Mikkel Aaland

Pro Tips for Taking Great Pictures
with Your Digital Camera

SHOOTING DIGITAL

Shooting Panoramas and Virtual Reality

With just a little help from special software, you can extend the capabilities of your digital camera to create stunning panoramas and enticing virtual reality (VR) images. This chapter shows you how to shoot—and create—images that are not only more beautiful, but also have practical applications in the commercial world as well.

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Chapter Contents

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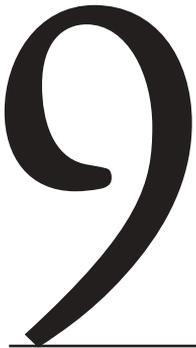
Panoramas and Object Movies

Look at Figure 9.1. It's not what it seems. This panorama is actually comprised of several images "stitched" together using a computer and special software. Because of the limitations of the digital camera's optical system, it would have been nearly impossible to make this in a single shot. Panoramas like this can be printed, or with an extended angle of view and more software help, they can be turned into interactive virtual reality (VR) movies viewable on a computer monitor and distributed via the Web or on a CD.

Figure 9.1: This panorama made by Scott Highton using a Nikon Coolpix 990 is comprised of four adjacent images, "stitched" together using Photoshop Elements' 2 Photomerge plug-in.

If you look at Figure 9.2 you'll see another example where software was used to extend the capabilities of a digital camera. This is part of an object movie, although you can't experience the full effect here on the printed page. While panoramic images show the view from a particular location looking outward in all directions, object movies are created by shooting with your digital camera pointed toward an object while the object is rotated through many angles. This yields a group of images that, once assembled into an interactive sequence, enables a viewer to interactively rotate the object on their computer screen simply by dragging their mouse. The effect is one of being able to virtually pick up an object and move it around in your hands, viewing it from any side. Object movies are often used by online retailers to sell products on websites such as eBay.

Figure 9.2: This object movie was also created by Scott Highton. To get the full interactive effect you need to view it on a monitor, which you can do by going to www.shooting-digital.com.

Let's see what it takes in terms of software and shooting to create these and other similar types of images.

Shooting Simple Panoramas

It's relatively easy to shoot and stitch a simple panorama comprised of two or three images. Some digital cameras even offer a panoramic shooting mode that guides you through the process and includes basic stitching software.

Inexpensive, off-the-shelf software is also available to stitch the images together. Some of these products include:

* Photoshop Elements (with its Photomerge feature) from Adobe, **www.adobe.com**
* PhotoVista Panorama from iSeeMedia, **www.iseemedia.com**
* PanaVue ImageAssembler (Windows Only), **www.panavue.com**

You can create these simple panoramas by shooting a series of overlapping images with a hand-held digital camera. However, for the best results—or if you want to expand your panoramas to include 360° views and use them for virtual reality— you'll need to adopt some good shooting practices.

The following general tips will ensure that your panoramas are as good as they can be.

Use a tripod

Using a tripod minimizes camera movement during an exposure. It makes you think a little more about your composition, subject, and framing before you shoot, so the results are more considered. But most importantly, when shooting panoramic images for stitching, the tripod allows you to maintain consistent alignment between the images, thus improving the stitch process. (⌁ "Accessories That Make a Difference: Tripods" in Chapter 7 to learn more about what to look for in a tripod.)

Use consistent exposure, focus, and focal length

If possible, turn off the autoexposure and autofocus mechanisms of your camera, or switch them to manual control. While some consumer cameras may not let you do this, they may have exposure lock and focus lock features that you can use instead. The stitching software looks for matching pixel patterns and blends the images based on these. So it is important for every image in a sequence to have the same exposure, focus, and size, or the blends will not work well. Exposure changes between shots will result in light or dark banding in the stitched image. Focus and focal length (zooming) differences will also result in stitching errors, where subjects along the seams don't blend properly. It is best to choose a focal length you like before you start taking pictures (usually the widest possible) and keep your finger off the zoom control while shooting.

Furthermore, you'll want to turn off your camera's auto white balance setting and use a preset such as "bright daylight" or "cloudy" or "shade" instead. (☞ "Know Your Camera: Adjusting White Balance" in Chapter 11 to learn how to do this.)

The good news is that even if your camera does *not* allow override of white balance, most digital cameras will at least maintain fairly consistent settings within a scene. However, if the camera is shut off and then turned back on during the sequence (this can happen if you pause too long between shots and the camera's auto shutoff feature engages), then the camera will likely reset its white balance to whatever it deems best for the light it's restarted under. This change can result in color banding in the stitched panorama. Once you've started shooting a panoramic sequence, try to complete it without delay.

