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Table Of Contents

Editor's Notes

This publication is dedicated to providing exposure techniques that you can use with your D-SLR. It covers basic exposure theory and practice, as well as how to use the tools in your camera to achieve the best exposures possible. For those somewhat familiar with photography through the use of a film camera it will be apparent that many of the laws of photography remain the same when photographing with a digital camera. But those "laws" are applied in different ways due to the difference in the nature of the materials that "capture" and "process" the image. This publication, the first in a series of *Petersen's Digital Photography Guides,* concentrates on digital exposure techniques that will yield the best exposures you can get from a variety of subjects and scenes. While it is true that no exposure made in camera is perfect, and that some further refinement is always a good idea, you will always get better results when you start with an exposure that does not put you in a "hole" that you must dig out of with extensive software manipulation.

Just what constitutes a good exposure? It's when you record as wide a tonal range of light to dark brightness values as possible with your camera, given the lighting conditions at hand. This exposure should have it all—true color, detail in the highlight and shadow areas and, most importantly, a range of values that can be manipulated further for even greater image enhancement.

You might wonder why you need to learn any exposure techniques when working with a D-SLR. After all, can't you just review the image in the LCD and, if there's a problem, simply reshoot it? And can't any exposure problem be easily "fixed in Photoshop" later? That's not necessarily so. The aim here is to cover techniques that allow you to get the kind of exposures that let you spend most of your time creating images rather than correcting them. My feeling is that every image needs some work, or can be enhanced in an image-editing program. But I'd rather spend my time enhancing, not playing catch-up with poor exposure or color. I want to use my creative time to go out and explore and make images, not labor in front of a computer over avoidable exposure mishaps.

Part of what this publication will cover is how to make a quick diagnosis in the field. That way all the images you keep on your card will always be the best possible. The core of this special issue is learning about light and your metering system, and how to tackle tough and challenging lighting conditions.

Future issues of the *Petersen's Photographic Guide* will cover printing, lighting, digital travel photography, and more. But we thought we'd start with the most fundamental and important issue first—mastering exposure with your digital SLR. ■

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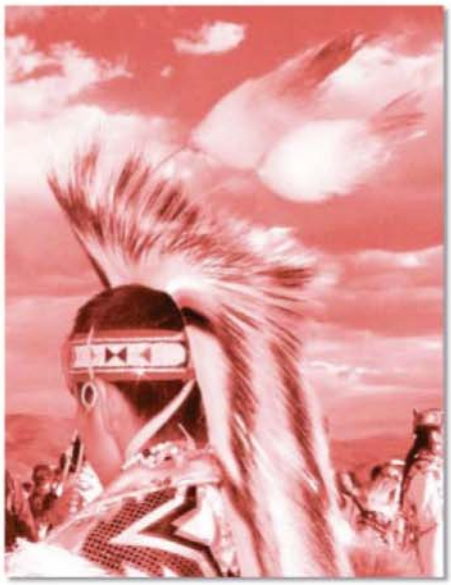
Exposure Basics I



"Exposure" is shorthand for the delicate balance of the light sensitivity of the recording material (in our case the camera's CCD or CMOS sensor with picture sites, known as pixels) with the amount of light in the scene. There are two parts of a camera system that control the amount of light coming through the lens—the aperture (the diameter of the opening in the lens) which is described as an "f" number, such as f/8, and the shutter speed, which is the amount of time the shutter stays open to receive the light coming through the lens, described as a fraction of a second, such as 1/125 sec (or just 1/125) or a full second or seconds.

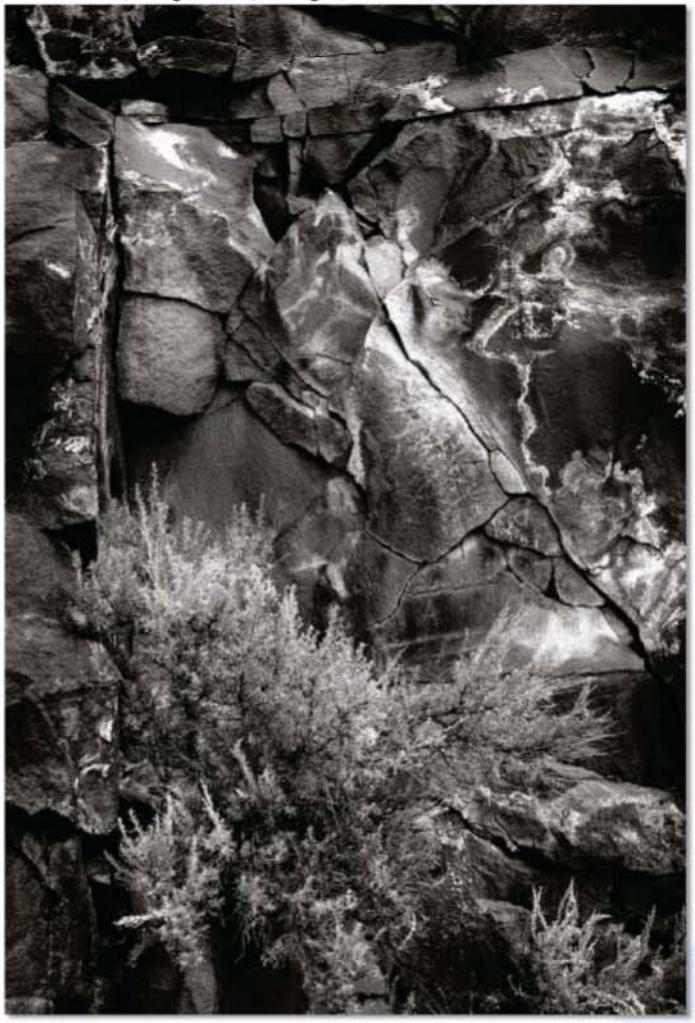
The light coming through the lens causes a change. In digital photography the light energy, or photons, creates an electrical charge, or reaction/excitation, within the picture sites, which then send that electrical signal to an image processor for conversion to digital binary code. The signal also includes color information, which is sorted through filters that sit atop the sensor into Red (R), Green (G), and Blue (B) components, which are later re-integrated to form the RGB (color) digital image.

