

## CHAPTER 1

# Introduction

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- What Counts as Digital Photography?
- What Else Do You Need?
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*“But digital’s not as good as film.”*

For years, if you pulled out a digital camera in the presence of a professional photographer, or even around a hobbyist photographer who had never used a digital camera, you invariably heard that digital was no competition for film. “Sure, that camera’s got a good lens, but film is much higher resolution.”

In the first two editions of this book, I included an entire chapter that discussed how digital output compared to film and what you could expect when making the switch to shooting digital. Those books were written at a time when one had to be a little defensive about shooting digital--when pointing out that a professional-quality print had been shot digitally would still raise eyebrows in amazement. For this third edition, I have very happily thrown that chapter in the trash because digital photography has arrived, once and for all.

*“Is digital as good as film?”* In years past, one would have to give a somewhat complex answer to that question: “Well, you have to consider how good your film processing is, and what kind of scanner you’re using, and how skilled you are with your scanning software,” and on and

on. What's more, the only digital cameras that could rival film quality sold for \$5,000 or higher. Now, for less than \$1,000 you can buy a digital camera that easily delivers images that rival the best 35mm film scans. You can even get under-\$1,000 digital cameras that use the same lenses and provide identical shooting features as professional 35mm cameras. At last, a film-quality SLR costs *less* than a good film camera and high-quality scanner. Once you factor in film and processing costs, digital quickly becomes the cheapest way to get film quality.

But eliminating the hassle and expense of scanning is only the beginning, because the digital photographer has luxuries the film photographer can only dream of: the ability to instantly view images and delete unwanted exposures, and the elimination of the environmental and financial concerns presented by film and film-processing chemicals. Artistically, the digital photographer can take advantage of unique in-camera features such as panoramic shooting, automatic image processing, exposure analysis, and the ability to shoot and shoot and shoot, trying many different settings, framings, and exposures without worrying about wasting film.

Film cameras have changed very little since their inception 150 years ago. Of course, lens, metering, and film technologies have improved tremendously over the last century and a half, but whether state-of-the-art or antique, all film cameras are basically a box that exposes a piece of film to light. By eliminating film, digital photography represents the *first* fundamental change in photographic technology since the mid-1800s. The simple fact that the camera does not record images on film makes digital photography a very different process--both technically and creatively--from traditional film photography.

In this book, we'll explore all of the technical and creative ins-and-outs of shooting digital--from choosing a camera to exposing an image to processing and printing. If you're new to photography, you'll learn the basic theory that photographers have studied for decades, as well as

the latest tools and techniques made possible by the shift to digital. If you're an experienced film photographer, you'll see how you might need to change your photographic process to adapt to digital shooting. From white balancing to exposing, you'll learn how to translate the knowledge you already have into the digital realm.

I have been writing about digital photography since the very first 640 x 480-pixel consumer cameras (Figure 1.1) became available, and wrote several magazine reviews of the first megapixel cameras. (At that time, the theory was that once the 4-megapixel "barrier" was reached, we would have film quality.) Despite watching the changes and advances over the years, it's still astonishing how quickly the technology develops. In the second edition of this book I wrote: "With super-high resolutions of 8 to 10 megapixels, digital camera backs offer alternatives for photographers who already have a medium- or large-format camera body. These options are typically very expensive (\$10,000 to \$25,000)." As of this writing, that was a year and a half ago. You can now buy 8-megapixel cameras from Sony®, Olympus®, Canon®, and Minolta® with an average price of \$800.

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The Kodak® DC40 was one of the first digital cameras to win mass consumer appeal. It had no LCD screen, no removable storage, a "high" resolution mode of 756 x 504 pixels, and an original price in 1996 of \$599. Nowadays, there are hundred-dollar cell phones that take better pictures. Nevertheless, the DC40 served an important role in getting people to recognize the practical advantages of shooting digital.



