Chapter 1

General Tone and Color Correction

When making image corrections of any kind, you'll tend to make broad, global corrections first before moving on to tackle isolated problems. If you have no plan of attack and try to correct an image by just going at it willy-nilly, chances are you'll end up with random results—sometimes good, and other times not. Starting with a basic plan of attack can help you get better results consistently.

The first thing you'll want to do when approaching any image is to evaluate and then adjust the general tone or color. A good general correction of your image balances the color and lighting and assures that the image you are starting with is the best and most dynamic it can be. These corrections should become automatic, but not *automated*.

Before making any corrections, you'll need to know what you are looking at on screen and understand some key concepts so your results and the process make sense.

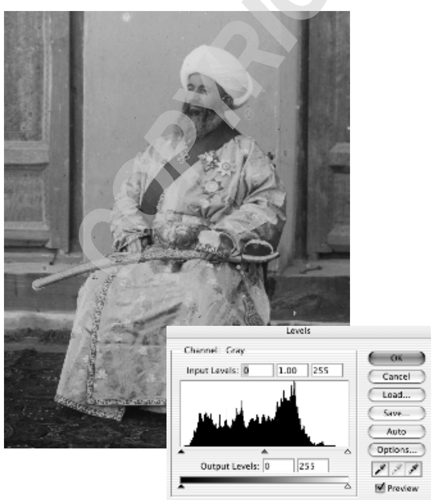
Looking at what you see on the screen

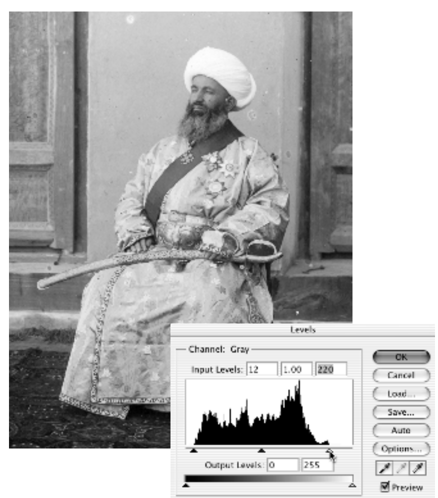
What makes an image

Dynamic tone and color with levels

Snapping image tone and color with curves

Curves for color correction





Looking at What You See on the Screen

With digital images, what you see on screen is only an approximation of the digital information that is stored—and is only a best guess as to what you will see when the image is used. There are a number of reasons for this, aside from the fact that your eyes will play tricks on you by adjusting to the lighting in the room or the monitor, or that you might have varying levels of colorblindness. You'll get the best images by intelligently hedging your bets using smart correction techniques and trusting only *part* of what you see.

Even people who know better often take for granted that what you see on screen is a good general representation: a representation of the digital information *and* of what your result will be in print—or even what you will see on other monitors. Making the image look on screen like it will in all these cases is actually a tall order, and sometimes more like a dice roll, depending on how you handle it. If you haven't made some effort to understand color theory and work within the limitations, your expectations may be a little unrealistic.

Monitor Color and Print Color

The biggest hurdle for many people is that color on a monitor doesn't translate one-to-one into the same color in print. That's because the two media use entirely different methods of producing the color we see.

When looking at a computer monitor, you see RGB color in action: color essentially created with red, green, and blue lights projected on the monitor screen. Projected light is an *additive* color scheme: Colors are created by combining various levels of those three primary colors. The more color, the brighter the result. Full strength of all RGB colors adds up to white. A lack of any color becomes black (or as near to black as your monitor screen will get).

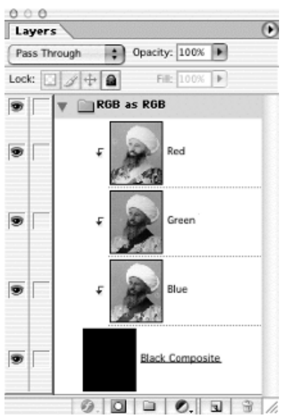
When looking at a printed page, you see reflected color: Color is created by combining different amounts of ink or pigment to absorb and reflect light. Usually these inks or pigments are cyan, magenta, yellow, and black (described by the acronym CMYK), but somewhat different color models can be used. The light that is left over (not absorbed) reflects from the page and results in the color you see. This is a *subtractive* color scheme; the more color added to the printed image as a combination of the inks, the more light is absorbed, and the darker the overall result. With less ink, the color is lighter until reduced to the color of the page—assumed to be white.

> Note: If you are printing on a nonwhite object (e.g., black paper), you may need to add white as a spot color to get images to print correctly.

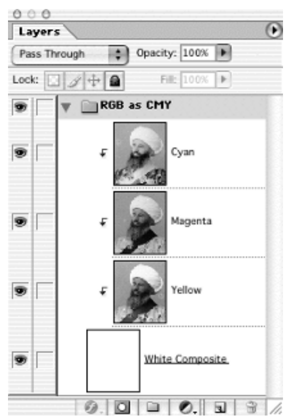
In both cases, your eyes receive light, either as projected or from the reflection. The color schemes are actually very much related: CMY (without the K) and RGB are complementary, cyan being the opposite of red, magenta the opposite of green, and yellow the opposite of blue on the color wheel (see the ColorWheel.psd file on the CD). Red, green, and blue channels can be separated and stacked in layers to mimic the additive light result. To do this, you would split out the color information for each of the color components (we will step through this process in Chapter 2), then specify Screen mode so that the component acts as projected light (using Screen mode). If you invert the colors that the layers represent (each RGB color for the CMY complement), invert the mode (Multiply for Screen), and invert the background (white for black), these same component layers can represent the subtractive color scheme. In theory, the same tone can be used in opposite schemes to represent the equivalent RGB and CMY result. You can see this in Figure 1.1, and in RGBlayers.psd and CMYlayers.psd on the CD.

Figure 1.1

Information for the color components in a CMY and RGB image can be identical.



RGB in layers using Screen mode



CMY in layers using Multiply mode


Blue channel in RGB, yellow in CMY


Green channel in RGB, magenta in CMY


Red channel in RGB, cyan in CMY

While there is a theoretical relationship between CMY and RGB color, in practice other issues muck up that relationship. The foremost of these issues is that the reflected light scheme is not as efficient as the projected light scheme. Other issues have to do with media being inefficient; the reflectivity and color of the paper; and the reflectivity and color of the ink. In other words, in a perfect world CMY could be interchanged with RGB and you wouldn't need any K, but because of inefficiencies the result degrades. Black ink is added to the CMY scheme to compensate for the deficiency in practice. But while it helps, the conversion from RGB to CMYK will still not produce a perfect representation of every color.

Every conversion that isn't perfectly efficient causes a change in the image whether it is a digital conversion (for example, converting RGB to CMYK) or a physical one (for example, projected light reflecting from ink). Previews attempt to compensate and make the conversions appear correctly on screen, but they can't account for every variable with complete accuracy. Considering what the odds are, Photoshop previews do a fair job. However, this all adds up to the fact that you can't trust what you see 100 percent.

Other Problems at the Capture Stage

Assuming that what we see on screen is the right thing is not all we may take for granted. It is easy to assume that the image was captured accurately. This suggests faith in the equipment and lighting. Any number of issues—from the quality of light (for example, lighting color), to distortion by the lens or scanner, to errors in processing, to incorrect monitor settings—can impart their personality on the result. For instance, when an image (taken with poorly color-balanced light and scanned from time-yellowed photographic paper using an uncalibrated scanner) appears on your monitor (which your child not-so-secretly adjusted so that the standard program palette grays are a more exciting purple), the images you painstakingly adjust to perfection on screen project an affinity for Martian culture by the green tint that appears in the skin tone of the prints. When you print out to laser paper—not meant for your photo-quality printer—even that green fades to a duller cast.

As odd as that might be, the result is actually mostly predictable, but it will sure look like an accident. If you fall into the category of having purple-y grays, and have never visited the Color Settings dialog box, you should have a look at setup instructions for Photoshop and several areas of the Appendix to this book, including information on calibration and handling profiles. However, these deviations may not be so broad as the scenario described here: You may have a slight tint to your shadows or a hue in highlights that can cause you to consistently over- or under-adjust areas of your image if all you do is look at the screen. You want to have the greatest chance of seeing the right thing on screen, not just something that will get you by. Calibrating your monitor can help reduce the appearance of deviations on most monitors, and will help you achieve more consistent results. If you haven't calibrated, do it now. Refer to the Appendix for more information.

