



Chapter 1

WHAT ARE RAW FILES REALLY ABOUT?



The RAW format has become the format of choice for most photographers today. JPEG still has its place, but the flexibility and power of RAW makes it extremely valuable for the photographer who wants the most from an image file. Yet, it is also critical to understand that RAW is no magic bullet that can correct any problem with the original photography. The photo must be shot right from the start to get images like figure 1-1.

The old debate of JPEG versus RAW still has a lot of misinformation in it, but it seems to be less of an issue for most photographers today. In fact, the newest version of Adobe Camera Raw lets you process JPEG files in it. Raw offers the thoughtful photographer a good deal of control, but also demands more in the workflow. JPEG can be used quickly and easily for those situations that require speed over adaptability and advanced control.



1-1

A RAW START

This is a tremendous time to be photographing. Cameras are better than ever and the whole digital transition has brought a new excitement to the craft. Digital capture of images offers so many great advantages, in everything from nature to people photography as shown in figure 1-2, that film is rapidly becoming only a specialized way of shooting.

One terrific innovation that came with digital photography is the RAW format, although technically, it is really the RAW formats. Every camera manufacturer has its own RAW format unique to its products, and each company keeps tweaking it with every new camera. Confusing, true, but it only has to be if you want to know all the formats. Really, all you need to know is the one specific to your camera model.

Adobe's DNG (digital negative) format was introduced to potentially become a universal RAW format. However, that has not happened, and given the camera manufacturers' penchant for keeping their files proprietary, this seems unlikely. For now, DNG is mostly used as an archiving RAW format.

This book covers RAW as if it were one format. That's easy to do in a book specifically about Adobe's Camera Raw program that comes with Photoshop CS3 because Camera Raw treats all RAW formats equally well. It also deals with them seamlessly, without any need to think about format variations.

NOTE

RAW is not an acronym, but simply the name for the format type. You will see it as RAW and Raw in various publications. This book uses RAW as the convention for referring to the files.



1-2

WHY USE RAW?

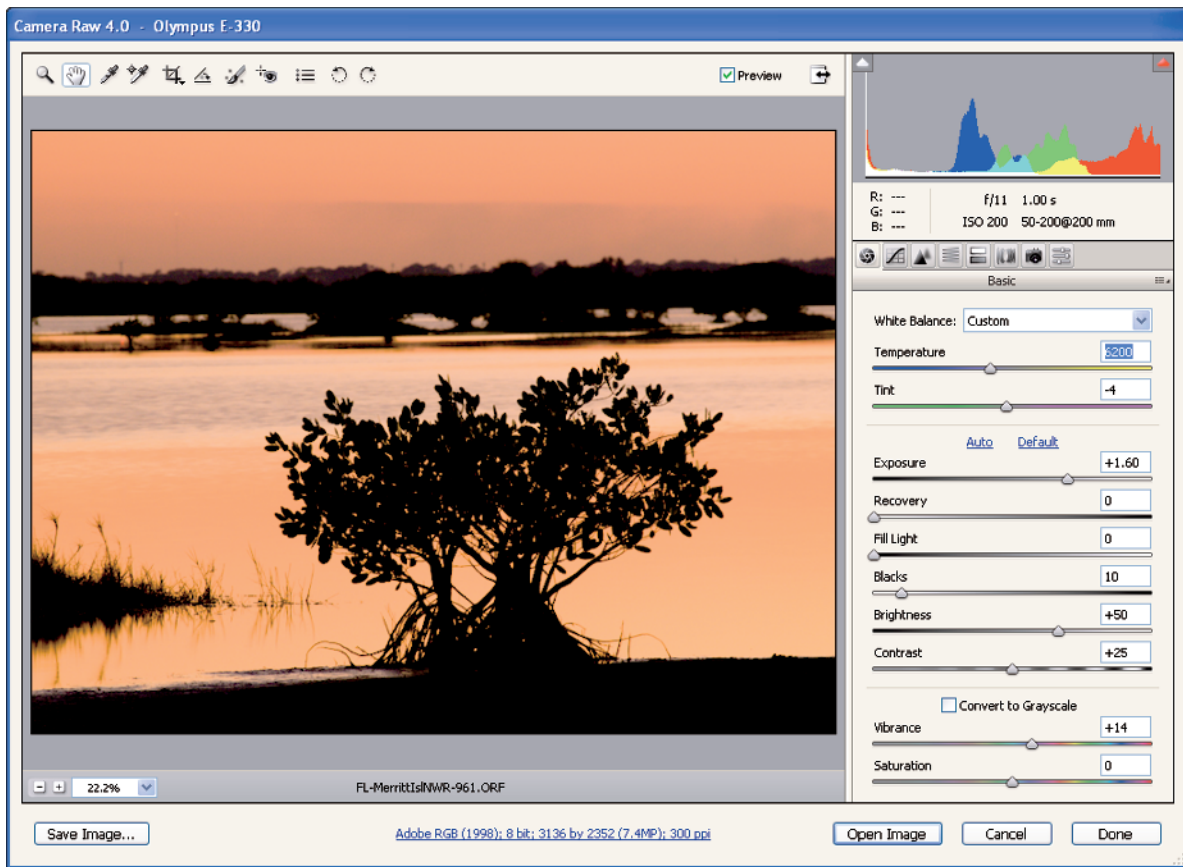
RAW is an extremely valuable tool for the digital photographer. There is some serious math involved because of the way the file is put together digitally. A RAW file is a 16-bit file that holds a huge amount of data compared to the 8-bit JPEG file. I could give you the actual numbers here, but I think they are misleading. They sure would seem impressive (and they are revealed later in the chapter). But photography is not about math unless you are a camera designer. Photography should be about the images. Yes, the higher bit depth in a RAW file can help, but that shouldn't be the only reason for using a RAW file. There are some reasons that figure 1-3 does well coming from a RAW file, as you'll discover in this book, but if the photograph isn't adequate, no amount of RAW math will help it. I believe that the photograph

