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COMPLETE

# Digital Photography

Sixth Edition



Ben Long

# **Complete Digital Photography**

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# 23

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## **CHOOSING A DIGITAL CAMERA**

*The Questions You Need to Ask  
When Buying or Upgrading a Camera*



If you're shopping for a digital camera, whether it's because you don't have one, or because you need to upgrade, this chapter should help you understand the questions and concerns you need to address when considering a particular model. I won't be presenting any specific recommendations here. Rather, the goal is to help you understand more about how a camera works and what the various features are that you'll have to choose from, so that you can learn to evaluate cameras on your own.

Before you head out to the store, though, you need to accept one painful fact: the camera you buy will be replaced very soon by a newer model. Waiting for the next generation isn't going to help, because there's going to be another generation right after that one, and another one after that, and so on. However, this sad fact doesn't have to be as depressing as it might seem.

The good news is that the digital camera market has matured to the point where the level of advancement from one generation to another is not as marked as it used to be. Back when the new generation meant a change from one megapixel to two megapixels, waiting around made sense. But these days, when the change is from 12 to 15 megapixels, or no change in resolution but the addition of new features, then the evolutionary advancement between generations isn't as critical. In fact, these days, new models are occasionally *inferior* to the previous generation.

As with computer gear, if you don't need a camera right away, then wait, because you might get more for your money later. But if you're ready to buy, start your research now. Many great cameras are out there, so there's no reason to put off picking one of them!

In this chapter, we'll take a fairly straightforward approach to choosing a camera:

1. First, determine how much you're willing to spend. Your goal is to get the best camera you can for your budget. *Best* is defined as the balance of features that serves your particular needs.
2. Next, decide whether you are looking for an SLR or a point-and-shoot camera. If you can't make this decision right away, that's fine. It will probably become apparent pretty soon after you start comparing cameras, or maybe even as you read further into the chapter.
3. Next, determine what resolution you need for the type of output you're creating.
4. Among the cameras with the right price and resolution, select the ones that have the shooting features and controls you want.
5. Of those cameras, make your final choice based on which model delivers the best image quality.

This last point will be your most crucial criteria. If you've narrowed your choice to two cameras, and one has great features but the other produces better pictures, you should go with the second camera. Of course, it's frustrating not to get everything you want in a camera, but you can work around most feature deficiencies. Trying to work around bad image quality is much more difficult.

## Budget

For most people, the first limiting factor in a digital camera purchasing decision is going to be price. Before you make any other choices or evaluations, you should decide how much you're willing to spend. Digital cameras run the gamut from \$100 point-and-shoots to professional-level SLRs costing thousands of dollars, so it's important to zero in on a price range you can afford. Bear in mind that you may have to buy some extra accessories in addition to the camera—for example, storage cards, rechargeable batteries, lenses, printer, camera case—so don't forget to factor these expenses into your budget.

Once you've selected a price range, your goal is to find the best camera that can be had for that price. *Best* is a subjective term—if portability is your main concern, a high-resolution professional camera with a super telephoto lens is not going to be the best option. After you've selected a price point, you're ready to begin evaluating the camera's features.

## Point-and-Shoot or SLR

As with film cameras, the digital camera market is divided into two major categories: point-and-shoot cameras and *single lens reflex*, or SLR cameras. While both types of cameras share many features and both are capable of producing great image quality, they vary significantly in their price, the way you use them, and their capabilities.

You don't have to make this decision right away, but most people usually have some idea fairly early on that they're looking for one or the other. Although you can change your mind at any time, if you can decide sooner rather than later that you're looking for one or the other, you'll have an easier time quickly narrowing the field of candidates.

Point-and-shoots and SLRs share many features and characteristics, and we'll cover those in detail, but first let's look at how they differ.

## Point-and-Shoots

The term *point-and-shoot* implies “lower quality” or “underfeatured,” but don't be prejudiced by this term. These days, point-and-shoot digital cameras can have pro-quality lenses, extensive feature sets, and can produce excellent images.

Point-and-shoots typically have three features that differentiate them from their SLR cousins. First, they have fixed, rather than interchangeable lenses. Fortunately, these days, all point-and-shoots have zoom lenses, and some offer an extremely wide zoom range.

Second, point-and-shoots have smaller image sensors than SLRs. A smaller sensor means that you'll take an image quality hit, usually in the form of more noise. The smaller sensors also don't allow you to shoot depth of field that's as shallow as what you can achieve with an SLR. However, as you'll see once you start examining cameras, some point-and-shoots can produce images comparable to some SLRs.

Most point-and-shoots rely on their LCD screen as a viewfinder, although some might also have an optical viewfinder. I'll have much more to say about viewfinders later.

Because they usually have smaller sensors and lenses, point-and-shoot cameras can be made very, very small, and they come in a huge array of designs and sizes (see Figure 23.1).



**Figure 23.1**

Point-and-shoot cameras run the gamut, from tiny, easily pocketable cameras to larger units with longer lenses, more controls, and advanced features.

Thanks to their small sensors and fixed lenses, camera makers can build point-and-shoot cameras with designs that would be impossible to achieve with a film-based camera. For example, some point-and-shoots have viewfinders that rotate independently of the lens, allowing for easy waist-level or over-the-head shooting. Twisting bodies, internal zoom lenses, and many other radical options are possible with a point-and-shoot camera. All this means that you can find cameras tailored to very specific types of shooting, from simple snapshot cameras to full-featured cameras with controls that outperform some SLRs. Point-and-shoot cameras can also be made very quiet, making them ideal for shooting in locations where a loud shutter noise is inappropriate.

While point-and-shoot cameras often provide full manual controls, they also excel at, well, point-and-shoot type snapshots. The current generation of point-and-shoots provides the latest advances in autofocus and autoexposure tools, making them ideal for “run-and-gun” shooting, where you only have one chance to capture a particular moment.

These days, many point-and-shoots pack built-in macro capabilities that would require a separate, expensive macro lens if you were shooting with an SLR, and while a few SLRs now provide video options, almost all point-and-shoots also offer video, and some can even shoot HD. Because of their quality lenses and excellent image processing, point-and-shoot cameras make very good casual video cameras. In fact, a point-and-shoot still camera will do a much better job of capturing video than a video camera will do at taking still pictures. So, if you’ve been looking for a single device that can do both, this may be your best option.

Although shapes and designs may vary, most digital point-and-shoots will have anatomical features similar to those shown in Figure 23.2.

**Figure 23.2**

Point-and-shoot cameras come in many shapes and sizes, but most will offer some combination of these features.

## SLRs

Single lens reflex means that your camera's viewfinder uses the same lens that is used to focus light onto the focal plane. By comparison, the optical viewfinder on a point-and-shoot uses one lens for the viewfinder and another lens to expose the focal plane. The advantage of an SLR is that what you see is usually very close to what you'll get in your final image, in terms of cropping. (Most quality SLR viewfinders show at least 95 percent of the image that will actually be captured.) In addition, you'll be able to see the effects of any filters or other lens attachments directly in the viewfinder.

A point-and-shoot camera's LCD screen also uses the camera's lens, but in every case, you'll find the viewfinder in an SLR to be much brighter and clearer than what you'll see on an LCD screen. There are other important viewfinder differences, which we'll discuss later.

Almost all digital SLRs use removable lenses, meaning you aren't locked in to a particular focal length range when you buy the camera. In addition, you can add specialty lenses, such as tilt-and-shift lenses for architectural photography or telescope mounts for astronomical photography. The ability to change lenses also means you can improve image quality by investing in better (although more expensive) lenses at any time.

Most SLR manufacturers have their own proprietary lens mounting scheme, so when you choose a particular SLR body, you're also buying into a particular lens system. You'll want to evaluate the lenses available for each system when picking a camera, a subject we'll discuss at length later.

## Don't Forget About Third-Party Lenses

In addition to the lenses made by specific camera manufacturers for their own lens systems, there are also very good third-party lenses made by companies such as Tamron and Sigma. Offering lenses for Canon, Nikon, and several other systems, these companies make very good lens alternatives, often at lower prices. When lens hunting, don't forget to consider these options.

The removable lens mounts on SLR cameras require a fairly large camera body, which means that the camera has enough room to hold a larger sensor. Larger sensors usually mean better image quality, because the individual photosites on the sensor can be larger and therefore more efficient at gathering light. As mentioned earlier, the larger sensors in an SLR also make it possible to shoot images with a shallower depth of field than what you can achieve with a point-and-shoot.

SLRs also offer other more professional features than their point-and-shoot counterparts, such as higher resolution sensors, more sophisticated focus mechanisms, faster burst shooting, the ability to shoot raw, advanced external flash systems, body designs tailored to rugged environments, and higher ISO settings (see Figure 23.3). Finally, most SLRs offer very speedy all-around performance. Image processing, menu navigation, file writing, and image playback are often much faster on an SLR than on a point-and-shoot camera.

On the downside, SLRs are larger and heavier, and because their lenses are removable, they're more prone to collecting *sensor dust*, which can appear on your image as specks and smudges (but can be cleaned off). In addition, not all SLRs offer the option to use the LCD screen as a viewfinder.



**Figure 23.3**

Most SLRs feature a design similar to this Nikon D80 and some variation of these controls. On some cameras, some of these features are accessible through dedicated buttons, while on other cameras, these features are controlled via menu options.



Shooting with an SLR represents a very different kind of shooting, where you look through the camera's viewfinder to block out the rest of the world and focus on your shot. While you can take exceptional images with a point-and-shoot, an SLR offers more control, power, and versatility than any point-and-shoot.

The biggest change in SLRs in recent years is the addition of video shooting. In fact, some SLRs capture better-quality video than video cameras costing thousands and thousands of dollars more. Shooting video with an SLR is more complicated than shooting with a point-and-shoot camera, or video camera, because you won't get autofocus on most SLRs when shooting video. So, you'll want to investigate the practicalities of video shooting before you put too much weight on this factor.

In the rest of this chapter, we will discuss all of the issues and features you need to consider when shopping for a digital camera of any kind, in addition to providing tips and guidelines for evaluating each feature. To begin, we'll look at the very guts of the camera and weigh the merits of different image sensors. Where appropriate, we'll provide separate discussions for SLRs and point-and-shoots.

## Four Thirds and Micro Four Thirds

Point-and-shoot cameras deliver great portability, while SLRs offer great image quality and tremendous flexibility. Both types of camera represent a compromise, though. Grab a point-and-shoot, and you might find yourself hobbled by a lack of features. But reach for your SLR, and you might think "Oh, it's so big...maybe I'll just leave it at home for now."

Recognizing that there's a need for something in between these two extremes of camera design, a consortium of camera manufacturers came up with a specification for a type of camera that fits somewhere between a point-and-shoot and SLR.

The Four Thirds specification defines a camera with a particular sensor size and lens mount. Yes, these cameras have removable lenses, just like a typical SLR. But the lens mount dictates that the lens be very close to the image sensor, which means that the camera bodies and lenses can be made much smaller than an SLR. However, because of this small size, there's no room inside the camera body for a mirror, which means you won't get an SLR-type viewfinder. Instead, these cameras use electronic viewfinders and LCD screens.

Four Thirds cameras were well-received, but as demand for even smaller cameras became obvious, the consortium then released a new specification: Micro Four Thirds.

Micro Four Thirds cameras are truly an ideal midpoint between the size of a point-and-shoot and the flexibility and quality of an SLR. Offering great lenses and image quality, as well as professional level controls, Micro Four Thirds cameras are conspicuous for their small size. You can typically fit a camera and a few lenses in the same space as an SLR and one lens.

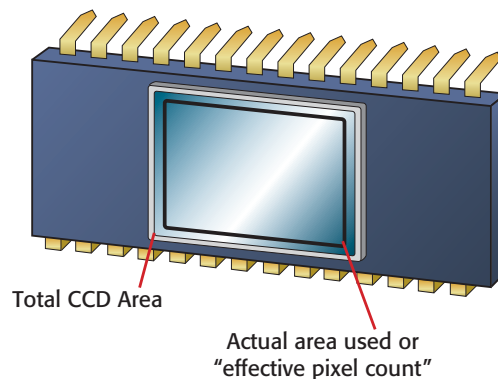
So don't ignore the excellent Micro Four Thirds offerings from companies like Olympus and Canon when shopping for a camera.

## Resolution

As you've probably already discovered, there are *many* digital cameras out there. The quickest way to winnow the field of possibilities is to focus on cameras with a particular resolution. Why not just buy the most resolution you can afford? *Because resolution is not the final arbiter of image quality!* If you learn nothing else from this chapter, take that maxim to heart. Obviously, more pixels mean more detail, which should mean a better picture. However, it doesn't always work this way because the *quality* of the pixels being captured is every bit as important as the *number* of pixels being captured. As such, pixel count alone is not a measure of a camera's quality. Consequently, it's important not to get caught up in the "resolution wars" many vendors wage with each other.

So how do you choose? By considering how you'll most likely be outputting your images. If you need to regularly create 13" × 19" print (or bigger), you definitely need a higher resolution camera. However, if you spend the bulk of your time printing out 4" × 6" prints or posting to the Web, you'll be able to get away with less resolution. The fact is, there's a *lot* you can do with just three or four megapixels. Given that you'll be hard-pressed to find a camera with fewer than six to eight megapixels, it's pretty safe to assume that, for typical output, *any* camera you buy will provide the pixel count you need.

Resolution can be a tricky number because many vendors make their resolution claims based on the total number of pixels on the camera's image sensor, when, in fact, the camera doesn't use all of those pixels (see Figure 23.4). For example, the Olympus SP-510 Ultra Zoom uses a CCD sensor with a resolution of 7.4 megapixels, but the camera's maximum image size is only 3,072 × 2,304, or 7,077,888 pixels. So where'd the other 300,000 pixels go? Some are masked away to deliver the 4:3 image proportions Olympus wanted, whereas others are needed by the camera for internal functions such as determining black levels and for demosaicing the pixels along the edge of the frame. (Remember, the camera determines the color of each pixel by examining the pixels around it. So there needs to be some extra pixels beyond the effective edge of the frame.) Olympus only claims a resolution of 7.1 megapixels for the SP-510 UZ, but other vendors are not always so honest. Therefore, if you're a resolution stickler, be sure to check the number of pixels being used, or the *effective pixel count*.



**Figure 23.4**

The actual number of pixels a CCD uses is often smaller than the total number of pixels it provides.

## Foveon—Full Color Without Interpolating

As you've learned, digital cameras perceive color by analyzing a group of pixels to determine the color of every single pixel in your image. This complex mechanism is necessary because the individual pixels in most sensors can read only light and dark, not color. Foveon, Inc. has developed an image sensor that uses a completely different approach. Their unique image sensors have separate red, green, and blue sensors at each photosite, meaning that each pixel in the sensor can read full color *with no demosaicing necessary*.

In theory, this setup eliminates any number of color artifacts and problems that derive from the color interpolation required by every other type of image sensor.

So why should you even consider a camera equipped with anything else? Because the simple fact is, if you compare a Foveon-equipped camera with a competing CCD- or CMOS-equipped camera, you'll probably find that Foveon hasn't yet caught up to the other technologies. CCD and CMOS have decades of research and engineering behind them. Foveon is a new technology with issues of its own. It's certainly possible that in the future, this technology will win out, but in the meantime, image quality and feature set—not potential coolness of the underlying technology—are still the benchmarks for camera value.

However, some good Foveon-equipped cameras out there are certainly worth your consideration.

## Choosing a Pixel Count

As mentioned previously, the quickest way to narrow your digital camera search is to zero in on a resolution that's suitable to the type of output you're going to produce. Simply put, to make a quality print of a particular size, you need a certain number of pixels.

Unfortunately, you can't always frame your image exactly as you want it in your final print. If you can't get close enough to your subject and don't have a long enough telephoto lens on your camera, you may have to shoot your image and crop it later. So, even if you never expect to print anything larger than, say, 5" × 7", having extra pixels will allow you to crop but still print at 5" × 7".

## Blowing Up Your Images

With modern imaging software, you don't have to settle for the resolution provided by your camera. Through interpolation (also called *resampling*), you can use your image editing software to enlarge your pictures.

However, you can enlarge a picture only so far before you begin to see interpolation artifacts (see Figure 23.5). Obviously, the more resolution you start with, the better the results will be.

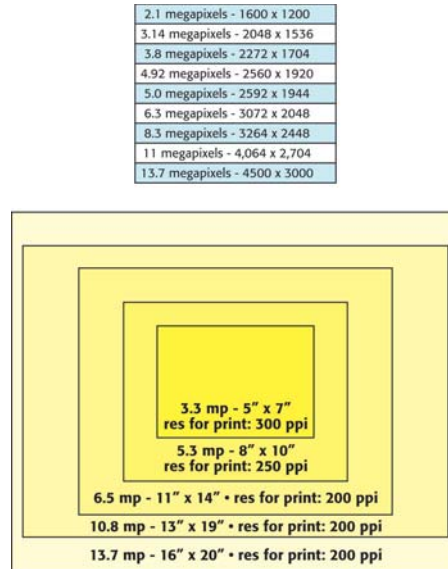
**Figure 23.5**

If you interpolate an image up too far, you will begin to see stair-stepping artifacts, posterization of tones, and loss of detail and sharpness.



## How Much Bigger Is That Extra Megapixel?

If you're considering spending the extra money for a camera with higher resolution, it's worth doing a little math. A 50-percent increase in the number of pixels in a camera adds only 23.5 percent more print area. This is the difference between an 8" × 10" print and a 10" × 12" print. Therefore, the extra resolution won't give you substantially bigger prints. However, if your camera and optics are good enough, higher resolution can give you better detail. You can see the difference in relative image sizes in Figure 23.6, which also shows you what size output you can reasonably expect to achieve with a given resolution. Figure 23.6 also shows the typical pixel dimensions for specific resolutions.



**Figure 23.6**

Before you decide that you need a particular resolution, it's important to understand that the difference between one resolution and another is not always as large as it might seem. Depending on how big you want to print, you might find that you don't need to spend the extra money on extra pixels.

## Buy Some Media Before Shopping

Because a camera's LCD screen is too small to accurately judge a camera's performance, consider buying your own media card. You can take the card to your local camera store, use it in a few different cameras, and then examine the results at home. When you finally buy a camera, you can always reuse the card.

## Sensor Size and Focal Length

Image sensors, whether CCD or CMOS, can be very small—as small as 1/4". Should you be concerned about the physical size of the sensor if it packs the resolution you want? In many cases, yes, because smaller sensors often suffer an image quality hit due to their reduced size.

As explained in Chapter 3, "Camera Anatomy," the surface of an image sensor is divided into a grid of pixels. On a larger sensor, each pixel is physically larger than those of a smaller sensor. Larger pixels are capable of collecting more light, which means they are usually more color-accurate than smaller pixels. In addition, on a smaller sensor, where the pixels are packed more closely together, there is a greater chance of electron spillage and blooming, which can appear as weird color artifacts in your images. Finally, larger pixels result in a better signal-to-noise ratio, resulting in images with less noise.

Building a lens that can focus onto a very small area can be difficult, so lens quality becomes *more* important when the image sensor is very small and as you increase pixel density on a sensor of any size. These are just some of the reasons why raw pixel count is not necessarily a measure of a camera's imaging quality.