Keep the camera level

Avoid tilting your camera up or down as you shoot, as this causes vertical lines to converge in your images and makes it difficult for the stitching software to match and blend the images properly. If you center the horizon in the middle of your viewfinder, then any vertical lines in your scene will remain straight up and down, and will match properly when you pan and shoot the next image in your panoramic sequence.

Turn the camera vertically to increase your field of view

It's common to take pictures while holding the camera horizontally. However, if you rotate your camera 90° into a vertical or portrait orientation, you'll have a larger view vertically (up and down) than you would if you held the camera horizontally. If you want more vertical coverage in your panorama, shoot your sequences with your camera oriented vertically. To increase your horizontal field of view, simply shoot as many adjacent shots as you can. For example, compare the two panoramas shown in Figure 9.3. The top image was shot with the camera in its normal landscape orientation, and the bottom image was shot with it in portrait orientation.

Figure 9.3: You can extend the vertical field of view of a panorama by shooting your camera in portrait mode. The top image shows an image shot with normal landscape orientation; the bottom shows it shot with portrait orientation. (Photos by Scott Highton)

To mount your camera on a tripod in portrait (vertical) orientation, you will probably require a right angle adapter plate or a specialized VR tripod head. Commercial products such as these are available from many photo manufacturers, including:

- Bogen/Manfrotto (**www.manfrotto.com**)
- Kaidan (**www.kaidan.com**)
- Peace River Studios (**www.peaceriverstudios.com**)
- SLIK (**www.slik.com**)

Alternatively, if you're handy with tools, you can make a right angle bracket by bending a piece of aluminum (or other metal), drilling a few holes in appropriate spots, and adding a couple of screws or bolts to attach everything to your tripod.

Pan the camera an equal amount between shots

You will need to pan your camera a specific angle between shots depending upon the focal length of the lens (or the focal setting of the zoom lens) you are using. It is best to try to keep this pan increment as consistent as possible between shots. Specialized panoramic tripod heads have preset click stops built into them at varying increments. This feature makes shooting easier, particularly when creating 360° panoramas. However, this is not critical when you are combining only two or three images. Simply look through the viewfinder as you pan the camera between shots, and stop when you still have 1/3 to 1/2 of the previous image in your frame. Shoot the next image, and then repeat as many times as needed in order to get the horizontal coverage you desire. Pan from left to right as you shoot.

Be consistent

Getting good results requires consistently good technique and attention to detail. We all make mistakes, and in photography, there are a lot to make. It's hard to diagnose what mistakes you need to correct if you constantly change things without keeping track of what you did or when you did it. Keep a small notebook in your camera bag and use it to jot notes about your location, your camera, exposure and lens settings for special shots, plus the number of images you shoot for each panorama. These will come in handy when you are trying to stitch the images later on. They will also help you isolate problems when they do arise, and help you figure out what to do to prevent those problems in the future. Once you find a combination of camera settings and techniques that work best for the kinds of images you create, remain consistent in their use in order to get consistent results. You can even buy notebooks specifically designed for panoramic and virtual reality photography at www.vrphotography.com.

Avoid Filters

Don't use filters, especially polarizing filters, when shooting images for panoramas or VR. Filters can cause slight vignetting or fading on the edges of the image, which will result in noticeable banding when images are stitched together. Stitching images that were taken with a polarizing filter can also result in unwanted banding because the filters can produce varying results depending on the position of the camera to light rays.

Shoot from left to right

Keep in mind that almost all stitching programs stitch images from left to right, so it is a good idea to shoot your panorama sequences from left to right as well. This practice will result in a more automated workflow when you are importing your digital files from your camera, as the files will be in a numeric sequence that matches the stitching sequence. It's not a disaster if you don't do this, but you'll find that using stitching software will be much easier if you shoot from left to right.

Allow the frames to overlap

It is important to allow 1/3 to 1/2 of the frame as seen through the viewfinder or LCD to overlap between shots. The stitching software looks for matching pixel patterns between images and then blends them together across the overlap area, forming a visually seamless combined image. This can be done repeatedly for many images, and can even be extended to compose a full 360° view. If you do not have sufficient overlap between each image however, the stitcher will be unable to match the pixel patterns properly, and the image blends will not align well.

Having too much overlap between images can be problematic, too, as it requires you not only to take more pictures than necessary, but also slows down the stitching process when your computer has to process far more information than is necessary. If you wind up with more than 50% overlap between your images, consider trying to stitch every *other* image together, rather than every image in your panorama sequence.

