

Chapter 1

Essentials of Images and Image Editing

There are really only a few things that can be done with an image, and they all revolve around changing content. To do so, you choose tools and work with tone, color, and composition. That's it. If your process covers color correction, composition changes, and tool selection, you are doing what you should for every image. Following a process and understanding the possibilities gives you a solid foundation to work from. Although the process for each image may be very different, you can use the same set of steps just about every time. The purpose of this chapter is to outline the process for you, and get you set up as you should be. With this foundation, we can then jump into making your images better.

The Image Editing Process

The Tools You'll Need

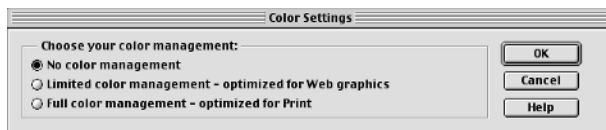
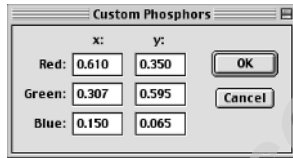
Basic Concepts of Tone, Contrast, and Color

Understanding and Using Color Management

Resolution

Know Your Equipment

Know Your Images



The Image Editing Process

When you go on a vacation, it is often a good idea to make a checklist to help you remember everything you have to do before you go and everything you want to bring along. If you are a seasoned traveler, you can probably do most of your packing and planning without a list. If you are visiting somewhere you've never been before, you might ask someone who's been there what to bring.

When approaching image correction, a checklist can help you ensure that you've covered all the essentials. The list should cover everything you will have to do to an image, and you'll want to do the steps in a particular order until you develop your own preferences and methods.

The following list consists of a procedure I have developed over many years of working with digital images, and it covers all the things you really need to do. For some images you'll skip a step, and for others you might spend hours indulging one step or another. During the process of correction, you will generally want to work from global changes down to smaller and more specific changes. The steps come in three parts:

Preparation Be sure your system and program setup are correct and that you know what you want to do with the image.

Correction Take specific steps to achieve the goal of the image.

Purposing Finalize the image to target it to specific output.

The following sections describe the basic processes of image editing starting with a corrections checklist. However, the most important information you will need cannot be provided by any book; you must know your equipment, and know your images. The final two sections of the chapter show you how to control your own individual circumstances to make your image editing a success.

Image Correction Checklist

Each set of steps in the image editing process is outlined in the following checklist, and this checklist will be the basis for discussion in the rest of the book. Consider this checklist your plan, and consider me your tour guide.

Preparation

1. Store the original image file safely and work with a copy to do all of your image editing. If any step goes awry, you will want to be able to return to the original image to start over, or you may want to repurpose the original in the future.
2. Be sure that your monitor is calibrated and that you have set up your preferences and tested your output. Doing so ensures your best chance of getting the results you intend. (See "Calibrating Your Monitor and Building an ICC Profile," later in this chapter.)

3. Consider resolution and color. Have in mind a target range for the resolution and a color mode for the final image. You may work at different resolutions and in different color modes throughout, but knowing what you need from the outset can help you work smarter, with fewer color conversions (which you generally want to try to avoid). See “Types of Color” and “What Image Resolution to Use”, later in this chapter.
4. Evaluate the image. This analysis can include looking at color and tone, determining the image type (high-key, low-key, high contrast), evaluating the extent of work to be done, and considering the composition. The result of the evaluation should be a short list of things you want to improve or change. See “Evaluating Image Tones” in Chapter 3.

Correction

5. Make general color and tonal corrections. Be sure to make a good general correction at this point, but don’t spend a lot of time getting it exact. A good general correction will point out some flaws that may otherwise lurk in the image until later in the process. While it isn’t bad to double back during the process, it can take your concentration away from progressing through. Overall, doubling back may unnecessarily increase the amount of time you spend on images. See “Redistributing Tone with Levels” and “Snapping and Fading Contrast with Curves” in Chapter 3 and “Levels Correction for Color” and “Curves Correction for Color” in Chapter 4.
6. Make any necessary general damage corrections, such as eliminating dust from scans, fixing cracks and holes in scanned images, and reducing digital noise. See “Do Minor Cleanup First” in Chapter 3 and “Minor Cleanup for Color Images” in Chapter 4.
7. Make more involved color correction. This means do more intensive tonal and color adjustments, but not spot adjustments (using selection). Those corrections will come later. See “Snapping and Fading Contrast with Curves” in Chapter 3 and “Curves Correction for Color” in Chapter 4.
8. Crop and size the image so that you are working with only the image area you really need. See “Cropping as a Tool for Composition” in Chapter 6.
9. Make major specific compositional changes and corrections, including replacing parts of the image with replacement parts you have created. This is the final compositional change. See Chapter 6 and 7.
10. Make targeted color and tonal correction to selected parts of the image. This is really using techniques you’ve learned throughout to select and mask changes to specific areas of an image. You’ll revisit techniques from all chapters 1 through 7 to finish this step. Chapter 5 might hold the most to mine in this step.

11. Make final fine-tuning adjustments to sharpening, contrast, and brightness.
12. Save the layered RGB version of the image. Be sure to give the file a new name, so you do not replace the original.

Purposing

13. Simplify the image as appropriate. This process may include flattening the image or merging layers, altering the color mode, or removing extraneous image information.

Don't delete or merge shape layers that may be important to your output.

14. Make final color and tonal adjustments to optimize the image for output and use. This process can include such changes as setting white and black points and making device-specific color changes.
15. Save the image in output file format.
16. Package the image for output and use.

This checklist may seem involved, but some things you will do naturally and others take just a moment. Practicing correction by following the steps in the list can ensure that nothing gets left behind in making adjustments and corrections and achieving what you intended to do with the image. The tools to use in each of these steps are discussed in the next section.

The Tools You'll Need

In each step of the image editing process, you can usually use a small subset of tools to accomplish your goals. Having these smaller sets in mind will streamline your image processing and keep you on target.



The tool sets listed in Table 1.1 are based on the steps described in the preceding section. These tools are mostly standard ones you already have in Photoshop Elements, along with some of the add-ins you will find on this book's companion CD. These "Hidden Power Tools" can simplify processes or add new functionality to Photoshop Elements.

You may occasionally reach outside these suggested tool sets for a special purpose, but this listing offers a general guideline to simplifying the tools needed to get excellent and consistent results. The choices are based not on which tool is easiest to use, but on which will get the best results.