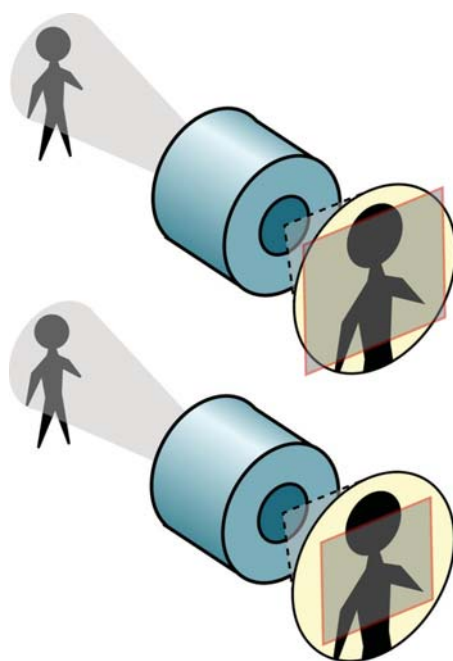
At the time of this writing, digital SLR cameras are topping out at around 23 megapixels. Some theorize that there is no need for resolution to go any higher than this because the physical size of the individual pixels is beyond the resolving power of the best SLR lenses now available. In other words, we might have reached the point where lens technology, not image sensor technology, is now the limiting factor on high-end SLR cameras.

If this is true, future improvements in image sensor technology will not involve more pixels, but will be made by crafting sensors with the same resolutions we have today but with larger pixels.

Unfortunately, image sensors are difficult to make, so it's more cost effective for a manufacturer to create physically smaller chips.

For a point-and-shoot camera, sensor size is not really an issue you need to consider when buying a camera. If your sensor has troubles related to its size, you'll discover them when you evaluate the camera's image quality.

### Focal Length Multipliers



**Figure 23.7**

Your lens projects a circular image, but your camera's image sensor crops a rectangular portion out of that image. The amount that is cropped depends on the size of the sensor. This is why different sensor sizes yield different fields of view for any given focal length.

All lenses project a circular image onto the focal plane. The film or image sensor that's sitting on the focal plane records a rectangular crop from the middle of that circle. Obviously, a larger sensor records a larger crop (see Figure 23.7).

Because of this, the same lens placed on a camera with a different sensor size will result in a different field of view.

The 35mm frame size has been the standard for so long that most people tend to “think” in terms of 35mm when they consider a particular focal length. So a 50mm lens is considered a “normal” lens, while a 200mm is considered telephoto, and 28mm is considered wide angle. However, as you just learned, if you place those same lenses on cameras with smaller sensors, they'll have the narrower field of view of a more telephoto lens. Therefore, when you place a 50mm lens on a camera with a smaller sensor, it might end up having the field of view of a 70mm lens on a 35mm camera.

For example, the sensor in a point-and-shoot camera is so small, camera makers can get away with using lenses that have very short focal lengths—usually in the 8–15mm range. In 35mm terms, 8–15mm is insanely wide-angle. Therefore, to learn what the equivalent focal length is in terms of a 35mm camera, you must multiply the actual focal length by a *multiplication factor* to determine the 35mm focal length equivalency.

Fortunately, with point-and-shoot cameras, if your manual doesn't list the multiplication factor, it will probably list the equivalent 35mm focal length range.

It's very important to understand that the lens won't have the same magnification as its 35mm equivalent; it will simply show the same field of view. For example, a true 75mm lens on a 35mm camera will have different optical properties than a lens with an equivalent 75mm crop on a camera with a smaller sensor.

All point-and-shoots, and most digital SLRs, have sensors that are smaller than a 35mm frame, so you'll probably need to spend some time figuring out the equivalent focal length ranges of any cameras you're considering.

### Full-Frame Sensors Versus Reduced-Frame Sensors

If you're shopping for an SLR, you will eventually encounter the "full-frame" debate. Currently, a handful of digital SLRs have sensors that are the same size as a frame of 35mm film. Other digital SLRs use a sensor that's roughly the same size as a piece of APS film. These differences in size have a few effects on image quality—some noticeable, some more theoretical.

As discussed in the previous section, an SLR with a reduced-frame sensor will have a *focal length multiplier* listed somewhere in the camera's manual. You'll multiply the focal length of any lens you attach to that camera by the focal length multiplier to learn the equivalent crop in 35mm terms. For example, most Nikon SLRs have a focal length multiplier of 1.5. A 50mm lens placed on one of these cameras will have the same crop as a 75mm lens on a full-frame camera ( $50 \times 1.5$ ).

This cropping factor can be very handy for shooters who like using very long telephoto lenses. For example, if you stick a 300mm lens on a Canon EOS Digital Rebel, which has a 1.6x focal length multiplier, you'll have the same crop as a 480mm lens. If you like shooting with wide-angle lenses, though, things are a different story. A 24mm lens—a very wide lens on a full-frame camera—will have a full-frame equivalent crop of 36mm—not very wide.

Fortunately, many camera vendors have responded to this problem by making lenses specially engineered for their cameras that have smaller sensors. Canon, for example, makes a 10–22mm lens that yields a 16–35mm equivalent range. These lenses will not work on a full-frame sensor, because they don't project a large enough image. Note, however, that full-frame lenses will work just fine on a reduced sensor camera.

### Digital Specific Lenses

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Canon denotes their "digital specific" lenses with the EF-S label, Nikon with the DX label.

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Until recently, the lack of wide-angle lenses was one of the best reasons to opt for a full-frame digital SLR. However, full-frame SLRs are significantly more expensive than their reduced-frame counterparts. Now that camera manufacturers are selling wide-angle lenses that work with reduced-frame sensors, why would you want a full-frame camera?

First, with a full-frame camera, you don't need to do any calculation to figure out the equivalent crop. If you're used to thinking in terms of 35mm focal lengths, this is a welcome convenience. Full-frame cameras have larger sensors, which allow for much higher resolutions—the *lowest* resolution full-frame camera currently available is the 12 megapixel Nikon D700. Just as importantly, in terms of image quality, larger sensors also allow for much larger pixels, resulting in better signal-to-noise ratio. With their larger sensor size, it's also possible to get slightly shallower depth of field with a full-frame camera. Finally, full-frame cameras also typically have larger, brighter viewfinders than their APS-sized cousins, and many feature high-end features such as rugged weatherproofing.

You'll pay a premium for this extra functionality, though. At the time of this writing, the cheapest full-frame digital SLR has a list price of \$3,000. However, that's just the beginning of the price difference. Because of their extra resolution, full-frame cameras are *very* unforgiving of mediocre lenses. If you want to get the best quality you can out of your expensive camera, you'll need to buy fairly expensive lenses to go with it. And since you're shooting higher resolution images, you'll need more storage.



As a lens gets longer and wider, it gets harder to engineer. Lenses engineered for a reduced sensor size can be smaller, lighter, and therefore less expensive than their full-frame counterparts *without* sacrificing image quality. This is not to say that all reduced-frame lenses are exceptional, but some are, and they come at a very reasonable cost.

Full-frame camera bodies are also physically larger than reduced-frame SLR bodies. Because of the larger sensor, a full-frame camera must have a larger mirror and larger pentaprism. All of this makes for a camera that is noticeably bigger and heavier. Since you'll also be buying larger lenses, your entire camera kit will probably be significantly heavier than a reduced-sensor kit with equivalent lenses.

Finally, if you do lots of extreme telephoto work—wildlife or sports shooting, for example—you might want to stick with a reduced-frame sensor. Because a reduced-frame sensor has more tightly packed pixels, you'll possibly get better detail on objects that are smaller in the frame.

Many people are confused about the full-frame versus reduced-frame debate. They feel that the industry will ultimately go toward all full-frame cameras, so investing in special “digital” lenses is a waste of money. But, while both Nikon and Canon have shipped full-frame cameras, they have continued to produce new digital specific lenses, indicating they're not going to be abandoning their digital lens mount system anytime soon.

The 35mm frame size (on which the “full-frame” sensor is based) was not created because of any special advantage or theoretical necessity; it's just something we've all become accustomed to. Sure, you can put more, larger pixels on it, but the 5D offers no better signal-to-noise ratio than Canon's reduced-frame Rebel T1i. If what you need is a very high-resolution SLR, then full frame is currently your best option; just be prepared to spend more money and carry more weight.

## Point-and-Shoot Lens Specifications

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If you're shopping for a point-and-shoot camera, you'll want to make some lens decisions fairly early in the process. You can't remove the lens on a point-and-shoot camera, so you need to pick a camera with a lens that will allow you to do the type of shooting you want to do.

Ideally, we all want a single lens with a focal length that goes from extremely wide to extremely telephoto, delivers excellent quality with a wide aperture across its range, and yet is small enough to fit in a camera the size of a credit card. Unfortunately, such technology doesn't yet exist, so you'll have to make some compromises. If you want a camera with an extremely long zoom range, you'll have to give up on the small size, as longer lenses require a bigger camera body.

Note, however, that camera manufacturers have adapted a convention used by the video camera industry and now typically specify the focal length of a lens by a multiplication factor. So you'll see cameras that have a 3x zoom lens, or a 10x zoom, or something in between. This is not particularly useful information, as it doesn't tell you which focal lengths are covered by that specific range.

In general, it's safe to assume that a 3x or 4x zoom lens will give you something like the equivalent of a 35 to 135mm lens on a 35mm film camera. A 10x zoom lens will usually offer you something more like a 28–200mm lens on a 35mm camera. However, these are approximations, and you'll want to check the camera's spec sheet for more info.

If you shoot wildlife and sporting events, or if you simply like shooting things that are far away, you'll want a lens with a longer telephoto reach. If you shoot architecture, street scenes, or prefer shooting wide angle, you'll want a lens that can zoom out to a short focal length. The typical 3x or 4x zoom will provide an excellent “walk-around” range that will cover most of the typical shooting situations.

After you've determined what focal length you want, you'll probably find that you've weeded out some cameras, either because they have more lens than you need or not enough. If you're feeling frustrated because you've found a camera you adore but it doesn't have the extreme focal length ranges you want, check a little farther and see if it supports any kind of lens extensions. Many point-and-shoots offer wide-angle and telephoto adapters that can greatly extend the range of your camera.

Later in this chapter, we'll cover the details of evaluating the quality of a specific lens.

### Internal and External Lenses

One thing to consider when point-and-shoot shopping is the configuration of the camera's lens. Some point-and-shoot cameras like the Canon S80 shown in Figure 23.2 have telescoping lenses that close up to be flush with their bodies. Other cameras have lenses that protrude from the camera even when closed. Still other cameras have zoom lenses that are oriented vertically *within* the camera's body (see Figure 23.8). A mirror at the top of the lens allows the vertically mounted lens to look out the front of the camera. If you want a camera with the smallest possible profile, you'll probably want a lens that retracts completely into the camera, or is completely contained within the camera. When considering a retractable lens, pay close attention to how quickly it extends and retracts, as this will have a bearing on how quickly you can take a shot.



**Figure 23.8**

When selecting a point-and-shoot camera, you'll want to give some thought as to whether the lens protrudes from the camera body. This Nikon S5 has a lens that is positioned vertically within the camera body, so it remains completely self-contained.

## Basic Controls

When you've narrowed your search to a particular resolution class, you're ready to start considering the features, controls, and designs of specific cameras. This stage of your decision centers on the specifics of what you need for the type of shooting you like to do and your personal preference for camera feel and—let's face it—what's cool.

## Exposure Control

After resolution, the next demarcation in the digital camera market is the degree of exposure control provided by the camera. In other words, are you looking for a simple, fully-automatic snapshot camera? Or do you expect a more advanced camera with extra control? Or perhaps you don't care about extra control and would like a snapshot camera with some extra manual controls that will let you grow into a more advanced level of photography.

In the old days of film cameras (circa 20 years ago), you had to pay a lot of extra money to get a camera that offered completely automatic operation. Now, every digital camera offers complete automation, and you have to pay a lot of money for a camera that offers any manual controls.

Typically, cameras that offer more control also offer higher quality lenses and therefore better image quality. Vendors figure that users who are serious enough about photography to understand manual overrides are serious enough to want higher quality components in their camera.

So what do we mean by manual control? If you read Chapter 6, “Exposure Basics,” you got an introduction to the concept of shutter speed, aperture, ISO, and exposure control. A camera with more sophisticated controls will provide you with several options for taking control of exposure decisions. Presented next are the shooting options you can expect to find on a camera, both point-and-shoots and SLRs. How many of these options are necessary depends on your photographic needs.

### Auto Mode

Most digital cameras provide a fully automatic mode that makes the camera function as a simple snapshot camera. In this mode, *every* decision about your next shot will be made by the camera. Shutter speed, aperture, ISO, white balance, focus—even whether to use the flash—are all determined by the camera. If you want to override any of these, you’re out of luck. If you don’t know anything about photography, Auto mode is a great way to start taking pictures immediately. Fortunately, these days the Auto features built in to most cameras are very good.

### Program Mode

Most digital cameras provide a *Program mode*, which gives you a little more control than the fully automatic mode. While shutter speed and aperture will be calculated automatically, the camera might provide a few options for overriding these decisions. In addition, you’ll have the ability to manually change ISO, white balance, focus, and flash. Depending on the quality of the camera’s automation mechanisms, this might be the only mode you need for 80 percent of your shooting. And depending on your camera’s controls, you might find that you can get access easily to all necessary manual overrides, meaning you might not ever need to switch out of Program mode.

However, automatic routines don’t always make choices that yield the *best* results. They often make choices that yield an *average* result. In a tricky lighting situation, average results are nothing to sneeze at. However, there might be times when the camera’s estimations are simply wrong for the situation. It is these times when you’ll want some additional shooting control.

### Preset Exposure Modes

In addition to a fully automatic Program mode, almost all digital cameras these days offer a selection of preset exposure modes. These modes don’t do any type of magic processing; they simply favor—or lock the camera into—particular apertures and shutter speeds that are appropriate to certain situations. Most cameras with preset exposures include variations on the following modes:

- **Landscape:** Cancels the flash, locks focus on infinity, and typically uses as small an aperture as possible for maximum depth of field.
- **Portrait:** Favors wider apertures to produce a softer background.

- **Pan-focus:** Provides settings intended for really fast shooting. Focal length is locked on full wide; focus is kept at infinity. This mode essentially turns your camera into a speedy, fixed-focus camera.
- **Fast shutter:** Forces a large aperture to facilitate a fast shutter speed; sometimes called “Sports.”
- **Night:** Uses slow shutter speeds for dimly lit scenes, and typically fires the flash to provide some foreground illumination. Sometimes called “Slow sync.” Many cameras let you choose whether to fire the flash at the beginning or end of the exposure (see Figure 2.19).
- **Sand and Snow:** Intentionally overexposes the scene so that snow is rendered white instead of gray. Sometimes called “Beach.”

Although these modes provide no facility for fine-tuning, they do let you bias the camera’s decision-making process in a direction that might be more appropriate for your current shooting situation.

### Priority Modes

Priority modes are where the real power lies for the serious photographer. With these modes, your camera gives up some of its autopilot mechanisms and lets you call the shots. For maximum creative control, you’ll want to have at least one of the following shooting modes in addition to the camera’s automatic mode:

- **Aperture Priority:** Aperture Priority mode lets you select the aperture you want to use, leaving the selection of an appropriate shutter speed up to the camera. When you are looking at a camera’s Aperture Priority mode, pay particular attention to the range of f-stops available. You want an aperture priority control that will let you pick any of the camera’s possible apertures.
- **Shutter Priority:** Shutter Priority mode is the opposite of Aperture Priority mode. Pick a shutter speed, and the camera will select the right aperture automatically.
- **Manual:** In true Manual mode, you can set both the aperture and shutter speed, giving you full control over the camera’s exposure.

When evaluating the Manual modes on a camera, be sure the controls for both aperture and shutter speed are easy to use and convenient. You don’t want to miss a shot because you couldn’t figure out how to change the camera’s aperture, or because it took too long to set the shutter speed. In addition, make sure the camera displays some type of meter reading while you’re changing your settings; otherwise, it will be impossible to know if you’re over- or underexposing.

If you know that you’re never going to adjust an aperture or shutter speed setting, you simply don’t need Priority or Manual modes. This decision will immediately eliminate some more cameras from your buying decision. Similarly, if you know that you want to be able to override automatic exposure settings, you can also eliminate some cameras from your field of view.

Now you’re ready to start looking at some of the other exposure features the camera offers. These are controls you need to think about, no matter what level of photographer you are and what types of pictures you most often take.

### Program Shift

As you learned in Chapter 6, many combinations of shutter speeds and apertures yield an equivalent exposure. Many cameras provide a simple feature, called Program Shift, that lets you automatically cycle through all reciprocal exposures after the camera has metered.

**Figure 23.9**

On Canon digital SLRs, the control wheel located just behind the shutter button allows you to automatically cycle through all reciprocal exposures after the camera has metered.



With Program Shift, you can meter your scene and then simply flip through all equivalent exposures until you find one that better suits your photographic intent. If you want a fast-moving object to appear blurry, for example, you can cycle through to an exposure combination that uses a slower shutter speed. Similarly, if you want an image with a shallow depth of field, you can cycle through to an exposure that uses a wider aperture. Program Shift allows you to have a fine degree of exposure control without having to resort to a Priority or Manual mode (see Figure 23.9).

### Exposure Compensation

Exposure compensation controls let you force the camera to over- or underexpose by a certain number of stops (or fractions of stops) without having to worry about actual apertures and shutter speeds. With exposure compensation controls you can, for example, tell the camera to underexpose by half a stop, and it will find a way to do so that still yields a good exposure. These controls are powerful and will often be the only exposure controls you'll need to use, even if you're a serious photographer.

Together, automatic reciprocity and exposure compensation controls provide all the manual control you'll need for most situations. When you are evaluating a camera, take a quick look to see how these controls are implemented. You'll be using them a lot, so make sure they're easy to use, and that you can find them by feel without having to take your eyes off the

viewfinder. You'll also want to ensure that both controls provide good feedback, allowing you to easily see settings as you change them. Finally, be certain that the exposure compensation control provides at least two stops of adjustment in both directions. Most controls let you adjust in 1/3-stop or 1/2-stop increments (see Figure 23.10).

**Figure 23.10**

This display shows a typical exposure compensation read-out. Here, you can see that we've dialed in +1 stop of exposure compensation.



### White Balance

*White balance* is not actually part of the exposure process. However, because it's a parameter you'll want to consider while shooting, we're going to discuss it alongside the exposure controls. The sooner you get into the habit of remembering to think about white balance, the better off you'll be.

White balancing is the process of calibrating your camera so it can interpret colors correctly under the type of light in which you're shooting. When you are assessing a camera, you'll want to consider the following:

- In addition to an automatic white balance control, find out if the camera offers separate settings for daylight, fluorescent, and tungsten. Some systems provide white balance presets that are measured in degrees Kelvin (5500°K, for example). This is fine as long as you know which *color temperatures* relate to which kinds of light (see Figure 7.12).
- For maximum flexibility, you'll want a manual white balance control that lets you set white balance for your particular situation by focusing the white balance system onto a white object. Make sure these controls are easy to get to, because you'll be using them often.

- Does the camera use a through-the-lens (TTL) white balance system or an external white-balance sensor? Ideally, you want a TTL white balance system for better accuracy.
- Many cameras offer “white balance fine-tuning,” a slider that lets you tweak the color parameters of the camera’s preset white balance modes. This fine-tuning lets you compensate for weaknesses in the camera’s built-in settings and for unusual lighting situations.

Finally, you’ll want to look at the quality of the camera’s white balance. Take some sample pictures using the appropriate white balance settings and check for odd color casts. If possible, test the auto white balance mechanism under mixed lighting.