Note: One of the great advantages of combining multiple images into a single panorama is that you can get a higher level of detail and greater resolution from the same camera than you can by simply using a wide-angle lens adapter or the "panorama" mode on most point-and-shoot cameras. Let's say that your digital camera records 2 megapixels of data in each photograph you capture. When you add a wide-angle adapter to your lens, you are not only degrading the quality of the optics you are using, but you are also compressing more visual information into the frame, resulting in less detail in the recorded image. However, when you shoot multiple pictures with the same 2-megapixel camera and then stitch them together, you are adding pixel data with each picture, rather than compressing the entire view into the same 2 megapixels. For example, stitching three images together, assuming they have 50% overlap, will yield a panoramic image of about 4 megapixels. Mind you, the stitching process can introduce problems of its own at times, but these are minimal to non-existent if you use the good shooting techniques described previously.

Extending Your View

It is possible to extend your field of view to include everything in a scene: 360° horizontally, and a wide angle of view vertically. These sorts of panoramas are commonly used for virtual reality (VR) applications, such as real estate virtual home tours (like the one shown in Figure 9.4), online tourist destinations, promotional websites for hotels, restaurants, and airlines, as well as corporate marketing, training aids, crime scene investigation, education, and interactive games.
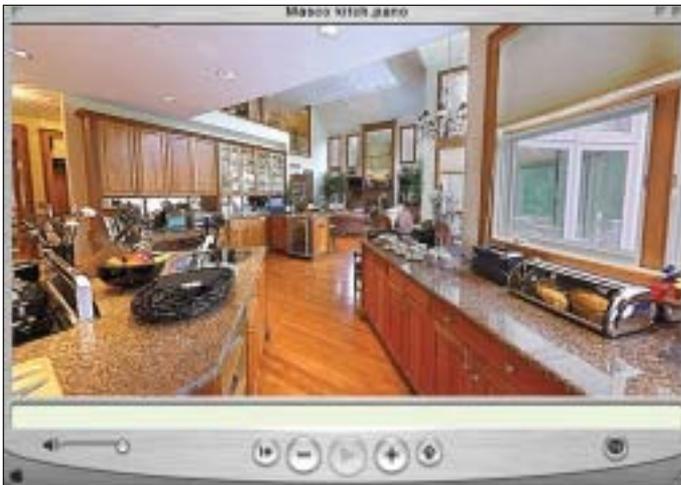
Figure 9.4: Part of a 360° panorama, viewed in QuickTime. Kitchen interior, Masco Virtual Showhome, Columbia, MD. The Masco Virtual Showhome project was produced by RDC Interactive Media, Inc., Palo Alto, CA. (Photography by Scott Highton ©1996)

Stitching these images together generally requires software specifically designed for VR authoring. The difference is that 360° panoramas will often require anywhere from a half dozen to several dozen source images, and the ends of the resulting

panorama need to be wrapped so that the beginning and end are also blended. It is even possible to create 360° panoramas with complete (180°) vertical fields of view, but this requires specific shooting tools and techniques, as well as VR software with spherical or cubic stitching capability.

There are a variety of software applications available. Each has its own requirements for the types of lenses that can be used and how their image sequences should be shot. All of the techniques recommended previously become essential practices when you are creating full 360° panoramas and VR scenes.

Such software applications include:

- Apple's QuickTime VR Authoring Studio (Macintosh only), approximate cost: $395 (**www.apple.com/quicktime/qtvr/**)
- Stitcher from REALVIZ (Mac and Windows), approximate cost: $499 (**www.realviz.com/products/st/**)
- VRPanoWorx and VRWorx from VR Toolbox (Mac and Windows), approximate cost: $149 (**www.vrtoolbox.com**)
- PhotoVista Panorama from iSeeMedia (Windows only), approximate cost: $49 (**www.iseemedia.com**)
- iPIX Builder and Wizard software from Internet Pictures (Mac and Windows) approximate cost: $99, not including licensing fees (**www.ipix.com**)

Once you have assembled a panoramic image, you can either display it as a printed stand-alone photograph, or you can convert it into an interactive VR movie that can be published on the Internet or distributed electronically. These movies are viewed with a variety of Web browser plug-ins or stand-alone media players, such as Apple's popular QuickTime available free for both Mac and Windows at **http://www.apple.com/quicktime/**. Sites offering this content typically include a download link for the appropriate plug-in.