and your connection to it should rule the process, not what you can do to it because of the technology.

RAW is remarkable and important for its broad photographic capabilities. There are four key photographic reasons to use it:

- > You gain some serious processing power for the image file.
- > You need the increased flexibility that RAW offers.
- > You avoid problems due to the limitations that can come with shooting JPEGs.
- > You like working through an image to get the most from it.

Once you do decide to work with RAW, it is very important to understand RAW requires a certain workflow to get the most out of it — a workflow you learn in this book.



UNDERSTANDING RAW

To use RAW to its best advantage, it helps to know a little about it. RAW cannot fix every lighting or exposure flaw in an image. Unfortunately, a mythology around RAW implies it can do this.

“Don’t worry about exposure or color; you can fix it when you shoot and process in RAW!” That way of thinking is seductive, yet very dangerous. An image like that in figure 1-4 is a problem, no matter if it’s shot in RAW or not.

RAW is

- > A type of image file with minimal change to the data coming from the sensor.

- > Not unprocessed data as you may have read. The sensor creates analog information that must be processed into digital data.
- > Image data that is converted from analog information with the A/D (analog/digital) converter and is a complex engineering challenge that, luckily, camera manufacturers have mastered for you.
- > Affected by exposure as it is increased or decreased to the sensor’s limits; the A/D converter will have problems dealing with those conditions.



1-4

RAW CAPABILITIES

A RAW file holds more tonal and color information than a JPEG — 16-bit versus 8-bit — and offers a great deal of flexibility in how you can work the tones and color in an image. With RAW, you can frequently extract tones and details from the brightest and darkest areas of an image that have no detail in a JPEG file. This can be quite remarkable because it can at times allow you to show information in your photo that more closely resembles the real-world subject you want to preserve compared to what you find in a JPEG file or even from slide film. Figures 1-5 and 1-6 are two examples where the higher bit-depth of RAW helps. The light tonalities in the image would be difficult to manage if I had shot these with JPEG.

Print film is a little different. Some people compared it to RAW, but there are significant differences between them. Both offer a great range of tones from black to



1-5

white, but they handle the tones somewhat differently. That is neither good nor bad; it is just different. Because this is a book about Camera RAW, you may wonder why I mentioned it at all. The reason: Some photographers, especially wedding photographers who have much to gain from RAW capabilities, traditionally shot print film and expected RAW (especially when it is compared directly to a film negative) to give them the same results. The two media require different approaches, so these photographers would become frustrated and disparage RAW. It is not RAW's fault, but misplaced expectations that are to blame. With proper use, shooting RAW can be easy and fun even for the traditional print-film shooter.