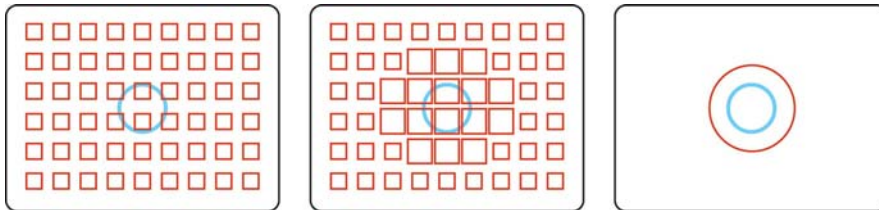
## Metering

Whether you’re shooting on full automatic or calculating your exposures by hand, if you don’t have a decent light meter, you’ll end up with the wrong exposure. The modern light meter is an incredibly sophisticated device, and many camera vendors have not scrimped on adding high-caliber, state-of-the-art metering systems to their digital cameras.

Arguing which company’s metering software is better is a discussion far too technical for this book. Fortunately, metering systems from the major digital camera makers come with years of refinements and are all generally excellent. However, you’ll probably find that metering systems from different companies have different characteristics and tendencies. Some might consistently meter shadows well, whereas others might excel at midtones or highlights. The good news is that a meter’s tendencies will usually be consistent, meaning that over time, you will come to learn how your meter will handle specific situations, and of course, you can always adjust your images in postproduction.

Most higher quality cameras include a selection of different metering modes (see Figure 23.11). These modes typically break down into variations of the following categories:

- **Matrix (sometimes called *multisegment*):** A matrix (multisegment) metering system divides the imaging area into a grid, or matrix, and meters the light coming from each cell. These readings are then analyzed and averaged to calculate the ideal exposure for the shot.
- **Center-weight metering:** A variation of matrix metering, center-weight metering also divides the image area into a grid, but lends more “weight” to the readings from the middle of the image.
- **Spot metering:** A spot meter reads only a single area in your image, usually the center. A spot meter lets you deal with complex lighting situations or tricky backlighting.



**Figure 23.11** Most cameras offer some combination of three metering types. From left to right, *matrix*, which averages meterings from across the frame; *center-weight*, which meters across the frame but gives more emphasis to the middle cells; and *spot metering*, which meters a single area in the center of the image.



As with white-balance sensors, you want a camera that uses TTL light metering rather than a meter that's external to the lens. With an external meter, your camera will not be able to accurately account for any filters or lens attachments you might be using.

Most cameras include some mix of the three systems described previously. To test them, try shooting in complex lighting situations (dark foreground with a bright background and vice versa, darkly shadowed areas, and areas with lots of bright highlights) and see how the camera chooses to meter. Does it preserve shadows? Does it blow out highlights? Most important, does it do these things consistently?

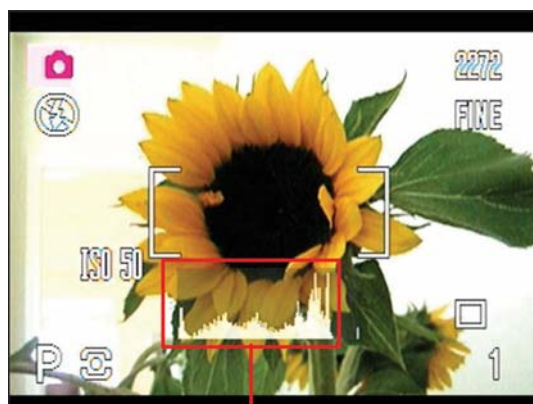
## ISO Control

With a film camera, you're limited to a particular film speed for an entire roll of film. With a digital camera, you can adjust the sensitivity of your camera on a shot-by-shot basis, by changing its ISO, giving you options that film shooters never dreamed of.

Most digital cameras have a standard ISO rating somewhere between 80 and 100. In other words, these cameras have a light sensitivity that is roughly equivalent to film rated at 100 ISO. Many digital cameras allow you to increase their ISO rating, typically offering a choice of 100, 200, or 400. Some cameras offer a slower ISO 50 speed, whereas higher end cameras can go as high as 25,600. These faster, more sensitive modes allow you to shoot in lower light without using a flash (which is ideal for situations where a flash is inappropriate), and allow you to use faster shutter speeds and smaller apertures in bright daylight. However, just as faster film produces grainier images, higher ISO settings in a digital camera produce images with much more noise (see Figure 7.28).

The ideal camera provides an automatic ISO mechanism (that is, it automatically selects a faster ISO when there is not enough light) and manual selection of ISO. Be sure to look at images shot with different ISOs to get a sense of how noisy the camera becomes at higher speeds.

Because you can change ISO from shot to shot, ISO serves as a third exposure parameter (after shutter speed and aperture). As such, you ideally want an ISO control that is easy to access and provides a clear indication of what the current ISO is so that you don't shoot indoors at ISO 400 and then forget to change back to a slower speed when shooting outdoors, because you'll be introducing extra grain into your images.



**Figure 23.12**

A live histogram display (shown here directly beneath the focusing target) is an excellent exposure tool that makes it much easier to determine the correct exposure.

**Live histogram display**

## Live Histogram

Histograms are an essential tool for determining if you've chosen the correct exposure when shooting. On many cameras, you must take a picture before you can examine its histogram. However, many point-and-shoot cameras now provide live histogram displays that can be used while shooting (see Figure 23.12).

A live histogram is particularly useful for cameras that lack optical viewfinders, because LCD viewfinders don't always provide a full view of an image's dynamic range.

Although not a feature for the typical snapshot photographer, if you have more serious photographic goals, a live histogram can be a handy, although not essential, feature.

## Exposure Locks and Panoramas

Panoramic shooting is a great way to capture broad vistas without having to spring for a fancy wide-angle lens or adapter. Although you might have experimented with shooting panoramas with your film camera, your digital camera is a much better tool for creating collaged (panoramic) images, thanks to powerful stitching software you can use to process your images.

When you buy a camera, it's worth trying to get one that has a *Panoramic* or *Exposure Lock* mode. Exposure Lock simply means that after you take the first image, the camera locks its exposure and shoots the rest of your panoramic series using those same settings to ensure even exposure across the entire image.

Some cameras offer a special *Stitch Assist* mode that provides visual cues to ease panoramic shooting. These modes often work with special software that can automatically stitch an image as it's transferred to your computer. Although such automation is nice, it's not required for high-quality panoramic shooting.

Exposure Lock can also be handy in normal shooting situations when you want to meter off one part of an image and then reframe your shot. You can do this on most cameras by pressing the shutter button, but you'll lock focus and exposure. A dedicated exposure lock lets you control exposure and focus independently.

## Depth of Field Preview Button

Many SLRs have a depth of field preview button that lets you see an approximation of the depth of field you will achieve with your current exposure settings. If you like shooting with depth of field effects, this can be an essential feature. Make sure the button is easy to reach.

## Selectable Color Space

There are many different ways of modeling and representing color. Each model has a particular gamut of colors it can display. The available gamut is referred to as a *color space*. For now, all you need to know is that some color spaces are better than others are, and many cameras offer a choice. Ideally, you want a camera that provides an assortment of color spaces, including Adobe RGB. Most cameras will shoot in the sRGB color space.

## Camera Design

By this stage, you should know whether you're favoring an SLR or a point-and-shoot, have an idea of what resolution you want, and know what basic exposure features you need to have for the type of shooting you do. You can further reduce the field of candidates by making some basic decisions about the physical design of the camera you want. These considerations range from the physical size of the camera, to the quality of the viewfinder, to the layout of the camera's controls. Like any tool, a camera will be of dubious value if it is poorly designed and difficult to use.

With the elimination of film—and all the film-handling mechanics a film camera requires—it's possible to make a digital camera that provides a size, body design, and features that film photographers of 10 years ago would never have dreamed of. Consequently, camera makers find themselves trying to balance the old against the new. Sometimes the balance works, and sometimes it doesn't.

When considering a camera's design, you will evaluate size, comfort, and features. However, camera selection also involves trying to find a camera that facilitates your style of shooting. If you're shopping for a point-and-shoot, you'll need to think about what kind of focal length range you usually need. Do you frequently shoot subjects that require a telephoto lens? Then you'll be looking at larger cameras. Is small size and easy portability your primary concern? Then you'll be looking at cameras with smaller lenses. Viewfinder concerns will also be a huge consideration when shopping for a point-and-shoot. All of these issues will inform the camera's overall design.

If you're shopping for a digital SLR, you won't have such a wide variety of camera designs from which to choose. There will be plenty of features that inform your decision, and we'll cover all of them. However, when it comes to basic design, you'll mostly be looking at differences in size and control layout.

The design of your camera's body influences how easily and quickly you can get to the camera's controls and settings. Therefore, you'll want a camera with a design that makes sense to you and allows you to "feel" your way around without having to take your eye off your subject.

## Size

Probably your first concern when considering the physical specs of a camera is its size. Are you looking for a tiny camera that will fit in a shirt pocket, or are you willing to carry something bigger? Although tiny and portable is great, there's a price to pay with a smaller camera, because smaller units typically lack the features and controls of larger models. On the other hand, a camera doesn't do you any good if you don't have it with you, so smaller cameras definitely gain points for the fact that you're simply more likely to carry them (see Figure 23.13).



**Figure 23.13**

These days, you can get a very good digital camera in just about any size. Tiny pocket-size cameras such as the Canon digital Elph series pack high-resolution sensors and very good lenses that produce excellent images, but lack some more sophisticated controls.

Larger cameras typically sport better viewfinders, often better lenses, have more controls, and are usually a little easier to shoot with. The larger size makes for an easier grip, whereas the heavier weight can make it easier to shoot steady, sharp images.

As digital camera technology progresses, vendors are integrating more and more functions into custom chip sets that can be dropped easily into any camera. For example, the Canon DIGIC image processing chip first appeared in some of their higher end cameras as a single-chip solution for all of the cameras' image processing needs. This chip soon migrated down to the lower end of Canon's lineup, bringing high-end features to less expensive cameras.

Many other vendors have followed suit, meaning you can now get a low-priced (\$200–\$400) mid-sized camera that offers the same program and manual modes as a higher end camera. What separates these models from their higher end brethren? Although high-end and low-end cameras now share more and more features and body designs, higher end cameras still sport better, more expensive lenses and often have additional high-end controls, as we'll see later.

One of the most important considerations to weigh when considering a particular camera is: Can you hold it comfortably for long periods of time? You don't want a camera that is so small that you'll easily drop it, nor do you want a camera that's so large that your hands will cramp up after a few hours of shooting. Before you purchase any camera, you should get your hands on it and make sure you can handle it comfortably.

## Body Design

Because film cameras have to have a mechanism for rolling film from one spool, across the focal plane, and onto another spool, they all have a basic design that is roughly the same. Digital cameras don't have this limitation. Since image sensors are so small, they can be tucked away into just about any part of a camera's body. This means that digital cameras can have radically different shapes and designs from traditional film cameras.

Consider, for example, the Nikon Coolpix S4 (see Figure 23.14). The S4 holds its lens, flash, and sensor in one housing, and its LCD screen, processor and controls in another. The lens tilts up and down, affording you a wide range of viewing angles, thus allowing you to use the camera while holding it over your head, at waist level, or up to your eye.



**Figure 23.14**

The Nikon S4 provides a split body design that houses the LCD and camera controls in a swiveling chassis held separate from the lens and image sensor.

These days, most cameras employ a typical boxy design reminiscent of point-and-shoot film cameras (see Figure 23.15). However, even within this traditional design, vendors often add some extra variations such as tilt-out LCD screens that provide the same shooting flexibility as the Nikon Coolpix S4.



**Figure 23.15**

Many point-and-shoot cameras offer traditional, boxy camera designs but with unique improvements, such as tilt-and-swivel LCD screens that provide incredible shooting flexibility, as shown in this Canon PowerShot S3 IS.

As you learned earlier, a digital camera takes pictures using the same basic mechanisms as a film camera: light is focused by a lens onto an image sensor, which captures an image and stores it on a memory card. Obviously, as with a film camera, you need some way of “aiming” the camera so you can see what the camera is seeing, to compose your shot. This is the role of the camera’s viewfinder.

## Viewfinders

There are three types of viewfinders. Point-and-shoot cameras will have a rangefinder viewfinder, an LCD viewfinder, or both, while an SLR has a through-the-lens (or TTL) viewfinder. Each type has its own advantages and disadvantages.

### Rangefinder Viewfinders

In a rangefinder camera, the image sensor is positioned directly behind the lens. An additional, smaller lens positioned above the main lens provides you with a view of your scene. In other words, the camera looks through one lens while you look through another (see Figure 23.16).

Because they are optically less sophisticated, rangefinder systems are much easier to build than other viewfinder systems. On the downside, because you’re not looking through the same lens the image sensor is looking through, you’re not necessarily seeing the exact image that will be recorded. If you’re using lens filters or extensions—such as a telephoto or wide-angle extension—you won’t be able to see the effects of these lens add-ons through your viewfinder.

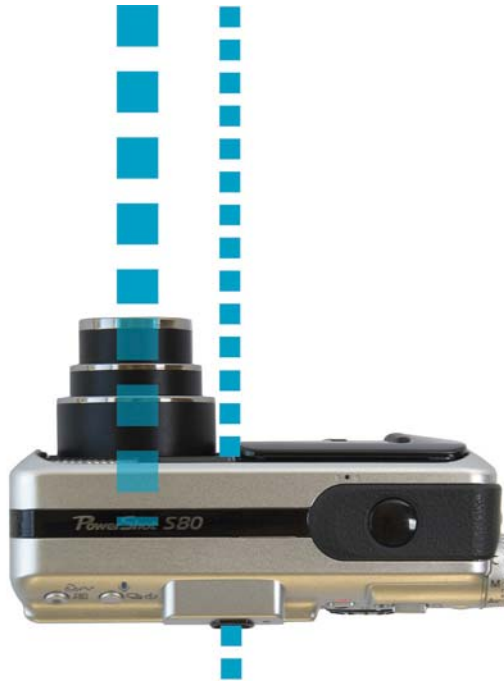
Also, because the viewfinder is positioned above or to the side of the imaging lens (or sometimes, a little of each), you might have trouble with parallax when shooting objects that are very close. Just as something very close to your face appears in a slightly different position when you close one or the other eye, objects very close to your camera will appear in a different position in your viewfinder than they will in your final image.



The viewfinder lens is referred to as the *optical viewfinder*, but most rangefinder cameras also let you use the camera's LCD screen as a viewfinder. More on these in a moment.

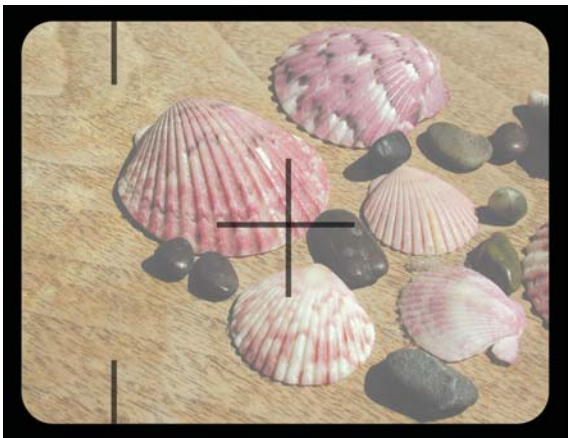
Unfortunately, most vendors don't put much effort into their optical viewfinders, so you won't have a lot of options when you shop around. When testing an optical viewfinder, check for simple issues such as clarity and distortion. Does the viewfinder provide an image that is clear and easy to see? Most cameras also include one or two status lights within their optical viewfinders—one to tell you the camera has focused, and another to tell you the flash is ready. Make sure these lights are easy to see within the viewfinder and are visible in bright daylight.

You'll also want to be sure that the viewfinder provides some type of focusing target such as crosshairs, and if you'll be doing a lot of macro photography, you'll probably want some parallax guides (see Figure 23.17).



**Figure 23.16**

In a rangefinder camera, the light passing through the camera's lens falls onto the focal plane. The viewfinder uses a completely different light path, meaning that what you're seeing in your viewfinder is not exactly what's landing on the image sensor.



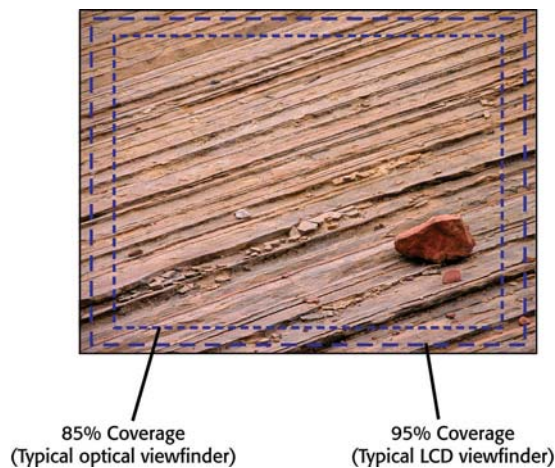
**Figure 23.17** When you shoot at close range, what you see through the viewfinder of a rangefinder camera is not what your camera will actually shoot.

Parallax guides give you an indication of where the real edges of the image are. The image on the left shows the view through the viewfinder, and the image on the right shows the resulting picture. Notice that the parallax lines allow you to correctly frame the left side of the image, even though you can't see the right side (because you're too close to the subject). If a camera's viewfinder is above the lens rather than next to it, the camera will exhibit parallax shift vertically rather than horizontally.



**Figure 23.18**

The LCD viewfinders on most digital cameras offer an almost complete view of the image that will be captured. The optical viewfinders on most point-and-shoot and prosumer cameras offer much lower coverage.



The most important thing to know about the optical viewfinders on rangefinder cameras is that they rarely provide good coverage. That is, they don't show you the same field of view the camera's lens is seeing. On average, an optical viewfinder will display about 85 percent of the final image, although some can go as low as 65 or 70 percent (see Figure 23.18). By comparison, LCD viewfinders and the viewfinders in high-quality SLRs deliver at least 95-percent coverage.

Because you're seeing a smaller-than-actual-size image, you don't have to worry about accidentally cropping something out of your frame, but you will have to crop your image later to get the same framing you saw when you looked through the viewfinder. Since you have limited resolution in your camera, optical viewfinders can be frustrating in that they don't allow you to make the best use of all the pixels at your disposal.

**Figure 23.19**

A diopter wheel lets you adjust your optical viewfinder to compensate for your own vision.



If you wear glasses, look for a diopter adjustment next to the optical viewfinder (see Figure 23.19). This is a small wheel that allows you to adjust the optical viewfinder to keep it in focus.

Many vendors model their digital rangefinder cameras off the same rangefinder designs they use for the point-and-shoot 35mm and APS film cameras. As such, you might feel comfortable and familiar with a rangefinder camera; familiarity makes for quick learning. These types of cameras can also be made very small, making it simple to carry them anywhere.

Because these designs span the

spectrum from low-end to high-end, you don't have to compromise image quality to get an easy-to-use, possibly familiar digital camera.