Shooting Tips for 360° Panoramas

As with simple panoramas, alignment and consistency between images are important when shooting full 360° panoramas. The better the alignment and juxtaposition between your source images are, the better the stitched results will be. Remember that you maximize your vertical field of view by rotating your camera to a vertical or portrait orientation.

Pan around the nodal point. For the best image alignment, it is important that your camera be rotated (panned) around the optical center of its lens, or what is known as the *nodal point*, rather than around the point where the camera's tripod socket happens to be located. Panning your camera around the nodal point of its lens means that close and distant subjects maintain their relative positions in your photos, no matter where these subjects are located in your frame.

Stitching software cannot stitch images together properly if the near and far subjects do not maintain their same positions relative to one another in between frames. Nodal point alignment becomes less of an issue the farther your subjects are

from the camera, becoming almost insignificant when your nearest subject is greater than 6 feet (2 meters) away from the camera.

Several manufacturers produce custom tripod heads for panoramic VR photography and also provide instructions for aligning the nodal point of your camera and lens. These specialized accessories allow you to both position your camera in a vertical or portrait orientation *and* to adjust its position on the tripod so that it rotates around the optical center of its lens. These manufacturers include Bogen/Manfrotto, Kaidan, and Peace River Studios, cited earlier.

A description of nodal point alignment is also available at www.vrphotography.com.

Use a wider lens and you'll need fewer shots. The wider the focal length of your lens, the fewer overlapping shots you will need to complete the full 360° view. One of the disadvantages of today's non-professional digital cameras is that their built-in lenses do not provide terribly wide coverage, so more images are needed to complete a full 360° stitched view. This is why up until recently, the best panoramic VR images were shot with film cameras, and the film was then digitized for stitching. However, this situation is changing with the introduction of better digital cameras and lenses, allowing for greater fields of view and higher resolutions, along with the commercial availability of multi-row stitching software.

Multiple-Row Panoramas

Unfortunately, with most consumer digital cameras, even shooting with the camera in portrait (vertical) orientation does not always enable you to include everything of interest in the scene. One solution is to use a multi-row stitcher, which allows you to stitch more than one row of source images. This lets you shoot a row of images with the camera level to the horizon, and then add additional rows with the camera tilted upward or downward. In this manner, you can increase the vertical coverage of your panoramas up to and including views directly overhead or below.

In order to shoot multi-row panoramas, you will need a multi-row VR panoramic head for your tripod, as well as multi-row stitching software. Currently, only Kaidan and Manfrotto offer multi-row tripod heads, and RealViz's Stitcher is the only commercial software application that can stitch multi-row panoramas.

Spherical Panoramas

There are other options for creating spherical or cubic (360° × 180°) panoramas. The most notable of these is the iPIX format. Using the iPIX system, the photographer adds a fisheye converter or lens to their camera, which captures a 180° circular image (or hemisphere view) with each shot. The camera is mounted on a rotator unit that allows it to be turned precisely 180° between shots. Only two photographs—one for each opposing hemisphere view—are required for a complete panorama. The iPIX software then digitally aligns these images inside a virtual sphere and outputs a VR movie that the viewer can pan around. The newest versions of iPIX's software also allow for the stitching of three hemispheric images (the camera rotates only 120° between shots) and

the larger overlap area improves blending of the seam areas. There are three major drawbacks to the iPIX system, however. It does not capture as much detail in a scene as either single- or multi-row stitching programs; it requires shooting with a special fisheye lens or adapter (not available for all cameras); and there is a fee (called a licensing "key" by iPIX) charged for every panorama created with their proprietary software. Information about the iPIX technology, as well as sales information for their camera and software packages is available from www.ipix.com.

A competing software application called Panoweaver allows for spherical and cubic fisheye image stitching (two or three hemisphere images), but without the per-image "key" or license fee that iPIX charges. More information is available at www.easypano.com.

Figure 9.5: Two commercially available 360° solutions. The iPIX system (left) and Kaidan's 360One setup (right).

There are also several specialized one-shot panoramic VR lens systems available that capture full 360° panoramas in a single shot. These systems involve a parabolic mirror that attaches to the lens of a digital camera, resulting in an *annulus* (donut-shaped image) being recorded. Their proprietary software is then used to dewarp the image into a normal 360° panorama, which can be made into a VR movie or printed as flat artwork. The advantage to this system is that you can capture the entire view in a single exposure, which eliminates the problem of objects in the scene possibly moving or changing between frames and causing stitching misalignments. In fact, the stitching process is eliminated with these systems. The disadvantages are that you cannot capture a full spherical view (these systems are limited to anywhere from 30° to 50° above and below the horizon), and the resulting sharpness and resolution are relatively low, since the entire scene is compressed into a single frame recorded by your digital camera. For more information:

• **360One** from Kaidan: www.kaidan.com
• **BeHere** system: www.behere.com

Object Movies

Interactive object VR movies are a unique feature of Apple's QuickTime VR, although their effect can also be simulated with the use of animated GIFs and a variety of other techniques. They are most often used for the promotion of commercial products on the Internet, such as items for sale in eBay auctions. They are also used extensively in education, online training, advertising, and visual documentation.