PROCESS STEP	TOOLS	USE THIS TOOL TO DO WHAT?	LOCATION
1: Store the original image	Save As	Save your image with a specific name and location.	File → Save As
2: Calibrate the monitor	Adobe Gamma	Do free, easy monitor calibration and ICC profile generation in one process.	Your computer's Control Panel, or the Photoshop Elements CD
3: Specify resolution and color settings	New	Set the color, size, and resolution to use for new images.	File → New
	Image Size	Change the size and resolution of an open image.	Image → Resize → Image Size
	Mode	Change the image color mode of an open image.	Image → Mode submenu
4: Evaluate the image	Eyedropper	Sample to check color and tone values in specific image areas.	Eyedropper tool in the toolbox
	Info palette	Display sampled readouts.	Window → Info
	Histograms	View a chart and statistics showing tonal mapping of the image.	Image → Histograms
5: Make general color and tonal corrections	Levels	Adjust tonal levels using simple sliders to effect tonal dynamic range.	Enhance → Adjust Brightness/Contrast → Levels
	Reduce Color Noise	Reduce color noise associated with digital capture	Hidden Power Tools
6: Make general damage corrections	Clone Stamp	Make brush-style corrections via sampling of other image areas.	Clone Stamp tool in the toolbox
	Masking	Customize selections using masking	Hidden Power Tools
	Copy	Copy the selected image area to the clipboard.	Edit → Copy
	Paste	Paste a copied area from the clipboard into a new layer.	Edit → Paste
7: Make advanced color corrections	Separations (Luminosity/Color and RGB)	Split color into tonal components to simplify and target adjustments.	Hidden Power Tools
	Curves	Adjust tone and contrast with sophisticated, multi-reference point corrections.	Hidden Power Tools
	Hue/Saturation	Adjust color by altering hue, increasing/decreasing saturation and effecting general lightness and darkness using slider controls.	Layer → New Adjustment Layer → Hue Saturation
	Color Balance	Adjust color by balancing the influence of color opposites.	Hidden Power Tools
8: Crop and size the image	Crop tool	Change the image size by cropping out or adding extra canvas area.	Crop tool in the toolbox
9: Make specific compositional changes	Marquee and Polygonal Lasso	Select regular and irregularly shaped image objects.	Polygonal Lasso tool in the toolbox
	Masking	Customize the transparency of replacement parts and grayscale control of selection.	Hidden Power Tools
	Copy	Copy a selected image area to the clipboard.	Edit → Copy
	Paste	Paste a copied area from the clipboard into a new layer.	Edit → Paste

Table 1.1

Tool Sets*Continues*

Continued

Table 1.1	PROCESS STEP	TOOLS	USE THIS TOOL TO DO WHAT?	LOCATION
Tool Sets	9: Make specific compositional changes	Transform	Reshape a pasted object.	Image → Transform submenu
		Guides	Place non-printing edges for alignment.	Hidden Power Tools
		Add Noise	Roughen up tones that are unnaturally smooth.	Filter → Noise → Add Noise
		Gaussian Blur	Smooth out tones that are unnaturally rough.	Filter → Blur → Gaussian Blur
	10: Make targeted color and tonal corrections	History Brush	Paint in adjustments from filtered results, such as to target Dodge and Burn.	Hidden Power Tools
		Gradient Map	Influence specific tones and colors using gradients.	Layer → New Adjustment Layer → Gradient Map
		Blend Mask	Influence specific tones and colors using tone and color measurement.	Hidden Power Tools
	11: Make final fine-tuning adjustments	Unsharp Masking	Work with both local and fine contrast in the image to improve edge definition and contrast in color and tone.	Filter → Sharpen → Unsharp Mask
	12: Save the image	Save As	Save with a new filename.	File → Save As
	13: Simplify as appropriate	Merge	Remove extra layers and image content when there are vector layers to preserve.	Layers → Merge Linked, Layers → Merge Visible, Layers → Merge Down
		Flatten	Remove extra layers and image content when there are no vector layers to preserve.	Layers → Flatten Image
		Type To Paths	Globalize type by converting to vector layers.	Hidden Power Tools
		Mode	Convert to final color space.	Image → Mode submenu
	14: Optimize the image for final output and use	Levels	Adjust tone.	Enhance → Adjust Brightness/Contrast → Levels
		Blend Mask	Adjust white point.	Hidden Power Tools
		Separations (CMYK and Duotone)	Create separations for print ready files.	Hidden Power Tools
		Save As	Save with a new filename.	File → Save As
	15: Save in output file format	Save For Web	Save Web images with limited color and transparency.	File → Save For Web
		DCS Templates	Use custom files to allow unsupported color modes (CMYK and spot color).	Hidden Power Tools

These tools will all be explored in this book as part of the exercises in making image corrections. This listing cuts out many tools, most of which provide redundant (and sometimes inferior) means of completing tasks. If you follow the methods described here you will find that tools other than those on this list are seldom necessary. Several other minor tools (not specifically mentioned) may sneak in at points during the exercises, but are mostly covered in the categories in the list.

One tool that does not fit into any category, but is very useful, is the History palette, shown in Figure 1.1. When doing serious correction and experimentation, it should become a good friend. When you have taken several steps that have not accomplished what you hoped, or you want to compare before and after changes, a single click on the History palette can step you back to an earlier point in the development of the image so you don't have to start all over again. It's a real timesaver and a helpful tool.

Basic Concepts of Tone, Contrast, and Color

Without light, there would be no images. Light is what shapes the subject of images. It strikes an object that you are photographing, reflects back through the camera lens, and creates the exposure for the image. It also helps shape the object, because shadows and highlights reveal object contour. The subtle interplay of tones and contrast gives shape to objects and defines the subject of an image.

Tonal range is the difference between the lightest and darkest image areas. The greater the difference is between the lightest and darkest areas of an image, the greater the tonal range. The way light and dark tones play against one another is *contrast*. The more stark the difference is between light and dark image areas, the greater the contrast. If tonal range and contrast are not balanced correctly, an image will appear too light, too dark, too flat, or too harsh and contrasty, as illustrated in Figure 1.2.

Creating a dynamic image starts with making the most of the tonal range that exists in the image. Contrast (or lack of contrast) between tones within that range helps further define image character. Not every image will have high contrast and a broad tonal range. Some images may be naturally high-key (light, usually with moderate to low contrast), low-key (dark, usually with moderate to low contrast), or simply low contrast. The goal of correction is to maintain the natural character of an image while adjusting tone and contrast to enhance and improve dynamics. If there are 255 possible grays for your image, and you only use 100 of those, the image is really only 40% as dynamic as it might be. If you adjust the tonal range, the image will become more visually dynamic; if you adjust with care, you won't lose the natural quality of the image.

Both tone and contrast work in almost the same way when dealing with color or black-and-white images: You want to make the most of tonal range and dynamics while maintaining image character. The difference is, when you extend the tonal range in a black-and-white image, you get more potential grays; when you make similar adjustments in color images, you get more colors.

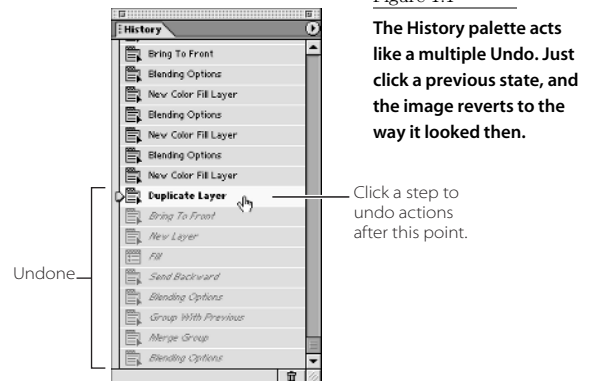


Figure 1.2

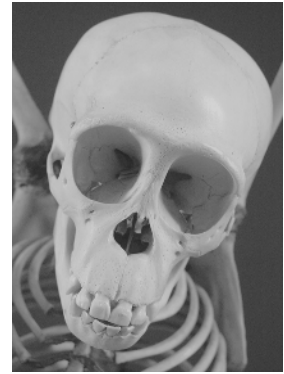
One image can look many different ways, but the best way usually uses full range and flattering contrast.