What Makes an Image

Digital images are usually assembled for you: Your scanner or digital camera gets the digital information by sampling the scene or scanned area, and provides the information neatly in a digital file format. The image information is most often captured using RGB theory: Light is measured as the red, green, and blue components, and the sampling is mapped to create color for individual pixels. These three light components can be combined to re-create an RGB rendering of the image.

Figure 1.2
Prokudin-Gorskii's images came out exposed to a glass plate. His images are archived on the Library of Congress website here: `http://lcweb2.loc.gov/pp/prokquery.html`. **Search the collection for Kush-Beggi to find this image.**

An extraordinary example of how light theory really works are the images taken by Russian photographer Sergei Mikhailovich Prokudin-Gorskii in the early 1900s. Prokudin-Gorskii took what were essentially color images before color film was invented. He did this by using a special camera that had three lenses, which allowed him to expose a scene to three glass plates simultaneously, resulting in three black-and-white images. Each of the lenses was filtered, one with a red filter, one with a green filter, and one with a blue filter.

The result was an RGB separation of the scene onto those three glass plates, which essentially represents the RGB channels in Photoshop (see Figure 1.2).

The only way Prokudin-Gorskii had to reproduce the images was by projecting the glass plates using red, green, and blue filters over the lenses of a special projector. Using the projector, the scene was re-created—more or less in full color—by re-introducing color to the filtered information that was stored. Prokudin-Gorskii only had a fancy projector; you, on the other hand, have Photoshop. Using it, you can re-create these scenes from scans of those plates, adjust the color, and fix damage, distortion, and exposure problems.

I've included an interesting and rather colorful shot on the CD of the Minister of the Interior, Kush-Beggi, for the first exercise. It was taken by Prokudin-Gorskii sometime between 1905 and 1915. I've taken the liberty of adjusting for most of the lens distortion between the plates and cut the plate scan up into the separate channels. I'll show you two ways to assemble this image and make color from the black and white, and quickly discuss a third as well.

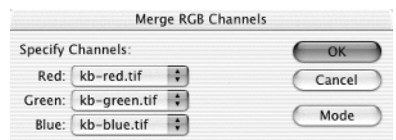
> While these step-by-step discussions may have some details (mostly shortcuts) that you already know, such detail will not be maintained throughout the book. Our goal is to cover the basics once and move on quickly.

Re-creating Color from a Separation (the Quick Way)

For this exercise, you'll need to get some images off the CD, so if you haven't taken the CD out yet, do it now. The three images are kb-red.psd, kb-green.psd, and kb-blue.psd. Don't have other images open when attempting this exercise to avoid confusion.

1. Open kb-red.psd, kb-green.psd, and kb-blue.psd in Photoshop using File → Open (or ⌘/Ctrl+O). You will be able to select multiple files in the Open dialog box by holding down the ⌘/Ctrl key.
2. Open the Channels palette if it is not already visible. Do this by selecting Window → Channels.
3. Choose Merge Channels from the Channels palette. See Figure 1.3.
4. Choosing Merge Channels opens the Merge Channels dialog box. Choose RGB from the Mode drop-down menu, as shown here. Be sure the number in the Channels field is 3, and click OK. The Merge RGB Channels dialog box will open.

5. Under Specify Channels, choose kb-red.psd as Red, kb-green.psd as Green, and kb-blue.psd as Blue, as shown here, and then click OK.



These five steps will create a color image from the three black-and-white images you opened in step 1. This is an uncorrected color depiction of the original plates. Save this image as kushbeggi.psd. You may want to come back to this image to fix some of the other problems later.

Re-creating Color from a Separation (the Harder Way)

To do this task a little more like Prokudin-Gorskii did, this set of steps shows a somewhat more difficult, but perhaps easier to understand, method. The idea here is to combine the separated colors using layer properties rather than channels:

1. Open the three images (kb-red.psd, kb-green.psd, and kb-blue.psd).
2. Copy the kb-blue.psd image. To do that, select the whole image, copy it, and create a new image. In the New window, set these options:
   - Select White as the Background.
   - The size will be automatically selected.
   - Select RGB as the Mode.
   - Type **`RGB Layers`** in the Name field.

Click OK, and paste (⌘/Ctrl +V). Pasting creates a new layer.

3. Rename the layer **Blue**. To do this, double-click the layer name in the Layers palette and type **Blue** when the layer name is highlighted. (See Figure 1.4.)

4. Copy and paste the kb-green.psd into the RGB Layers document. For the most part, this process will resemble step 2, except that you will use the document already created rather than creating a new one. Name the layer **Green**.

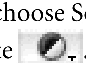
5. Copy and paste the kb-red.psd into the RGB Layers document. Name the layer **Red**. These steps get all the necessary image information into the RGB Layers document and stack the layers in RGB order.

6. Activate the background by clicking on it in the Layers palette (or press Option/Alt+Shift+[). Fill the layer with black. To do this, either use the Fill function (Edit → Fill → Black) or the Paint Bucket tool. You can choose the Paint Bucket tool by pressing G (or Shift+G to toggle from the Gradient tool); press D to change the colors on the toolbar to the defaults, and fill in the background with black by clicking the tool anywhere in the image. Be sure the tool options are set as follows:

   - Set Fill to the Foreground color.
   - Set Opacity to 100%.
   - Deselect Use All Layers (if necessary).

   These settings will create a black background (a dark projection screen) for you to add your color.

7. Change the mode of the Red, Green, and Blue layers to Screen. Pressing Option/Alt+] will help you navigate up the layers in the palette if you feel it is easier than clicking them. When you are done, leave the Red layer active.

8. Create a new Fill layer. You can hold the Option/Alt key and either choose Layer → New Fill Layer → Solid Color, or choose Solid Color from the New Fill or Adjustment Layer button on the Layers palette . Holding Option/Alt with the second option will make sure the New Layer dialog box appears. In this dialog box, click the Use Previous Layer To Create Clipping Mask option, and set the Mode option to Multiply in the Layer Options palette (see Figure 1.5). Set the color to red (255, 0, 0 in RGB) in the Color Picker.

   Using Multiply mode will darken all the grays in the Red layer to red. This represents how the red light information will look. (You can shut off the Green and Blue layers to preview.)

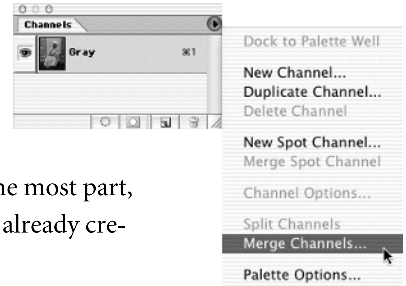


Figure 1.3
The Channels palette has a pop-up menu that you access at the upper right of the palette; the menu allows you to choose channel-specific tasks.

Figure 1.4
When you finish step 3, you'll have the background and a new layer named Blue.

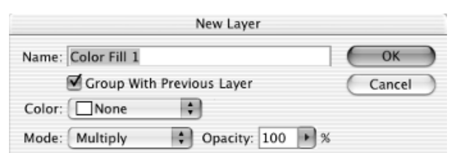


Figure 1.5
You can name the layer, set its mode, and choose Group With Previous Layer in this dialog box.

9. Create a Fill layer for the Green layer. Activate the Green layer, and then create the fill layer as you did in step 8, using green (0, 255, 0 in RGB).
10. Create a Fill layer for the Blue layer, using blue (0, 0, 255). This will complete the setup. The layers should look like they do in Figure 1.6.

At this point, save the image as kushbeggi-filterlayers.psd. What these steps show is essentially what Prokudin-Gorskii did to re-color his grayscale separations: he applied the red, green, and blue colors to the separated information using filters and projected them onto a screen.

Multiply mode works just like a filter would, darkening the brightest area of a channel to the pure representation of the filter color. All Photoshop channels really do is create this representation for you.

Yet another, more advanced way to accomplish this same result is to throw out the color fill layers and use the RGB check boxes in Layer Styles to modify the color. To open the Layer Styles palette, double-click on one of the layer thumbnails. With the palette open, leave only the box checked for the color channel the layer should affect: R for Red, G for Green, and B for Blue. Figure 1.7 shows how the palette looks when affecting blue only.

Selecting the check box targets the layer so that it only affects the information in the channel(s) you specify. To merge the layers back together, you can just flatten the image. We'll look at how to make separations from full color in Chapter 2.