Digital cameras are ideally suited for use in object movie VR. Because it may be necessary to shoot a large quantity of images to create object movie sequences, it is far more cost-effective to shoot them digitally than on film. Also, precise alignment of the images between shots is virtually impossible to achieve with traditional film cameras. The alignment consistency that is provided by the fixed sensor inside a digital camera allows for smooth playback when the images are played in rapid sequence.

An object movie is composed of anywhere from less than a dozen to hundreds of images surrounding a subject. Each is taken from a slightly different angle and then all of the images are arranged in a series of linked playback sequences. Most often, an object will be placed on a turntable and photographs will be shot as it is turned in 10° increments.

The more shots you have (the smaller the rotation increment), the smoother the playback of the object sequence will appear in the movie window. However, this increases file size—and therefore also increases the time it will take for your viewers to download the movie. Fewer shots yield a smaller file size, but the playback does not appear as smooth. There is greater movement or "jump" between each frame in the movie because the object is rotated more between each frame.

It is critical to shoot object sequences with your camera mounted on a tripod or other device that keeps the camera in the same position relative to the object, and the object itself mounted on a turntable or rotating platform. (For example, Figure 9.6 shows the setup used to shoot the frames for the object movie shown in Figure 9.2.) The only movement between one frame and the next should be the rotation of the object. If the camera moves between shots, then the movie sequence will appear jittery when played. Remember that you're essentially doing stop-motion animation when you shoot an object sequence, so it's important to keep everything as stable as possible when you shoot.

Figure 9.6: A simple object movie shooting setup: the object is mounted on a turntable, and the camera is on a tripod. (Photo by Scott Highton)

A basic turntable for small objects can be made from a lazy susan, available from many kitchen or department stores. In fact, Rubbermaid makes a plastic one that can be bought for about $5 at many houseware and grocery stores. If you want to build one that is a bit more heavy duty, you can buy a lazy susan mechanism for about $10 at your local hardware store, to which you can mount a piece of wood or other flat surface of your choosing. These can hold and rotate objects weighing hundreds of pounds. Use a protractor to determine degree increments, and mark them on the outer edge of your turntable. Then simply rotate your object on it in prescribed increments as you shoot.

Accessories That Make a Difference: Commercial Rigs for VR Photography

There are a number of sophisticated commercial turntables and rigs available specifically for object VR photography. Their prices range from around $100 to almost $20,000. The most basic of these are manually operated with click-stop increments. The more advanced versions are computer-controlled and feature precision electronic stepper motors. They allow you to shoot multiple level sequences (so you can go above and below the object, as well as seeing it from all sides) and they can be configured for high volume, automated object shooting. For more information, see the Kaidan and Peace River Studios sites mentioned earlier in the chapter or Corybant West at **www.corybantwest.com.**

Once you have captured a series of images for an object, you need to bring them into a computer and sequence them into a movie. These images can be played in sequence as a normal QuickTime or video movie. The result will show an object that rotates in the movie window as the frames are played in rapid sequence.

However, if these images are made into an interactive object movie, the viewer can control the rate and direction of playback simply by moving the mouse cursor in the movie window. If you've photographed the object from multiple levels, then moving the mouse upward or downward changes the view to one from above or below. The viewer can even zoom in or out on the object while it rotates in an interactive object movie.

Fully interactive object movies can be displayed properly only in the QuickTime format. (Other popular media players, such as those provided by Microsoft and RealNetworks, treat these interactive movies as traditional linear movies and simply play their frame sequence from beginning to end.) Integrated QuickTime players and Web browser plug-ins are available at no cost for either Mac or Windows systems from Apple's website at **www.apple.com/quicktime/products/qt/.** (If you post an object movie on your own site, be sure to include a link to the QuickTime download page.)

Object movies can also be displayed quite effectively in linear (rather than interactive) form if they are programmed to loop repeatedly from beginning to end. Figure 9.7 shows how the object movie would appear in the QuickTime viewer. The object rotates continuously and automatically on screen without interactive viewer control. Such sequences can even be assembled as animated GIFs for presentation on websites where no media player other than a basic Web browser is required to view them.