1-6

In addition, you can maintain the quality of image tonal changes through greater adjustments when you work with RAW. You can creatively push and pull the tones of a photo to make it better do what you want. This format also allows you to enlarge or interpolate digital images to a larger size with higher quality because it starts with more information that can be interpreted for enlargement.

DO NOT SHORTCHANGE RAW

The misconception that RAW is so adaptable that you do not need to worry about exposure or color shortchanges the capabilities of RAW, creates more work for you to do on the computer, and can result in less than the best tonalities and color. Let me tell you that I have no desire to spend more time working on a photo that I have to — I am a photographer, not a computer engineer. A poorly shot file is a frustrating image for me: I have to spend more time fixing it compared to a properly exposed image because I did not get it right in the first place.

Consider these three things:

- > **RAW still comes from a sensor that has a finite range from black to white — if your exposure is outside of that range, nothing can bring it back, not even RAW.**
- > **Because RAW comes from a digital translation of analog information given by the sensor (the A/D converter I mentioned previously), the old adage of garbage in, garbage out is definitely appropriate here.**
- > **RAW does its best when it has good information coming from the sensor right from the start.** A sensor has its definite strengths and “sweet spot” for exposure of tonalities and colors, so if you miss that, the RAW file can never offer its best.

That’s the key to any good picture, not just RAW: Shoot it right in the first place. If you have doubts, try another exposure. Following is a look at a few problems that come from poor photographic technique when shooting RAW.

I cover how to deal with all these issues in depth in the later chapters.

> **Underexposure.** This is the worst problem. If you underexpose a RAW file so that the tonal information is mostly in the dark areas, you do not have the best tonal or color information to work with (see figure 1-7). When you brighten those areas, you also bring out noise. Even the best of digital cameras shows annoying noise when an image is underexposed.

> **Overexposure.** Excess exposure causes tonal and color problems in later adjustments, again because of weaker colors and less tonal information. Added noise is not the problem here, but you get blocked-up, detail-less highlights that are a pain to deal with, as shown in figure 1-8.



Underexposed

1-7



Overexposed

1-8

> **White balance.** Shooting on Auto white balance does not cause quality problems when you're shooting RAW, but it can create workflow issues later. If you set a specific white balance on your camera when using RAW, no pixels are harmed. But a tag of information about that setting goes with the file so that when it opens, it opens in the RAW converter with a specific white balance. You now have a point of reference to adjust from rather than the arbitrary and sometimes capricious white balance the camera chooses, as shown in figure 1-9.