I have included a copy of a scan from the original glass plate on the CD, called `gorskii-original.psd`. As an advanced project, you may want to take the image and attempt to adjust for the lens distortion. You may need to use Transform, as well as other distortion tools and filters, since the glass for each lens and the incident angle on the scene are slightly different. If you'd like, you can download the 68MB original scan in 16-bit form from the Library of Congress website to indulge in 16-bit editing as well.

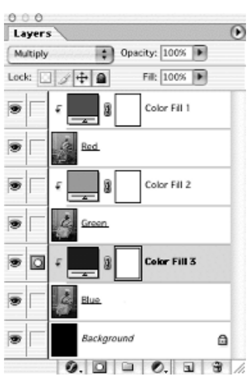


Figure 1.6
Be sure the layers are in this order. Fill layers should be Multiply mode, and color layers should be Screen mode.

This process, 100 years in the making, actually shows how a digital image is stored. Your camera or scanner will follow just about the same steps as Prokudin-Gorskii did so long ago, by separating the color information in the scene into RGB components (red, green, and blue). The separation is stored as grayscale information; in this digital era, it is stored in a digital file rather than on film. The image is re-created on the monitor by projecting that stored information as red, green, and blue light—in this case, by tiny phosphors on your screen.

In a certain sense, the color is always affected by limitations in color sensing and the ability to store information. 8-bit-per-channel images can store "only" about 16 million colors; 16-bit per channel images can store more than 30 trillion colors. The latter is arguably only a very good approximation of actual tone and color.

The quality of what you see on screen depends on the quality of what is captured, but it also depends on limitations in the display. If the filter colors (or light color) are wrong when input or when displayed, the image will appear "out of color" as opposed to out of focus. We can make the best of what we have captured by making intelligent color corrections. We'll look at color corrections in the next few sections. Now that we have the Prokudin-Gorskii image back together, we can use that image and make general corrections and work more in-depth with the hidden power of tone in your color images.

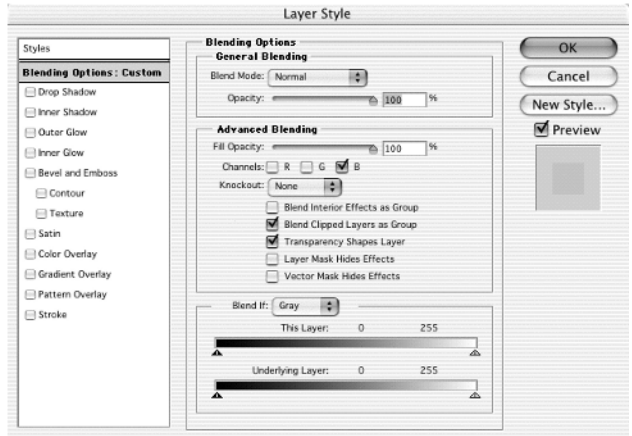


Figure 1.7
Deselecting the R and G check boxes under Advanced Blending will make the layer information affect only the blue light component in the image.

Dynamic Tone and Color with Levels

The Levels tool can be used for a variety of things, but one of the most useful is extending the dynamic range of tones and colors already in an image. Say, for example, you were using black-and-white film to take a picture and you underexposed the image. This means enough light won't get in, so the whites in the image will be a little dull. It will make the whole image a little flat because the image won't use the entire dynamic of possible color and tone. The compressed range will sap some of the life from it.

Using the Levels tool, you can redistribute the image information that was captured by redefining what should be the dynamic range of the image. All you have to do is look at the Levels graph, and it will show you where the image is missing tone (open the Levels graph by pressing ⌘/Ctrl+L). Figure 1.8 shows the blue channel (kb-blue.psd) from the Prokudin-Gorskii image before and after adjustment.

To make this adjustment, take these steps:

1. Open the kb-blue.psd image.
2. Open the Levels Adjustment Layer dialog box (Layer → New Adjustment Layer → Levels). Looking at the graph ("before" in Figure 1.8), you can see that the grayscale values in the image don't extend to the full width of the range; the graph is flat at the black and white ends.

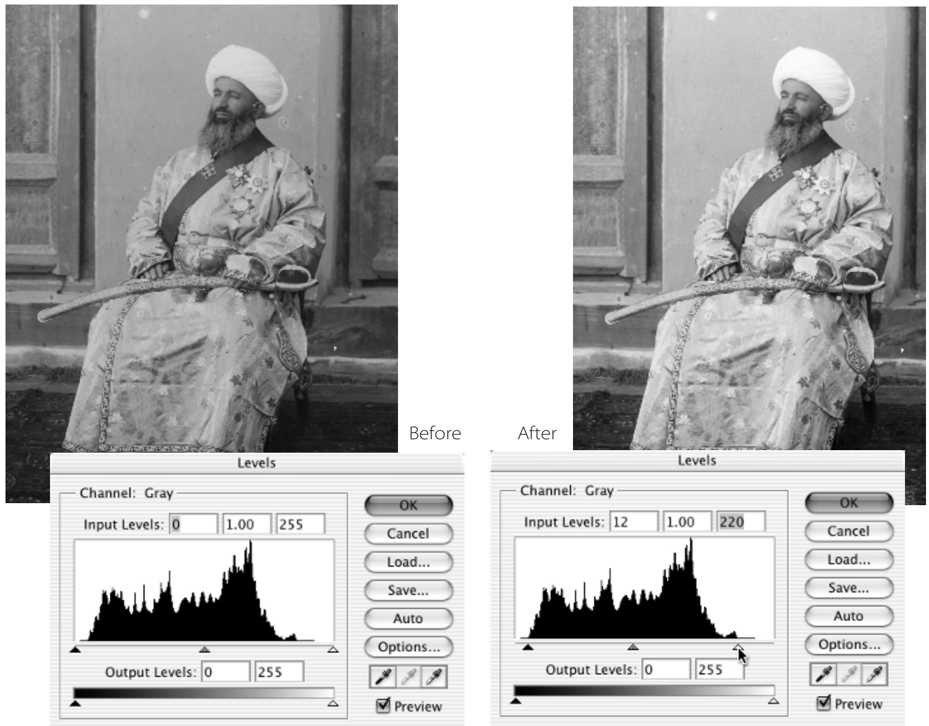


Figure 1.8
The blue channel for the Prokudin-Gorskii image used in the previous exercise can be adjusted to balance color by using levels to redistribute the tone.

3. Using the Input sliders, correct the shortened tonal range by adjusting the slider positions. Drag the black slider to where the graph begins to climb and the white slider to where it ends ("after" in Figure 1.8).

You can use this technique for any grayscale tone adjustment; simply move the black and white sliders in to where the information in the graph begins and ends. Doing this redefines the tonal range for the image. The correction takes the information and redistributes it from black to white (rather than black to gray, gray to gray, or gray to white). The result is that the dynamic potential of the image is expanded.

The Input and Output numbers you see on the Levels palette represent levels of tone. Tonality is captured in 256 levels of gray (between 0 and 255). Each level is a distinct tone ranging from white (255) to black (0). The number 256 reflects the number of possible tones in one channel of an 8-bit image (for more on bits, see the Appendix).

The Levels tool should be one of the first tools you reach for when doing color and tone correction. It can help you correct underexposure, overexposure, and many other related problems in a few simple steps. It can also correct for general color shifts due to lighting or filtering or related general color problems. Correcting color is almost identical to correcting tone. The only difference is that you want to correct the tone in each of the color channels for a color image, rather than just the composite.

To correct the color using Levels:

1. Open kushbeggi.psd. This image is on the CD, but you can use the one you saved earlier when you compiled the RGB channels.
2. Create a new Levels adjustment layer.
3. Select Red from the Channels drop-down list.
4. Adjust the tonal range for the red channel by moving in the black and white sliders directly below the graph where it just begins to climb to redistribute the tone.
5. Repeat steps 3 and 4 for the green and blue channels.
6. Switch to RGB and move the center (gray) slider to adjust image brightness.

The result after these changes should be a brighter, more dynamic image for our example. The same technique will work on many images to improve them—especially faded images and those lit by a single light source, or those that have a predictable, linear shift. For more complicated shifts, this type of correction may need to be used in conjunction with a curve (or other) correction to better control the result.

Save your image as kushbeggi-L.psd. You can compare the before and after by clicking Open on the History palette and then clicking the final step.

