profile (don't color manage).** This option again defeats the purpose for color management. As a matter of rule, don't select this option.



1-22

Photoshop's Color and Tonal Correction Tools

If you travel back in time to Photoshop 1, 1.7, or later in Photoshop 3 when Layers were introduced, you find some essential correction tools that are still present in the latest version of Photoshop. Your correction tools for adjusting brightness and contrast and correcting color that were available in the first release of Photoshop were Levels, Curves, and Hue/Saturation. These three tools are your most important assets when it comes to correcting your digital camera images.

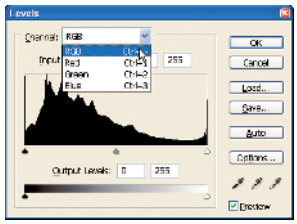
In later versions of Photoshop, we saw the introduction of some tools that were intended to make the job of color correction easier such as the Auto tools (Auto Levels, Auto Contrast, Auto Color), Match Color, Replace Color, Selective Color, Channel Mixer, Photo Filter, Shadow/Highlight, Exposure, and Variations.

Are these newer tools better for handling brightness and color adjustments with your digital photos?
Quite simply, let us put it this way. If you gave us Photoshop 3, we could correct just about any photo using only Levels, Curves, and Hue/Saturation. (We could perform all these corrections in Photoshop 1, but having Layers makes the job much easier). These three tools are incomparable when it comes to balancing color and making brightness/contrast corrections in Photoshop. Upon occasion, you can get a little help from some of the newer tools, but nothing is better for any given adjustment in Photoshop than the three staple tools. Throughout this book, we show you various techniques using these three tools for just about all corrections made on images with a wide range of problems.

Some of the essential basics for color correction involve using:

- **Levels.** Your first step in correcting any image involves observing the Levels dialog box. Press Command/Ctrl + L to open Levels. As shown in Figure 1-23, you see a histogram containing 256 levels of gray and the frequency for each gray

level represented by the peaks in the graph. You can adjust the tone levels by moving the Input sliders for the composite RGB channel, or you can select a channel from the Channel drop-down menu where adjustments are made to individual channels.



1-23

The spikes at either end of the histogram show data clipping. In the histogram in Figure 1-23 some of the highlight and shadow data is clipped, meaning there is data loss in these areas of the photo, perhaps because the camera's sensor was unable to capture the full dynamic range of the image.

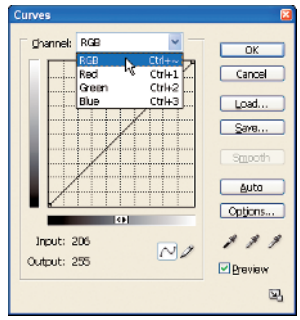
On the left, you find the black point, on the right is the white point, and the middle slider is the midtone adjustment. You also find three Eyedropper tools that can be used to sample an area in a photo (by selecting an Eyedropper and clicking in the background photo) to set the black point, midtones, and white point.

PRO TIP

For information on using the sliders and buttons in the Levels dialog box, see Chapter 4.

> **Curves.** Your single most important correction tool in Photoshop is the Curves dialog box. You can adjust brightness and contrast as well as perform color correction all within the Curves dialog box. Many of the adjustments you make in Curves can also be handled in Levels, but the Curves dialog box provides you an easier, more intuitive method for corrections once you become familiar with how to use Curves.

As is the case with the Levels dialog box, you also find a Channel drop-down menu where adjustments can be made to the composite RGB channel or the individual channels as shown in Figure 1-24. You also find a tone curve representing all the 256 levels of gray and you make adjustments by clicking on the diagonal line to plot points and move them along the tone curve.



1-24

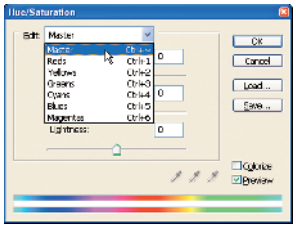
We talk about using the Curves dialog box throughout this book. The first thing you'll want to do is set up the Curves dialog box to make it easy to follow our mention of using Curves. You press Command/Ctrl + M to open the Curves dialog box and press the Option/Alt key and click on the grid. The grid changes from a default view of four horizontal and vertical gridlines to ten horizontal and vertical gridlines. Keep the Curves dialog box set to ten gridlines for easier manipulation of the tone curve.

Another adjustment you want to make in Curves is to change the direction of the curve. By default the curve begins with the white point and extends to the top right corner to the black point. This direction is opposite the Levels dialog box where the tone curve runs from black to white. To change the direction so black appears in the lower left

corner and white appears in the top right corner, click one of the arrows on the gradient bar below the grid. The direction is changed and matches the same direction as the Levels dialog box.