The rapid advances in technology have brought a lot of changes to the camera information in this new edition of *Complete Digital Photography*. Chapter Five's "Choosing a Digital Camera" has been thoroughly updated with current features and capabilities. It has also been reorganized to better match the organization and landscape of the current market.

However, simply updating camera information is only the beginning. Chapters 2 and 3—"How a Digital Camera Works" and "Basic Photography: A Quick Primer"—have both been rewritten and are, I believe, easier to understand.

As mentioned earlier, previous editions included a chapter that argued digital photography's merits against film. That chapter has been replaced with Chapter 4, an overview of how to evaluate a digital image. Learning to recognize what makes one image look better than another is handy for evaluating a camera when you're ready to buy, and an essential skill when using image-editing software to correct and improve an image.

As in the previous edition, the book's image-editing examples and tutorials are built around Adobe® Photoshop®. Although Photoshop is the premiere image-editing application, there are plenty of other good editors out there, and in Chapter 6, "Building a Workstation," you'll learn how to pick a package that provides the tools typically used by digital photographers. Fortunately, most image-editing programs provide the same basic tools and interfaces, so you should have no trouble adapting the lessons described here to other editing packages. All of the tutorials have been updated for the latest release of Photoshop (Photoshop CS and Photoshop Elements 2 as of this writing). Although most of the screen shots are from the Macintosh® OS® X version of Photoshop, the program's interface is the same whether you use a Macintosh or Windows®-based computer.

In Chapter 7 you'll get started with your camera by learning the basics of shooting. In addition to learning how to configure your camera's settings for particular situations, you'll learn the basic details of framing and focusing as well as simple flash photography. Finally, you'll learn the rudiments of light metering. Like the rest of the chapter, the light metering section has been completely rewritten and is much easier to understand.

Chapter 8 builds on Chapter 7's basic concepts but delves into the creative possibilities provided by your camera's manual exposure features. You'll learn about motion control, depth of field, contrast, and detail, and all of the other imaging choices that are possible when you take control of your camera's manual features. As in Chapter 7, Chapter 8's explanations and examples have been rewritten and are now easier to understand.

Knowing the basics doesn't do you any good if you tend to shoot in unusual environments or like shooting particularly tricky subjects. Chapter 9 helps you with all of the more specialized forms of shooting that you might engage in, from macro photography to black and white. Many new examples are provided, and the chapter has been updated to include the latest advances in gear as well as the newest features and utilities.

Once you've got a camera full of images, you're ready to start editing. Chapter 10 covers everything you need to know to prepare Photoshop's color management system, as well as detailing how to handle all of the initial cropping and resizing that you'll need to do before you can start editing. Both Photoshop CS and Photoshop Elements 2 include brand-new Image Browsers, which make finding and managing images much easier--you'll learn about these new features in this updated chapter.

A digital image editor is capable of extraordinary retouchings and special effects. But 90 percent of the chores you'll perform with your editing

program are color and tone corrections. In Chapter 11, you'll learn about Photoshop's color-correction tools. By the end of the chapter, not only will you know how to perform the bulk of the corrections that you'll need to make, you'll also have a solid foundation for the more advanced correction techniques discussed later in the book. Readers of previous editions will find many new discussions and tutorials in this chapter, as well as several new technique examples.

With basic correction skills under your belt, you're ready to move on to Chapter 12, where you will expand your repertoire with a study of masking, cloning, making complex selections, and some basic layering techniques. Chapter 12 includes many new masking and selecting techniques, as well as several new examples of blending and compositing tricks.

Chapter 13 kicks up your image-editing skills several notches with discussions of many advanced masking techniques, followed by a thorough exploration of workflow. Knowing which order you should perform your editing operations in is essential to maintaining image quality. After introducing an outline of workflow, Chapter 13 details each workflow step. You'll move from initial cleanup and color and tone adjustment, to edits, resizing, and finally sharpening. Chapters 13 and 14 have seen more changes than any other chapters. Here,, you'll you'll find many new techniques, including image-based masking, better noise removal tutorials, and new sharpening strategies. Chapter 13 also includes a detailed discussion of how to use Adobe Camera Raw and how Raw files affect your overall workflow.