Figure 9.7. An object movie by Scott Highton being viewed in a QuickTime viewer.

Before you start shooting object movies, determine which software application you want to use for their assembly, and then familiarize yourself with how it works. Each one has specific recommendations for image organization, file formats, and general workflow. Make sure you understand those requirements. Interactive object movies can be created with software such as the following:

- Apple's QuickTime VR Authoring Studio (Macintosh only)
  www.apple.com/quicktime/qtvr/
- VRObjectWorx and VRWorx from VRToolbox (Mac and Windows)
  www.vrtoolbox.com
- ImageModeler from RealViz (Mac and Windows)
  www.realviz.com/products/im/index.php
- PhotoVista 3DObjects and Reality Studio from iSeeMedia (Windows only)
  www.iseemedia.com

Non-interactive single row object movies can be authored using the same source images and sequencing them as animated GIFs or other linear movie formats. These can be done with software such as:

- Photoshop, Photoshop Elements, and Premiere from Adobe
- iMovie, Final Cut Pro, and QuickTime Pro from Apple
- Director and Flash from Macromedia

Shooting Tips for Object Movies

Once you have a turntable set up to hold your objects, along with an appropriate tripod or object rig to support your camera, you are ready to start shooting object movies. However, there's a bit more to doing this successfully than simply exposing frame after frame as you rotate the turntable.

Compose the frame carefully

First, choose good perspective, shooting position, and lens focal length. Ideally, you'll want to fill the frame as much as possible with your subject so you capture adequate detail in each image. If you are limited to a fixed-focal-length lens, you will need to adjust your camera distance to frame the image you want. However, with a zoom lens, you can set it to a longer (telephoto) focal length before you distance the camera from the subject in order to fit the frame. Commercial products generally look more natural when photographed with a longer lens from a distance than with a wider lens from close up. The closer your camera is to the subject, the more distorted and unflattering the subject will appear.

Keep in mind that most objects have varying dimensions on each side. You will need to rotate the object on the turntable as you are framing it in your viewfinder to make sure that it still fits the frame throughout the 360° rotation. For example, a model train engine is relatively small and compact when viewed head on. If you fill

your frame using this view when you set your camera position, the engine will over-flow the frame when it is turned to a 90° profile. In general, you will want your composition to include the entire object throughout its 360° rotation.

Choose an appropriate background

Background choice is your next important decision. Shooting objects against a black or dark background is often the easiest, because your main worry is how the object itself looks, and uneven or uncontrolled light on the background is less of a problem. Also, postproduction of images with dark backgrounds is often more straightforward than it is with light or white backgrounds, which often require more masking, retouching, and image manipulation. Keep in mind that you may need to retouch *every* frame of your object movie, so any retouching necessary is multiplied by the number of frames you've shot. However, dark backgrounds tend to give a more somber feel to product photos, and may not be the best choice when you're trying to sell or promote a product.

White seems to be the background of choice for commercial products, but it is very difficult to get pure white backgrounds from a digital camera and still expose the object properly. Auto-exposure cameras are often fooled by large expanses of white in a scene, and will try to darken the exposure to keep detail in these highlight areas. Because this is generally the exact opposite of what you want, it's best to use a camera with manual exposure control or exposure lock capability when shooting object movies so you can control your exposure more precisely.

Avoid anything that will cause flicker

Remember that even the slightest change in your camera's position, focus, framing, or exposure settings during the object sequence will result in a flicker or jitter when the images are displayed as a movie. Use a remote release to fire your camera so that the pressure of your finger on the shutter release button doesn't move the camera slightly between frames. Lock your exposure, focus, and white balance settings, and make sure that you don't accidentally touch the zoom control. If you accidentally bump either your tripod or the object turntable while shooting, no matter how lightly, start the sequence over again to be on the safe side. It is usually far more efficient to reshoot the whole thing while you have the chance than it is to try to correct continuity problems in postproduction.

Lighting for Object Movies

Lighting is the final thing to think about before you shoot. You will learn much about what works and what doesn't with every shoot you attempt, but if you start out with a few simple rules of thumb, you should be able to produce pleasing results fairly quickly.

1. Keep it simple. Remember that you need to make the object look good from every angle it rotates through, not just a single one. The simpler you can keep your lighting, the better. As you're setting up and shooting, constantly look through your camera's viewfinder to make sure that your subject looks okay throughout the object's rotation. You want to discover and correct problems with lens flare or uneven lighting before shooting, rather than having to deal with such problems after the fact in postproduction.