Using the Levels tool in this way is based on solid science and works as a general correction technique for almost any image. The reason has to do with visible light and the way we perceive light. A scene will usually appear to your eye to have a full dynamic range in tone from white and black. If the scene is lit with pure white light, it also has the potential for every color in between, because white light contains the full potential of the red, green, and blue light components. The light interacts with the scene and is reflected, then captured on film or digitally. What is captured should reflect the potential of what should be in the scene. In other words, a perfect world will reflect the full potential of the light in it, and some of each component will be captured.

For the image to properly reflect full potential dynamic for color and tone, each channel has to have a full range. Making the levels change corrects for aberrations in capture.

There are often differences because the science of capture is less forgiving than our perception. While our eye might adjust to a scene automatically, digital and film capture will not adjust—they just grab what's there. A scene lit with impure or colored lighting or captured with poor exposure reflects what the camera sees—which is not necessarily the potential of the scene. Levels give us the opportunity to easily see what failed to be recorded and restore the potential and dynamic range. The upshot is color and tone balanced for white light.

If individual color channels don't have full dynamic range, it cuts down not only on the potential tones (black to white), but the potential colors. For example, if the green channel has a graph that shows only 50 percent of the potential range, the image can't have the color created by mixing with that range of green. In fact, each level missing from the range cuts down the potential colors by more than 65,000 possibilities. Restoring the range restores the potential and is effectively a safe (rather than destructive) color correction.

If any Levels graph shows a shortened range, it suggests one of the following:

- The light source was not pure.
- The capture wasn't balanced.
- Filtering was used.
- Exposure was not optimal.
- The light in the scene was otherwise influenced.

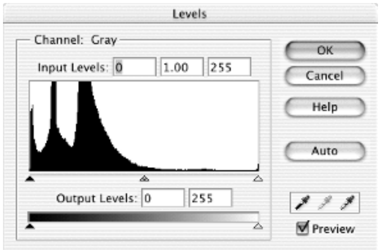
Extending the dynamic range in the color channels helps correct for and restore the color imbalance by reestablishing a balanced source based on white light and the potential for all colors.

The only instances where the levels correction of this sort fails or does not improve an image are cases where a color shift is desired or where there is a nonlinear influence. The desired color shift can be exemplified by a scene where you used a color filter on purpose, or if a scene has an intentional or inherent light cast (as in a sunset), or where the color and tonality in the scene is very limited. (Correcting to create the full range of color levels could have a bad influence on the image.) Nonlinear influence might be exemplified by an incandescent light in a blue room: The color might shift red in highlights due to the reddish color of the direct source, but blue in shadows because of reflected light from the walls.

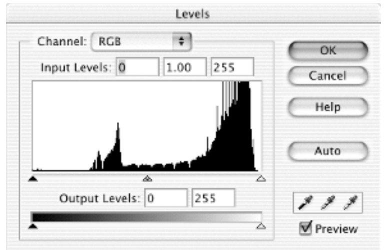
Of course, Levels is not your only tool for image color correction, but it does offer a good starting point. You will need to learn to understand histograms and work with curves for more versatile corrections.

Understanding and Reading Histograms

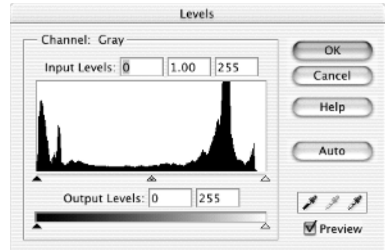
Histograms appear in several different places in Photoshop, including the Histogram palette and the Levels dialog box. The width of the histogram graph represents the range of potential tonal values. The height of a given line in the graph represents the number of pixels in the image with a particular tone. Aberrations in the graph, such as steep peaks and valleys, gaps in information, and/or clipping (spikes in information that run off the chart), may represent some form of image damage, limitation, or loss of image information. The graph can also describe high-key, low-key, high-contrast, and low-contrast images. Evaluating a histogram is as easy as looking at it and understanding a few basic properties. Figure 1.9 shows examples of how histograms look with different image types.



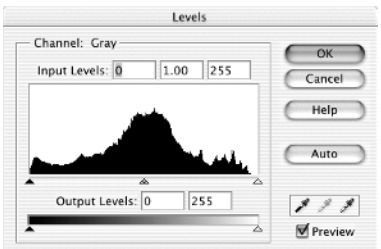
When weighted toward the blacks or dark end of the graph, the histogram represents a low-key (dark) image.



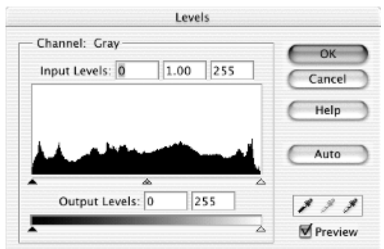
A histogram that is skewed to the light (right) end of the graph represents a high-key (bright) image.



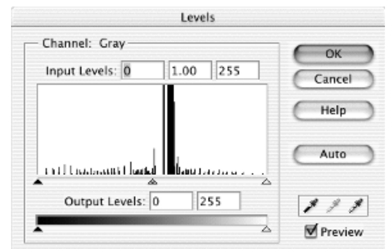
A histogram that peaks in the dark and light areas while having lower pixel density in the middle of the graph represents a high-contrast image.



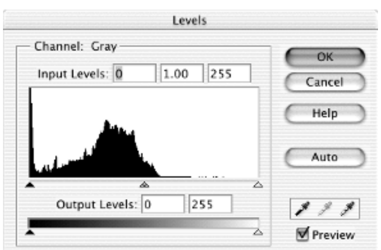
A histogram that shows a peak in the center is low-contrast.



An image with a mix of global and local contrast displays as a flattened graph in the histograms with few peaks and valleys.



Gaps between tones on the histogram or sparse information suggest the image has limitations or damage, such as poor scanning.



Graphs that show clipping (information that runs off the chart) suggest a concentration in the tonal range. Concentrations often occur in the extreme highlights or shadows of an image and may also suggest damage.

Figure 1.9

The look of a histogram graph can tell you about the content of an image.

It is possible to evaluate a section of an image by selecting it with the selection tools. The histogram charts the results only for the active or selected portion of an image.

Apparent anomalies can be the result of capture, such as bad scanning (faulty techniques or equipment), incorrect image exposure, filter use, or unusual lighting conditions. Anomalies can also easily be the result of image processing: mode conversions, corrections, poorly applied filters, and so forth. Any abnormalities might not always represent problems, but they are certainly good indications of unusual conditions.

Do not be overzealous in accepting the appearance of the histogram as an absolute judge of the image; be sure to make the visual assessment as well and use the two assessments in tandem. Your visual assessment should override the digital one, especially if you get good results in tests and have reason to trust the view of your monitor. Your primary goal should be a good image, not a good histogram.

Sometimes shifting the range using levels—even radically removing information in the image—can work to the benefit of the image by improving contrast and dynamic range. When the histogram presents a "tail" toward the shadows or highlights (see Figure 1.10), it can often be clipped in part or whole. Tails on the histogram often represent highlight or shadow noise, rather than actual image detail. Snipping the information turns it to absolute white for a highlight (or absolute black for a shadow).

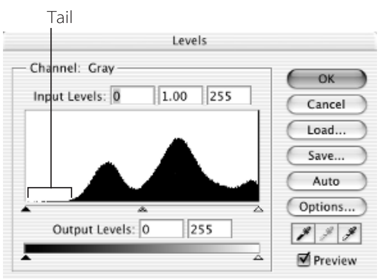


Figure 1.10
A "tail" in a histogram usually represents nothing more than image noise.

It is sometimes desirable to eliminate none, some, or all of a tail, depending on the image and the length of the tail. As a general rule, the longer the tail, the less—proportionally—you should cut off. For example, you may completely remove a tail that covers 15 levels, you might trim half or less of a tail that covers 50 levels, or 33 percent of one that covers 100 levels. This will help retain image integrity and character.

Don't feel that you have to crop a tail in the image just because it's there. If the results seem too drastic after cutting a tail, they are. Put simply: Crop a tail if doing so improves the image; don't crop a tail if it compromises the image.

Images that appear too dark or light can be corrected by using the middle slider in the Levels tool. Moving the slider to the left lightens midtones, whereas moving it to the right darkens them. This may seem slightly counterintuitive; however, it makes a lot of sense. The idea is that you are moving the median so that more levels of tone fall within the lighter or darker half of the tonal range.

As a general guide, try not to move the midtone slider more than 25 levels (10 percent of the image tonality) in any direction when making corrections with the middle slider. This keeps the redistribution small and more forgiving. You can always come back and lighten or darken an image later in additional steps and adjustment layers, or adjust using other tools like curves, which we'll look at in the next section.