You'll note that the Curves dialog box also includes three Eyedropper tools. These tools are used the same as when working in Levels to set white point, midtone, and black point.

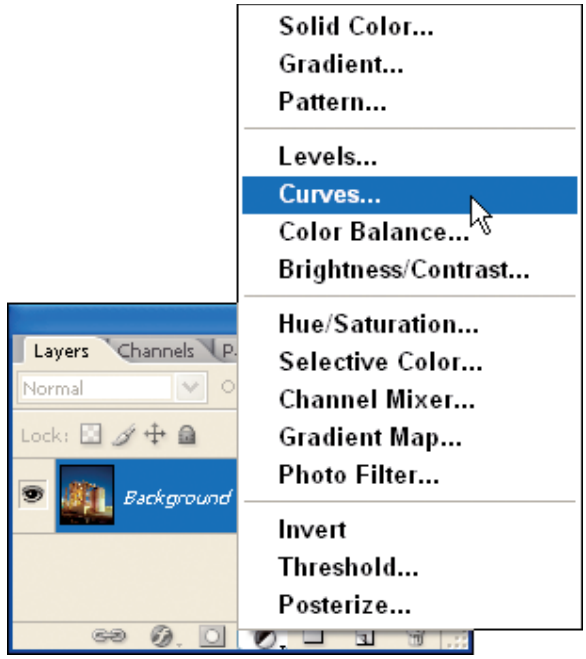
> **Hue/Saturation.** The Hue/Saturation dialog box opens when you press Command/Ctrl + U. From the Edit menu in the Hue/Saturation dialog box, you can target colors for adjusting the Hue, Saturation, and Lightness by moving the respective sliders as shown in Figure 1-25. You also find three eyedropper tools used for sampling areas in the photo where colors can be identified for making adjustments within a range of a given color.



1-25

> **Adjustment layers.** Quite often a single Levels, Curves, or Hue/Saturation adjustment may not be enough to color balance or correct brightness in images. Once you make an adjustment, you may want to return to a dialog box and make some changes to the settings applied in the dialog box. Handling these options is best performed using an Adjustment layer. You can create many adjustment layers and you can return to any adjustment layer to change the settings.

Adjustment layers are created by clicking the Create new fill or adjustment layer icon in the Layers palette and selecting the adjustment you want to make from the drop-down menu as shown in Figure 1-26.



1-26

You can also apply a blend mode to an adjustment layer. You can make a change from the Normal blend mode to any one of the other blend mode options after creating an adjustment layer or you can choose to select the blend mode you want at the time an adjustment layer is created.

Many times throughout this book we use the Luminosity blend mode to apply corrections to the brightness values in an image. Luminosity doesn't disturb the color balance when using any of the correction tools when you make tonal adjustments. To change the blend mode when you create an adjustment layer, press the Option/Alt key when you select an adjustment layer menu item from the Create fill or adjustment layer drop-down menu. After making a menu selection, the New Layer dialog box opens as shown in Figure 1-27.

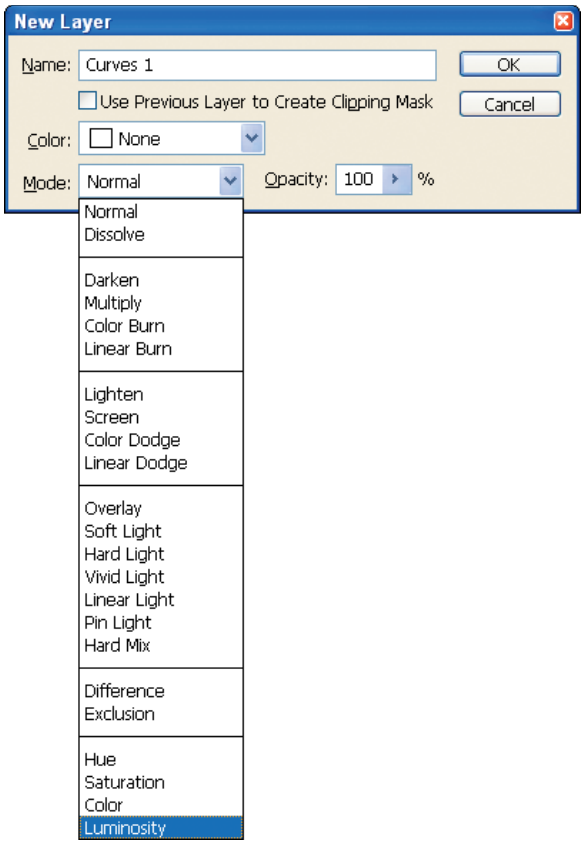
In Figure 1-27 we pressed the Alt key down and selected Curves from the Create a new fill or adjustment layer drop down menu to open the New Layer dialog box. From the Mode drop-down

menu we can select a blend mode before the Curves dialog box opens. As we make adjustments, the image preview is applied to the background image using the blend mode we choose in the New Layer dialog box.