Chapter 14 rounds out your post-production knowledge with detailed descriptions of how to simulate shallow depth of field, stitch panoramas, convert color images to grayscale, add texture and grain, and create hand-colored images. An entirely new section on portrait touch-up is included, as well as discussions of compositing and print preparation. As

with Chapter 13, this chapter includes substantial new examples, tutorials, and discussions.

Finally, with your images edited and corrected, you're ready to output. Chapter 15 covers everything you need to know to get your images *out* of your computer, whether through a printer, Web page, or e-mail. Printer technology is advancing as quickly as camera technology, and this chapter has been updated to cover the latest printing options. In addition, you'll learn the details about resolution choice and image preparation.

In addition to the tutorials from the first edition, two video tutorials are included on the CD-ROM. In these QuickTime® movies, you can watch "over my shoulder" as I perform a number of imaging and adjustment techniques. Because many image correction processes are "interactive" rather than strictly procedural, these movies give you the opportunity to learn techniques that cannot be explained in a written, step-by-step form.

The tutorial movies are included in the Tutorials folder on the CD-ROM. You can watch them in any order, but it would be best to view them when they are called out in the text, since some of the techniques assume that you have already learned certain concepts.

## ***Who Is the Audience for This Book?***

This book is for photographers of all skill. Whether you're new to photography or simply new to *digital* photography, this book will provide the explanation and answers you need to get the best images possible,

Using a film camera is a two-step process. First, you shoot your pictures—with the goal of getting as much color, contrast, and tone into your

image as you can manage. Then, you develop and print the images in a way that takes maximum advantage of that information. Shooting digital photographs is no different. As with a film camera, you first shoot your subject, after carefully calculating the proper exposure. Then, you digitally process and print your image.

Although cameras might change, the physics of light remains the same (fortunately!). Consequently, digital and film photographers share all of the same concerns over apertures, shutter speeds, and metering techniques.

Overall, the book is divided into four broad sections. Chapters 1 through 4 provide the basic technical information you'll need to understand all of the topics covered later in the book. Chapters 5 and 6 help you select the camera, computer, and software that's right for you

All of your additional shooting concerns, from choosing the right exposure to using filters and flash, are covered in Chapters 7, 8, and 9. Although experienced photographers might already be comfortable with much of the information presented, they'll still want to take a close look at these chapters for information on the particular idiosyncrasies of shooting with digital cameras.

Digitally editing and correcting your images is covered in Chapters 10 through 14, and outputting (either to print or electronically) is covered in Chapter 15.

It is difficult to separate the artistic and technical concerns involved in creating a good photo--after all, it is your technical control that allows you to achieve your artistic goals. Nevertheless, this book makes no attempt to cover certain "artistic" issues. Composition, artistic intent, photographic narrative, and many other concerns are not discussed, mainly because there are so many good books already available on this subject. See Appendix A, "Suggested Reading," for a list of valuable resources.  
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Because *Complete Digital Photography* is intended for users with a variety of experience levels, many terms have been defined in the Glossary rather than within the main text.

## ***What Counts as Digital Photography***

Many people use the term *digital photography* to cover any photographic process that involves correcting and editing a photograph digitally. By this definition, shooting with your film camera, scanning your film or prints, editing them on your computer, and then printing them on a desktop printer counts as digital photography.

In this book, digital photographs are photographs taken with a digital camera. This is an important distinction because shooting with a film camera and shooting with a digital camera involve different concerns and practices, and scanning is a science unto itself. The simple fact is that there are many things that you must do differently with a digital camera. But don't worry--this book covers them all!

## ***The Best-Laid Plans***

Though lots of effort has gone into ensuring accuracy in this book, mistakes do sometimes happen. An updated list of errata and corrections can be found at [www.completedigitalphotography.com/errata](http://www.completedigitalphotography.com/errata). A quick check of this page will fill you in on any problems that have been found in the book since its publication. You can report any mistakes by sending an email to [oops@completedigitalphotography.com](mailto:oops@completedigitalphotography.com).