Wrong white balance

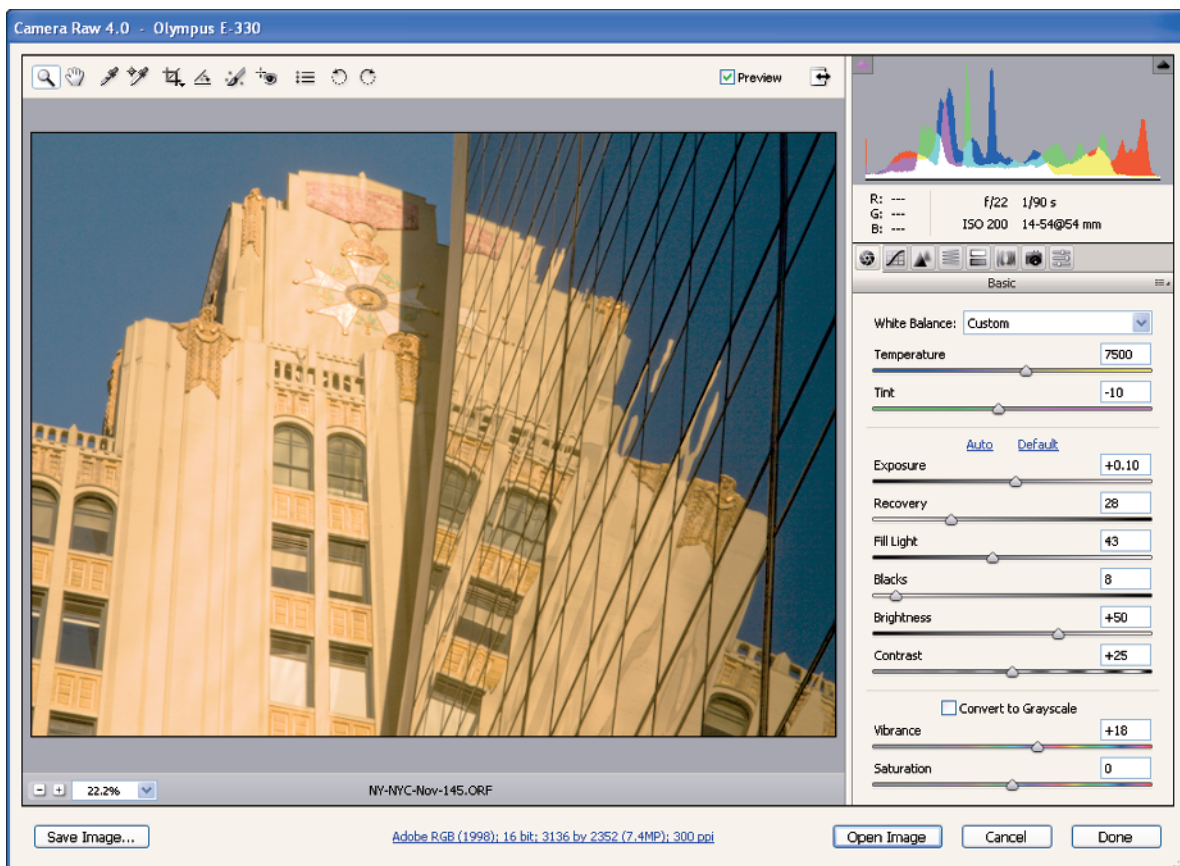
1-9

WHAT IS 16-BIT ALL ABOUT?

Image files work with data based on how many levels of gray tones exist between black and white for each of the three colors of digital: red, green, and blue (RGB). For a very long time, 8-bit data was the standard. It offers 256 distinct tones per color, for a total of more than 16 million color values. This is considered true photographic quality and it is a lot of colors, obviously; anyone who tells you that you can't get a quality image from 8-bit color is working by computer-ese and not photography. Photoshop was originally based on it, and digital camera files in JPEG use it. The use of 8-bit color does match how you see tonal and color information and can be perfectly capable of excellent results.

Problems with 8-bit occur if you have to stretch it a bit in processing as is the case in figure 1-10. There is very little stretch room because as you stretch data, you lose steps of color and tonal information, resulting in problems with gradations of brightness and colors. If your exposure is off or there are contrast issues in the image, you quickly run out of tonalities with which to adjust. In addition, the color of 16-bit expands the working range of colors and tones exponentially. You can do a lot of heavy-duty adjusting without the image suffering.

Technically, however, most digital cameras are only capable of capturing 12-bit color, which is still more than 8-bit (a few cameras are now 14-bit, which will probably become more common over the next few





years). This 12-bit data is put into a 16-bit bucket, so to speak. At 12-bit, you get 4096 distinct tones per channel for a total of more than 68 billion color values. That's 4,000 times 8-bit, which is a lot.

PRO TIP

Remember that your camera meter wants to create an image with middle gray tones. It makes a bright scene darker and a dark scene lighter. Metering something with middle gray tones in a scene can give you a good starting point for exposure. If you use auto exposure, also use the plus and minus exposure compensation control — plus for bright scenes, minus for dark scenes.

But remember, this is not expanding the capture range of the camera. For example, pure white and pure black still correspond to the limits of the sensor. What 16-bit (or the actual 12-bit of captured data) does is give more steps in the working range, which increases the number of divisions between white and black, light and dark, and provides a huge amount of flexibility and control over the tonality of the image.

Those extra divisions of tonality and color really do matter when you want to find more detail in certain parts of the range. You can stretch that portion without damaging the overall tonality of the image. In addition, those extra steps allow you to make major changes anywhere along the range of tones without causing problems to the tonalities and colors that are left (because there will be a lot of them left). Figure 1-11 is a converted but unprocessed RAW image to give you an idea of an image with a lot of dark tones and a group of light tones, but much less in the mid-tone range. This is an ideal subject for RAW compared to 8-bit JPEG.