Too light



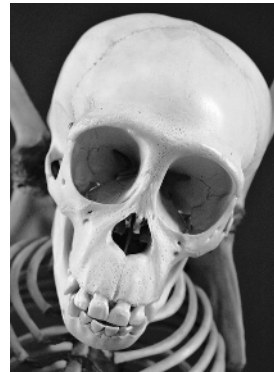
Too dark



Too flat



Too harsh



Balanced

Color as Tone

Color is a pretty simple thing to manage if you're only picking out clothes, drapes, or upholstery. In those cases it is already mixed and applied for you. If you don't have experience with color mixing, it isn't until the first time you actually try to correct the color of an image that the complexity of color comes alive. If you've never had any training in art and color theory, understanding how color works can be a little confusing. Add to that the fact that there are different color modes (theoretical ways of defining color) and color gets still more complex. However complex, you have to understand color to apply it and achieve the results you want in your images. Because color can be split into simple grayscale components, it is important to understand how grayscale (tone and contrast) can also define color.

For the most part, images that you will work with in color will be in RGB mode. RGB stands for red, green, and blue. It is an additive light-based color theory, where different

combinations and intensities of red, green, and blue lights combine to make up the set of available colors. As the red, green, or blue lights are made brighter and applied with more intensity, the resulting color gets brighter, and colors mix in these varying intensities to form other colors. It is a theory that works great with projection, like on your monitor and some projection TVs and the like. Breaking images into their component RGB colors is how your monitor displays color.

Each color you see in an image is made up of these three colors in different combinations. Each of the three colors has just 256 different intensities, which are stored as grayscale information in your image files. Light coming into a camera or sensed by a scanner is actually broken into these three components and stored so the information can be reassembled to reproduce the RGB image on your computer. The theory and practice have been around for quite a while.

One of the earliest photographers to create color images did it in Russia in the early 1900s. Sergei Mikhailovich Prokudin-Gorskii (1863–1944) made glass plates three at a time when he took pictures with a specially designed camera, filtering for the red, green, and blue components of light to record the strength (tone) of each component on what was essentially grayscale film. The plates would record the captured light as grayscale, and then using a special projector, Prokudin-Gorskii would project the images simultaneously with red, green, and blue filters to reproduce the color images on a screen. Figure 1.3 shows one of Prokudin-Gorskii's images; a composited version of this image is also presented in this book's color section. (These plates are from the collection at the U.S. Library of Congress, which can be accessed at <http://lcweb2.loc.gov/pp/prokquery.html>.)

Inside each of your RGB images are the primary source colors: red, green, and blue. These source colors are stored as grayscale representations and mappings of the intensity of red, green, and blue light in every pixel in your image. When you work on color images, the changes that you make affect all three of the source colors at the same time.

Figure 1.3

This image by Prokudin-Gorskii, titled *Man in Uniform, Seated on Chair, Outside*, was taken around 1910 by separating color into grayscale RGB plates. Scans of the glass plates can be composited to achieve a full-color result (as shown in this book's color section).



Red



Green



Blue



Composite

The full version of Photoshop has a palette called Channels, which is another palette like Layers that allows you to get into colors and manipulate them separately (in RGB as well as other color modes). This can be a great tool in making complex color corrections. Although Photoshop Elements doesn't have a Channels palette, this book will show you how to access and alter channel information easily, just as if you had a Channels palette working for you.

Breaking down color information into separations may not always be to your advantage when making corrections. However, the grayscale color components can be separated out of your images, as Prokudin-Gorskii did in creating his plates, by filtering. When they are separate, they can be adjusted one at a time. This can help when correcting color-specific defects, in simplifying an approach to images and corrections, in developing a better understanding of what happens when you apply a tool to color images, and in doing the most complex color alterations and corrections.

Types of Color

Color in your images can be measured in several different ways. In Photoshop Elements, these are *color modes*, which are really just different ways of depicting color and tone. The four modes you can use are Bitmap, Grayscale, Indexed Color, and RGB. Image color mode and file type are two very different things. Knowing which color modes appear in which file types (and which file types to use with a certain color mode) is often essential.

For the most part, people using Photoshop Elements will be working with color images in RGB mode. This mode offers the broadest flexibility for color and tone, and will be the mode most images will originate in (from a camera or by scanning). There are 16 million potential colors in RGB, based on 256 possible tonal variations in each of the three primary colors ($256 \times 256 \times 256 = 16,777,216$ possible variations). That's one big box of Crayolas! In fact, it is by far the largest color set of any of the color modes you will be working with in Elements. A larger number of colors allows changes that you make to images to blend more evenly.

Generally you will work in RGB for the best access to tools and the most predictable behavior of images. When the image is complete (e.g., all changes you are going to make have been made), then you can consider converting the RGB image to other modes as required for your final purpose. You can save RGB files in many formats, but you will probably most often use TIFF (print), Photoshop (archive), JPEG (Web), and PDF (portability).

Indexed Color is a much more limited color mode than RGB and is almost always associated with GIF Web images. This color set has a maximum of 256 colors. The colors are created as a table using hex values: six-character codes that represent specific colors (see the hex code chart in the Hidden Power tables in the Appendix). The colors cannot be mixed, and must be one or another of the colors in the table. The goal of limiting colors, especially in the case of Web images, is to simplify files and make them smaller. In the case of Web images, this helps transfer them more quickly.

Without any experience in converting to Indexed Color from RGB, it may be obvious that converting all of your 16 million potential colors from RGB into a measly set of 256 colors for Indexed Color may not always produce the best results. In converting to Indexed Color from RGB, almost all of your original color will have to change. Of course, the results can be disastrous to a full-color image. However, there are color tricks (such as dithering) that can make color sets appear larger than they really are. Because color is applied rather than mixed, Indexed Color is a difficult color mode to work in. This color mode will almost always be a last step conversion, and almost always will be done in converting images for display on the Web (when JPEG is not used). They are almost always saved in GIF format.

Grayscale (Figure 1.4) is also limited, but to no color at all. This “color” mode has 256 levels of gray tones that make up all you see in standard black-and-white images, or when working with individual color channels (such as those from RGB images). Generally you should convert images to grayscale when you are printing images without color, so that you can get the best depiction of tone (without depending on the color device to convert color for you). Taking the color out of an image can be simple, but it can also be considered an art, because what looks good in color may not look good at all in a straight conversion to black-and-white. Grayscale images are most often used in black-and-white print jobs.

Bitmap images are like grayscale, but are more strictly formed in black-and-white. There are no grays in a bitmap image: pixels are either white (off) or black (on), as illustrated in Figure 1.5. For the most part, bitmap images are used with line art (pen-and-ink type line drawings). This will probably be the least used color mode of those available. If used, you will probably save in TIFF or BMP formats.