If you break an image down to "channels" you can see the components that combine to form a full color image. A digital image is recorded through various color filters—R (Red), G (Green), and B (Blue). The image processor then integrates these signals to form the full-color image. In digital you can have a profound influence over how color is recorded (its hue) and the brightness (light and dark) of those colors.

You could think of the exposure system as a seesaw in which you want to achieve balance, using exposure to mediate between the sensitivity of the sensor (its ISO) and the brightness values (the lights and darks) in the scene.

The goal of exposure techniques is to capture all the brilliance of color and light from the scene, as in this early morning shot at the Taos Balloon Rally.

When you master exposure you can get image effects that create mood and allow you to get creative when you process the image later. This portrait of Kallie Polgrean was made with window light and a very shallow depth of field, aided by some edge blurring later in software.



Modern digital cameras allow for steady shots in lower-light levels than ever before. You can change the ISO on the camera to raise the sensor's light sensitivity, as was done with this ISO 800 photo from Glacier Point in Yosemite National Park.

Exposure is all about manipulating light for image effects. All digital photos are RGB photos, but here the image was converted to black and white and made darker during processing to bring out the texture and interplay of light and dark in this canyon wall.

The goal of all this is to record as many different and as wide a range of brightness values, or what are called tones, from the scene. Think of a piano keyboard. If you can play with more keys you will get a richer musical sound. Now think of those notes as dark and light values. The wider the range of values recorded the richer the images. The wider the range of values the more interpretation is available to you.

A photographic image is a continuous range of brightness values; continuous tone is a large part of what makes for the illusion that a photograph is "real." Rich tonal values and a range of colors allow us to more easily buy into its magical illusion. ■

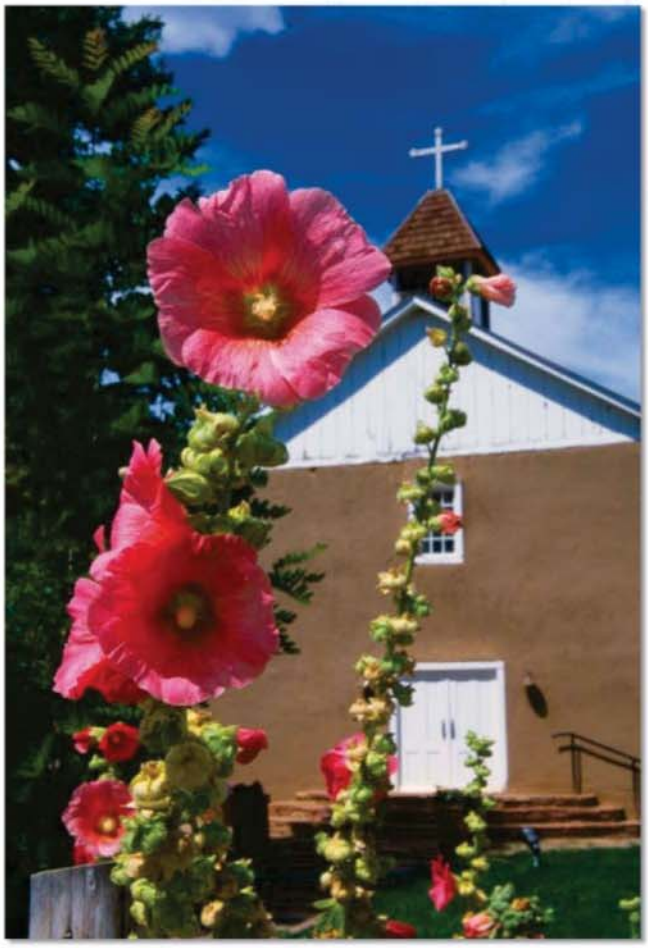
Equivalent Exposure

Now we come to how ISO, aperture, and shutter speed relate to one another. They exist to balance the amount of light in the scene with the recording made by the sensor and ultimately made into an image file on the memory card. Your goal is to record the scene with as true and balanced a color and lightness of what you saw when you snapped the shutter.