PRO TIP

If you use JPEG, use only the highest quality settings. In addition, remember that this is a capture format and should not be used as a working format in the computer. Once you open and work on a JPEG-captured image, save it as a TIFF or Photoshop PSD file.



1-11



PROPRIETARY FORMATS

One of the big challenges for everyone shooting and processing RAW is that camera manufacturers have consistently refused to create a common RAW format that everyone can use. Here are some of the extensions associated with varied RAW formats to give you an idea of how many there are (versions unique to certain camera types actually extend this list): Nikon (NEF), Canon (CRW, CR2), Olympus (ORF), Sony (SRF), Pentax (PEF), Fuji (RAF), and Leaf Valeo (MOS).

I have used multiple camera types from several manufacturers to take photos and find their RAW formats all equally good. Hard-core marketing folks will tell you this isn't true and that significant differences exist that are worth worrying about.

Not really. Yes, there are differences, but image quality is high among all of these competing variations of RAW. I challenge anyone to show me or anyone else a photograph where you can see differences that significantly affect the photographer's results. You cannot. Image differences among RAW images are far more affected by the sensors the cameras use, A/D converters, lens quality, light, composition, and so forth. Different formats affect workflow, however, and some offer unique features that you can access only in a manufacturer's RAW conversion software.

Those features may or may not be worth it to you. They typically do little to affect actual image quality and more to affect how you work on an image. On the other hand, the convenience of working with Camera Raw directly in Photoshop is huge. In addition, Camera Raw has been tweaked and refined in every new version to give you improved control over the photo.

NOTE

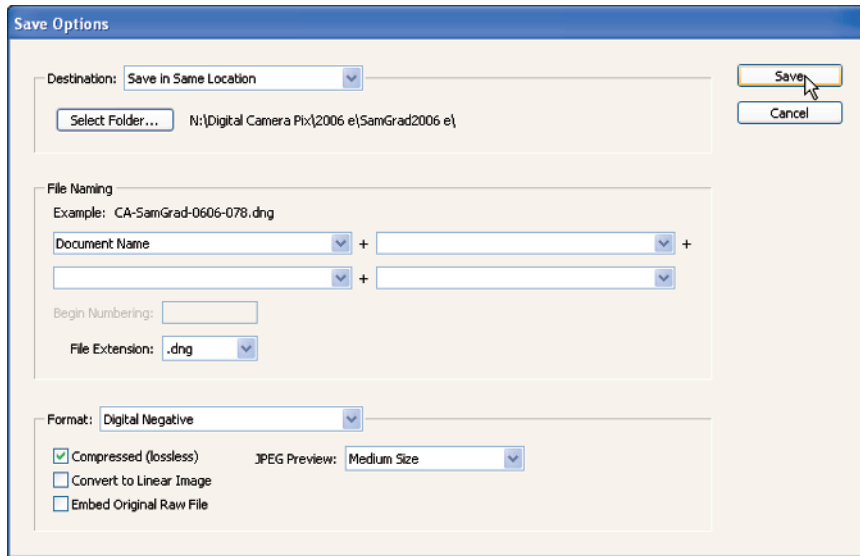
Those pesky proprietary formats are a problem for Adobe. None of the camera manufacturers actually shares details of how the format is put together. It so happens that the computer engineers at Adobe are very bright and have figured out how to deal with all RAW formats by literally taking them apart and examining how they are constructed. The problem with this approach, unfortunately, is that when a manufacturer comes out with a new or revised format, you are unable to use Camera Raw until the Adobe engineers deconstruct the new format and program the software to recognize it.

THE VALUE OF DNG

I have to be straight with you. Manufacturers do not really care about Adobe's challenges with RAW files. As far as they are concerned, photographers will do just fine with their RAW conversion software programs and don't need Camera Raw. However, using multiple, changing RAW formats presents a challenge. First, you may have two cameras with two different RAW formats, even from the same manufacturer (especially if your cameras are very different in age). That can be a pain to deal with. Second, it is entirely possible that older RAW formats will be discontinued over time, making them difficult to use in the future.