These bitmap images are different from the color bitmaps that used in screen shots and other images on a PC.



a



b



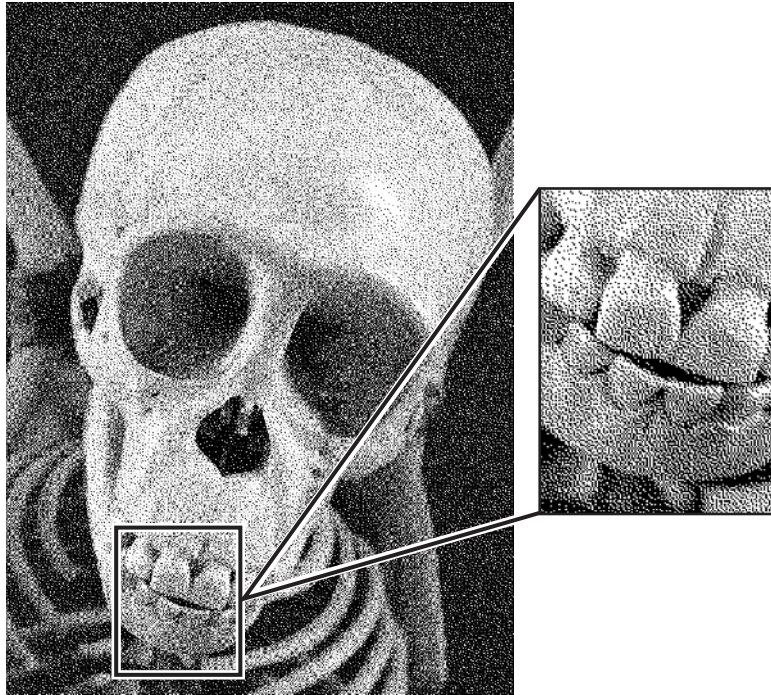
c

Figure 1.4

Grayscale gradients showing white to black gradients in (a) 10 steps (10% darker in each), (b) 25 steps (10 levels darker in each) and (c) 255 steps (every level of gray).

Figure 1.5

The magnification of a portion of the original bitmap image reveals the bitmap patterning.



CMYK color mode is not really available to Elements users. It is how color is most often depicted in print. The theory is similar to RGB in that a limited set of colors (cyan, magenta, yellow, and black) are used as inks to create visible color. CMYK at the same time is perceptually the opposite of RGB. While RGB is based on additive color (the more you add, the brighter it gets), CMYK is subtractive (the more ink you add, the darker it gets, because the light striking the color is absorbed). Figure 1.6 shows how two ink halftones combine for a darker result.

Conversion from RGB to CMYK is often a disappointing one, because CMYK can actually portray fewer colors even though there is one more color in the set. The reason for this is probably easiest to understand by simply looking at efficiency. While light is pretty much 100% efficient when projected, the absorption of light by ink pigments is not. Because pigments do not provide perfect light absorption, the color they reflect is not a perfect conversion. Black was added to the CMY color set as an attempt to increase the efficiency of absorption. As an additive, it really produces only redundant color (color that should have been reproducible in a 100% efficient CMY pigment set).

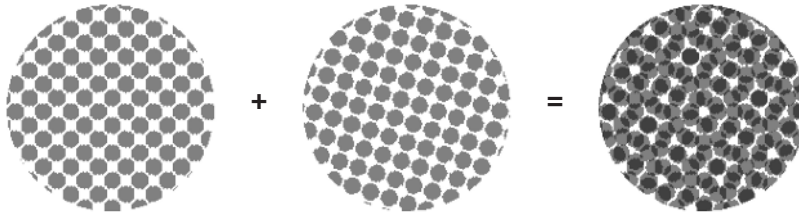


Figure 1.6

Samples of black (45°, left image) and cyan (108°, middle image) halftone dots as grayscale. When the halftone dots are printed over one another (right), colors combine to absorb more light.

There is a supposition that you cannot work with CMYK images in Elements, but this is not entirely true. While the program is not set up to handle CMYK directly, an indirect approach can allow users to make custom CMYK separations and usable CMYK images which may improve printed output. The file format used with CMYK is often TIFF, PDF, or Photoshop EPS. Regretfully none of these will work, directly. However, users can essentially hijack another file format (DCS: Desktop Color Separation) that will allow saving and manipulating files as CMYK.

Some users wonder—and even worry—about using 16-bit mode for image editing. 16-bit images offer more color detail: where 8-bit can reproduce “only” 16 million colors per pixel, 16-bit can reproduce about 281 trillion. While this difference between 16-bit and 8-bit may be significant for archival purposes, for most cases in the real world, it should not make a noticeable difference in your images. Most output devices can’t handle the additional image information, and it is questionable whether technology will meet the 16-bit challenge in the near future, or if human perception can really distinguish between the results. Elements does not support using 16-bit color. The only real gain you would have is in temporarily extending the usable color space for your images while you work on them.

Understanding and Using Color Management

A buzz phrase in image correction is *color management*. If you are not familiar with this term, or if you have heard of it and are embarrassed that you don’t know quite what it is, this section will cover all you really need to know. While it is something you should take seriously, it does not have to be as complex or mysterious as it tends to be. This brief discussion will help you get familiar with it, poke it with a stick, and see that it is dangerous if completely ignored. We’ll look at your options, get you set up, and get on with the main course of editing images as we pass color management by with a better understanding and a knowing grin.

Color management is supposed to be a means of helping you get better color consistently. By using color management you can have a better chance of your images looking the same from a variety of outputs (print and display). Color management uses a profile that describes how your display handles color to help translate what you see to other devices and how they handle color (via a common color palette and profiles of those other devices). The profile from your monitor can be embedded (saved) with your image file to act as the color interpreter for other devices (monitors and printers).

Every device has its own profile, which acts as the interpreter on its end, essentially so the devices can speak the same color language and adjust for differences. The key to full color management is that every device has to have a profile to be able to interpret other profiles, so the translation will work reliably. The embedded profile will affect images behind the scenes, both to help represent color correctly on screen and to serve as a translator to other devices. In theory, that results in a better image. All this automatic translation sounds very appealing, like I'm serving the chocolate cake first.

This is all nice in theory, but the sad fact is, it doesn't necessarily work in practice. There are a lot of points in image processing where detours or errors can occur. Your profile can get dropped, changed, or ignored, or it can just plain be wrong. Profiling can occur where you don't expect it, and other profiles can be wrong, causing information in your image to be misinterpreted. Any of these can cause unexpected results.

First, you are responsible for building yourself a color profile. You have to set up the profile correctly, and there is no guarantee that you will (even if you follow instructions). Second, every step between saving your image and sending it to the printer has to both respect the color management and process it correctly. This is where the chocolate cake turns to mud pie.

While profiling was planned to function behind the scenes and stay with your image, you can't be sure that the results you get are based on the choices you have made to embed your monitor profile in the image. You also can't be sure that you really want the process to respect your profile (if it is not correct). Embedding a profile doesn't work consistently because it can't be enforced: even if you embed a profile, some device or person along the way can drop your settings. There are devices that don't recognize color management settings; there are services that don't use them in processing. If your results depend on the color management and the wrong color profile is embedded or the profile is missing, you are just as likely—or more likely—to get a bad result than you are without embedding color profiles.

Your only chance for guaranteed success using embedded color profiles is to make a study of how the profiles work, and become intimately knowledgeable about the output types and processes you use. Reading your printer manual is not necessarily intimate knowledge, it goes somewhat deeper than that.

Even with this additional effort, using color management and embedding profiles requires testing. Funny thing is, you have another choice: *not* embedding profiles. Not embedding profiles also requires testing, but it removes the potential complexity of using embedded profiles. In the long run, if you set your system up correctly by calibrating your monitor and creating an ICC profile (which you should do even if you are not embedding profiles in your images), not embedding profiles can actually be more predictable. I find embedding profiles to be an extra half-step that can just as likely trip you up as ease your progress up the stairs—depending on how much you are paying attention. My experience is that you are more likely to trip over that half-step and swear at it than praise it.