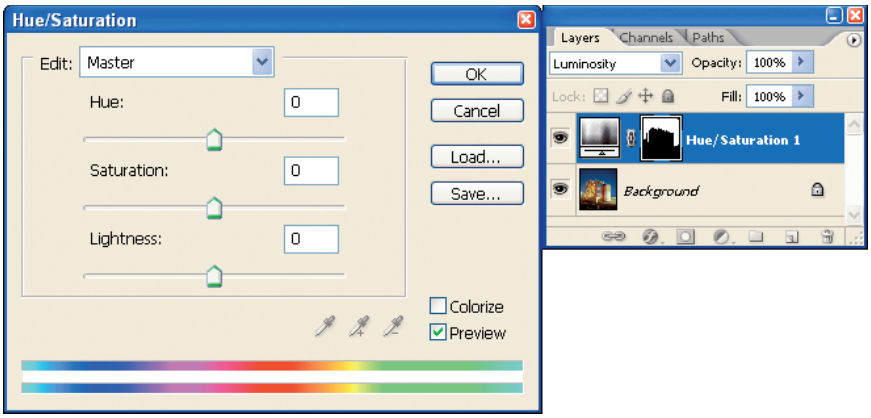
> **Layer masks.** You may often find images needing color balancing and/or tonal corrections applied independently to different areas of an image. Backgrounds and foregrounds, for example, may require different adjustments. When you make a selection in an image, then create an adjustment layer, you additionally create a layer mask. The layer mask enables you to make adjustments to only the selected area without affecting the unselected portion of your image.

To create a layer mask, first create a selection. While the selection is active, create an adjustment layer. In Figure 1-28 we created a selection and chose Hue/Saturation from the Create new fill or adjustment layer drop-down menu. The Hue/Saturation dialog box opened. In the Layers palette, the white area in the layer mask is the only area that will be affected by our edits in the Hue/Saturation dialog box.

Upon occasion we use a few other tools in Photoshop to perform color and tonal corrections; however, many of the other tools are used in combination with the three basic correction tools you'll find used throughout this book. Once you learn how to effectively use Levels, Curves, and Hue/Saturation dialog boxes and you understand all the blend modes and masks used in adjustment layers, you can use the full potential in Photoshop to correct any image.



1-27



1-28

Q & A

Why don't I get 16-bit images with my digital camera?

You may be saving pictures in JPEG format, and Photoshop doesn't support 16-bit in JPEG format. Try changing the capture mode to saving Camera Raw format. Another reason might be that your camera doesn't support Camera Raw and capturing 16-bit images. Consult your camera's manual to see what formats and bit depths are supported.

If all you have to work with are 8-bit JPEG images, either because your camera doesn't support shooting Raw or because you have files where only JPEG is used in a photo shoot, you can convert 8-bit images to 16-bit as explained in Chapter 4.

Why does a dialog box open when I try to use Merge to HDR informing me that my images don't have enough dynamic range?

There is not enough total dynamic range (exposure difference) in the bracketed image files being used to create a 32-bit file. Try using wider camera exposure variations for the files to be merged to HDR.

If you shoot images with a one-stop difference, try changing your EV (Exposure Values) to more extreme differences such as two or three stops. At first you'll see radical over/underexposures; but when you use the Merge to HDR command, Photoshop is likely to create the merged file.

Why don't I embed my monitor color profile after I calibrate my monitor?

Your monitor profile is used for correcting views on your monitor and doesn't have anything to do with the file you are editing and saving from Photoshop. The color working space affects your image and should be embedded in your photos so the color can be converted to other monitor workspaces and output profiles.

If I print files to my desktop color printer, do I need to set up my CMYK color workspace and convert to CMYK color?

Everything depends on the printing equipment you use. In most cases, desktop color printers are designed to print RGB files. Although these printers have CMYK inks and variations thereof, many take advantage of the larger RGB color gamut.

When printing files to your printer or using service centers, read the printer manual documentation or ask the technicians printing your photos what color mode is preferred for the device that ultimately prints your photos.