Snapping Image Tone and Color with Curves

Curves are the ideal tool to help fine-tune and reshape the tone of an image. Whereas levels have only three control points that you can change, curves can have many (up to 16), and this can help you work in different tonal ranges with targeted results. Curves are both a more versatile correction tool and a more volatile one than levels because of their power. You'll find that using curves for corrections can reduce the steps involved because you can apply one curve and make numerous corrections to various parts of image—often without selection. While levels are a good tool for evaluating and adjusting dynamic range in an image, curves are a good tool for adjusting image contrast and dynamic range in small chunks of the tonal range.

Because curves are powerful, applying them requires a little more savvy than applying levels. Before we begin, let's take a brief look at the interface and how to manipulate the curve.

Using the Curves Function

You access the Curves function by creating a Curves adjustment layer (Layer → New Adjustment Layer → Curves) or by selecting Curves from the Image menu (Image → Adjustments → Curves). You can also access a similar interface when working with duotones and assigning transfer functions.

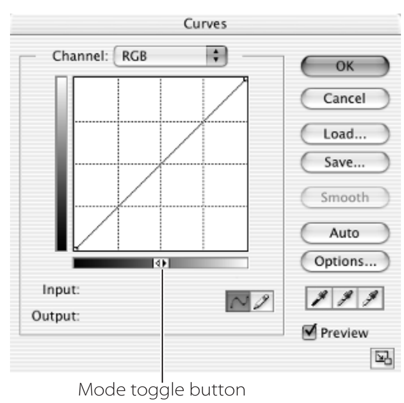
> The difference between using curves (or any other adjustment, for that matter) in adjustment layers is that the adjustments can be revisited without making a permanent impact on the image and layers to which they are applied. Applying an adjustment directly will make a permanent change that cannot be revoked without retreating in the image History.

Curves can be used in two modes: one based on percentage and the other based on levels. The line that runs from lower left to upper right of the graph represents tonal response. When you first open the dialog box, the graph will read out an even tonal response if the Input value (the original tones) is equal to the Output value (the result). Changes that you make to the graph by adding and moving points modifies the relationship between the original image tones and the result. So, say you add a point to the graph at 128, 128 and move it to 128, 64; all of the midtones will become 50 percent darker (going from 50 percent black to 75 percent). The shape of the curve that results shows how moving this one point affects the rest of the image tones. Moving any point on the curve can affect that entire image in different proportions based on the shape of the tonal response curve.

Depending on the mode, the initial points either represent levels (0 = black, to 255 = white) or percentage (0 percent black—or white—to 100 percent black). You control the mode using the button on the gradient bar directly below the graph (see Figure 1.11). Levels may be thought of as referring to RGB measurements, pertaining to 8-bit grays (and 256 possible levels of gray per tone); percentage may be more appropriate for CMYK, referring to percentage of ink coverage. Either can be used, depending on what you find more intuitive.

Figure 1.11

The Curve mode button in the center of the lower gradient bar switches between percentage black and levels when clicked.



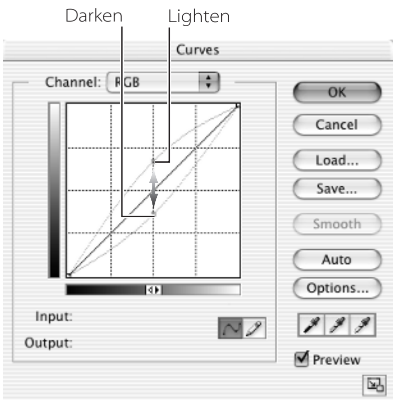


Figure 1.12

Moving points on the curve (pictured here in tone levels mode) will darken the image with less volume under the curve and brighten it with greater volume.

If you roll your cursor over the graph, the Input and Output numbers below the graph change as per the position of the cursor. These numbers represent the vertical (Output) and horizontal (Input) positions on the graph.

If you click on the graph and drag (holding down the mouse button), you can move the point and the curve. As you move the curve, the tonality of the image shifts according to the change in the curve. When you're viewing in tone levels, the image will get lighter as you shift the arc of the curve up, and it will become darker as you shift the arc of the curve down (see Figure 1.12). When you're viewing percentage, the relationship is reversed.

You can manipulate the position of points that you have placed on the graph that are active (highlighted in black) by typing numbers into the Input and Output fields. If you roll your cursor over the image with the Curves dialog box open, your cursor will become an Eyedropper. This will allow you to sample color and tone directly from the image. To transfer a sample to the curve, hold down the ⌘/Ctrl key and click the mouse. Photoshop creates a new point on the curve representing the tone sampled in the image.

Though the Curves dialog box includes other options, the ones listed will be all you'll need to make specific adjustments.

WORKING WITH POINTS ON A CURVE

To add a point:

- Hold ⌘/Ctrl and click to sample the image.
- Roll the cursor over the curve and click.

To move a point:

- Click on the point and drag.
- Highlight the point (by clicking it) and change the Input/Output values.
- Highlight the point (by clicking it) and press the keyboard arrows in the direction you want to move the point. Hold the Shift key to move 10 levels in the arrow direction.

To remove a point:

- Roll over the point, hold ⌘/Ctrl, and click.
- Highlight the point (by clicking it) and press Delete.
- Click on a point and drag it off the graph.

Manipulating Curves

If Levels is a tool that affects *dynamic range*, the Curves feature can be considered a tool for affecting *contrast*. You can make sweeping changes to an image or fine-tune delicate areas of tone with curve adjustments depending on how you handle them.

A simple way to look at curves and curve adjustments is that contrast *increases* in the tonal range between points where the curve is steeper and contrast *decreases* in the tonal range where the curve flattens out. The curve in Figure 1.13 will increase contrast in the image midtones (between 25 and 75 percent black).

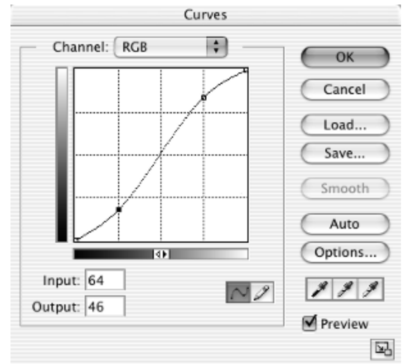


Figure 1.13

A steeper rise in the curve between Input values of 64 and 191 tone levels make contrast more intense through the midtones.

The curve in Figure 1.14 will decrease contrast in the midtones over the same range. Note that the increase in contrast over the midtones in Figure 1.13 decreases the contrast in the highlights and shadows. In Figure 1.14, decreasing the contrast in the midtones increases the contrast in the highlights and shadows.

You'll work with this type of trade-off (somewhat like equal and opposite reactions) when you're manipulating curves.

When you add points to a curve, you won't always do so to move the curve. At times it will be useful to place anchors on the curve to keep the tone in that area of the image from changing, or to act as a pivot for adjustments. For example, anchors set in the highlight and midtone can keep the tone in the highlight from changing while you adjust shadows (see Figure 1.15).

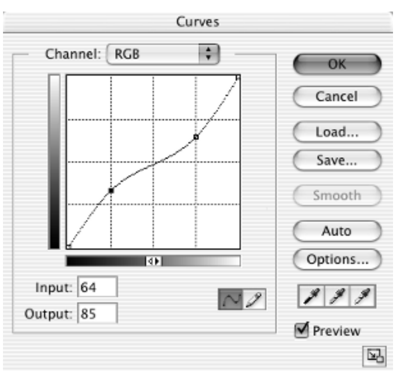


Figure 1.14

Decreasing the grade of the curve slope in the midtones increases contrast in shadows and highlights.

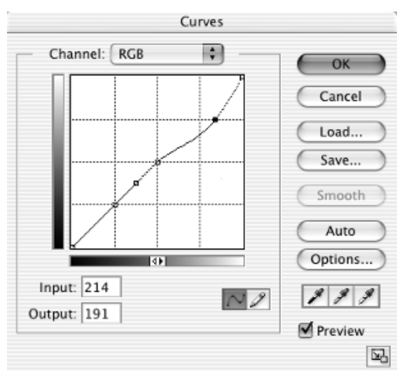


Figure 1.15

Anchoring the curve with extra points that just hold the curve in place can reduce the effect of an equal and opposite reaction in your changes.