## ***Digital 101: A Few Basic Ideas***

In the old days, photographers made their own photographic papers, films, and *emulsions*. Whether it was to achieve a particular style or texture or to gain more control over their printing processes, photographers such as Ansel Adams, Alfred Stieglitz, and Eduard Steichen had to know a good deal about chemistry to create their prints. Similarly, to really understand how to get the most out of your digital camera, it's important to understand some of the technology behind it. Chapter 2, "How a Digital Camera Works," covers the details of how a digital camera works, but before you dive into that, you need to have a basic understanding of the *digitizing process*.

The "real" world in which we live is an *analog* world. Light and sound come to us as continuous analog waves that our senses interpret. Unfortunately, it's very difficult to invent a technology that can accurately record a continuous analog wave. For example, you can cut a continuous wave into a vinyl record, but because of the limitations of this storage process, the resulting recording is often noisy and scratchy and unable to capture a full range of sound.

Storing a series of numbers, on the other hand, is much simpler. You can carve them in stone, write them on paper, burn them to a CD-ROM, or, in the case of digital cameras, record them to small electronic memory chips. Moreover, no matter how you store them, as long as you don't make any mistakes when recording them, you'll suffer no loss of data or quality as you move those numbers from place to place. Therefore, if you can find a way to represent something in the real world as a series of numbers, then you can very easily store those numbers using your chosen recording medium.

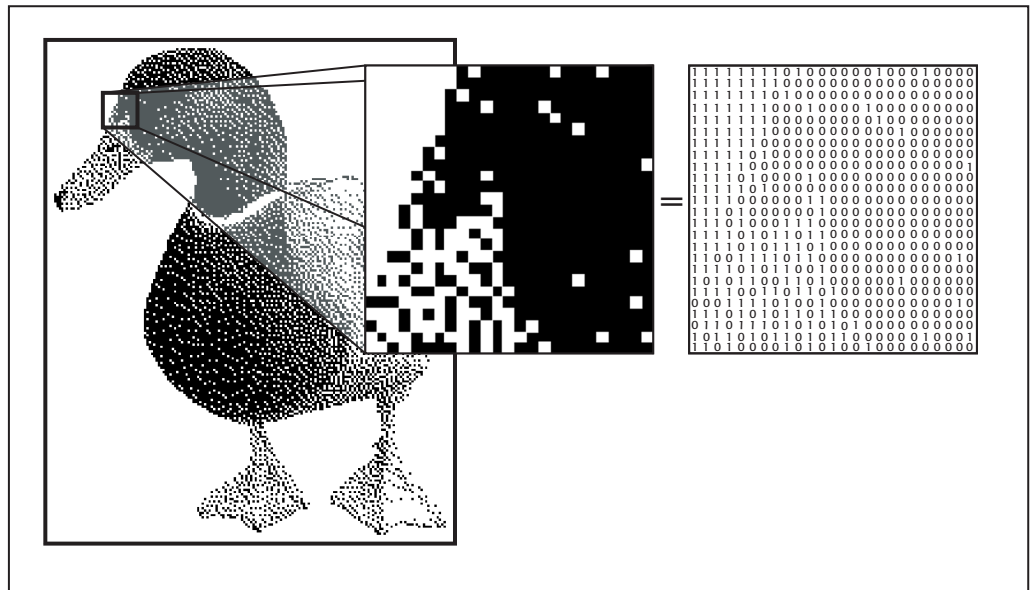
The process of converting something into numbers (or digits) is called *digitizing*. The first step in digitizing is to divide your subject into distinct units. In the case of an image, this is a simple process of dividing your

image into a grid of *picture elements* or *pixels*. How fine your grid is (that is, what *resolution* it has) varies depending on the sophistication of your equipment.