For these reasons, Adobe introduced the DNG, or digital negative, format. Adobe's engineers thought a lot about creating a consistent RAW format that can be used by all camera manufacturers and can be archived by photographers without fear that they cannot access it in the future, as seen in the Save Options dialog box in Camera RAW shown in figure 1-12. They even included flexibility in this format to allow camera manufacturers to add their own unique tweaks to it as well.

In spite of DNG's potential to reduce confusion and make it easier for the average photographer to work with RAW now and in the future, camera manufacturers are not showing much interest in this format.



1-12

For now, many photographers use DNG as an archiving format for RAW files because Adobe has said it is committed to preserving this format for use into the future for just that reason. You can save any RAW format file to a DNG file in Camera Raw in Photoshop CS2 or CS3; or if you have Photoshop CS or 7, you can download a program from Adobe's Web site that can convert any RAW file to a DNG.

DOES JPEG HAVE A PLACE?

Digital offers so many new options that the choices are confusing at times. And sometimes the choices are not perfectly clear, such as to use RAW or JPEG. Photographers sometimes use RAW even when it does not meet their needs, but they feel guilty if they shoot JPEG. Well-meaning experts often promote one approach to digital, because that is how they do it, but unfortunately, they don't adequately explore alternatives as really used by photographers.

You need to understand a bit about using JPEG, because shooting 100 percent RAW is neither effective nor efficient for every photographer or in every

situation. In spite of hype within the computer industry and from some Photoshop gurus, JPEG can be a high-quality format — it just is not as flexible and adaptable as RAW. In addition, Adobe Camera Raw can now process a JPEG image in the same nondestructive way it deals with RAW files.

Some photographers think that RAW is the format for professionals and JPEG is for amateurs. This can get you into trouble as it gives the wrong impression of what RAW does for you. Both formats are capable of providing high-quality images.

RAW is a tremendous tool when you need it, but if you arbitrarily use RAW at all times, and it doesn't always fit your needs, personality, or style, you may begin to find you have less enjoyment from working digitally. I don't shoot RAW all the time, and I have had many JPEG-shot photos published. Earlier in the digital changeover in photography, I shot mostly JPEG because the memory and processing overhead for RAW was a pain to deal with.

RAW no longer has that overhead problem. I like the rich capabilities of RAW, and now that large memory

cards have come down in price, I use it extensively because it is such a valuable tool. Cameras that shoot RAW and JPEG at the same time are very useful but require larger memory cards. RAW is very important for digital photography, but it should never be used as an odd way of separating the good photographers from the bad. That comes from what's in the RAW or JPEG file, not from the file itself. Don't let any photo guru bully you into using either RAW or JPEG when they're not appropriate to your needs.

PRO TIP

Many photographers now shoot RAW and JPEG to take advantage of the best of both — a great way to go (especially because memory cards now offer a lot of megabytes with less cost). This gives you the benefits of both formats — increased flexibility from RAW whenever you need it and the ability to work quickly with JPEG files when that is appropriate.

When should you shoot RAW or JPEG? Make that your own choice. Know that you can get top quality from both — figure 1-13 came from a JPEG file. RAW gives you a great deal of flexibility and control in processing your images to get the most from your subject, but it requires more work, more storage space, and slows down a camera. JPEG offers far less flexibility and control, but it is fast, requires less work, and needs less storage space. One reason I shoot both is because I can get prints anywhere from a JPEG almost immediately, which I can then give to people I have promised prints to, even while shooting in remote locations.