None of this is to say that you can't embed profiles with success! You can, and if you do currently, don't change what you do. My perspective on using or not using profiles is a lot like my perspective on images: don't change what works, change what doesn't. If you currently use embedded profiles and everything works fine, stay with it. If you don't, or you have never looked at them, or you don't understand what they are and how to use them, practice color management with the following fast, safe, and effective system:

1. Calibrate your monitor and create a profile (we'll do this in a moment).
2. Don't embed profiles.

To be reasonably successful with color management, all the Photoshop Elements user needs to do is to calibrate, create a monitor profile (which Elements uses for image viewing), and choose how to handle profiles by making a selection in Color Settings. We'll discuss these procedures in the next few sections.

What You See Should Be What You Get

One problem with trusting your visual sense is that it assumes that what you see on screen is the right thing. Regrettably, that is not probable without calibration. All monitors are different, and the settings for display and color will affect what you see. If you haven't calibrated, colors on your screen might look different from colors on someone else's—and worse, they might not match the color that gets printed.

If you are looking at a screen that is shifted green and you depend on the color to be accurate, you will tone down the greens when looking at the screen to make the image look right. This will cause output of any kind to be shifted toward reds. Calibration will help compensate for shifts by flattening the response of your screen.

The goal of calibration is simple: you want to be able to trust what you see on your monitor, within reason. If you can trust what you see, you can mostly use your visual sense to correct your images.

I say “mostly” because even if you've calibrated your monitor, you have merely adjusted it for best performance. You are going to get the most out of your monitor, but the monitor

itself may have some limitations. While you probably won't reach perfection, calibrating your monitor gives you a far better chance of at least coming close. With some selective checking, you should be able to feel confident in what you'll get as a result.

Calibrating Your Monitor and Building an ICC Profile

Here I'll show you how to use Adobe Gamma, a utility that comes with Photoshop Elements, to calibrate your monitor. Before you begin, you should know several things about the response and performance of your monitor, including the manufacturer-suggested color temperature, gamma, and phosphor settings. *Color temperature* reflects the monitor display color for the *white point*, which really measures the color of white on your monitor. It is usually 5000, 6500, 7500, or 9300 degrees on the Kelvin scale. It is a characteristic of your display and can subtly affect the appearance of color on screen.

Gamma is a measure of tonal response, often a number with two decimal places between 1 and 3. *Phosphors* are a set of six numbers with *x* and *y* coordinates for red, green, and blue; these numbers can be up to three decimal places. These settings vary between monitor brands and models, so don't make assumptions about them or copy someone else's. Find the settings in your manual or contact the manufacturer (via the website or technical support).

Monitor manufacturers don't always put monitor specs for phosphors, white point, and gamma in the manuals. When you obtain the information, write it down. I usually write the settings right on the cover of the monitor manual for easy reference.

Your monitor should be in an area that will minimize glare, and lighting (except where noted during the calibration) should be as you will have it when you are most frequently using the computer and monitor. Lighting should generally be subdued and indirect if possible. Changes in lighting will require recalibrating the monitor. The monitor can be calibrated to different light conditions, but it is easier to maintain a consistent room lighting than to add it as a variable in color corrections. Extremely bright or overly dark rooms might cause some problems with calibrations and monitor viewing. Optimally, room lighting should be bright enough that you can read and view materials that are not on the screen, yet not so bright that it causes glare or washes out the display. After creating your profile, be sure the lighting where you work remains the same as when you calibrated the monitor.

Before you begin, you should also locate the monitor's brightness, contrast, and color controls. If your monitor has an option to reset to factory settings, do it now.

1. Turn on your monitor and system, and let the monitor warm up for at least 30 minutes.

Calibration will be slightly different in every operating system and OS version, though the screens will be similar. For example, in Mac OS X, you should use the Display Calibration Assistant. I'll walk you through the Mac OS 9 version, and you can adapt this to your computer.

2. If you haven't done it yet, read the owner's manual for the monitor to see if it provides suggestions for calibration.
3. Open Adobe Gamma by double-clicking the icon in the Control Panel folder. You should see the screen illustrated in Figure 1.7. If Adobe Gamma is not in the Control Panel folder, find it on the Photoshop Elements CD.
4. Click Step By Step. This will lead you through the process of calibrating and creating an ICC profile for your monitor. Click the Next button.
5. In the Description field, type a name for the profile you will be creating (Figure 1.8). You can enter a lot of information here, but it's best to keep it short. I find it handy to name the monitor and add the date, so the profiles are easy to identify. If you use output white point settings (Step 12), you may also want to include this value in the name. Click the Next button.
6. Using the monitor controls, set the contrast all the way up and then adjust brightness until the smaller gray box in the center is dark enough that it is just barely discernable from the larger black box surrounding it (see Figure 1.9). If you notice the white frame beginning to darken at any point, stop darkening the screen. If necessary, adjust the brightness lighter a bit until the frame is bright white again. As you fine-tune this adjustment, it may help to squint or use your peripheral vision to get the center square as dark as possible without losing the brightness of the white frame. When you are satisfied with the adjustments, click the Next button.



Figure 1.7

The initial Adobe Gamma screen



Figure 1.8

Type the profile name in the Description field.

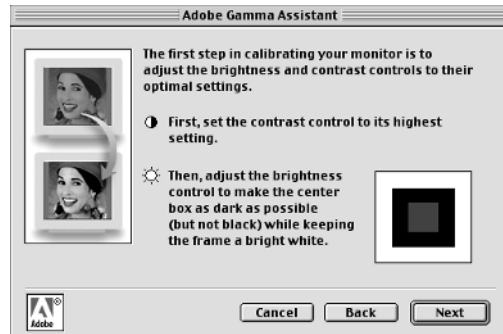


Figure 1.9

Concentric squares help the user adjust the screen contrast by observation while making adjustments to the physical monitor settings.

- On the screen that appears, select Custom to open the Custom Phosphors screen shown in Figure 1.10.
- Type the six values obtained from the manufacturer of your monitor in the appropriate fields. You don't really have to know what each number means, but you do have to place each one correctly. Click the OK button to close the Custom Phosphors screen and accept the changes. This returns you to the Adobe Gamma Assistant dialog box.
- Click the Next button. The screen that appears (Figure 1.11) allows you to adjust gamma. Check the View Single Gamma Only check box. Using the slider, adjust the appearance of the outer square (the alternating lines of black and white) so that it matches the tone of the 50% black center. Adjust the appearance by squinting at the screen (to blur the box slightly in your vision) while moving the slider. The goal is for the entire square to seem to have a uniform tone.

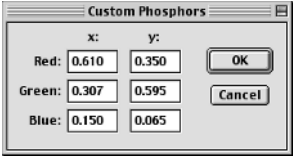


Figure 1.10
Phosphor values describe the monitor's response to color.

If you change monitors, you will obviously have to build a new profile. Other less-obvious reasons to build a new profile are: monitor aging and changes in response due to use, replacing your system hard drive, and changing room lighting (or computer placement).

- In the Gamma field, type the Gamma value you got from the manufacturer. You will be able to enter a two-decimal value, but Adobe Gamma will round the value off when you save the entry.



Figure 1.11
Sliders help you visually adjust for the monitor gamma.

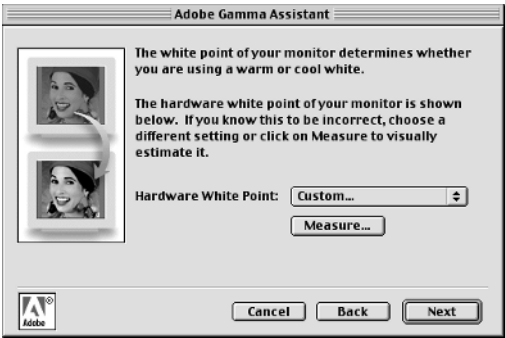


Figure 1.12
White point is a measure of the "color" of the brightest parts of your monitor, measured in degrees Kelvin.