Next, each pixel in the grid is analyzed to determine its content, a process called *sampling*. Each sample is measured to determine how “full” it is; that is, a corresponding numeric value is assigned that represents that pixel’s contents, a process called *quantizing*. Finally, these numeric values are stored on some type of storage medium.

Figure 1.2 is a simple image composed entirely of black and white pixels. As you can see, it’s very easy to assign a 1 or a 0 to each pixel to represent the image. Because it takes only a single *bit* to represent each pixel, this image is called a *1-bit image*.

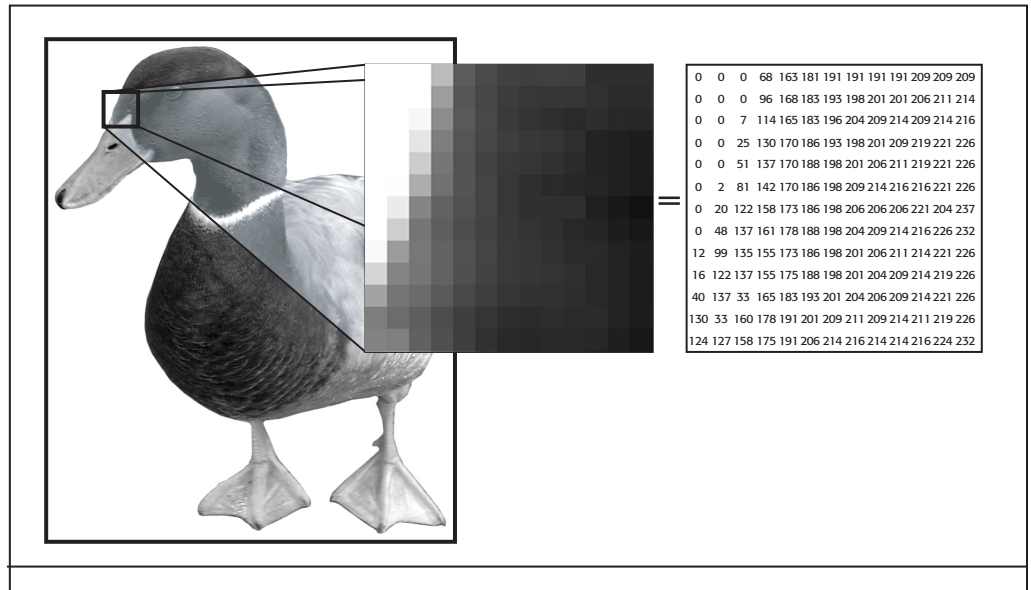
Each pixel in this 1-bit image is represented by a 1 or a 0.



In the example shown in Figure 1.2, our individual samples can be only 0 or 1 (that is, they have a very small *dynamic range*) because we are storing only one bit of information per pixel. If we want to record more than simple black and white images, we need to be able to specify more colors--that is, we need to have more choices than just 0 or 1. By going to a higher *color depth* (sometimes called *bit depth*)--let’s say 8 bits, which

allows for 256 different values--we can record more information, as seen in Figure 1.3.

By storing bigger numbers for each pixel, we can store much more than simple black and white dots. With the ability to use gray pixels, the image looks much more realistic.



With 256 shades from which to choose, we can represent a finer degree of detail than we could with only two color choices. To store full-color images, we must go to an even higher bit depth and store 24 bits of information per pixel. With 24 bits, we can represent roughly 16 million colors, allowing us to store photo-quality images. Note that because we're storing 8 bits per pixel as opposed to 1, our second image requires more storage space.

To sum up, two of the factors that determine the quality of a digitizing process are resolution (the size and number of your individual pixels) and dynamic range (how big a range of color choices you have for each pixel).

Many other factors affect the quality of a digitized image, from your camera's lens to its compression software. Before exploring these questions, though, let's look at how your camera manages all of this sampling, quantizing, and storage. Understanding how your camera per-

ceives, captures, and stores color information will make certain types of editing operations easier later on.