   The simplest lighting setup you can use is outdoor sunlight. Try shooting your objects outside in the early morning or late afternoon/early evening when the sun is not too high in the sky. Direct sunlight is a fairly hard light source, and may be a bit too harsh. Sunlight early or late in the day is usually softer than mid-day light because it is more diffused as it comes from a low angle and has to pass through more air and haze in the atmosphere. A slight cloud overcast will also soften it considerably more.

   Put the object on your turntable and walk around it to see which angle gives you the best definition or desired look. Since you can't move your light (the sun), you have to walk around the object rather than rotating the turntable for this step. Once you have your object at the best angle relative to the sun and your camera, then you can position your background. Lock in your framing, composition, exposure, white balance, etc., and begin shooting.

2. Use Fill light when necessary. If the light is still too harsh, consider adding a reflector to bounce additional light into the shadow side of your object. This technique will even out the light somewhat and reduce the contrast between highlight and shadow areas. Your reflector can be a large piece of white artboard (put aluminum foil over it to reflect even more light) or a commercial photo reflector from companies like Visual Departures (Flexfill) **www.visualdepartures.com** or PhotoFlex **www.photoflex.com.** Position this reflector on the opposite side of your object from the sun. Move it in closer to increase the amount of fill light, or move it farther away to decrease it. Experiment until you find an arrangement that works well, and remember that the sun will move slowly across the sky as you shoot, so you may need to subtly adjust the aim of your reflector as the sun moves.

3. Experienced commercial photographers find that soft light is usually better for most product photography, particularly with shiny or reflective subjects. You may find that when you are shooting object movie sequences, it is far easier to get pleasing results with soft lighting than it is with hard light sources such as direct sunlight or your camera's built-in flash unit.

You will find many sources of soft light once you start looking. Any indirect light is usually softer than direct light. Try shooting your object under a covered porch, where the sun is not shining directly on it, or where it is being lit by reflected light off a white wall. (Note that any color painted on the wall will cause the reflected light to take on that color). Shooting indoors with a large window as your primary light source is also an excellent way to get soft lighting. Position your setup with the window to the side of the object, rather than directly in front or in back of it. If the window has direct sunlight coming through it, you can hang up a piece of sheer fabric or gauze to diffuse the light. You can buy fabric samples large enough to cover most windows at your local fabric store. Again, use the purest white fabric you can find so it doesn't filter the color of the light shining through it. If you still need to add fill light into the shadow side of your object, you can again use white artboard, reflectors, or even a small mirror.

Of course, you can always use electronic strobes or studio lighting with soft box attachments, along with a variety of grip or support equipment. If you have these available, you can get fairly precise control of your lighting and make it absolutely repeatable from frame to frame, or even from day to day. For more on this equipment, ☞ "Accessories That Make a Difference: External Artificial Lights" in Chapter 10.

4. Position your lighting off-axis from the camera. Keep in mind that if you use an on-camera flash or other light source directly in line with your camera, your subject will wind up looking flat and lifeless in your pictures. It is tempting to shoot with an on-camera or built-in flash unit, because they are so conveniently provided by the camera manufacturers. But your subject will likely look as though it was rendered as a series of mug shots from a police lineup. It is best to position your primary light source at an angle off to the side of your subject if you can.

5. Separate your background from your subject. Try to position your background some distance away from the object you are photographing. This technique accomplishes several things:
   • The greater distance means that the background will be more out of focus and will be less distracting (remember to focus your lens on the object, not the background).
   • The object will be less likely to cast a shadow on the background (which makes postproduction image retouching easier).
   • You can light the object and the background independently (this requires multiple light sources). In the case of a white background, you can make it considerably brighter by shining more light on it without the extra light spilling onto the object. In the case of a black background, you can better block light shining on the object from spilling onto the background. The increased distance from the object light sources means that less light reaches the background. The background will be rendered darker in the photographs, and will make retouching easier.

Know Your Camera: Lenses

Most consumer and prosumer digital cameras come with non-interchangeable lenses—usually with focal lengths ranging from wide to telephoto. Professional digital cameras offer interchangeable lenses, which are often purchased separately from the camera body itself.

The lens is a critical component of a digital camera. Many of you who already own a digital camera likely made a buying decision based at least partially on the specifications and characteristics of a camera's lens. If you purchased a professional SLR digital camera, lens compatibility with your older film camera lenses may have been a top consideration.

It only takes a few shooting sessions to determine if your optical system meets your needs.