The Eyedropper can help you measure the actual range you want to affect. The Eyedropper appears as you drag your cursor over your image when the Curves dialog box is open. In Figure 1.16, the original image was taken in direct sunlight, resulting in a high-contrast exposure. Curves can help reduce the quick transition from highlight to shadow. In this image (included as contrast.psd on the CD), measure the brightest and darkest areas of the tonal range you want to include. To do this, drag the Eyedropper on the image and ⌘/Ctrl+click to make sample points. You can also note the sample value and enter it in the input field manually.

To make an image correction using Curves:

1. Open the image you want to correct (contrast.psd is included on the CD).
2. Set the options for the Eyedropper and Info palette. For the example, we chose a sample of 3 by 3 for the Eyedropper and changed one of the Info palette colors to K (Grayscale).
3. Open the Curves dialog box by choosing Curves from the New Adjustment Layer submenu (Layer → New Adjustment Layer → Curves).
4. Sample the bright end of the range you want to correct (see Figure 1.17) and create a curve point.

Figure 1.16

This image was taken in direct sunlight and shows harsh shadows.

Figure 1.17

The highlight area of the cheek is the lightest portion of the area that will be changed.

EVALUATING COLOR AND TONE WITH EYEDROPPERS

The Eyedropper samples image information and displays the result on the Info palette. All you have to do is put the cursor over the image area you want to measure, and the Eyedropper will sample the composite of the visible layers. It can be helpful in evaluating an image throughout the correction process. For example, comparing grayscale values for sample and target areas before cloning can tell you whether those areas are a good match before you make the clone.

The Sample Size setting for the Eyedropper tool affects the result of samples used with curves. Tool options include only Point Sample (samples the pixel at the tip of the tool icon), 3 By 3 Average, and 5 By 5 Average. The Average options look at a square of pixels (the tip of the tool icon as the center pixel) using the selected dimensions and average those to determine the result. In certain cases where tone is noisy, such as skin tones, you should use a broader sample size to get a better average reading of the tones you want to measure. Using too small a sample size might only make confusing samples; values between one pixel and the next might change too rapidly to make sense. Control+clicking/right-clicking brings up the Sample Size menu when you're using the Curves dialog box.

To use the Eyedropper, follow this general procedure:

1. Select the Eyedropper tool (press I).
2. Choose the radius for the sampling area on the options bar.
3. Bring the Info palette to the front by selecting it from the Window menu, or by clicking the tab in the palette well.
4. Spot-check with the Eyedropper by passing the cursor over various areas of the image that you want to check while noting the values in the Info palette.

Samplers can also be placed (using the Sampler mode for the Eyedropper Tool) in the image to provide a constant readout of a particular spot in an image. You can place them with the Sampler tool , which you access by scrolling the Eyedropper tool (press Shift+I to scroll the tool), or by holding the Shift key with the Eyedropper tool selected. Up to four samplers can be placed in each image. These samplers will not move until they are removed from the image (press Option/Alt with the Sampler tool active, roll the cursor directly over the sampler to be removed, and then click). Each sampler will have its own readout in the Info palette.

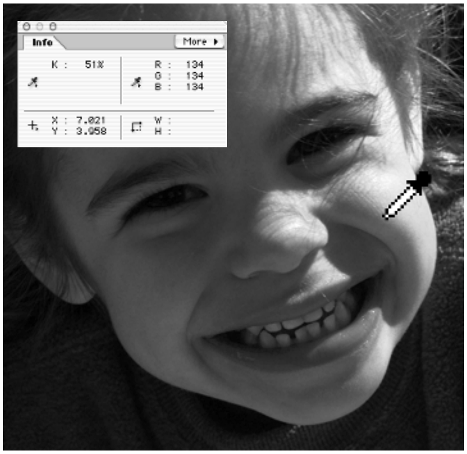


Figure 1.18
The image moves pretty abruptly from light to dark. The second sample should be somewhere in the area where the image tone makes the transition to shadow.

5. Sample the dark end of the range you want to correct (see Figure 1.18) and create a curve point.
6. Use the input fields to adjust the position of the curve points to effect the desired change. In Figure 1.19, the 51 percent (134 levels) point was changed to an output of 33 percent (171 levels).
7. Continue adding points and adjusting for other tonal relationships by repeating steps 5 through 8.
8. Accept the changes in the curve by clicking OK.

It is possible in some cases that you will want to include additional curves using steps 3 through 8 to make further modifications to the tone. See Figure 1.20, for example. Such modifications may be the exception rather than the rule in fine-tuning delicate areas.

Keeping a curve smooth rather than choppy or abrupt is more likely to render good results. Jagged curves tend to be unpredictable and will more likely produce special effects than corrections. If changes seem extreme or become difficult, make them over the course of several applications of curves rather than just in one shot. This approach will allow you to compare adjustments by toggling layer views, as well as allowing you to fine-tune.

Controlling color with curves works somewhat in the same way as making contrast adjustments. Results can actually be calculated to make exacting corrections that would otherwise be impossible.

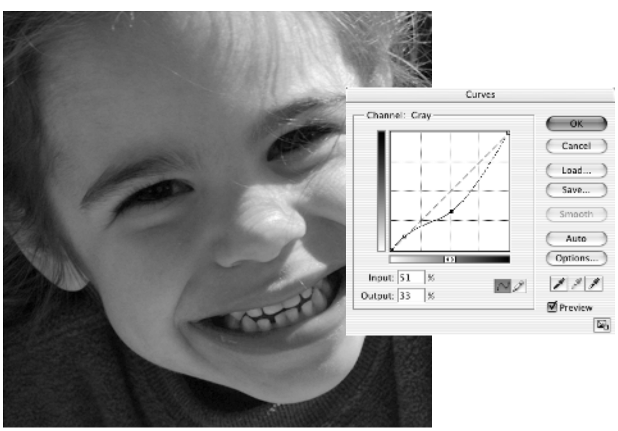


Figure 1.19
The changes in the curve lighten the image and reduce contrast in the midtones while improving contrast in the highlight and shadow detail.

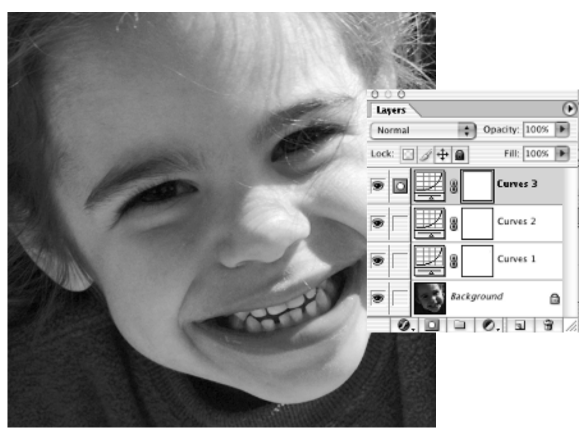


Figure 1.20
The result of several curve applications has improved the tonality of the image by lessening the harsh contrast between light and dark while enhancing contrast in selected areas.

Curves for Color Correction

Color casts in images can result in flatness and unnatural or plain old bad color. Basic color correction with levels often eliminates most of this problem, but color casts and shifts between the lightest and darkest parts of an image are often a little more complex than looking at a histogram or doing a general color correction in levels. If a color shift is in only one portion of the color range (shadows, midtones, or highlights), levels may not do enough to make the correction. Curves are a more sophisticated means of fine-tuning color—either to make it exacting or simply more dynamic in a specific range. This is a correction you will make after, and in addition to, a levels correction.

> Those newer to "color correction" are probably sometimes misled by the term, which suggests there is a "correct" color to shoot for. Color correction remains more an art than a science, and corrections may reflect color that is more interesting, bolder, and more dynamic, rather than just "correct."

The problem is knowing exactly what to do with your curves. It is difficult to just look at an image and envision how a curve should look to make the desired correction. While it may be easy to determine what looks *wrong*, correcting it can remain a puzzle. Just fiddling with curves and hoping for a result will usually be a frustrating exercise—and if you do hit on a correction, it'll be an accident.

Say you are looking at an image and the color of the subject's skin just looks wrong. Skin color is something we are all familiar with, so most people can tell when it just doesn't look right. If the skin tone looks wrong, the image will look wrong. In fact, if you can correct for the skin tone, it is likely that everything else in your image will fall into place.

However, a problem arises when you try to correct for skin tone: The difference in skin tones is vast. Skin tone has many colors and shades, so no value can be an accurate reference—unless you measure it from the original subject, and there isn't much chance you'll be doing that. Certainly there are approximations, but you can just as well make approximations if you can trust your eyes (and monitor).