### LCD Viewfinders

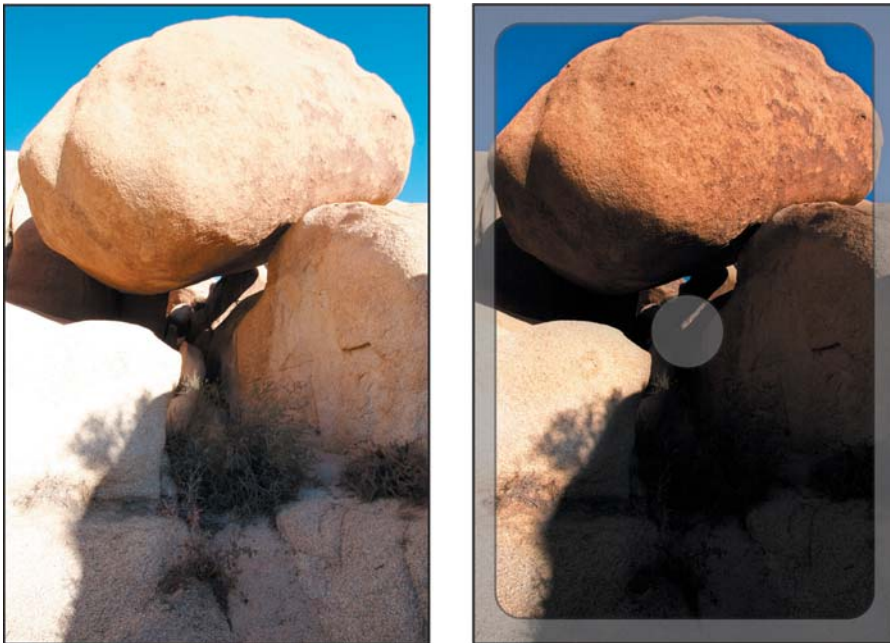
All point-and-shoot cameras include the capability to use their LCD screens as a viewfinder. With the LCD viewfinder, you'll have much more flexibility in the way you shoot because you can position the camera wherever you want. Moreover, because the image on the LCD is coming directly off the camera's image sensor, you get to see a close approximation of your

final image. It's not an exact image because your camera might do some processing (color correction, sharpening, noise reduction, and so forth) of the image data before saving. If you're using any lens filters or lens attachments, you'll be able to see their effects on the LCD.

The downside to LCD viewfinders is that images in them can be difficult, if not impossible, to see in direct sunlight. Similarly, shooting in very dark situations can be difficult, because the camera's image sensor may not be able to resolve enough detail to make a clear image. (This doesn't mean the camera still can't take a legible image by using a long exposure. It just means you'll have a difficult time framing that image.) Also troublesome is that LCD screens can be battery-hungry.

The biggest problem with an LCD viewfinder has to do with composition and dynamic range. Your eye has the ability to see a tremendous range of light to dark. Current camera technology, whether digital or film, can only record about half of this range. Consequently, a big part of your decision-making process when shooting and editing is to decide what you want to capture from the full range of brightness your eye can perceive.

When you look through an optical viewfinder, you perceive the full dynamic range of the scene. You can then make any relevant exposure decisions, which will allow you to capture the scene in the way you want. The image shown on your camera's LCD viewfinder is generated by the camera's image sensor, which means it has a more limited dynamic range than your eye has. As such, you won't see the full range of tones that are present in your scene. Most cameras will adjust the image on the LCD viewfinder to protect the highlights—that is, to allow you to still see detail in the brightest parts of the image. This means that shadow areas will probably turn completely black (see Figure 23.20).



**Figure 23.20**

The image on the left shows how this scene looks to your eye. The image on the right shows how it looks through the more limited dynamic range of an LCD viewfinder. Since you can't see all the details, it can be more difficult to judge composition while looking at the viewfinder.

This can greatly complicate composition on an LCD, because you simply can't see all the details in your image. Photographers who have only worked with digital cameras usually don't notice this difference, but if you're coming from a film background (even a point-and-shoot film background), making the switch to an LCD viewfinder can be tricky.

## LCD-Only Cameras

Some cameras eschew the optical viewfinder/LCD combo in favor of an LCD-only approach. Available in a range of resolutions and packing vast arrays of features, these cameras often offer the most radical departures in camera design.

When considering an LCD-only camera, you'll need to weigh all the same factors you would with any other type of camera, but you'll probably want to put a little extra emphasis on assessing the quality of the camera's LCD screen. After all, because this is your only way of framing a shot, you'll want to be certain it provides a good view.

### Evaluating an LCD Screen

While the built-in LCD screen is one of the great advantages of a digital camera, a bad LCD screen can actually be an impediment to good results, especially if your camera only provides an LCD viewfinder. When you evaluate a camera, be sure to consider the following issues regarding the LCD screen:

- **How big is the LCD?** When it comes to LCD viewfinders, bigger is better. Most LCDs range between 1 1/2 and 3 inches (measured diagonally).
- **How bright is the LCD, and how visible is it in bright sunlight?** Brighter is better because it will make the screen easier to read in direct sunlight. Transreflective LCD screens use a combination of backlighting and reflected ambient light to create an image that is very clear in bright sunlight. If you plan to do a lot of outdoor photography, this feature is valuable.
- **How good is the refresh rate?** The frequency with which the camera updates its LCD viewfinder is referred to as the *refresh rate*. A camera with a low refresh rate will deliver a stuttery image in the viewfinder. A low refresh rate can also cause smeared color artifacts and lower resolution.
- **How does the LCD viewfinder perform in low light?** If you plan to do a lot of night shooting, you'll probably need a camera with both an LCD and an optical viewfinder, because there's a good chance that images in your LCD screen will appear black in low-light situations. Some cameras, though, offer special modes that artificially brighten the image in low light. If you spend most of your time photographing in the dark, this will be a worthwhile feature to seek out.
- **How good is the coverage on the LCD?** Most LCD viewfinders show an image that is 95 percent to 98 percent of the image that will actually be shot. Any less than this should be considered a liability.
- **Does the LCD have an antireflective coating?** This feature can make a big difference when you are shooting in bright sunlight, because it will greatly cut down on glare on the LCD.
- **Does the LCD offer a brightness control?** Many cameras feature LCD screens with adjustable brightness. Although a brighter screen uses more power, it can be easier to see in direct sunlight.

You'll also want to consider the physical design of the LCD. Most cameras simply have their LCD screens mounted on the back of the camera body, but as you saw earlier, some models place the LCD on a swiveling panel that can be flipped out, away from the camera.

## Viewfinder Hoods

Although the quality of LCD viewfinders has greatly improved, it can still be difficult to see them in bright sunlight. Special hoods that fit over the LCD screen, such as the Hoodman (see Figure 23.21), offer a simple, portable solution for reducing glare in direct sunlight. For more information, check out [www.completedigitalphotography.com/hoodman/](http://www.completedigitalphotography.com/hoodman/).

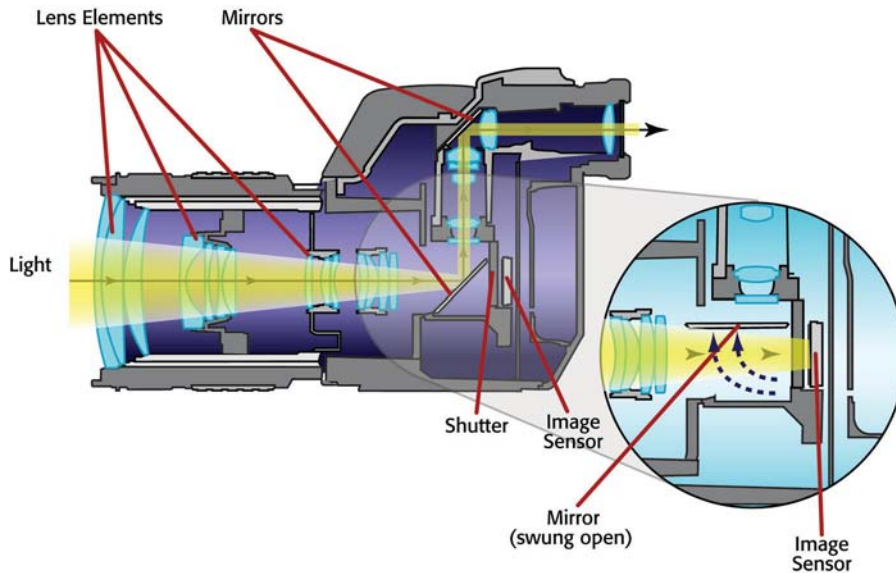


**Figure 23.21**

Hoodman, USA produces numerous LCD hood accessories that make your camera's LCD screen much easier to see in bright daylight. In addition to shielding the screen, many Hoodmans also include built-in magnifiers that produce a larger image.

## Single Lens Reflex (SLR) Viewfinders

In an SLR, the image sensor is also positioned directly behind the lens. However, unlike a rangefinder or LCD-only camera, in an SLR a mirror is positioned between the lens and the image sensor. (The shutter sits between the mirror and the sensor.) This mirror reflects the light coming through the lens up into a prism, which bounces the light out through the eyepiece. When you press the shutter button, the mirror flips up, so that the light coming through the lens passes onto the image sensor (see Figure 23.22).



**Figure 23.22**

In an SLR camera, light passing through the lens is bounced off a mirror and up into the viewfinder. This through-the-lens (TTL) light path ensures that you are seeing the same thing the camera sees. When you press the shutter-release button, the mirror is flipped up so the light can pass onto the image sensor.

The movement of the mirror is what causes your viewfinder to black out when you press the shutter release. (With the mirror pulled up, your viewfinder is no longer being fed the light that's coming through the lens.) Because they look directly through the lens, SLR viewfinders present a much higher quality view than a rangefinder, which looks through separate, low-quality optics. The result is a viewfinder that is usually brighter and clearer than the optical viewfinders on a typical rangefinder camera.

In addition, because you are looking through the same lens the image sensor looks through, you can see the effects of any filters or lens extensions you may have installed on your lens, and you don't have to worry about parallax. You also typically get better coverage from an SLR viewfinder than you do from the optical viewfinder found on a rangefinder camera. Finally, SLR viewfinders usually include status displays that show exposure information and other camera settings. Because you can see your image and all your settings in the same viewfinder, you're free to concentrate on your image.

However, there can be a downside. One of the great advantages of digital cameras is the capability to use the LCD on the back of the camera as a viewfinder. This is achieved by pulling the "live" image off the image sensor and passing it to the screen. In an SLR, though, there *is* no light hitting the image sensor until you press the shutter release. Therefore, on most SLRs, you can't use the LCD as a viewfinder.

However, over the last couple of years, most SLR makers have started offering Live View on their SLRs. A Live View feature lets you use the LCD screen as a viewfinder, just as you would on a point-and-shoot camera. Olympus was the first company to offer Live View, and they implemented it by placing a beam splitter in the camera's mirror chamber. This passed some of the light coming through the lens onto the LCD.

Most SLRs implement Live View by simply flipping the mirror up when you put the camera into Live View mode. This causes the optical viewfinder to black out, but that's not really such a problem. Unfortunately, because an SLR's autofocus sensors are typically in the prism chamber at the top of the camera, they also go blind when the mirror flips up, so your autofocus feature ceases to function normally. Most cameras get around this in two ways, they either use the camera's image sensor and on-board computer to calculate focus, which can be slow, or they flip the mirror back down when you half-press the shutter button, causing a blackout of the LCD screen.

When evaluating an SLR's optical viewfinder, you'll want to consider how bright the viewfinder is, how big it is, and whether its brightness extends evenly from edge to edge and corner to corner. You'll also want to pay attention to what type of status display is shown in the viewfinder. Ideally, you want to see at least shutter speed, aperture, ISO, and exposure compensation in the display.

Finally, some SLRs allow you to change the focusing screen. The focusing screen is the flat translucent plane onto which the image in the viewfinder is projected. Some focusing screens have markings or textures that are intended to serve as focusing aids. In a camera with interchangeable focusing screens, you can replace the default screen with one that is perfectly clear. This can be an essential feature if you intend to do a lot of manual focusing or specialized shooting such as astrophotography.



## Electronic TTL Viewfinders: The “Other” SLR

Many cameras have an SLR appearance, but they don't actually have a true single lens reflex design. Although these cameras have a viewfinder positioned just like a real SLR, the viewfinder is not optical. Rather, it is an electronic viewfinder—a little LCD screen—just like you'd find on a video camcorder. These electronic TTL viewfinders show the same image as the LCD screen on the back of the camera. Although this is a terrific advantage over the typical optical viewfinder found on a rangefinder camera, it is far inferior to a true SLR viewfinder.

Electronic TTL viewfinders lack the clarity and resolution of a true SLR viewfinder, which makes manually focusing extremely difficult, and can be distracting when framing. They're often difficult to see in bright light, and many of them freeze their displays while the camera is autofocus-ing, which makes it very difficult to track moving action. In addition, the lack of clarity and freezing image can be a distraction in your picture-taking process.

In addition, because they are limited by the performance of the camera's imaging chip, electronic viewfinders inherently have a lower dynamic range than an optical viewfinder. Although this means that the viewfinder will show a truer representation of the range the camera can capture, it also means that you're not seeing the full range of colors that are actually there, which might hamper your process of deciding which colors you want to capture.

To their credit, they offer extensive feedback of the camera's current settings and, unlike an external LCD screen, can be seen in bright sunlight. You'll want to evaluate these viewfinders just as you would any other LCD screen. If you're set on a camera with an electronic viewfinder, try to find one that also offers a live histogram feature. Because you'll be looking at an inferior image, you'll need all the technical feedback you can get.

## What We Know So Far

Keeping in mind the questions we've outlined so far, you should have narrowed your decision based on the following criteria and decisions:

- You've made a budget and determined your price point.
- You should have selected a resolution.
- You've made some decisions about the basic control and exposure options you want.
- You've identified the size of camera you're looking for.
- You know whether you want an SLR or a point-and-shoot camera.
- If you're shopping for a point-and-shoot, you've identified the focal length range you want to have.
- Based on your understanding of the advantages and disadvantages of different viewfinder systems and how they relate to your photographic style, you should have further refined your search.

In other words, you should have narrowed your selections to cameras with a particular resolution, of a particular size, and design.

Now you're ready to start evaluating the individual features of each camera you'll consider. No matter what resolution, size, or style of camera, the next section will give you an idea of what features you might want to look for and how to evaluate them when you find them. There are many features available, but if you've resolved the previous criteria, you've done most of the difficult work of selecting a camera.



### “Okay, How About My Camera Phone?”

While Nikon and Canon may be the big names in photography, Nokia still sells more cameras than both of them combined. If you bought a cell phone in the last few years, the odds are good that it has a camera on it. Camera phone resolutions are increasing all the time, with some vendors touting five-megapixel phone cameras.

Hopefully by this point, you recognize that just because a phone has a five-megapixel imaging chip doesn't mean it's a good camera. Camera phones have tiny, plastic lenses, no dedicated image processing circuitry, and must heavily compress their images due to limited on-board storage.

You can take attractive pictures with a camera phone, but they'll be attractive because of their flat, smeared color and “lo-fi” look. While tiny camera phones may one day be a substitute for a “real” camera, they're still a long way from being a serious photographic tool.

## Features

It used to be that when you bought a camera, you got a device that took pictures. Well, not anymore! Now when you buy a camera, you get a device that takes pictures of many different sizes, with many different color options and effects, using many different automated tools, and that might even shoot full-resolution video with sound. Sure, you might not need *all* these features, but for quality work, you will need many of them. Consequently, it's important to spend some time considering the quality and performance of the various hardware and software systems onboard any camera you're considering.

In this section, we're going to work through all the major options found on today's cameras. In the process, you'll get a better idea of whether each feature is valuable to you, and will learn some criteria by which you can evaluate each option.

## Lenses

Your camera's lens is where the whole imaging process starts. (Actually, your light source is where the whole imaging process starts, but let's forget about that for the moment.) If you have an inferior lens that can't do a good job of focusing light onto the camera's focal plane, the quality of the camera's image sensor and internal processing software won't really matter.

If you're shopping for a point-and-shoot camera, there's some good news, thanks to the small sensor sizes used in digital point-and-shoots. Because a lens doesn't have to project a very big image to cover the very small image sensors used in point-and-shoot digital cameras, point-and-shoot lenses can be much shorter, and of much smaller diameter, than a lens for a 35mm camera. This is great news for lens designers, because it's much easier to correct aberrations in shorter lenses with small diameters. Consequently, point-and-shoot cameras—even inexpensive ones—tend to have very good lenses. Often, the lens on a point-and-shoot digital camera will be far superior to the lens on a point-and-shoot film camera, meaning that you'll usually get *better* results from a low-end digital camera than from a low-end film camera. Of course, there are exceptions, but in general, you can expect to find point-and-shoots packing decent to very good lenses.

If you're shopping for an SLR, you have good news of a different variety: because you can change the lenses on your camera, you have many more options in terms of quality, features, and focal lengths. What's more, you don't have to commit to a particular feature set or quality when you make your initial purchase. If you're on a budget, you can select a starter lens to begin with and then upgrade with better lenses later.

### Evaluating Lens Image Quality

As with other features, you should test the quality of a lens before you commit to buying a particular camera (or a particular lens, if you have an SLR). The easiest way to test a lens is to shoot some images with it and look for aberrations and image quality troubles. There are a number of different types of lens aberrations ranging from astigmatism to comas, but in a modern, high-quality lens, you need to worry about only a few types of issues. When you look for aberrations or image-quality troubles, be sure to test the lens throughout its zoom range. When evaluating a lens, consider the following information:

- **First, check for general focus and sharpness.** How well does the lens render fine detail? Are the corners of the image as sharp as the middle? Be sure to check throughout the camera's zoom range. Often, as you zoom to a wider (shorter) focal length, the camera will have more trouble maintaining sharpness from corner to corner. Also, try shooting with a number of different apertures. Most cameras have an aperture "sweet spot" that yields the best focus—it's often two stops down from its widest aperture.
- **Does the lens have trouble with chromatic aberrations?** Shooting trees or telephone wires against a bright sky is often a good way to force chromatic aberrations. This problem usually occurs only at wider—sometimes fully wide—angles. Even the best lens can suffer from chromatic aberration, so don't immediately discount a camera if you see some purple or red fringing around an object. Rather, try to assess how severe the problem is, how extreme your shooting situation is (in other words, will you realistically be shooting in such a situation very often), and whether the problem is actually bad enough to show up in your final output, whatever it may be.
- **Vignetting is a darkening of the image around the edges and corners that usually occurs at the extremes of the camera's zoom range.** Look for changes in brightness across the image and throughout the zoom range.
- **Barrel and pincushion distortions are spatial distortions of your image that are similar to a funhouse mirror.** Barrel distortion causes a straight vertical line to be bowed outward toward the edges of the frame; pincushion distortion causes a straight vertical line to be bowed inward toward the middle of the frame. These distortions are more prevalent at the wide angles of your zoom lens and will definitely occur if you attach a telephoto, wide-angle, or fisheye attachment to your lens.
- **The contrast produced by a lens might vary when you are using smaller apertures.** Try shooting some high-contrast areas using the widest and narrowest apertures of the lens.
- **Wider-angle lenses are more prone to lens flares** (see Figure 23.23). Zoom the lens to its widest angle and shoot some tests into bright light sources (but never point a camera directly at the sun!) to test for flares. If a lens has a propensity to flare, be aware that you can often prevent flares through the use of a lens hood.
- **Lens quality can also affect color reproduction.** If you find that a camera tends to shoot images that are a little "warm" or "cold," the trouble might be in the lens.

It is impossible to eliminate all aberrations in a lens. Your goal in testing a lens is to determine what kinds of troubles it has, how bad those troubles are, if you think they will affect the type of shooting you tend to do, and if you can work around them. For example, all aberrations except for distortions can be reduced by stopping down the lens, and many kinds of distortion can be eliminated using special software.



**Figure 23.23**

This lens flare is an example of one of the types of flares that can occur as light bounces around inside the lens. Better lenses are less prone to flaring.