11. Click the Next button. The screen that appears (shown in Figure 1.12) allows adjustment of the monitor's white point. Set the monitor's white point by choosing the value in the drop-down list that corresponds with the number you got from the manufacturer. (If you do not know what value to choose, see the following note.)

A second option on this screen allows you to measure the white point. To do this, dim (or turn off) the lighting in your work area and click the Measure button. A set of three gray squares will appear on a black background. Click the square that seems most flatly gray and repeat until the test closes.

12. Click the Next button. The screen that appears (Figure 1.13) will allow you to select a white point for output. This selection should be based on the color temperature of the intended output media. If you are unsure, or you are creating images for the Web, use the Same As Hardware setting.
13. Click the Next button. The next screen (Figure 1.14) allows you to compare calibration before and after the adjustments you made in the previous steps. Click to toggle the Before and After buttons several times, comparing the appearance of your screen as you toggle back and forth. Specifically, note the grays in the dialog box and see whether the color appears more neutral before or after adjustment. The more neutral (lacking any color, and looking flat gray), the better the calibration.
14. If the before and after results are noticeably different, run through the process again (Steps 3 to 13).
15. Click the Finish button to accept the changes.

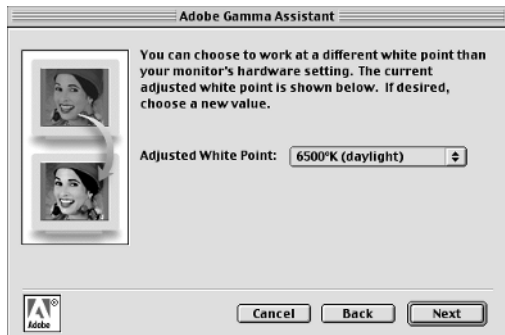


Figure 1.13

Output white point differs from monitor white point. This setting should reflect the color temperature of your output. This may be another monitor, paper, or a projection screen.

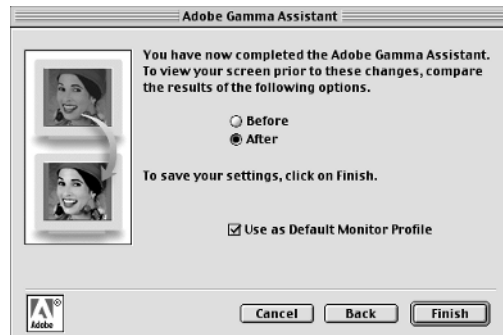


Figure 1.14

Compare the Before and After settings by toggling the radio buttons.

I never calibrate one time and sit back satisfied—even when using a calibration device. I run through the process a few times.

What you have just done is calibrated your monitor and created an ICC profile for it. The calibration helps you to be sure the image information you see on screen is reasonably accurate. The ICC profile is a description of your color space and other data that helps describe how color appears on your system. This information can be used if you embed profiles in your images, to help describe color in your image to other ICC-aware devices.

Although Adobe Gamma is an adequate tool for visual calibration, calibration devices (see the example in Figure 1.15) can measure more accurately than your eye, and will probably measure a greater number of gray levels and create more accurate profiling. The devices take measurements directly from your screen, and create a profile based on those measurements. Using such a device can ensure that your monitor is calibrated properly, and it may actually save some time during calibrations.

Figure 1.15

A calibration device attached to a monitor



Color Preferences

Most Preferences settings in Photoshop Elements are just a matter of personal preference, and they can be changed at any time as you see fit. However, the one you will be required to make a choice about is Color Settings. This is where you can define how Elements handles images with profiles that you open, what color space you want to work in, and whether profiles get embedded in your images by default. The choice you make can be important to your results, and will certainly effect how you work with images.

The Color Settings choices will make themselves known immediately when you first open the program after installing. The dialog box pops up before you do anything. If you have already dismissed this (or want to change preferences after reading this), you can revisit the setting by opening the Color Settings dialog box (Edit → Color Settings), which is shown in Figure 1.16. The three choices seem straightforward enough, but they really don't tell you what they do, and the Help isn't much help.

You actually have more than the three options that appear here. If you want to experiment a little, you can open an image using one Color Settings option and close it using another. Changing Color Settings will enforce different rules and create different results. Here are descriptions and some important background information for each choice:

No Color Management This choice ignores any existing profile in an image if one is present when you open it. On saving, Photoshop Elements will not embed a profile with your image. The option to embed a profile is available by choosing Save As from the File menu; to embed a profile, you simply check the Embed Color Profile checkbox. The profile embedded will be based on the ICC profile you created for your monitor. If you change the Color Settings while an image is open, changing to Limited Color Management will offer the option to embed the sRGB profile if using Save As, but will not embed a profile otherwise. Changing to Full Color Management will save a profile fitting to the current color mode (these options are outlined in the following description for Full Color Management).

Limited Color Management Selecting this option will convert to the current profile any profile that exists in an image you are opening. The resulting profile for the image will use the sRGB color space. On Save, no profile will be embedded. The option to embed is available using Save As, and the sRGB profile will be embedded if you choose this option. If you change color management settings while the image is open, changing to No Color Management will allow you the option of saving by manually embedding the profile you created. Changing to Full Color Management will save the image with a profile fitting to the color mode (these options are outlined in the following description for Full Color Management).

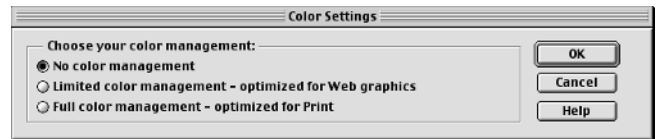


Figure 1.16

Do most users understand their options here?

Full Color Management Retains a color profile if it is present in an opened image. On Save, the original profile will be retained with the image. The option to disable embedding the profile can be found in the Save As dialog box. Opening a new image (an image with no existing profile) will cause Photoshop Elements to make a decision for the profiling to be retained with the image based on the color mode. These choices are the same when changing Color Settings while an image is open:

- RGB will have the Adobe RGB (1998) profile.
- Indexed Color will have the Adobe RGB (1998) profile.
- Grayscale will have a Dot Gain 20% profile.
- Bitmaps will have no profile.

Notice that if you want to ignore, convert, or retain a profile *and* embed your own (sRGB or Adobe RGB), you can do that by manipulating the Color Settings before and after the image is opened. This may be a pain, and it is something you probably won't do very often, but it can come in handy when you get a bad profile or an opened file does not convert during opening the way you think it should. Attempting to open the image using different settings might improve the initial result.

Color space definitions will be the relative mystery here. A *color space* is really just a defined color set. Some color sets are larger than others, meaning they can encompass more color. You can know the name of the color space, but that may not tell you a lot about what you are working with. sRGB is a limited RGB color space that assumes some limitations of a common RGB monitor to display all RGB colors. Because of inherent limitations in monitor projection, a larger RGB color space may allow you to record color in your files that your monitor can't display. The drawback to that would be that you may be manipulating color that you can't actually see. All this really means is that there are fewer colors in the sRGB color space than in a full-gamut RGB, and that the images you make in sRGB color space are more likely to be compatible with other monitors.