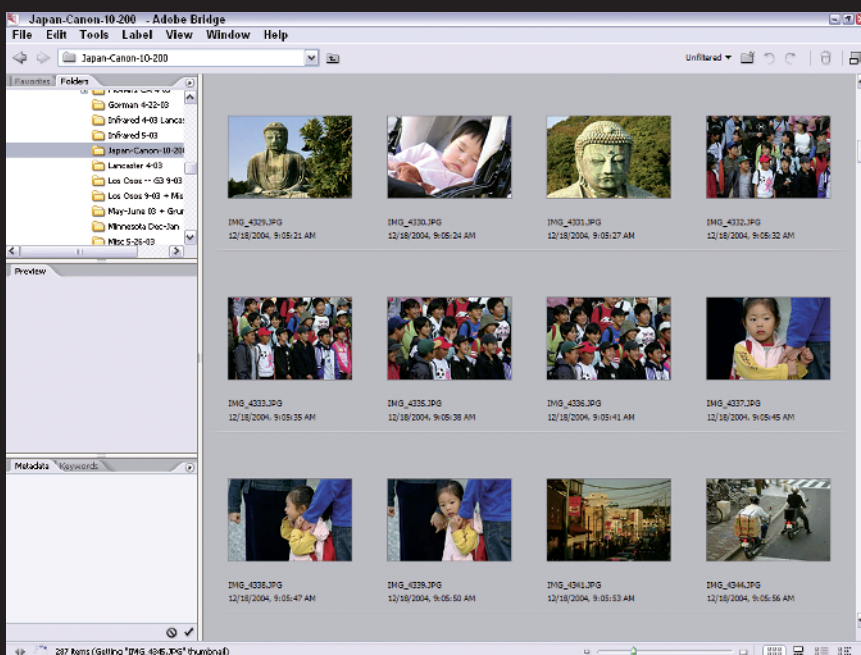
1-13



When JPEG Works

JPEG shot at the highest quality in modern digital cameras can give quite remarkable results from today's cameras. All camera manufacturers build some amazing processing capabilities into their cameras to convert sensor data for JPEG files. I know from talking to Canon folks, for example, that its DIGIC chip was designed to process RAW to JPEG while holding highlight detail

very, very well and helping minimize noise. The very powerful processing capabilities built into the camera (which essentially is processing the RAW file for you) can offer great results when you're shooting high-quality JPEG. It does require you to pay attention to how you work — you have to expose right, choose the white balance correctly, and so forth, as shown here.



It is like having a little RAW expert doing conversions for you in the camera. That said, realize that this conversion is done automatically with no control on your part. Engineers working to maximize camera appeal and sales create algorithms that make good-looking JPEG files, but if you

want to have this control, then you must shoot RAW and make the conversions yourself. As you will see from this book, there are many benefits to doing exactly that, and you will be able to get files impossible to achieve from JPEG.



When should I use RAW?

You can use RAW for any photography, but you should use it for its capability to make a good photographer better, not as a substitute for craft. It is extremely valuable for the photographer who really likes to work his or her image, prodding tones and colors to get the most from the image file. RAW offers the greatest amount of tones and colors possible from your digital camera.

But it can also waste time and memory space if you shoot quickly and expect to make minimal changes to your images later. It can be a problem to use when you want to work fast, such as you do with sports photography. When shooting JPEG, many cameras shoot faster and longer before having to stop to empty their buffers

RAW is especially valuable when shooting scenes with a lot of important highlight or shadow detail. Its 16-bit capabilities allow much more adjustment of such tonalities than the 8-bit capacity of JPEG. This format is also very valuable when you're shooting under changing conditions where you cannot precisely control exposure or white balance. Its versatility and adaptability mean even problem images can often be brought under control.

Can any photographer use the DNG format?

Absolutely. It just is not being used by any of the major camera manufacturers. What many photographers are doing is using this format as an archival RAW format. Some camera manufacturers have already changed their RAW formats in the relatively short history of digital cameras. Who knows if these variations of RAW will be supported in the future?

Because DNG is a broad-based format that any photographer can use at any time and can be made from any RAW format image, and because it is supported by Adobe, who does not make digital cameras, there is strong likelihood that this format will be around for a very long time. Adobe promises to always support it. This makes it ideal to use for important images that you want to archive in a RAW format. You can convert any RAW file into the DNG format in free software available from Adobe (www.adobe.com) or in Camera Raw.

What if I shoot in JPEG? Can it be changed to RAW?

The simple answer is no. You have to set the camera to RAW (or RAW + JPEG) in order to have an image recorded in RAW. You cannot convert a JPEG file to a RAW file once the image is recorded, either.

However, you can convert a JPEG file to a DNG file in Camera Raw. You don't gain any quality boost from doing that, and while you get a 16-bit file, you don't get any new benefits over 8-bit (because that's all the JPEG file has). However, you do get an archival format with more flexibility and potentially better processing capabilities in the future should you need to rework your file someday.