When looking at cameras, you'll often see specifications that describe a lens as being *aspherical*. This simply means that the lens is not a perfectly round hemisphere. Aspherical lenses contain some nonspherical elements that are designed to eliminate certain aberrations. You might also see that a lens has some type of coating on it that usually serves to reduce reflections and flares.

In addition to the quality issues described previously, you'll want to consider the following lens features when evaluating a point-and-shoot camera:

- **What is the focal length range of the lens?** You can't change lenses on a point-and-shoot camera, so you're stuck with whatever focal length range the built-in lens has. For maximum flexibility, you'll want as wide a range as possible; however, this will probably mean buying a bigger camera. Think about the type of shooting you like to do, and make sure your candidate cameras offer a focal length range that will support your shooting style.
- **Does the lens support add-on extensions?** Some point-and-shoot lenses support add-on extensions such as telephoto or wide-angle adapters. These can often provide you with the extra focal length range you'll need, without having to go to a larger camera with a bigger lens. If you think you'll want such extensions, be sure to consider how easy they are to attach and remove when evaluating the camera.
- **Does the lens have threads?** A threaded lens allows you to add filters, which can be essential for achieving certain effects. Some cameras require a special adapter for attaching threaded components. If you're considering such a camera, be sure to add in the cost

of the extra adapter, and try to determine how easy it is to attach and remove it. In addition, find out if you have to remove your attachments before you can remove the adapter, because these actions will make the camera a bit more difficult to use.

- **Does the camera have an electronic or manual zoom control?** On a longer lens, a manual zoom mechanism—usually a rotatable ring on the camera’s lens—is better than an electronic mechanism because it allows for a finer degree of control, faster zooming, and less use of battery power. On smaller cameras, manual zoom controls are simply not possible.
- **Is the camera’s zoom control proportional?** A proportional zoom control varies zoom speed, depending on how far you push the zoom button. In other words, if you push the zoom control just a little way “in,” the lens zooms in slowly. If you press it a long way “in,” the lens zooms in quickly. Proportional zoom controls make it easier to make fine adjustments and to get the lens zoomed quickly to the area you’re targeting.

### Interchangeable Lenses

If you have opted for a digital SLR that supports interchangeable lenses, your lens evaluations are going to be more complicated simply because you have so many more choices. You’ll have the option to use lenses that can go much wider or much more telephoto than what you’ll find on cameras with built-in lenses. You’ll have options for many different zoom ranges and prime lenses—non-zoom lenses of a fixed focal length. And you’ll be able to choose from a selection of lenses with drastically varied quality.

When evaluating a lens for a digital SLR camera, you’ll want to consider all the same issues discussed in the previous section. In addition, you’ll need to weigh the following factors particular to interchangeable lenses:

- **Focal length:** Whether you’re looking at a zoom or a prime lens, your first concern is to get a lens that provides the focal length you want. If your camera has an image sensor that’s smaller than a piece of 35mm film (and currently, almost all digital SLRs have smaller image sensors), remember that the effective crop of any lens will be narrower than it would be on a 35mm camera. For example, many Canon EOS SLRs have a focal length multiplier of 1.6x, meaning any lens you use will have an effective crop that is 1.6 times greater than it would be if mounted on a 35mm camera.
- **Image stabilized:** Many lenses include image stabilization hardware. These mechanisms track the jitter you produce with your hands and automatically alter certain optical properties of the lens to counteract the effects of that jitter. Therefore, if you jitter to the left, the lens alters itself to bend the light passing through the lens back to the right to counteract the jitter. Image stabilization is not meant to be a substitute for a tripod. Instead, it provides enough stability to make it easier to frame a shot when using an extremely telephoto lens, and can allow you to shoot in much lower light, with slower shutter speeds, without worrying about hand shake. Stabilized lenses will often rate the degree of stabilization in terms of a number of stops. For example, a lens that provides three stops’ worth of stabilization will let you shoot with a shutter speed that is three stops slower than what you would normally expect for that focal length.
- **Size of the lens:** Obviously, you’ll want to consider the size and weight of a lens, simply to assess whether you really want to lug it around with you. With a very large-diameter lens—such as an extreme wide-angle lens—you’ll want to also check to see if the lens casts a shadow when used with the camera’s onboard flash.

A reduced-sensor SLR can be very generous to a lens. For example, some wide-angle lenses are susceptible to lens flares and vignetting around the edges and corners. However, because a reduced sensor SLR captures only the middle portion of the lens, these troubles are often cropped away. (If you're using a lens designed for a reduced-sized sensor, you'll be capturing edge-to-edge and will need to check the edges for flares and vignetting.)

That said, a cheaper lens that fares sufficiently well on a 35mm film camera might not perform as well on a high-res digital camera, simply because a high-res camera requires a lens that can focus well to a very tiny area.

### Stabilized Sensors

While some vendors, such as Canon and Nikon, make lenses that have built-in stabilizing mechanisms, a few vendors, such as Sony and Pentax, have opted to stabilize the *image sensor* itself. The sensor sits on a movable plate that can be shifted from side to side and up and down to compensate for any jitter introduced by your hand. The advantage of a stabilized sensor is that it will work with any lens you attach to the camera. The disadvantage is that stabilization mechanisms usually need to be tweaked to a particular focal length for optimal performance. Consequently, you'll typically find that sensor stabilization methods don't yield as much stabilizing effect as stabilized lenses. In addition, with a stabilized sensor, the stabilization is happening *after* you've looked at the image, which means that a stabilized sensor offers no advantage when trying to shoot with an extremely telephoto lens. A stabilized lens, on the other hand, provides a steady view while framing, which can make telephoto shooting much easier.

### Check Your Speed

Whether you're looking at an SLR with removable lenses or a point-and-shoot, you'll want to give a little thought to lens speed. The "speed" of a lens simply refers to the widest aperture to which it can be opened. Therefore, a lens that can open to f1.2 is a very fast lens. With such a wide aperture, it can gather a lot of light in a short amount of time, meaning you can use faster shutter speeds. In addition, you can shoot with shallower depth of field.

Zoom lenses typically have an aperture range that corresponds to their focal length. So you might see a zoom lens that lists its speed as f4–5.6. This means it's f4 at the wide end and 5.6 at the telephoto end. You probably won't be able to find a point-and-shoot camera with a zoom lens that's a constant speed across its range. In fact, you probably won't have many options, speed-wise, when shopping for a point-and-shoot. However, your depth of field options are limited on a point-and-shoot anyway, due to the smaller sensor size.

If you're shopping for a lens for an SLR, you have many more speed options. In general, speed differences will be one of the primary factors that impact a lens's price. For example, Canon sells an excellent 50mm f1.8 lens for under \$100. Their 50mm f1.4 lens, though, sells for several hundred dollars. Making a fast lens is not easy, so you'll pay a price for it. In addition, faster zoom lenses are usually much larger than their slower counterparts. Therefore, if you want speedy lenses, you'll need to balance price/weight against slower speed.

Another option is to shoot with prime lenses, which allow you to buy a speedy lens in a smaller package. You won't have a choice of focal lengths, of course, and you'll still pay a premium.

## Bokeh

A very fast lens will be capable of shooting with shallow depth of field. How shallow will vary depending on the focal length of the lens and the size of your image sensor. You'll use shallow depth of field when you want to blur out the background behind a subject to isolate that subject and bring more attention to it. Believe it or not, different lenses blur with different qualities. You might think that blur is just blur, but some lenses generate a prettier, smoother blur with no weird artifacts or shapes. The term *bokeh* simply refers to the quality of the out-of-focus areas in an image. Bokeh is a completely subjective quality, with no real definition or quantifiable attributes. When you hear people speaking about a lens having "great bokeh," they simply mean that the quality of its background blur is very attractive to them.

## Of Digital Lenses

As you saw in Figure 23.22, the very rear element of a lens does not extend all the way to the focal plane of a camera. You have to have room for the shutter and, in the case of an SLR camera, the mirror that bounces light up into the viewfinder. However, if you can position a lens closer to the focal plane, you can make a lens smaller (which often equates to higher quality, since there's less glass in the lens). Because of this, some camera makers have created new lens mounts for their digital SLRs. Canon's EOS-S-compatible SLR bodies and Nikon's DX-compatible SLR bodies both use a smaller mirror, which means there's more space inside the camera. Thanks to this extra space, S and DX lenses can have a rear element that extends further into the camera, and thus closer to the image sensor. (All this is possible because digital image sensors are smaller than 35mm film, so the lens doesn't have to cover as big an area.) At the time of this writing, both the S and DX series provide an excellent selection of high-quality lenses. Fortunately, S- and DX-compatible cameras also work fine with any "normal" lenses designed for a full-frame sensor.

## Lens Attachments

Many digital cameras that have built-in lenses include support for lens attachments. These additional lens elements screw onto lens threads or attach to other special mounting devices on the lens. For a camera that doesn't have interchangeable lenses, such attachments provide a way for you to add extra wide-angle or telephoto power to your camera.

When buying any lens attachment, evaluate it carefully, checking for all the aberrations and potential problems discussed earlier. Many third-party attachments use inferior optics that yield lousy image quality.

In addition, pay attention to the following:

- Does the attachment block the optical viewfinder? Some attachments are large enough that they will obscure part of the optical viewfinder, making it difficult to frame your shot.
- Does the attachment cast a shadow when used with the camera's onboard flash?
- Does the attachment require a special adapter or step-up ring? If so, you'll need to be sure to buy one.
- Finally, you'll also want to see how easy it is to attach and remove the device, including any adapters or step-up rings it might require.

A camera that supports lens attachments can be a less-expensive and smaller alternative to a full-blown SLR with interchangeable lenses.



## Lens Rental

If you're shopping for lenses for your SLR, consider renting the lenses you want. Many photo stores rent SLR lenses at daily or weekly rates, which can be a great way to try out a lens and make an informed buying decision. If you don't have a rental house in your area, consider renting online from services like [www.rentglass.com](http://www.rentglass.com).

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## Digital Zoom

Loosely related to lenses are the digital zooms provided by most cameras. Evaluating a digital zoom feature is a simple two-step process:

**Step 1:** Turn off the digital zoom feature.

**Step 2:** Don't ever turn it on again.

That's it! You're done and can now go on to consider other features.

The fact is that most digital zoom features do a terrible job of acting like a zoom lens. Obviously, the camera cannot digitally increase its focal length, so these features work by cropping the image, and then scaling that cropped area up to the full size of the frame. The problem with most digital zooms is that they use bad interpolation algorithms when they scale up, so they tend to produce jagged, blocky images. Consequently, rather than using a digital zoom, it's much better to shoot the image with your camera's maximum optical zoom, and then crop and enlarge it yourself using an image editor. Most image editors provide more sophisticated interpolation options.

There are three occasions when a digital zoom can prove useful:

- If you don't have any image-editing software that is capable of cropping and upsampling.
- If you don't want to magnify the JPEG artifacts in your image. Because the camera enlarges your image *before* compressing, digital zooms don't worsen any JPEG artifacts. Enlarging the image in an image editor will.
- If you're shooting at one of the camera's lower resolutions, a digital zoom may help. Most of the time, when you shoot at a lower resolution, the camera simply shoots at full resolution and then downsamples. Because there's more resolution to start with, using a digital zoom on a lower-resolution image often produces fine results.

If you must use a digital zoom feature, you ideally want to have one that offers good interpolation and provides a continuous range of zooming rather than fixed zoom ratios.

## Focus

No matter how much you spend on a camera, you're going to get a camera with an autofocus feature. Believe it or not, using the autofocus mechanism properly is one of the biggest problems new users face when they first start shooting. Fortunately, all these mechanisms work the same way.

Using the camera's viewfinder, you place the focusing target (usually the middle of the viewfinder) on the object in your scene you want to have in focus (see Figure 23.24). When you press the shutter release button halfway, the camera measures the distance to that object and locks the focus; pressing the button the rest of the way will take the picture. (If your camera has a fixed-focus lens, you can skip this section.)



**Figure 23.24** Many cameras have multiple focus spots. When you press the shutter button halfway, the camera determines which focus spot is on your subject, automatically focuses the lens to that point, and locks the focus. Here, the camera has selected the upper focus spot.

When you choose a camera look for the following items:

- **Passive versus active autofocus:** Autofocus systems that use a passive TTL system determine focus by looking through the lens. Active autofocus mechanisms employ a separate sensor outside the lens to measure distance; focus is then set accordingly. Passive autofocus systems are usually more accurate and have the advantage of working with lens extensions and attachments.
- **Focus-assist lamp:** The downside to most passive TTL autofocus mechanisms is that they don't work well (or at all) in low-contrast situations. A focus-assist lamp (sometimes called an *autofocus-assist lamp*) is a white or red light that the camera automatically shines into your scene when there isn't enough contrast to lock focus. Look for a focus-assist lamp that can be deactivated for more discreet shooting.
- **Number of autofocus points:** Although less-expensive cameras will always use the middle of the viewfinder as the autofocus "target," fancier cameras will usually provide several autofocus points that can be used for determining focus. The camera tries to assess what elements in the scene need to be in focus (that is, what's in the foreground and what's in the background) and selects an autofocus point accordingly. These systems often provide much more accurate focus, but they can make mistakes, so look for a camera that has the option to select an autofocus point manually or to default to a center point for focusing. Because autofocus mechanisms are typically more sensitive to horizontal features, having more image points can make up for this lack of sensitivity to vertical elements and improve the camera's capability to focus. Also, if your camera has a servo-tracking feature (the capability to automatically track and focus a moving object), having more autofocus points will result in better tracking.
- **Number of autofocus steps:** With more autofocus steps, there are more locations a lens can set itself to, in order to get focused.
- **Special focusing aids:** Through the early days of digital photography, camera makers simply migrated many systems over from their film cameras. The autofocus and metering systems they had already built for 35mm cameras moved easily into their digital counterparts. These systems have been improved over the years, but vendors have also found new ways to take advantage of the LCD screens and computing power built in to digital cameras.

Many cameras now feature special auto focus features that can automatically detect faces in your scene and use that information to determine correct focus point. These systems are easy enough to evaluate—just try them. If you find that you can consistently get good focus, in varying degrees of light, and with complex compositions—your subject off-center, multiple people in one shot, and so on—there’s no reason not to embrace these new technologies. However, you’ll still want the option to turn these features off and return to a typical autofocus system.

### Continuous Autofocus

Some cameras offer a continuous autofocus, which constantly refocuses as you move the camera. The advantage to this mechanism is that when you’re finally ready to shoot, the camera might already be in focus. If you’re considering a camera with a continuous autofocus feature, make sure it’s possible to disable the feature because you might need to turn it off occasionally to save your battery.

Some cameras are now sporting a variation of continuous autofocus that automatically starts the continuous autofocus mechanism when the camera is not moving. The idea is that if the camera has stopped moving, it’s probably because you’re trying to line up a shot. The advantage of these systems over continuous autofocus is that they’re more battery efficient because they’re not continuously focus hunting.

### Manual Focus

Manual focus can be a boon for times when your camera’s autofocus mechanism can’t lock focus or when you want to force the camera to focus on something in particular. Unfortunately, most point-and-shoot digital cameras don’t have an old-fashioned, lens-mounted manual focus ring. Instead, they typically use a special menu option that requires you to dial in the distance to your subject or use buttons on your camera to manually focus the lens. Although these controls are adequate, the lack of high-quality viewfinders on most point-and-shoots can make manual focusing difficult or impossible.

At the very least, try to get a camera that has a manual infinity focus lock. This will allow you to lock the focus on infinity, which can be a real battery and timesaver when you know you’ll be shooting objects that are far away.

## Shutters and Apertures

Your camera’s shutter and iris controls allow you to change exposure to control the brightness or darkness of your image, and the depth of field and motion-stopping power. Whereas film cameras have mechanical irises and shutters—actual metal, cloth, or plastic mechanisms that open and close—digital cameras often use different methods, such as electronic shutters, for exposing the image sensor. Rather than having a mechanism that opens and closes in front of the sensor, a camera with an electronic shutter simply turns its image sensor on and off for the appropriate length of time. One shutter mechanism is not necessarily better than another, as long as the camera offers the shutter-speed control you need to take the kind of shots you want.

All digital cameras offer an automatic exposure feature, which will automatically calculate the appropriate shutter speed and aperture at the time you take a picture. Some cameras, though, also offer manual controls for shutter speed and aperture. When you are assessing a camera’s manual overrides, make sure the camera offers a good range of shutter speeds—ideally ranging from a few seconds to at least 1/500th of a second. It’s also nice to have a Bulb mode, which makes the camera leave its shutter open for as long as you hold down the shutter release button. On many cameras, Bulb mode is only accessible through a remote, either wired or wireless.

As in a film camera, the aperture in a digital camera is controlled by an iris, an interlocking set of metal blades whose opening can expand or contract to make a bigger or smaller aperture. Many small point-and-shoot digital cameras have only two apertures, usually f2.8 and f5.6 or f8 and f11. These cameras make up for their lack of aperture options by varying shutter speed. Although this configuration doesn't limit the conditions under which you can shoot, it does possibly hobble your creative possibilities. Ideally, you want a camera with more aperture options.

Alternately, some small cameras use their iris as a shutter, simply snapping it open and closed to make an exposure. The downside to this scheme is that at higher shutter speeds, the camera might require you to use smaller apertures, because a wider aperture would take too long to close and would prevent the camera from achieving the desired shutter speed. Again, if you want maximum creative flexibility, this type of mechanism might be too limiting.

Also, some cameras limit their minimum aperture to f8 in an effort to avoid certain diffraction artifacts caused by the camera's lens. The automatic meters in these cameras, therefore, tend to favor wide-open apertures. These factors can limit your creative flexibility, so you might want to do a little investigation when evaluating a camera.

On an SLR, you won't need to worry about any of these issues. SLRs have real shutters and apertures and offer a much larger range of shutter speeds and apertures. In general, most SLRs will offer far more shutter speed range than you'll need for most shooting situations. If you know you need a fast shutter speed for the type of shooting you do, you'll want to weigh that into your decision. Many SLRs offer shutter speeds up to 1/8000th of a second.

Similarly, if you like doing long exposure work—for low-light shooting, infrared, or astrophotography, for example—you'll want to choose a camera with a Bulb mode. You might also want to check into the camera's remote control options. For long exposure work, a remote control that offers a shutter lock can be essential.

## Image Control

In a film camera, once you select a type of film, you're stuck with the characteristics of that film until you shoot the entire roll. Different digital cameras have particular imaging characteristics, but most include a number of controls that let you fine-tune how you want the camera to process and store images.

### Image Resolution and Compression Controls

Almost all digital cameras offer a choice of resolutions. In addition to the camera's maximum resolution, most cameras offer lower resolution options that allow you to fit more images onto the camera's storage card. Even though you might have spent the extra money for a seven- or eight-megapixel camera, you might not always need to shoot at full resolution. For example, if you need to shoot images for the Web (and you're *sure* you'll never want to print them), your storage will go much farther if you shoot at VGA or XGA resolution (that is,  $640 \times 480$  pixels or  $800 \times 600$  pixels, respectively) than if you shoot at the camera's full resolution.

For maximum flexibility, you want to choose a camera that provides a range of switchable resolutions. Most cameras offer at least full resolution, an intermediate resolution, and two Web-quality low resolutions (usually VGA and XGA).

## Put Your Money Where Your Storage Goes

Nowadays, digital camera storage is so cheap that there's really no reason not to always shoot at the highest resolution your camera provides. In other words, instead of trying to conserve space on your storage card, just buy some additional cards. By shooting at full resolution, you'll have the option to enlarge parts of your images, and if you decide later that you want to print your images, you'll have the resolution you need to get a good print.