- Does the lens cover a wide enough angle of view? Or are you constantly finding yourself with your back to the wall and still not getting everything you want in the shot? Is the telephoto long enough? Or are the objects you shoot—birds, for example—coming out as just tiny specks on the image?
- Most digital cameras boast a "macro" mode for extreme close ups. But "macro" for one lens might mean 6 inches, and for another, 2 inches. If you are shooting rare old coins, the distinction is critical.
- Is the widest aperture of your lens wide enough? Remember, aperture is expressed as f-stop, and the wider the f-stop, the more light passes through the lens to the sensor. This will make a difference in low-light situations without a flash. Also, the wider the aperture, the more control you have over depth of field. Some camera lenses feature f/1.8 as their widest aperture, which is considered very good, but it's not that uncommon to find lenses rated at f/3.5 or even narrower.
- Does your lens stop down enough? If it only stops down to f/8, you won't have the flexibility to shoot in extremely bright circumstances unless the camera features a very fast shutter speed to compensate. (Because of the size of the sensors, increased depth of field isn't usually a problem with digital cameras, regardless of how narrow the aperture is.)
- How easy is it to use the lens? Does it focus quickly in manual-focus mode—assuming you have a manual-focus mode? How does it feel when you zoom from one focal length to another? Is the zoom responsive? Does the lens barrel move quickly and smoothly? Some digital camera lenses offer a motor-controlled zoom; others a mechanical manual zoom. Are you more comfortable with one over the other?
- Is the autofocus system responsive enough for your needs? This is only partially a function of the lens, but involves other electronic components of the camera as well. Depending on what you shoot, an autofocus system that works well in a variety of lighting conditions is extremely important. Some digital cameras, such as the Sony F717, for example, offer very sophisticated "laser" or other type of light assists that can greatly improve performance in low light.
- If your lens has an image stabilization mode, does it work satisfactorily? If it does, you should be free of the restraints imposed by slow shutter speeds.

The actual quality of a lens is more difficult to ascertain. If your images aren't sharp, you can't assume that optics are the reason. Image processing, which occurs after data is captured by the sensor, can also introduce blurriness. In order to know the quality of your lens, you'll need to research the Web for carefully controlled tests conducted by independent camera reviewers. You can, if you wish, purchase targets created specifically for precise resolution testing. These targets contain carefully calibrated test patterns that you photograph using the equipment in question and then visually inspect and analyze the results. These targets are available from a number of vendors, including Eastman Kodak, Sine Patterns, and Edmund Industrial Optics.

If you aren't satisfied with your lens, what can you do? Focal length inadequacies can be worked around, to a point, with add-on lenses and teleconverters. There can be a tradeoff in quality, but that will depend on the actual shooting situation.

With careful shooting techniques and considerations, you can work around the limitations of so-called "slow" lenses—ones whose widest aperture is say, f/3.5 or narrower. This might mean using a slow shutter speed and a tripod, for example. There are also ways to decrease your depth of field, ☞ "Know Your Camera: Controlling Depth of Field" in Chapter 2.

Even some of the best lenses suffer from optical distortions known as barreling and pincushioning. These optical aberrations can often be easily fixed with camera-bundled software such as Olympus's Camedia Master. Check your owner's manual for more information.

There is not much you can do to make a lens more responsive or comfortable, except to learn to live with it and anticipate its shortcomings. There really isn't anything you can do to improve the inherent optical quality of a lens, either, except understand that most lenses—even the bad ones—have a "sweet spot." This spot is the place where a certain focal length, used with a particular f-stop (usually 2-3 stops down from the widest opening), produces the sharpest image.

If you are using a professional SLR digital camera with interchangeable lenses, you can always swap an inadequate lens for one that meets your needs. Just be particularly careful when you remove your lens not to allow dust into the sensor.

Lens maintenance is another important consideration, and one over which you have control. Protect your lens from dust and scratches with a lens cap. You an also use an inexpensive UV filter if your lens has a threaded mount. If you are using interchangeable lenses, be particularly careful when switching lenses not to bump or bang the lens, and store your lenses carefully in shock resistant containers. A small amount of dust on a lens will not affect image quality very much unless you are shooting extremely close up. Oily smudges or fingerprints should be removed immediately, because they produce acids that can permanently etch the lens coating. Cleaning should be done only when needed, and use blown air or a soft brush. If this isn't enough, dampen a lens tissue with lens cleaner and gently rub in a circular motion. The risk here is abrasive particles creating tiny scratches in the coating. Avoid this by rolling or turning the tissue or switching to a new sheet of tissue often.