Adobe RGB (1998) is a larger-gamut RGB color space than sRGB. Because it allows a larger number of colors than sRGB, Adobe suggests that it may be a better choice for working with images that are intended for print.

Your ICC profile (you'll see it as the Embed Color Profile choice in the Save As screen when you are using No Color Management) is a custom profile based on the calibration and choices you made while using Adobe Gamma.

You can choose whether to manage color and how to do it. However, the level of complexity and unknowns in working with images seems to rise quite a bit if you choose to embed profiles. Personally, I work with color management off until I get an image that seems to have a profile embedded. In that case, I might try to open the file using different Color Settings to

see if I get a better-looking conversion. Otherwise, I stick to the things I normally do because I can depend on them to get consistent results. I never embed a profile (although I might if I were ever to develop a closed workflow where outputs, services, processes, and personnel remained the same).

Resolution

Put as simply as possible, resolution is a measure of potential detail in your images. High resolution suggests that there will be intricate detail; low resolution suggests that detail may be compromised. It would seem, if this description holds, that you would always want high resolution if you consider detail important. But that's not always the case. What you really want is the *correct* resolution, and this depends not only on what size you want the result to be but also on what medium you will be using. Output and display can use image resolution in different ways, so the result doesn't depend only on what the resolution of the image is; it depends on how much there is as well as how it is used.

In print, if you don't have enough resolution to meet the needs of the output, images won't look as sharp as they could; if you have too much, file sizes are unnecessarily large and processing will take longer than it needs to. On the Web, images without enough resolution will be too small; those with too much will be too large. This rule also carries over into other display-based technologies such as film recorders, which makes high-resolution images on film from digital files. You can't really just guess how much image information you need; you have to know the amount you really need and work within those parameters. Understanding what resolution is and how it is used is the only way to use it correctly.

While dpi is really an output term, it's often used casually as a universal term for resolution (spi, ppi, dpi, and even lpi). It can be confusing if you randomly throw out acronyms (abbreviations) when you really mean something specific, but it can also be confusing to use the proper terms consistently. To simplify with better accuracy, use spi when speaking of capture (scan sampling), ppi when discussing digital files, dpi when considering output resolution, and lpi in the context of halftone dot size.

Spi (Samples Per Inch) Capture resolution. The number of scanning and digital capture samples per inch.

Ppi (Pixels Per Inch) Digital file resolution. The assigned number of digital pixel elements to be used in printing or display of an image.

Dpi (Dots Per Inch) Printer resolution. The number of bitmap dot (smallest printing component) an output can create per inch.

Lpi (Lines Per Inch) A measure of halftone dot size. Halftone dots are made of multiple printer dots. The number of rows of halftone dots per inch.

How Image Resolution Is Measured

Image resolution is usually measured in one of several ways: the number of total pixels (image dimension in pixels), the size of the file (number of bytes, kilobytes, or megabytes), or the amount of information per inch (ppi, or pixels per inch). One way of measuring the file size is not necessarily better or worse than another, as long as you can consistently achieve the desired result—without guesswork.

Measuring image resolution in total pixels or file size is not the most intuitive or useful approach for most people working in Elements. Both of these are usually used to measure source image size, such as with scans or images from digital cameras. While the measures tell the quantity of image information in a file, the parameters don't dictate how the information is used. A 2100×1500 image in total pixels could be a 7×5 inch image at 300 ppi, or a 21×15 inch image at 100 ppi—and it can be used that way simultaneously. The number of pixels used in an image measured as total pixels is essentially arbitrary. An image measured with a file size of 12 MB might be about a third larger in RGB than CMYK. In black-and-white (grayscale), a 12 MB image would be much larger still—about four times the size of a 12 MB CMYK image. The lack of a controlling parameter to lock in the size of the image when using total pixels or file size keeps you from knowing exactly what you have and how the image will be applied if you look at file size alone. File size is probably the least-used measure of resolution, and it only really makes sense in a workflow where color mode is static (e.g., images are only either RGB or CMYK).

Most Elements users will use ppi as a measure of image resolution because it is the most compatible in comparing to output resolutions. This type of measure tells how much of the image pixel information should be applied per inch. Because printer resolution is most often a finite measure (based on the printer's dpi: how many printer dots can be made per inch), using ppi measurement makes it easy to determine the optimal match between digital image information and what the printer will need to produce the best results.

What Image Resolution to Use

Some people generalize and suggest using 300 ppi as a standard resolution for images going to print. For Web images it is usually accepted that images should be 72 ppi. While these are pretty good as general-purpose guidelines, they don't tell the entire story. 300 ppi may be more than is necessary for all home printers, and may actually be too little for demanding output (such as film recorder output). Since monitor resolutions can vary, your 72 ppi image on a 96 dpi screen would actually be about 75% of the intended size. Neither choice is very likely to ruin your output, in most cases.

Because output differs, there is no one universal magic formula to figure out what resolution to use. Each output type has a target range (minimum and maximum), based on its capability to process and use image information. If you know that range, you simply use that

range as a target when working on an image. Know what your service company or printer manufacturer recommends for output on the devices you use. This may require reading the manuals, or giving a call to the service company to find out.

Table 1.2 shows the approximate resolutions you will want to use for your images depending on how you want to use them. An image sent to a device that uses a specified output resolution should have a specific target ppi. The table shows some real-world examples of output resolution and workable ppi ranges. Calculations for the table were based on the formulas shown in the Calculation Used column; square brackets in the calculations indicate the range of values used to determine the lowest and highest resolution acceptable in that media.

MEDIA	OUTPUT RESOLUTION	APPROXIMATE IMAGE FILE RESOLUTION	CALCULATION USED
Web	72–96 dpi (monitor)	72–96 ppi	ppi = dpi
Inkjet (stochastic)	720 dpi	180–234 ppi	[1 to 1.3] × (dpi / 4)
Inkjet (stochastic)	1440 dpi	360–468 ppi	[1 to 1.3] × (dpi / 4)
Halftone, low resolution	75–100 lpi	116–200 ppi	[1.55 to 2] × lpi
Halftone, normal	133–150 lpi	233–350 ppi	[1.55 to 2] × lpi
Halftone, high resolution	175–200 lpi	271–400 ppi	[1.55 to 2] × lpi
Lineart	600–3000 dpi	600–1342 ppi	(dpi/600) ^{1/2} × 600
Film recorder	4K (35mm)	2731 × 4096 pixels	Total pixels
Film recorder	8K (6 × 9)	5461 × 8192 pixels	Total pixels

Table 1.2
Approximate Resolu-
tion for Various Media

Note that these resolutions are suggested and not absolute. Images will still print and display at other resolutions, but the results may not be predictable or efficient. Actual resolution needs may be somewhat flexible based on circumstances, such as paper and equipment used, original image quality, expected results, etc. Be sure to read manufacturer suggestions, and take most of the advice offered by service companies—they should know how to get the best results from their equipment.

Resizing Images

Changing the size of an area that a group of pixels occupies can come in two forms: one causes you to resample an image (using Bicubic, Bilinear, or Nearest Neighbor interpolation), and the other changes the resolution to redistribute pixels over a smaller or larger area. Redistributing pixels does nothing to actually change the content (mathematics) of the image information that is stored; it just suggests that the content will be applied over a different area. Resampling, on the other hand, actually changes the content of your images, and changes it permanently. The larger the amount of resizing (the greater the percentage increase or decrease), the more it affects the image content. One of these two things, redistributing or resampling, has to happen each time you either change the size of the whole image (using Image Size, not Canvas Size) or change the size of a selection by stretching or transforming.