### Image Compression

Compression can save a tremendous amount of storage space, but can also adversely affect image quality. Ideally, your camera will offer a range of compression settings, from a high-quality JPEG compression to a really squeezed, low-quality JPEG compression that yields very small files. JPEG compressors that deliver 3:1 or 4:1 compression ratios are considered high quality. Lower quality JPEG compression typically provides ratios of 10:1 or 20:1.

Compression settings are not something you'll change often. In fact, you'll probably change them only if you start to run out of storage. Ideally, you want a camera that offers the flexibility to mix and match different image sizes and compression settings. At the very least, you want two or three compression settings for each resolution setting on the camera.

On many digital cameras, the best-quality JPEG settings are so good that they're indistinguishable from uncompressed images. Nevertheless, certain shooting conditions leave your images especially susceptible to JPEG artifacts. Areas of complex contrast, such as foliage and leaves, and areas of broad, flat color, such as skies, are often prone to bad artifacting. Having an uncompressed option can be a lifesaver if you find yourself shooting under these circumstances.

### Raw Files and Uncompressed Files

If image quality is your highest concern and storage is of little consequence, you'll want to get a camera that can also store an uncompressed image, usually a raw, or TIFF file. Although these files are typically very large—roughly eight megabytes for a raw file on an eight-megapixel camera—they offer many advantages over JPEG files.

Remember that your camera works by taking data from the pixels on the image sensor (which is usually 12 or 14 bits of data per pixel) and interpolating it up to 16 bits per pixel before processing, compressing, and storing it on your camera's storage card. In raw mode, the camera stores the *original* information that came directly off the sensor. Since raw files are not downsampled to eight bits of color per pixel, the way JPEG files are, they preserve all the color information your camera is capable of capturing.

If a camera doesn't have a raw mode, it might provide a TIFF mode. However, because raw data has not been interpolated (you do the interpolation later, using your computer), it's usually significantly smaller than a full, uncompressed TIFF file. For example, a raw  $2048 \times 1536$  pixel image usually comes out to around 3.9MB, whereas a  $2048 \times 1536$  TIFF image typically weighs in around 9.4MB. TIFF files don't offer the editing flexibility and options raw files provide, but they *are* free from compression artifacts.

If you're not sure if you want to make the leap into working with raw files, you might want to look for a camera that can save raw and JPEG files at the same time. In this mode, when you shoot a picture, a raw file and a normal JPEG file that has been processed according to your camera's current settings are stored on your card. If you need to quickly review or use an image, you can simply use the JPEG file. For more serious editing work, you can turn to the raw file when you're ready.



Because raw files are so large, some cameras simply can't muster the processing power to do anything else while they're writing a raw file to a storage card. After shooting a raw image, these cameras will lock up and not be capable of shooting another image until the raw file is stored. Obviously, this is hardly conducive to rapid shooting. So, if you plan to shoot lots of raw files, be sure to try a few shots in raw mode to see how quickly the camera can handle repetitive raw shooting.

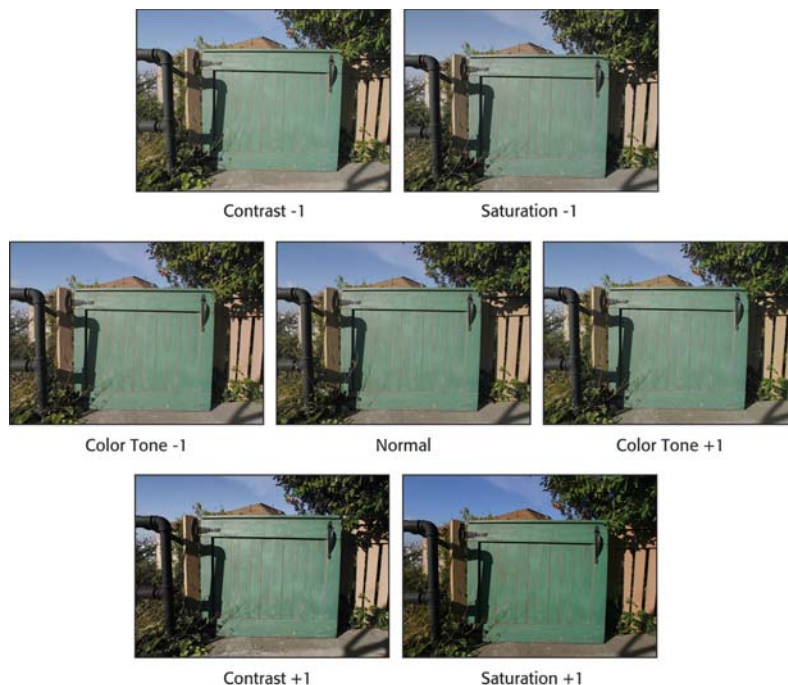
### Macro Mode

Most point-and-shoot digital cameras include a special macro mode for shooting extremely close objects (see Figure 12.28). Digital point-and-shoot cameras fare much better than most 35mm cameras when it comes to macro photography. Because they have tiny lenses with a deep depth of field, digital macro photographers have a focus advantage over cameras with larger lenses. Some digital cameras can focus on an object as close as two centimeters away! In addition, movable LCD screens can make the physical process of macro photography much simpler.

When evaluating a macro mode, try to get a sense for how close you can get the camera to your subject and still lock focus. Also, some macro modes have a focal length "sweet spot." That is, you'll get better results when you zoom the lens to a particular part of its zoom range. Some cameras provide a meter that indicates when you're in the ideal macro zone.

### Sharpness, Saturation, and Contrast Controls

Many digital cameras include adjustable levels of sharpness, saturation, and contrast. Technically, these settings have nothing to do with exposure. Rather, they control the postprocessing your camera performs before storing the image. The idea of "too much" sharpening might seem strange at first, but it is possible to oversharpen an image. Similarly, the default settings on some cameras yield images that can be oversaturated. Adjusting these parameters lets you tailor your camera to your personal tastes and to the needs of particular shooting situations (see Figure 23.25).



**Figure 23.25**

If your camera supports different contrast, saturation, and color settings, you can dramatically change the camera's color qualities. All photos shown here were shot using full-automatic mode. The only difference was the change in settings noted beneath each image.



### Aspect Ratio

The ratio of an image's length to its width is called the *aspect ratio*. Most point-and-shoot digital cameras use the same 4:3 aspect ratio your computer screen and television use, but some—and almost all SLRs—use the 3:2 aspect ratio of 35mm film (see Figure 23.26).



**Figure 23.26**

Most digital cameras use the same 4:3 aspect ratio as your computer monitor. Some cameras offer the 3:2 aspect ratio of 35mm film.

Some cameras offer a choice of either aspect ratio (see Figure 23.27). However, many of these cameras achieve the wider 3:2 aspect ratio by simply shooting a cropped version of the camera's native 4:3 ratio. Therefore, when you shoot 3:2, you're shooting lower resolution images. It's often better to simply shoot 4:3 and crop the image later. If you prefer a particular aspect ratio, you'll want to choose a camera that can shoot with those dimensions.



**Figure 23.27**

Some cameras offer a choice of aspect ratios. Usually, the wider choice is nothing more than a cropped version of the normal 4:3 aspect ratio. It is better to shoot full screen and do the cropping later.

Some cameras even offer the option of an extremely wide 16:9 aspect ratio (the same as HD TV). Many of these cameras achieve 16:9 through a crop of their original 4:3 image, but some cameras, such as the Panasonic Lumix LX 2, have a true 16:9 image sensor. A switch on the front of the lens lets you change easily from 16:9 to 3:2 or 4:3. The camera is at its maximum resolution when shooting at 16:9, and at lower, cropped resolutions when shooting at the smaller aspect ratios.

## Flash

No matter what level of camera you are considering, most units will have a built-in flash. Obviously, bigger cameras will have a larger, more powerful flash unit, but even small cameras can offer good flash hardware.

Flash photography is one of the most difficult things for any camera to handle, and digital cameras are no exception. Consequently, it's important to carefully evaluate a camera's flash system before you buy.

There are a few simple issues to clarify up front:

- **What is the range of the flash?** Because of their small size, most built-in flashes have a range of only around 10 to 15 feet. Although this is fine for most snapshot situations, for more serious work you'll need additional lighting. If you're looking at a particular small camera, pay close attention to flash coverage. Because smaller cameras have such small flash units, it's sometimes difficult for them to cover even a mid-sized room with their built-in flash.
- **Does the flash produce a color cast?** Do some simple flash tests to ensure that flash pictures are not plagued by weird color casts. Unfortunately, some cameras have trouble calculating a proper white balance when shooting with a flash.
- **Does the camera have a hot shoe or external flash sync connection?** For maximum flash flexibility and control, you want a hot shoe for connecting an external flash (see Figure 23.28). These standard connections are usually designed to work with specific flash units made by the manufacturer. If the camera doesn't have an actual hot shoe (or is too small to have one), look for a connection for an external flash sync, which will allow you to connect an external flash (again, usually a specific model) to the camera using a small cable. You'll probably need to buy some type of bracket to hold the flash.



**Figure 23.28**

For serious flash work, you'll want a camera with a hot shoe or an external flash sync connector.

- **Where is the internal flash positioned?** Ideally, you want a flash that is as far from the lens as possible. If the flash is too close to the lens, the camera will be more susceptible to red-eye.
- **What flash modes does the camera offer?** Look for a camera that offers a completely automatic mode, where the camera decides when to use the flash, a force flash or fill flash mode, which allows you to force the flash to fire to provide a slight fill light, and a red-eye reduction mode, which reduces the chance of red eye in your image by first firing a short flash to close down the irises in the eyes of your subject. Many cameras also offer a slow sync mode that lets you combine flash photography with long shutter speeds to capture more background detail when shooting in low light. Be sure the camera lets you specify whether the flash fires at the beginning or end of the exposure. And, of course, you want the capability to turn off the flash altogether.
- **Does the camera offer control over flash intensity?** Many cameras let you control how strong the flash will be by specifying a flash exposure compensation, usually measured in f-stops, or fractions of a stop. Given the difficulty many cameras have with flash metering, this manual override can be essential to getting good flash photos.
- **How quickly does the flash recycle?** Try to get a feel for how frequently you can fire the flash. This will vary depending on how strong the camera's batteries are, but some flashes are simply faster at recharging than others.

In addition to the physical specifications of the camera's flash, you'll want to assess how well the camera meters and white balances when you use the flash. The best test of a flash's performance is to shoot pictures of people's faces indoors under a slight mix of lighting. The human eye is well tuned to flesh tones, so pictures of faces make a good test of how well a flash system is reproducing color.

Look at the overall exposure of your image. A poor flash system will overexpose the highlights, resulting in bright white smears instead of smoothly gradated highlights. Skin tones will often go pale or wash out when they are shot with a less-capable flash system. A flash that is too bright will also cast harsh shadows across and behind your subject.

Look at the overall color tone of the image. Is there a color cast of some kind? If you're in a room with strong lights (usually incandescent, or tungsten, lights), your camera might choose to favor those lights when it white balances, resulting in an image with slightly blue highlights. If your image ends up with a slight yellow cast to its highlights, the camera probably favored the onboard flash when it was white balancing.

If your camera has a special manual white balance setting for use with a flash, be sure to switch to that setting and try a few shots. You might get better results.

SLR shoppers will want to consider the external flash systems that are available for each candidate camera. In addition to the usual price and power concerns, you'll also want to consider these issues:

- Does the camera offer TTL metering with the hot shoe?
- Can multiple external flash units be used in a master/slave configuration? If so, can the camera's built-in flash be used as a master?
- Does the flash have a zoom capability that can read distance information from your camera's lens?
- Can the flash be swiveled and tilted? At the very least, you want a tilt for bouncing the flash off the ceiling. With a swivel, you'll have the additional option of bouncing the flash off walls and other reflectors.



## Body Design and Construction

You'll want to spend some time considering the body design and construction of your potential purchase. Poor design can make a camera's controls difficult to use, which can often cause you to miss shots. And flimsier construction can shorten the life of your camera.

Modern cameras can be made of any number of materials, from metal to carbon fiber to aluminum to plastic. Obviously, sturdier materials are more durable (and usually feel better in terms of finish and heft), but even a predominantly plastic body can hold up well in rough conditions.

When you are assessing a camera, try to get a feel for the quality of its build. If you lightly squeeze it, does it creak or does it feel solid? A creaky camera might just get creakier—and possibly more fragile—as its screws and joints loosen. If the camera has a split body or flip-out LCD screen, try to get an idea of the durability of the swiveling mechanism. Will it hold up to normal use, or might it wear out?

Digital cameras can often have strange designs, so make sure your camera sports a finish and moldings that make it comfortable to hold onto and difficult to drop. Finger moldings and rubberized components can make an otherwise odd shape comfortable to hold. If you're a nature photographer who spends a lot of time shooting in cold weather, you may want to consider how easy the camera is to operate with gloves and whether it has water-resistant seals and seams. Smaller cameras can be particularly difficult to hold onto and use comfortably, so spend some time determining how comfortable the camera is to use with one or both hands, and make certain it includes a wrist strap.



**Figure 23.29**

Pay attention to the doors and covers a camera uses for its media, batteries, and ports. You'll be opening and closing these a lot, so make sure they're sturdy and durable.

Doors and port covers can be especially fragile components. Check the battery compartment door and media card door for durability and easy access (see Figure 23.29). You'll be using these mechanisms a lot, so make sure they can stand up to repeated openings and closings. In addition, make sure that you can get to them in a hurry if you need to, even when the camera is mounted on a tripod. Rubber or plastic port covers (such as what might go over a battery charging port or a USB port) are often the flimsiest part of a camera. Try to get a feeling for the weaknesses of these covers. Although you won't be able to improve them, they might at least last a bit longer if you are aware of how easily they can be broken off.

Heft is often a concern for more serious photographers. A heavier camera, although a bit of a pain to lug around, is usually easier to shoot with, because extra weight makes for a more stable shot. If you're used to a film camera with a good deal of weight, you might want to look for the same thing in a digital camera.

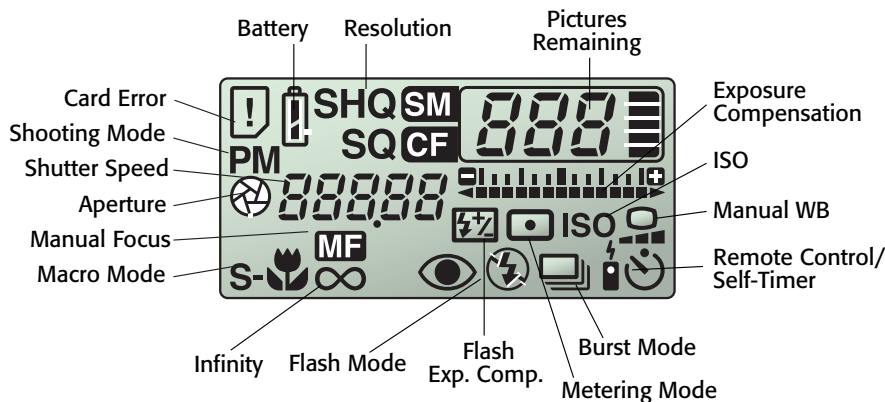
Finally, try to get an idea as to how much of the camera's body and internal chassis are made of metal. Heat can greatly degrade image quality, and components such as LCD screens and large-capacity memory cards can produce a lot of heat. Metal substructures and chassis can serve to dissipate heat that might otherwise affect image quality.

## Status LCDs

Not to be confused with your camera's full-color viewfinder/playback LCD is the small status LCD that might be present on the top of the camera. These screens are used for displaying current camera settings and the number of shots remaining.

Some cameras skip these displays and assume you'll simply get this information from the viewfinder LCD. However, if you're in bright sunlight or if your batteries are running low, you might not want to activate your main LCD just to find out if your flash is turned on. Most important, having a permanent display of camera status makes for faster, more convenient shooting.

Figure 23.30 shows a typical, full-featured status LCD.



**Figure 23.30**

You'll want your camera's LCD status display to show a full range of status and setting information. When you're shooting on the go, you don't want to have to dig into the camera's menu system to check on a particular setting.

If a camera *does* use its main LCD as a status display, you'll want to check that it displays the status information you want. Also, if the camera has an optical viewfinder, be sure you can turn the LCD screen off easily when shooting, so the glare doesn't corrupt your field of view. Finally, make sure that the screen is visible and readable in direct sunlight.

## Tripod Mount

This might seem like a superfluous item to bring up for discussion, but a poor tripod mount can really mess up a shoot, if you're trying particular techniques. Any experienced photographer will tell you that there is a difference between a good tripod mount and a bad one. The following features make for a good tripod mount:



- **Metal construction:** A tripod mount is a simple screw socket recessed into the bottom of the camera. (Some tripod mounts also include additional stabilizing holes.) If the screw socket is made of plastic, it can be very easy to strip out the screw threads by forcing the tripod in at the wrong angle. Even if you're always very careful, fragile plastic threads can wear out with repeated use. Look for a metal screw mount.



Figure 23.31

Ideally, you want a tripod mount that lies on the same axis as the lens.

- **Positioned along the lens axis:** Ideally, you want a tripod mount that is positioned so the camera will pan (rotate) around the axis of its focal plane (see Figure 23.31). Such a tripod is required for shooting panoramas. If you're not serious about panoramic shooting, an off-axis tripod mount shouldn't be a deal-breaker.
- **Positioned so you can remove the batteries and media:** Once you put a camera on a tripod for a shoot, you don't want to have to dismount it to change batteries or storage media. Make sure the battery and media doors are unblocked when the camera is tripod-mounted.

## Image Buffering

After a digital camera exposes its CCD, the image data is passed to a special onboard computer for processing. After it is interpolated for color, white balanced, sharpened, and de-noised (among other things), the data is compressed and then stored on the camera's storage device. All this processing can take a lot of time, which means your camera can be too busy to take any more pictures.

Fortunately, most cameras include special memory buffers (and sometimes separate processors) to handle the processing of an image, which frees up the camera to shoot again immediately. Ideally, you want an image buffer that can hold at least five or six full-resolution shots. Odds are that you won't be shooting more than that in quick succession, but if you are, you'll need to use a special "continuous" shooting mode.

## Continuous Shooting

Many cameras offer special modes for shooting a rapid series—or burst—of images. With speeds varying from a single frame to 5 to 10 frames per second, these features are ideal for shooting sports or fast-moving objects. But burst shooting is handy for more than just sports or nature photography. Shooting bursts of people is the best way to capture a particular moment or the best expression. By shooting a burst, you can grab a series of frames, and then pick the best one of the bunch.

Referred to as *burst*, *continuous*, or *drive mode*, continuous shooting modes usually work just like an autowinder on a film camera. Just press the shutter button, hold it down, and the camera will shoot as quickly as it can (see Figure 23.32).



**Figure 23.32** If your camera has a drive mode, you can shoot a sequence of shots in rapid succession. Not all cameras support burst shooting at full resolution.

Note that some cameras can achieve their full burst speed only when they are shooting at a lower resolution. If you want full print quality from your burst images, make sure that your camera's continuous mode supports the full resolution of your camera. Note, too, that some cameras can shoot up to only a certain number of shots before they have to stop and flush the series of images out to storage. Be sure to investigate the maximum number of burst shots that can be taken at once.