Paradoxically, the best reference are areas that should be grays. Grays can act as a reference because they are easy to measure: They should have even amounts of red, green, and blue. When you measure with the Eyedropper, the R, G, and B values displayed in the Info palette should all be the same—or very nearly so. Looking for areas that should be gray can give you a definitive value to adjust for.

In a perfect world, you could find areas of your image that should be grays of 75 percent (64, 64, 64), 50 percent (128, 128, 128), and 25 percent (192, 192, 192) black as reference in your images; you could then set accurate white and black points, and your images would balance nicely. It usually isn't too easy to find these references unless you place them right in your image. While you can do this using a reference card, it is not something that everyone will take the time to do. An example gray card can be as simple as printing shades of gray on a white sheet and getting that reference in the image.

A reasonable substitute for a gray card are grays that already exist in the image. If you look closely, you may find something that should be a flat shade of gray, such as a steel flagpole, chrome on a car, asphalt, ice skate blades, certain types of tree bark… Anything that should be flat gray, paradoxically, becomes very useful for color evaluation. While black and gray objects can vary in color to some degree, they will be easier to judge and correct for than something like skin (where there is no absolute reference). Making corrections for grays should become one of the more useful staples of your efforts in curve "corrections."

You'll try an example of this method next.

Correcting Color Using Gray Points

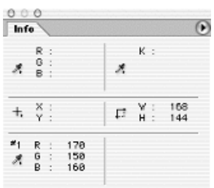


Figure 1.21
Samplers stay in place in the image until you remove them by holding down Option/Alt and clicking the sampler. The image information read by the sampler(s) appears in the Info palette.

Once you determine your reference objects, curves can help you easily adjust image color. All you have to do is measure the tone and color of the gray object, and then adjust the curves to make those objects gray, while ignoring everything else in the image.

To determine the values for a gray object to use in correction, take the following steps:

1. Locate an object in your image that should be closest to gray.
2. Be sure the Info palette is visible and that one of the sample types is set to RGB Color (RGB).
3. Select the Eyedropper from the Tool palette. Be sure that the sample option is set to 3 or 5 pixels. The wider range is effective on images with greater resolution.
4. Put the tip of the Eyedropper over the reference area. Place a sampler by pressing the Shift key and clicking. This sampler will remain in place until you remove it. Values under the sample will appear in the Info palette (see Figure 1.21).
5. Note the RGB values in the Info palette. You may want to have another sample value showing the grayscale so that you know the approximate tone you are sampling from. Say you end up measuring these values:

Red	170
Green	150
Blue	160

6. Adjust the red, green, and blue channels with curves so that the color reflects an average of the RGB values. You will adjust the values in the example from the measured

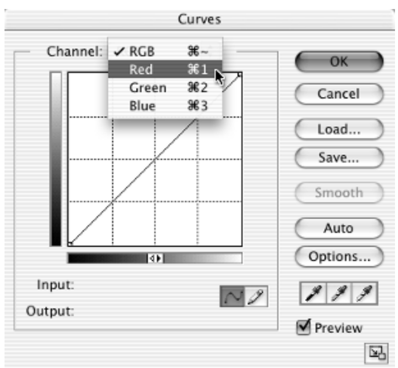
value (input) to the desired value (output). Just place points on the curve and then adjust by entering the appropriate Input and Output values. See Figure 1.22.

	Input	Output
Red	170	160
Green	150	160
Blue	160	160

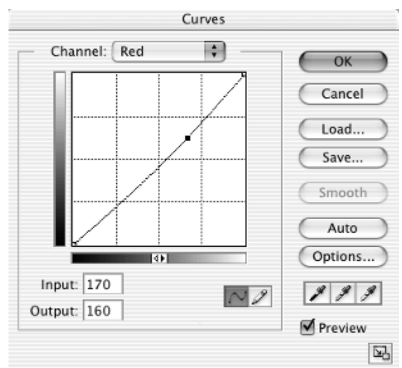
When you have finished making the correction, the sample that was 170, 150, 160 will now be 160, 160, 160 (you can check this in the Info palette easily if you placed the sampler in step 4). Other values in the image will change based on the change in the curve.

With this level of control, your choice in selection of a gray reference is very important to the outcome. If you choose a gray that in reality is supposed to be slightly green and you don't allow for that, your corrections will end up somewhat warm. Again, visual inspection and the numbers have to work hand in hand to achieve the best result. The more reliable gray points you measure, the more accurate your curves correction will be. The next section looks at implementing this technique with gray values placed directly in the image just for that purpose.

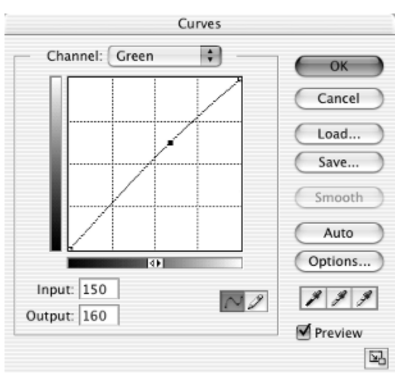
Figure 1.22
Make adjustments by number, one adjustment for each channel in the Channel drop-downlist.



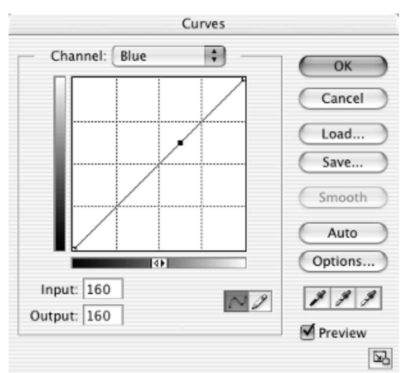
Select the channel from the Channel pop-up list.



Red



Green



Blue

Tempering Curve Corrections

When using an object that you are not sure is gray (e.g., tree bark) as the reference, you may only want to make a percentage adjustment, rather than just assuming you want a completely flat gray. That is, you may want to give some credence to the existing values. This is similar in concept to not cropping off the entire tail in levels, since you will be looking to make only part of the correction as a compromise. Instead of making a drastic change, you make only part of it.

For example, if the difference in the colors is broad, or skewed to one of the channels, it may be preferable to average 50 or 75 percent of the difference. The more positive you are that the value you are measuring should be gray, the stronger the percentage you should apply; the less sure you are that it should absolutely be gray, the less percentage you should apply.

To change by a percentage, you would take the difference between the measured and average value, multiply by the percentage you choose, and add it to the measured value: Target value = measured value + {[(average value) - (measured value)] x percentage}. Using the numbers from the last example, your calculation for the red channel will look like this:

Target value = 170 + ([160 - 170] x .75)

Target value = 170 – 7.5

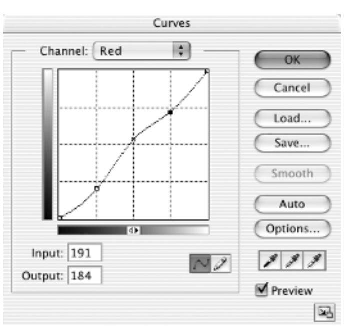
Target value = 163

The following list shows how the table would look if making only 75 percent of the change:

	Input	Output
Red	170	163
Green	150	158
Blue	160	160

Figure 1.23

If using several sample grays, place them on the curve for each channel in one step. This curve shows a red correction for 64, 128, and 191 levels changed to 51, 137, and 184.



Compound Curves Correction

Simply correcting for one gray won't really give you a much better correction than using levels. What you'll really want to do to benefit from curves is correct for several grays. The more levels of gray you correct for, the more accurate your correction. Try to space out the tones of the grays you measure. For example, sample grays at the quartertones: 25, 50 and 75 percent gray. If you measure several grays, make the corrections all at once by placing as many points on each curve as you have sample spots (see Figure 1.23). This will ensure that you are changing the measured spots relative to one another; if you change the values sequentially on separate curves, the changes will work against one another rather than together. The more evenly you divide the gray levels used for the correction, the better.

Figure 1.24 shows an image that was photographed with a homemade 25 percent, 50 percent, 75 percent gray card. To correct the image, you'd open it, correct the levels (which sets the white and black points), and then make corrections using the values for the gray card as your target Output (result) values.

Let's run through the correction for the image.