When you upsample or downsample an image or image area and retain the resolution, Photoshop Elements has to interpret and redistribute tonal and color information, either creating (upsample) or removing (downsample) pixels. It does this through interpolation (or decimation), which is really a fancy name for making an educated guess. Resampling an image to make it larger will never fill in information that is not already there, no matter what you do and which plug-in you use. That trick you've seen on TV, where a pixelated image gets clearer and clearer as they zoom in, is reverse engineered. The only thing you can really do to reclaim image detail that you don't already have is reshoot an image or rescan (assuming that the detail is present in what you are scanning). What resampling will do is estimate and average differences between pixels to make a best guess. Details will tend to soften (upsample) or be lost (downsample).

Photoshop Elements has three methods of interpolation—that is, of figuring out how to insert new pixels or remove existing ones as you change an image's size:

Nearest Neighbor Using Nearest Neighbor interpolation, when you resize, Photoshop Elements picks a representative color from the color that is already in the image according to the surrounding color (whether upsample or downsample). There is no averaging to create new colors or tones. It is useful, for example, for controlled upsample of screenshots without blurring.

Bilinear Bilinear interpolation behaves much like Bicubic and is supposed to be faster, but I've never clocked them. During the sampling, new tones and colors can be introduced between existing colors that are not in the original image. This can blur sampling of hard edges, but can provide a smooth transition for tones (Nearest Neighbor might provide a blockier, stepped result). One thing about Bilinear upsampling is that it remains more true to simple averaging between neighboring tones and adds less new qualities to an image than Bicubic (sometimes a good or less good thing). It is useful when you want a straight-forward averaging, which may be useful when downsampling images.

Bicubic The resampling process creates new image information by averaging, like Bilinear, but goes one step further to provide what is perhaps a tiny bit of something like sharpening to the result. This is intended to counteract the blurring result of averaging. It affects change in a greater number of pixels with the same radius setting as Bilinear, but may generally give a better visible result in most cases than Bilinear. It is the real workhorse for sizing images.

While making up information and decimating it sound like bad things, each has their purpose. Usually you should avoid upsampling—especially if the option exists for gaining more detail through a better-targeted source image. However, images can be upsampled with some success, depending on the desired quality—provided the change isn't huge. Upsampling 10% or even 20% may not be noticeable if the source image is sharp. Usually you will

only upsample to make up small gaps (if necessary) between the resolution you have in an image and what you really need, or to adjust borrowed image components.

Downsampling, while certainly damaging and compromising to image content, should be less noticeable in your results. Image information indeed gets averaged or eliminated, but if downsizing is being done for the right reason, any details you lose would have been lost on output or display anyway. Detail loss is inherent in the process of downsizing or outputting images at a smaller size: even if the equipment used could reproduce detail at a smaller size, eventually details will pass the limit of the human eye's ability to discern them.

Multipurpose Images

Making images that you'll use with more than one purpose (e.g., print and Web) can cause a little problem. Optimally, you'd like to work with images so that you target the result. Doing so will ensure that you retain all of the actual image detail rather than relying on interpolation or decimation and your choice for sampling type to produce the right results. It is a simple fact that an image going to print on a high-resolution printer should have more information than one at the same size used on the Web, or you will not optimize detail. Your only solutions in working with dual-purpose images are:

- To create two images with specific purpose, or
- To create one image and resize.

Either of these choices poses a trade-off. In creating two images, you sacrifice valuable time by simply trying to achieve similar results in two images using the best process. In creating one image and resizing, you have to allow either interpolation of new image information or decimation, which may not be the optimal process.

You can't work on small images and resize up, because detail will not be present. It is often self-defeating to work on two images to produce the same results (even using a detailed script) because the difference in size and volume of information in the image will produce different results with the same application of tools.

The best way to go about working with multipurpose images is usually to work with them at the highest resolution, and resize them smaller. Working at the higher of two or more resolutions retains the details for the higher-resolution presentations, and decimates detail that will not be reproducible at lower resolutions.

Your Images and Equipment

There are some miscellaneous aspects of working with digital images that may fall into a gray area. Part of working with images on your computer is learning the nuances of systems and software, and having some idea what you expect to do with an image. You are responsible for knowing your equipment and the purpose of your images.

Know Your Equipment

Because all computers and systems are not alike, it is impossible to cover every nuance of every system in every situation in one book. There are innumerable digital cameras on the market, a plethora of ways to get the images off the cameras, and hundreds of home printers to print the result to. Software configurations and utilities can cause problems while solving others, and compatibilities can be an issue with both hardware and software.

If you have trouble getting the images off your camera, or have trouble with your printer or computer, the place to find answers is in the user manual for these devices and through technical support from manufacturers.

The following is a short checklist of maintenance items you should recognize and understand for your computer, peripherals, and software.

Scanners (and analog film)

- Calibrate your scanner per manufacturer suggestions.
- Maintain a regimen for cleaning the scanner and scanned objects.
- Be sure to use proper connections and connection settings.
- Consider having important images scanned by scanning services, which may have better equipment and resolution than you may have at home (e.g., scan negatives and slides to a Kodak PhotoCD rather than on a home flatbed scanner).

Digital cameras

- Choose appropriate settings per manufacturer recommendations, and don't change settings if you don't know what they do.
- Learn about special features and settings by reading the manual.
- Understand image control and exposure.
- Understand how to format camera storage.
- Know how to properly connect a camera to your computer and download images from the camera.

Printers

- Use appropriate paper and inks as suggested by the manufacturer.
- Read maintenance and cleaning suggestions and follow these practices rigorously.
- Don't expect RGB results from a CMYK printer. CMYK is a smaller color space, meaning there are simply fewer colors available.

Computer software and hardware

- Maintain a firewall if using an open Internet connection.
- Use virus protection software to minimize problems with infected digital files, especially if you trade a lot of files. Never open a file from an outside source (even a known source) if it has not been scanned for viruses.
- Maintain a schedule of maintenance for data backup, disk error scanning, and associated digital maintenance (such as defragmenting).
- Check manufacturer websites regularly for software updates, bug fixes, and compatibility notices.
- Keep a log of program installations to help locate software conflicts.
- Don't jump to conclusions. Note multiple problems in the operation of your system. If you have problems with more than one program or device, there may be a common link to the real cause.
- Simplify your system whenever possible by detaching chronically unused peripherals and uninstalling unnecessary software.

Know Your Image

Some matters involved in repairing and compositing images are not really judgment calls, and some are. One thing no book or manual can tell you is exactly what you want to do with an image. While I can suggest proven ways of getting good results, learning to evaluate an image's composition and deciding what to do to improve it will be a judgment call.

Don't ever say it is good enough if it isn't good enough. Give up on an image only when it is not worth the effort to improve it. There is almost nothing you can't do with an image if you have the desire. You can also correct the same image from now until doomsday, improving it in increments all the time. Sometimes putting an image aside for a day or two can give you a new perspective: when you come back to it, you may see solutions you hadn't previously considered. Solutions won't always jump out at you, and sometimes you'll have to manufacture them. In trying to stretch your limitations, no matter what you are attempting to do to an image, chances are you will learn from each solution you attempt.

The more you work with images, the easier and quicker the manipulations will become.