## Continuous Flash Shots

Most cameras can't use a flash when shooting in continuous mode, because there isn't enough time for the flash to recharge. However, some cameras can manage roughly one frame per second when shooting with the built-in flash. If you have a job that needs continuous flash shots, keep an eye out for this feature.

## Movie Mode

Many digital cameras offer the capability to shoot movies, in either AVI, QuickTime, or MPEG format. Most cameras provide movie modes that can shoot  $640 \times 480$  video at 30 frames per second including sound, with a duration that's limited only by the amount of storage space on your card. In addition, the compression used in these modes is often better than what you'll get out of a DV video camera. Many cameras now offer full HD movie mode or something in between.

Most movie modes work the same way: you simply press the shutter button and the camera begins recording; press it again and recording stops.

When you are assessing a point-and-shoot camera's movie mode, you'll want to look at maximum frame size, maximum recording time, and quality of the compression. In addition, you might want to see if the camera can zoom while recording video—many cameras cannot zoom in video mode. If you want maximum flexibility when shooting video, you might want this feature. An external mic jack can also be essential for getting decent audio. However, if you're really serious about video, you should buy a video camera, rather than hinging your still camera buying decision on video features.

For SLRs, you'll want to look at the same considerations, especially regarding external audio. Movie-capable SLRs actually offer some advantages over dedicated video cameras. First, they typically offer exceptional low-light performance, and some offer manual exposure control, meaning you can perform the same creative choices that you make when shooting still images. A digital SLR with a fast lens can shoot video with film-like shallow depth-of-field effects—something not possible on a normal video camera.

However, there are significant usability questions with these cameras, the main one being that they typically can't be used for more than 15 or 20 minutes at a stretch without overheating. For documentary work, or shooting lots of re-takes, or heavy coverage, this might be a deal-breaker when compared to a normal video camera.

Finally, note that some cameras require special flash cards rated for a specific speed to record video. These cards are usually a little pricier. If you want to ensure video capability, you may need to choose your storage card very carefully.

## Black and White

Many digital cameras offer special black-and-white modes for shooting grayscale images. Because you can use your image editing program to convert a color image to grayscale, and because a black-and-white image takes the same amount of storage space as a color image does, you might wonder why you would want to shoot in black and white. After all, isn't it better to shoot in color and have the option of black-and-white images later?

The biggest advantage of a dedicated black-and-white mode is that it lets you see your image in black and white immediately. Learning to visualize scenes in black and white can be difficult, so having an on-the-fly black-and-white view of a scene can be very helpful for the beginning shooter. Some cameras even offer built-in processing that mimics the types of lens filters film photographers have traditionally used to improve contrast in black-and-white photos.

Finally, if speedy grayscale workflow is essential, and you don't want to spend time performing conversions by hand, a camera with a built-in black-and-white mode can be very handy.

## Self-Timers and Remote Controls

At some point, you've probably owned a film camera that had a self-timer on it. You know, you set the timer and then run as fast as you can to try to get in the shot and look natural in the five seconds or so you have before the camera fires. Most digital cameras have the same type of feature.

Some cameras also offer wired or wireless remote controls that provide zoom and shutter controls (see Figure 23.33). These remotes facilitate self-portraits and serve as a shutter release for long-exposure images. If remote operation is important to you, consider the following:

- Make sure the range of the remote is long enough for your typical remote-shooting jobs.
- For wireless remotes, you'll ideally want to have an infrared sensor on both the front and back of your camera.
- If you will be using your camera to run slide shows (through the camera's video out port), you'll want remote playback control and shooting control.
- Some remotes offer a time-lapse feature (sometimes referred to as an *intervalometer*), which will automatically take a shot at a given interval. Some intervalometers also let you specify the number of shots you want taken at each interval. This allows you to perform time-lapse bracketed sequence, when used in conjunction with your camera's auto-bracketing mode.
- Some remotes also offer a long-exposure timer that allows you to take longer exposures than you can manage with the camera alone. (In other words, these remotes provide a Bulb mode to cameras that might not otherwise have them.)



**Figure 23.33**

A wireless remote control lets you shoot hands-free, just as you would with a cable release on a film camera.

## Camera Timings—or Is Your Camera Speedy Enough to Get the Shots You Want?

Great image quality doesn't do you any good if your camera is too slow to get the shots you need. Because a digital camera must do so much calculating and processing to create an image, it's easy for it to get bogged down in ways that film cameras can't. You'll *definitely* want to consider the speed and performance of a camera before you buy one. In addition to the speed of the menu system, be sure to consider and measure the following:

- **Boot time:** How long does it take the camera to boot up? Ideally, you'll want a camera that boots up instantly, or as close to instantly as you can get, as this will afford you a better chance of getting a shot in a hurry. Check to see if the camera offers a low-power Sleep mode, and test how long it takes the camera to wake up. One of the downsides to cameras with an extending lens is that they take a while to boot up because they have to take the time to extend the lens. In addition, you might not feel comfortable walking

around with the camera in Sleep mode, because the lens will still be extended. However, if you shut down the camera to retract the lens, you'll be forced to wait through a boot cycle when you're ready to shoot again. Consequently, for cameras with extending lenses, it's imperative to take note of boot time. You should find that most SLRs boot up nearly instantaneously.

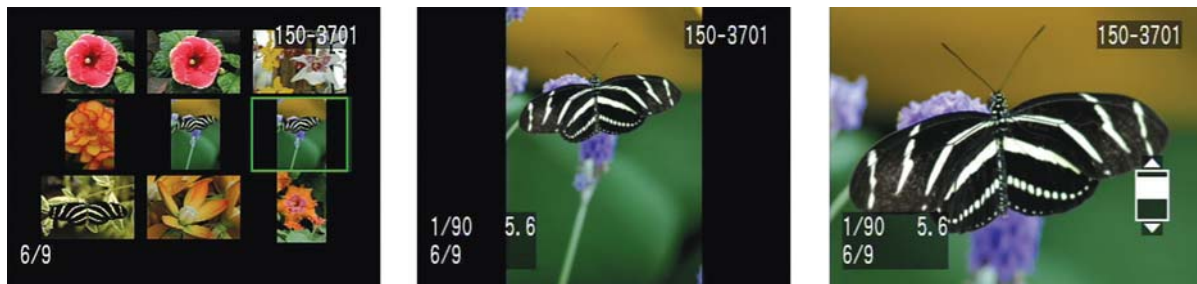
- **Prefocus time:** When you press your camera's shutter release halfway down, the camera will perform all its autofocusing, metering, and white balancing. When you test a camera, try to get a sense of how quickly it can perform these prefocusing steps.
- **Shutter lag:** Some digital cameras have a noticeable lag between the time you press the shutter release and the time the camera actually takes a picture, even if you've already prefocused. If the shutter lag is long enough, you might miss the moment you were trying to capture. This is probably the most important performance characteristic to assess before you buy.
- **Recycling:** Be sure to check how long it takes the camera to recycle itself after you take a shot. Ideally, you'll want to be able to shoot again immediately. Most modern cameras can recycle right away by storing the previous image in a memory buffer. When the buffer is full, you'll have to wait for it to flush out to the storage card. Be sure to test the camera's performance both before and after the buffer has filled.

## Playback Options

You'll be spending a lot of time reviewing images using your camera's playback options, especially when you're in the field. Consequently, it's worth taking a little time to explore a camera's playback features. Are they easy to use? How quickly can you switch from record to playback mode?

In addition to general usability, look for the following features:

- **A thumbnail view that lets you view multiple images on-screen at once.** This feature can greatly speed navigation of a large media card (see Figure 23.34).



**Figure 23.34** A thumbnail view lets you see the contents of your media card quickly. Some cameras also allow you to zoom in on an image and pan around it, making it easier to check focus and depth of field.

- **Zoom features that let you zoom in on an image and pan around.** A good zoom feature can be a great way to ensure that a shot was in focus. For panning about an image, a smooth pan is much better than a camera that restricts you to looking at specific “quadrants” of an image.

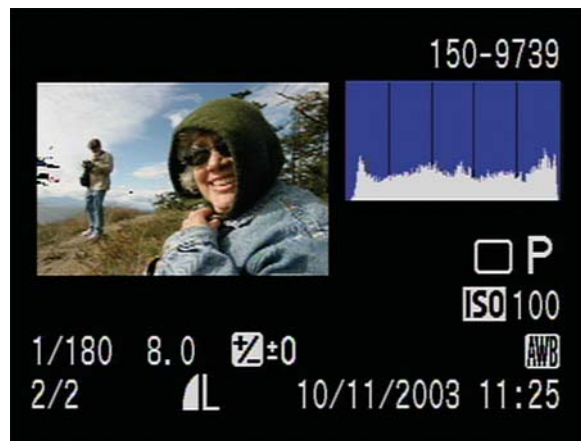


- **Easy deletion and locking of features.** You want a speedy interface for deleting single or multiple images. When you have to free up space on a card, you don't want to miss a shot because your camera's interface is too complex.

Some cameras also offer features that automatically rotate the image so that it's upright, whether you shot it vertically or horizontally. This feature is of questionable advantage when using the camera's Playback mode—after all, it's not too hard to simply tilt your camera. Most cameras store this rotation information with the picture. If your image editor or cataloging program can read it, it will automatically rotate your image.

Other cameras feature printing commands that let you print to special printers designed to work with your camera. Such features can turn your digital camera into an instant camera, but for serious work, you'll want more image editing and printing control.

Finally, as you'll learn, histograms (computer-generated graphs of the distribution of tones in an image) can be a great exposure calculation aid. Many cameras can display a histogram of an image you've already shot (see Figure 23.35).



**Figure 23.35**

Having a camera that can display a histogram is an invaluable aid for using your camera's manual exposure features. This feature is valuable if you plan to use any manual exposure features.

## Storage and Input/Output

A digital camera isn't much good if you can't get your pictures out of it. Fortunately, most cameras come equipped with a number of interfaces for moving your pictures to another device.

### Transferring and Viewing Images

Today, almost all cameras come equipped with a USB connector of some kind, along with a cable to connect the camera's USB port to the standard USB port on your computer. USB is a good interface that makes for a reasonably quick transfer of images. Some cameras also provide remote camera control through the USB port. If you need a computer-operated camera (either for time-lapse or other automated operations), be sure your camera's software supports remote operation.

Note that smaller cameras often achieve their small size by leaving off the USB port. Instead, they provide a special dock in which you can place the camera. You then connect the dock to your computer. There's no penalty for this, performance-wise, but it is an extra piece of gear you'll have to carry if you want image-transfer capability on the road.

USB-2 and FireWire are better alternatives to USB-1, simply because they're much faster interfaces. However, you'll find FireWire ports only on higher end cameras, and even there it's somewhat rare. If you're concerned about transfer time, don't worry. There are plenty of ways to move images to your computer speedily.

### Transfer Software

Your camera will come bundled with software for transferring images to and from your camera. Some units come with a simple TWAIN driver that can be used from within your editing package, whereas others offer stand-alone applications that allow for media cataloging, simple editing, and printing. Many computer operating systems (such as Apple's OS X and Windows 7 and Vista) offer automatic image transfer through a system called *Picture Transport Protocol (PTP)*. With these systems, any time you plug a camera into your computer, the OS automatically transfers all the images in the camera to your hard drive.

### Video Input/Output

Most cameras provide a special video output port that lets you connect your camera to a television to view your images. Although televisions don't provide nearly enough dynamic range to view your images in all their glory, they do seem to be everywhere, providing a convenient way to review images when you are traveling. A video connection can also provide a convenient way to present a slide show of images, and most cameras offer some type of automatic slide-show feature that allows you to step through all the images on your camera.

Because not all countries use the same video standard, make sure you get a camera that supports the appropriate standard. Most cameras come in either NTSC or PAL versions.

### Storage

Film is a clever invention because it can both capture and store an image. An image sensor, on the other hand, can only capture an image. Consequently, once your camera is done sampling and processing an image, it needs a place to put it.

Today, pretty much all cameras use some form of flash memory card. These are small wafer-like cards that house a type of RAM that doesn't require a constant stream of power (that is, it is nonvolatile). Therefore, after your camera has recorded an image, you can shut off the power without worrying about what has been stored on the memory card.

Flash memory cards (or just "flash cards") are a great solution to the digital camera storage problem. They're small, they can hold huge amounts of data (up to 16GB in some cases), and can be easily swapped with other cards, just like a roll of film.

With higher capacity cards costing less and less, it can be tempting to invest in a single card with loads of space. Bear in mind, though, that a large card is something of an "all your eggs in one basket" situation. If that card crashes, you lose everything. As such, you might consider investing, for example, in two 1GB cards rather than a single 2GB card. One advantage of a large capacity card is that you won't have to interrupt your shooting to change cards. For event shooting—weddings, concerts, performances—choosing a bigger card can keep you from missing shots while you change media.

### How Much Do You Need?

How much storage you need depends largely on your shooting conditions, how many pictures you typically take, how big your camera's images are, and what level of compression you're using. Obviously, if you're shooting in a computer-equipped studio, storage is less of a concern because you can dump your pictures to disk as you shoot. Similarly, if you're in the field with your laptop, you'll be able to clear your camera's storage as it fills. However, if you're planning a three-month trip through the Amazon (or even a three-hour trip to the zoo, and you tend to be shutter-happy), storage might be a bit of a concern.

If you're like most people, when you shoot film you probably take 36 exposures and get back three or four shots you like—maybe. Digital cameras are no different. For every 40 or so images you shoot, you'll maybe want to keep a third of them. However, with a digital camera, you don't have to wait until you've shot all 40 before you decide which ones you want to keep. Rather, you can delete the bad pictures as soon as you've taken them. Consequently, digital camera storage goes a little further than an equivalent number of film exposures because you'll be more selective along the way.

Unfortunately, experience is the only way to find out what your storage needs are. It's safe to assume that on a typical two- or three-megapixel camera, a 32MB card will get you two dozen high-quality images. Start with this estimate and try to get an idea for what this translates into in terms of “keeper” images. Then make sure that you have an appropriate amount of storage before embarking on an important shoot.

If you're working with a higher resolution camera, you'll need to carry more storage. With an eight-megapixel camera, you'll get approximately 260 high-quality JPEG images on a 1GB card and roughly 100 raw images.

Currently, there are several major competing flash memory standards. For the most part, there's little practical difference between these formats, but some are more popular than others, and that can sometimes translate into cheaper card prices, and a greater number of available sizes. However, at the time of writing, flash cards are roughly the same price/megabyte no matter which format you choose.

Probably the only reason to choose a camera with a specific media type is if you need a particular capacity. For example, CompactFlash cards currently have larger capacities than any other medium. If you're going to be backcountry shooting for an extended period, larger cards will give you more shooting capacity. (Another alternative is to use a “digital wallet” device.)

## Size *Does* Matter

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Although vendors usually measure their flash cards in terms of megabytes, many vendors define a megabyte as being 1,000,000 bytes. Your computer, on the other hand, defines a megabyte as being 1,048,576 bytes. Therefore, when you stick a flash card in your computer, it might display a slightly smaller capacity than what you were expecting.

Although people will make arguments for one format over another, there's really not much difference. They are all equally reliable, equally speedy, and (mostly) equivalently priced.

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## Media Tips

There are a few things you should know about removable media. Obviously, these cards are fragile, so treat them with care. Also, consider the following issues:

- The number of images a card can hold depends on the resolution and compression settings with which you're currently shooting. These vary greatly from camera to camera, so you'll need to consult the camera's manual to find these statistics.
- The bigger the card's capacity, the more power it takes to keep it running. Consequently, in theory, smaller cards use less battery. Although it's difficult to tell if this has any bearing in the real world, switching to a smaller capacity card when your batteries run low might garner you a few extra shots.

- Larger capacity cards generate more heat. If you're using a tiny camera, which tends to get hot simply because of its design, it might be worth sticking to smaller capacity cards.
- If something goes wrong with a larger capacity card, you'll lose more images than you would if you had been using a smaller capacity card. Therefore, it might be worth buying a number of smaller cards instead of one big one.
- X-rays don't seem to matter, so feel free to take your camera with you to the airport, dentist, or thoracic surgeon.

## What's in the Box?

When you buy a camera, you'll want to consider everything you're getting for your money, so take some time to assess what else is bundled with your camera (see Figure 23.36).



**Figure 23.36**

Ideally, you want a camera package that includes these components.

Don't expect to get a huge media card with your camera. If the card that came with your camera seems small (if it came with one at all), that's probably because it is. Because of the economies of scale, adding a bigger card would usually raise the price of the camera by more than it would cost you to buy a bigger card on your own. Therefore, you should plan to buy some additional media along with your camera.

## Batteries

What with the image sensor, the LCD screen, the media drive, the flash, and the motorized zoom lens, the typical digital camera demands a *lot* of power. Your camera will use one of two different battery systems: a proprietary (custom) battery or batteries of standard size (usually AA).

- **Proprietary batteries:** More and more vendors are using special proprietary (custom) battery packs in their cameras. The advantage to these is that they usually provide extremely long life and include special controllers that can provide accurate charge estimates and special power-saving operations. What's more, these batteries tend to be smaller and lighter than an equivalent amount of AA or AAA batteries. On the downside, custom batteries require custom chargers, so if your battery dies in the field, you can't just run down to the corner store and buy another. Of course, you can protect yourself against this eventuality by buying an extra battery for your camera. Note that there are now many third-party battery options available for most popular digital cameras. These batteries usually offer equivalent performance and longevity at a *substantially* lower price. Even if you're wary of the quality of these batteries, they're usually so cheap that it's worth buying one just to try it out. (Camera vendors may tell you that using third-party batteries can damage your camera, although I've never personally experienced any troubles.)
- **Standard-size rechargeable batteries:** Offering the same battery technology as a proprietary battery, standard-size rechargeable batteries offer much longer life than normal, non-rechargeable alkaline batteries, and have the advantage of universality. As better battery technology comes along (as long as it comes along in the same size), you can drop these batteries into your camera. Standard-size rechargeables are much cheaper than proprietary designs, are readily available, and in a pinch can always be replaced by alkaline batteries.

In addition to sizes, there are a number of different battery technologies available.

- **Alkaline batteries:** Alkaline batteries are really not good for much when it comes to a digital camera. In some cases, you'll be hard-pressed to get half a dozen shots out of a set of alkalines before they are too weak to be used. Digital cameras have very specific power requirements, and as soon as a set of alkalines drops below those levels, the camera will register them as dead. You can usually continue to use them for a while in a lower power device such as a radio or tape player. In general, use alkalines only when you absolutely have to. The cost, waste, and environmental impact just aren't worth it.
- **NiCAD (Nickel Cadmium) batteries:** NiCADs don't deliver a lot of power, and need to be drained completely before you recharge them or they will develop a "memory" that will prevent them from being completely recharged. They're a bad choice for your digital camera.
- **NiMH (Nickel-Metal-Hydride) batteries:** NiMH batteries are relatively inexpensive (usually \$25 to \$30 for a set of four, plus another \$15 or \$25 for a charger), powerful, quick to recharge, and lack a memory. In addition, NiMH batteries are more environmentally friendly than either NiCADs or alkalines. NiMH batteries are the ideal choice for the digital camera owner. In fact, buy a few sets—one for your camera, an extra set to go in your pocket, and a set to go in your recharger.
- **L-Ion (Lithium Ion) batteries:** L-Ion batteries are also a good choice, although not as prevalent, and are sometimes more expensive. You can often find chargers that will charge both NiMH and L-Ion batteries.
- **Lithium batteries:** Lithium batteries are not rechargeable but offer a lot of power for a long time. Roughly the shape of two AA-size batteries stuck together, you'll need to be sure your camera can use Lithium batteries. Although strong and long lasting, they're still disposable and are usually rather pricey.