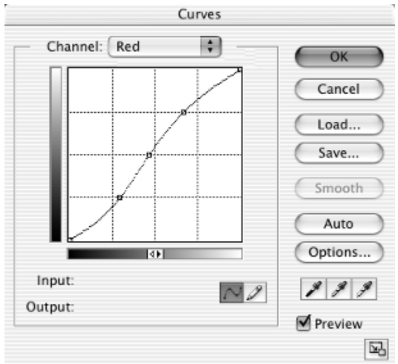
1. Open lillycard.psd from the CD.
2. Place a sampler in each of the three gray card areas in the image to measure the grays. You should see these measurements, or something very similar to this:

	25%	50%	75%
Red	170	119	75
Green	196	153	85
Blue	213	148	52

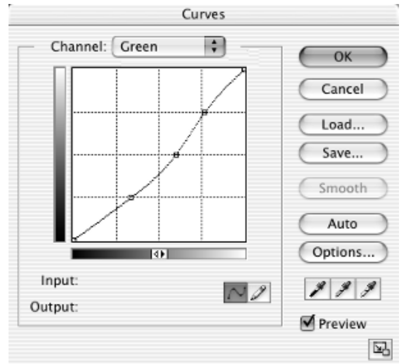
3. Open a Curves adjustment layer by choosing Curves from the New Adjustment Layer menu: Layer → New Adjustment Layer → Curves. You can also choose Curves from the Create New Fill or Adjustment Layer menu at the bottom of the Layers palette.
4. Select the red channel by choosing it from the Channel pop-up list.
5. Add a point to the curve by holding ⌘/Ctrl and clicking on the darkest gray card swatch (75 percent). You can click directly over the samplers you placed.
6. Change the Output value to 63 in the Curves dialog box.
7. Add another point to the curve by holding ⌘/Ctrl and clicking the medium gray card swatch (50 percent).
8. Change the Output value to 128 in the Curves dialog box.
9. Add the last point to the red curve by again holding the ⌘/Ctrl key and clicking the light gray card swatch (25 percent).
10. Change the Output value to 191 in the Curves dialog box.
11. Repeat steps 6 through 11 for the green and blue layer components. See Figure 1.25.
12. Click OK to accept the changes.

Figure 1.24
The gray card (to the right) can help balance color at three levels of gray.

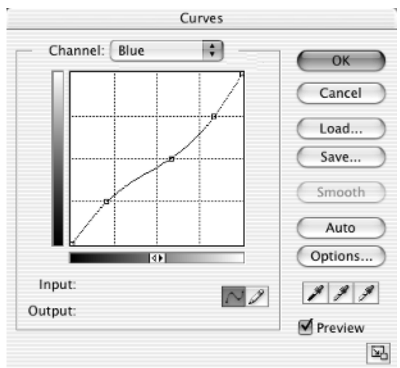
Figure 1.25
Each of the curves should look almost exactly like the curves pictured here for red, green, and blue when you make the corrections.



Red



Green



Blue

When you are done correcting the color, you can use the measurements to correct tone as well. Because you know that the card is 25, 50, and 75 percent gray (191, 128, and 63 levels), the measurements you checked will correspond to those values.

Now that the image is "correct," you may want to make other adjustments that are not quite so correct. In other words, this is where the artistic part comes in and takes over. The image may be technically correct in that it should be a reasonable match with reality, having realistic tone and color. While it may appear realistic, there can still be other problems, and you may want to make improvements accordingly. Additional adjustments could involve adjusting the curves further, or adding other adjustments (Color Balance, Hue/Saturation, etc.).

Sticking with curves for the moment, let's reopen the adjustment layer you have created (double-click the icon in the layer) and make our adjustments there. To adjust individual points, just click on them, and move the points while looking at the preview (either freehand or using the arrow keys). Note the initial Input and Output values (so you can return to those settings if desired); you may want to just duplicate the curve layer and play with duplicate, so you don't have to write down or remember the original values. If using a duplicate, shut off the original.

While it is possible that you can stumble into a correction for the color that looks better, it is more likely that you will get the result you want by observing and making targeted changes. For example, if you have a red that you think needs to be redder, you can set a sampler on it and increase the red, reduce the green and blue to darken (to *purify*), or add green and blue to lighten (to *desaturate*). Having a goal in your curve corrections rather than going at it at random will have you spending less time fiddling to get results. There are better tools to fiddle with (like Color Balance, as we'll see in a moment).

At the point where you have made the curve adjustment according to gray targets, the image is balanced. It is more likely that you will get pleasing results with curves when experimenting by applying them to image tone or color separately rather than to the RGB. Applying a curve to image color can help you work with image saturation (adjust the RGB curve) or in making specific increases/reductions in one of the component colors overall. Applying a curve to image luminosity can help you adjust tonality and contrast. The next chapter looks at many possibilities for isolating color and tone. You may actually get better color by making additional corrections and/or selectively replacing colors and tones, making corrections not so strictly tied to measurements, and in some cases by altering color completely. Making targeted and selective tone and color changes can help. Selective changes are covered in more depth in Chapter 3.

You can make other corrections using curves to adjust the image color and dynamic, but corrections without using targeted measures are less precision corrections than artistic decisions. Because they will also be based on the image preview, you will have to trust your perception (and your monitor) to go this route.

CORRECTING SPECIFIC COLORS

Color correcting doesn't just work for grays. You can correct for known color values as well. In instances where you know any specific color in the image, you can use curves to make your correction but just target the color. Say, for example, you take a picture of a business and know that the logo color on the building is an official color. You can target the change in color according to that measurement. Just take a measurement of the color in the image (after a levels correction), and use the RGB value for the target color as the output values. If you don't have a gray card and want to use paint swatches (gray or otherwise) from a local paint store, as long as you know the color values, you can make the adjustment for that color. Other adjustments may be necessary to other levels of the image (just as when you use multiple gray sources) to adjust the image over the entire range from highlight to shadow.

The Art of Color Balance

While levels and curves corrections are excellent tools for normalizing color, you might note one problem with making corrections by the numbers: This approach may make for pretty accurate correction, but it may not always produce the most pleasing color. If you don't know where to start your correction, the techniques we've looked at so far are definitely a fine start and will get you moving in the right direction. A final tweak of color balance may do quite a lot to enhance your image's color.

The idea of the Color Balance function (see Figure 1.26) is to allow you to shift the balance between opposing colors. Cyan balances against red, green against magenta, and blue against yellow, with separate adjustments for highlights, midtones, and shadows. While you could make similar changes with curves, the Color Balance dialog box is a friendlier and easier way to make these changes. The result is usually a fine-tuning to help bring out the interesting and inherent character of an image.

Rather than trying to calculate a result, you'll find it easier to work with color balance interactively. The goal is really to achieve more vibrant color:

1. Continue working with the lillycard.psd you have open (corrected in the previous section).
2. Open Color Balance by pressing ⌘/Ctrl+B.
3. Start with the Midtones (under the Tone Balance panel), and slide the Cyan/Red slider between –50 and +50, watching the effect on the image. Narrow down the range that looks best by swinging the slider in smaller ranges until the best position is achieved based on the screen preview.
4. Repeat step 3 for the Magenta/Green slider.
5. Repeat step 3 for the Yellow/Blue slider.
6. Repeat steps 3 through 5 for Highlights.
7. Repeat steps 3 through 5 for Shadows.
8. Repeat steps 3 through 7.

While the steps here might seem an oversimplification, this is really all you have to do. Your result can be a dramatic change in the image, even with small movements of the sliders, and changes will influence color, saturation, and dynamics.

The color result of a correction on the lillycard.psd appears in the color section, showing the original image, the image corrected for grays, and then the image color balanced with curve saturation and tone enhancements. The original looks bluish due to the over-cast sky; the image corrected for gray shows a flat response and realistic color; and the enhanced version shows how the scene would look with warmer, yellowish lighting (note the cast on the card).

These general corrections are something you will probably do to any image. Yet, there are still a number of ways to further break down image color and get very specific about the changes you will make—and why you will make them. Making the best color changes after general corrections will be a matter of knowing how to properly purpose images by adjusting color and tone. Control over this aspect begins with understanding separation (breaking color and tone out of an image into separate components), which we will look at in Chapter 2.

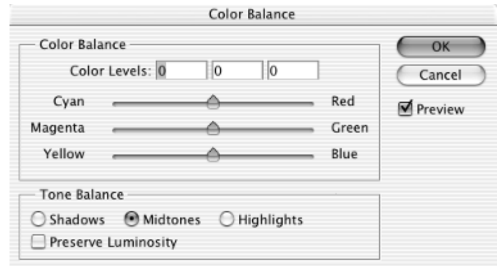


Figure 1.26
The Color Balance dialog box provides an easy, intuitive interface for adjusting color cast and balance.