When you shop for a recharger, you might want to consider its strength. Some chargers can recharge faster than others—in some cases, as fast as 15 or 20 minutes. In general, any recharger will probably serve you just fine. If you plan to travel to other countries, look for a recharger that can work with a range of input voltages.



## Special Features

On top of the many features we just discussed, many vendors pack their cameras with special, unique features that can be a boon or a burden to the digital photographer. With their onboard computers and automatic functions, digital cameras can perform many tricks film cameras can't. Listed next are some unique features you might encounter in your camera shopping. Some of these features are great; others are rather silly.

- **Time-lapse (intervalometer):** Unfortunately, only a few cameras offer a time-lapse feature that lets you program the camera to automatically shoot a picture at a predefined interval. A good time-lapse feature will let you specify an interval ranging from a few seconds to a few days. For documenting slow processes, creating animations, or producing high-quality time-lapse video, a time-lapse feature is essential. Some cameras provide time-lapse features through an external remote control.
- **Remote computer control:** Some cameras include software that lets you control your camera from your computer via the same serial or USB link the camera uses to download images. If you need to take pictures in harsh, industrial conditions, or want to leave your camera unattended, this feature might be the answer.
- **Auto-bracketing:** *Bracketing* is the process of shooting the same image with slightly different exposure settings to help ensure you get a good shot. Many cameras feature an auto-bracketing feature that will automatically shoot four or five images with slightly different exposures each time you press the shutter release.
- **Dust reduction:** Because the lenses on many SLRs are removable, it's possible for dust to get inside the camera. More and more cameras are including built-in dust-reduction systems that automatically shake the camera sensor (or a plate in front of the camera sensor) or use other tricks to keep the sensor clean. You won't choose a camera simply because it has a dust reduction feature, but ending up with a camera that has one is a great convenience.
- **White-balance bracketing:** Similar to exposure bracketing, white-balance bracketing automatically shoots a series of frames with slightly altered white balance in each shot. For tricky lighting situations where you're unsure of what the proper white balance should be, this feature can help you get the right color. However, it's not a deal-breaking feature you absolutely have to have.
- **Focus bracketing:** This feature does the same thing as exposure or white-balance bracketing, but alters the focus slightly in each shot. To be honest, this is kind of a silly feature. It's probably most useful if you do a lot of macro photography, a situation where proper focus can often be difficult.
- **Voice annotation:** Although the capability to record and store small voice annotations (comments) with each image is not a tremendously useful feature, some applications—real estate photography, for example—can benefit from it. Remember that it will use up storage on your media card, so you'll want to buy more storage or shoot at a lower-quality level (or both).
- **Best-shot selection:** Some cameras include a “best-shot selector” that automatically shoots a series of images when you press the shutter button, analyzes them to determine which one is best, saves that one, and throws out the rest. This feature is best used in tricky macro situations where it can be difficult to hold the camera steady enough to get a clear shot. (Best-shot selection seems to work by simply selecting the largest file as the best. Because the sharpest image will compress the least, the file with the largest size is most likely the sharpest.)

- **In-camera effects:** Many cameras offer special effects features that can automatically solarize, tint, or turn your images into negatives. There are even cameras now that will make your subject look thinner! These are, of course, all tasks that can be performed in your computer with a great deal more control. It's almost always better to skip these features and shoot the cleanest, best-looking image you can.
- **Neutral density filter:** A neutral density (ND) filter is normally a physical filter you attach to a camera's lens. It cuts the intensity of the light entering the lens without altering the light's color. ND filters can be useful for bright situations where you'd like to have a little more aperture or shutter-speed latitude. Some cameras now include an internal ND filter that can be activated automatically or manually. Although somewhat rare, it can be a handy feature.
- **Noise reduction:** Some cameras include special noise reduction modes that kick in automatically during longer exposures. Such schemes can often greatly improve the quality of low-light shots.
- **Pixel mapping:** It is possible for a pixel on your camera's image sensor to die or "get stuck." Some cameras now feature pixel mapping features that will cause the camera to analyze its image sensor and map out any dead pixels. The camera will then interpolate the missing pixels when it produces the final image.
- **User sets:** User sets allow you to define different combinations of features that can be accessed quickly by simply changing feature sets. For example, you might define a particular configuration for indoor flash photography and another for outdoor manual exposures.
- **Automatic image rotation:** Some cameras are able to detect whether you're holding the camera in portrait or landscape orientation (that is, vertically or horizontally), and can mark the image as being rotated or not. When you play back the image on the camera, it will be rotated automatically. Having the image rotated on the camera is actually not that useful, because it's easy enough to rotate the camera. However, if you use an image editor that can read image rotation information, the image will be automatically rotated when you open it.
- **Custom tone curves:** Before your camera saves an image, it applies a mathematical curve to the data in your image to correct for the fact that your camera records data in a linear fashion. Some higher end cameras let you manually create custom tone curves that can be downloaded to the camera, giving you precise control over the camera's contrast and color response. Presently, this feature is found only on very high-end professional digital SLRs.

## Accessories

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A good camera bag is essential, and there are many, many options available from vendors such as LowePro, Tenba, Tamrack, M-Rock, Kiesel, and others. Everyone has his or her own idea of what makes a good bag, but your first consideration is that it can hold the gear you want to carry for a particular shoot, which these days might include a computer, a camera, and lenses. If you're shooting with an SLR, you might find that you need multiple bags for different camera configurations. For example, on a day of street shooting, you may find that you don't need your macro and telephoto lenses, while on a day hike you might prefer to carry only certain prime lenses. The best advice for bag buying is to get your hands on the bag ahead of time. If the bag you want isn't available in a nearby store, consider a mail-order house that provides a good return policy.

## Tripods

A tripod can be a must-have accessory for many different types of shooting. If you need to shoot with long exposure times that preclude handholding, you'll need a tripod. Even if you're shooting at hand-holdable speed, if you're very concerned about sharpness, you'll want to shoot with a tripod. While it may seem that a fast shutter speed is too quick to capture any camera movement, even the tiniest amount can produce a noticeable lack of sharpness if you intend to blow up your images to a very large size.

A cheap tripod is better than no tripod at all, and there are plenty of options available from vendors such as Slik and Bogen. Most \$100 or sub-hundred dollar tripods include a built-in head that provides separate controls for locking the pan-and-tilt axes.

When considering a tripod, you'll want to assess the following factors:

- **Weight:** How heavy is the tripod? Heavier tripods provide more stability, but if a tripod is so heavy that you're less likely to carry it, it doesn't provide much value. If you will only be using a tripod in a studio, you can go for a heavier tripod, but if you plan to carry your tripod on long trips or all-day hikes, you'll want to consider an aluminum or carbon fiber tripod to save weight.
- **Carrying capacity:** You'll want to note exactly how much weight the tripod is designed to hold. This amount will need to include the weight of your camera, heaviest lens, and the head (if the tripod doesn't have a built-in head). Many tripods are designed to hold heavy, large-format cameras with expensive lenses. Fortunately, most digital cameras are much smaller and so require a much lighter tripod.
- **Built-in head:** If the tripod has a built-in head, you'll want to assess how stable it is. An inferior head will still have a little bit of movement and flex even when all the axes are locked down. Also, check to see if the camera stays where you want it when you lock it down. In other words, after positioning your camera and then locking the pan-and-tilt locks, does the camera stay in that exact spot, or is there a little droop? Droop is always frustrating.



**Figure 23.37**

This Manfrotto tripod has lightweight carbon fiber legs, a mount for a removable head, and a center column for additional height.

- **Removable head:** More expensive tripods don't provide a head; instead, they include only a mount onto which you attach a head you buy separately. A tripod with a removable head offers several advantages. First, it allows you to choose precisely the type of head you want (more on heads in a moment), and it allows you to use different heads for different situations. This can be especially useful if you want your tripod to do double-duty as a video tripod (see Figure 23.37).

- **Center column:** Some tripods have an additional center column that can be raised above the top of the tripod itself. While this can get you extra height, be aware that a center column basically turns your tripod into a monopod, albeit a very stable one. Still, if you're shooting in very windy conditions, you may not want to use the center column. Therefore, this will need to factor into your assessment of the usable height of the tripod.

- **Height:** Tripods come in many different heights, the trade-off being that a tripod that can go higher will be more comfortable to shoot with (less stooping to look through the viewfinder), allow more flexibility (shooting from a greater variety of altitudes), but will be larger and heavier. Therefore, you'll want to carefully consider weight and portability when choosing a tripod height.

On some tripods, the center column is removable, so you don't have to carry it if you don't want to. These tripods also often allow you to fit the center column into a horizontal orientation, allowing you to shoot straight down or straight up (see Figure 23.38).



**Figure 23.38**

The capability to remove the center column allows you to lighten the tripod, and many tripods let you re-mount the center column in a horizontal position for shooting straight up or down.

- **Legs that can be extended to 90°:** Some tripods allow you to extend the legs to an angle greater than 90°. This allows you to put the tripod on uneven terrain, and makes it possible to get the camera into any position you need.
- **Number of leg segments:** Some tripods have two leg segments, some have three, and some have four. The more segments there are, the thinner the legs are, and thinner legs can mean potentially less stability. However, a tripod with more segments will collapse into a smaller, easier-to-carry package. So you'll need to balance carryability versus stability. If you regularly shoot in very windy conditions, you'll probably want a sturdier tripod. However, you usually get into very windy conditions by hiking, which means you'll want a lighter tripod. You'll simply have to decide how much you're willing to carry. However, for extra stability, you'll want to look for a weight hook.
- **Weight hook:** Many tripods offer a hook at the bottom of their center column, which allows you to hang a weight for greater stability. Many photographers carry empty sandbags they can fill up in the field (if you're in the wild you can just use dirt; if you're in an urban area, you can find a nearby hotel and try to sneak off with some ashtray sand), but you might find that your camera bag itself offers plenty of weight.

## Tripod Heads

If you've opted for a tripod that doesn't have a built-in head, you'll need to purchase a head in addition to the tripod itself. Tripod heads fall into two major categories: pan-and-tilt and ball heads. A pan-and-tilt head provides separate locks and controls that let you lock down either the pan or tilt axis so you can independently move either axis (see Figure 23.39).



**Figure 23.39**

A pan-and-tilt head allows you to independently tilt, pan, and swivel the camera. Because you can lock down any axis, it's very easy to make controlled camera moves.

Pan-and-tilt heads are great for situations where you need a very fine degree of positional control. You can first position one axis, lock it down, and then position the other. The downsides to pan-and-tilt heads is that they're usually larger, and so are heavier and more difficult to carry, and a cheap pan-and-tilt head can suffer from the same "drooping" problems as an all-in-one tripod.

A ball head uses a simple ball-and-socket mechanism that allows the camera to be positioned in just about any orientation

(see Figure 23.40). The advantage of a ball head is that the ball-locking mechanism is very simple, which means it's usually very stable. Once you lock the camera down, it won't droop or drift. In addition, a ball head provides far fewer moving parts, and so is less likely to break and is easier to keep clean.



**Figure 23.40**

A ball head like this AcraTech Ultimate Ball Head allows you to position the camera freely in any orientation. Even inexpensive ball heads are very stable, and most are fairly lightweight, when compared to pan-and-tilt heads.

The downside to a ball head is that it's very difficult to move the camera on just one axis. For example, you might get the camera positioned with the tilt you want, but then realize that it's not quite level. Trying to level the camera might alter your tilt. Ideally, you'll want a ball head with a separate pan axis, which rotates the entire head, allowing you to isolate your panning moves.

Most ball heads have a notch cut into the side, so you can tilt your camera into a vertical position for shooting in portrait orientation. However, note that if you have a very heavy camera, this can throw off the center of gravity on your tripod. An L-bracket mount will allow you to position your camera on the ball head in



either portrait or landscape orientation. Obviously, you'll need a bracket that fits your head and camera, and doesn't get in the way of your battery or media card doors. Also, you'll ideally want a bracket that isn't too heavy.

No matter what kind of head you're shopping for, you'll want to consider the following:

- **Weight:** You're already carrying a camera, lenses, and a tripod, and now you have to throw in a tripod head as well. Even a smallish head can weigh a pound or more, so you'll want to consider your options carefully.
- **Carrying capacity:** Like a tripod, a tripod head has a maximum load it was designed to bear. Make certain the head you're considering can hold your camera and heaviest lens.
- **Mounting bracket:** Most tripod heads (removable or nonremovable) have a mounting bracket that attaches to your camera. You can leave this bracket on your camera all the time, allowing for quick and easy mounting of the camera onto your tripod. When assessing an all-in-one tripod or tripod head, consider the size and weight of the mounting bracket. If it's something you can't leave on your camera all the time, it may not be the best choice. Mounting and unmounting a bracket can be a hassle, and might make you less inclined to use your tripod.

If a tripod head doesn't have a mounting bracket, offering instead just a screw, you'll have to screw the tripod onto the camera (or vice versa), which can be cumbersome and time consuming.

### Tiny Tripods and Alternative Heads

If you have a small camera, there's no need for a big bulky tripod and head. Many vendors make tiny tabletop tripods that are ideal for stabilizing everything from compact point-and-shoots to mid-size SLRs. Tabletop tripods are lightweight and can easily fit in a back pocket. Set them up on a wall or pile of rocks and you have a good substitute for a full-size tripod.

Some vendors also make special ball heads designed specifically for small cameras. These often make more sense than a much heavier head designed to support far more weight than you need (see Figure 23.41).

Many other types of camera mounts exist, from suction cup mounts you can stick on a window, to special car mounts for shooting out of a car, or new designs such as the Jobi Gorillapod, which has multiple jointed legs that can wrap around poles, trees, furniture, and more.

Finally, many photographers swear by the simple beanbag. A beanbag sized just a little smaller than your camera will keep your camera steady, and will conform to the base of your camera to provide good support on any type of terrain.



**Figure 23.41**

You can use a tiny tripod for point-and-shoots or SLRs. For times when it's not possible to carry a big tripod, or when you need to get your camera into a difficult spot, desktop tripods can be a lifesaver.

### Sensor Cleaning

If you're using a digital SLR, at some point you will probably encounter the problem of sensor dust. Because the lens on an SLR is removable, it's possible for dust to get inside the camera body and collect on the sensor. Sensor dust will appear in your images as smudges or black specks, and you can tell if you have a sensor dust problem if you have a smudge or speck that appears in the same place in every image (see Figure 23.42).



**Figure 23.42**

Sensor dust appears in your image as dark specks or smudges. With care and some special tools, you can clean your sensor.

Many cameras now include special built-in sensor cleaning mechanisms, but if yours doesn't, or if yours does and you've been in a particularly dusty situation, you may be faced with the problem of sensor cleaning.

- **Determining if you have a dirty sensor.** Sometimes, what appears to be sensor dust might actually just be something on your lens. Your first step when cleaning is to determine if your sensor actually needs to be cleaned. The easiest way to do this is to put your camera in manual focus, point it at a blank white wall (or clear blue sky), defocus the lens, and take a picture. Bring this image into your image editor and increase the contrast using a Levels adjustment. Any dust problems should be readily apparent.
- **Cleaning your sensor.** Sensor cleaning is not to be taken lightly. The image sensor in your camera is an extremely critical component, and you don't want to do anything that might damage it.

## No Compressed Air!

Never, ever, use compressed air to clean your sensor! The propellants used in cans of compressed air can leave a physical residue that can permanently mar your sensor.

- To clean your sensor, you'll need special cleaning tools and a little time. If you're not comfortable with this type of endeavor, you can send your camera to its manufacturer for cleaning.
- There are two types of cleaning: dry and wet. Dry cleaning involves using a special brush to remove debris from your sensor, while wet cleaning involves special swabs and chemicals for removing particularly stubborn particles. You can find both types of products, and excellent sensor cleaning tutorials at [www.visibledust.com](http://www.visibledust.com). The Visible Dust Corporation has a long history of making cleaning materials for high-end microscopes and other optical devices, and their products are top notch.
- **Prevention.** With just a little effort you can keep your sensor from getting dusty in the first place. Most of the dust that lands on your sensor is delivered by the end of the lens. So keeping your lenses clean is a good way to keep your sensor clean. Before you go out on a shoot, use a blower bulb or blower brush (but never compressed air) to blow out the camera end of your lens.

## Built-in Sensor Cleaning

Some cameras include built-in sensor cleaning mechanisms that shake the sensor automatically, or a clear plate in front of the sensor, every time you turn the camera on or off. For the most part, these mechanisms are ineffective. At the time of this writing, Olympus' Sonic Wave Filter technology is the best, but you shouldn't base your buying decision on any of these sensor cleaning mechanisms. They don't hurt anything, but they're not a reason to choose a particular camera.

When changing lenses, try to use gravity in your favor. Keep the camera pointed down and don't remove one lens until you have the other lens in-hand, ready to attach. It might feel like it requires three hands, but if you hang the camera around your neck and practice, you'll develop the coordination to make speedy lens changes.

Some people also claim that turning off your camera before changing lenses will reduce the chances of dust getting on the sensor. Because your sensor has a static charge when powered up, the argument goes, it can attract dust. Whether this charge dissipates immediately upon powering down is unclear. Unfortunately, there's no easy way to test this hypothesis, but if you're trying to be very cautious about dust, go ahead and power down the camera before any lens changes.

## Dust Problems with New Cameras

If you have lots of dust problems when you first get your camera, this might be because some of the materials inside the sensor chamber are shedding residues of different kinds. This should abate after a few months.

## What Should I Buy?

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As you've seen, choosing a digital camera involves balancing and compromising on a number of different features and technical considerations. If you've followed the procedure outlined throughout this chapter, you should have made the following decisions:

- What resolution do you need?
- How much exposure control do you need? Fully automatic, or a mix of automatic and manual controls?
- What type of camera are you looking for? Tiny pocketable camera? Mid-sized point-and-shoot? Pro-level SLR?
- What features do you need?

Each of these steps should further reduce the field of possibilities, making your buying options simpler as you make each decision. Here are some of the baseline features and capabilities you should look for:

- Resolution that's appropriate for your intended output medium. Although it's simple to follow the "more is better" approach when choosing a resolution, this isn't always the case.
- Satisfactory (or better) image quality. Always defer to image quality as the ultimate arbiter of camera value, because when the shooting's over (no matter how easy or difficult it was), if you don't have a decent image, you've wasted your time.
- For maximum creative flexibility, look for manual exposure and priority modes.
- Exposure compensation controls that are easy to access.
- Manual white balance control is a must for ensuring color quality.
- Adjustable ISOs guarantee that you'll be able to shoot under different lighting conditions.
- At the very least, your camera should have two metering modes: a matrix metering mode and a spot meter.
- Controls and body design you find comfortable and that will facilitate the way you like to shoot. This includes the shape and feel of the camera, the quality and coverage of the unit's viewfinder(s), the focal length of the lens (in other words, does the lens provide the wide angles or telephoto qualities you want), the right type of storage and connectivity, and support for any external flash units you might want to use.

Obviously, your needs might go far beyond this, but these items will help to ensure that you can get the shots you want.

## Wondering About a Specific Camera?

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The goal of this chapter was to give you the skills to evaluate cameras on your own, so that even as technology changes and improves, you can still make an intelligent decision about what makes a good camera. Nevertheless, it's always nice to get other opinions about particular models. To check out reviews of some of the latest digital cameras, look at [www.completedigitalphotography.com](http://www.completedigitalphotography.com).

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