To review, the ISO setting of the camera sensor is the sensitivity to light. We raise or lower it according to the light level and how we want to utilize aperture and shutter speed settings.

The aperture and shutter speed solve the exposure problem and create balance between the brightness outside and the sensitivity of the sensor inside the camera. We control them for various image effects, weighing one against the other in every frame we take. We want to create balance, or equilibrium between all the factors.

An equivalent exposure is one that relies on the same amount of light for the proper exposure but juggles the aperture and shutter speed settings to yield different image effects. This waterfall was photographed with two exposures, one at f/22 at $^{1}/_{15}$ sec and one at f/8 at 1/125 sec. This is the same, or equivalent exposure, but the result is entirely different in terms of image effects. The narrower aperture resulted in a slower shutter speed to make the water appear like a ribbon, while the wider aperture caused a faster shutter speed and changed the effect.



Let's define some terms. There's a commonly used abbreviation for working with light and that's EV, or Exposure Value.

EV is used in many ways, but just keep in mind that it always deals with working with light. It can be:

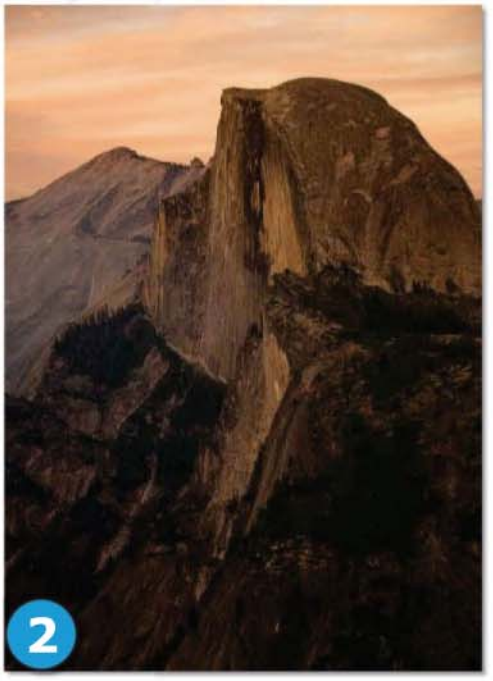
- The combination of aperture and shutter speed that create a certain exposure.
- It can be used as shorthand for a light level (how bright the scene is, expressed in aperture and shutter speed combinations at a certain ISO setting).

"Each time you photograph you make a choice about image effects."

- EV is also used to denote a change in that level, either through the actual amount of light in the scene getting brighter or dimmer, or in how you change the combination of aperture and shutter speed to allow a certain amount of light through the lens to make the exposure.

Each time you photograph you make a choice about image effects. When you work with aperture you can have a shallow or deeper depth of field, which changes the foreground/background relationship of subjects within the frame. Here the flowers and church are photographed at f/11 at $\frac{1}{60}$ sec and f/4 at 1/500 sec; again, equivalent exposures yielding quite different image effects.

For example, if double the shutter speed (say from 1/250 sec to 1/500 sec) you are changing that value by 1 EV. And if you halve or double the aperture setting (which you do by going from, say f/8 to f/11) you are changing the value by 1 EV. So, think of EV as shorthand for how we deal with changes in light levels or



light recording in photography.

You'll also encounter EV numbers in exposure compensation, flash output compensation, and in some instances in actual exposure settings.

The other terms used are AV (Aperture Value) and TV (Time Value) (or just S) for Shutter Speed or Value.

So now let's join all these terms and see how they dance together.

Say you are shooting on a fairly bright day and the camera is set at ISO 100. The reading is 1/125 sec at f/8, which happens to be EV 12. (This is an arbitrary number—don't concern yourself with it.) You want to change the shutter speed or aperture to create different image effects. You do not want to change the exposure, as that is the right exposure needed to record all the brightness values correctly. Here's how it all works:

At EV 12 you get the same amount of light coming through the lens (the exposure) with:

f/11 at 1/60 sec or
f/16 at 1/30 sec or
f/5.6 at 1/250 sec or
f/4 at 1/500 sec.

When you make aperture decisions you are determining just how sharp, or unsharp the background will be. In some cases you'll want to include the entire background in sharpness to give the subject context. In others you might want to isolate the subject by unsharpening the background, or at least make the background a less prominent part of the image. Here (1) the decision was made to have both the foreground tree and background sharp to give context to the main subject, thus an aperture of f/16 was used on a 28mm lens.

As you open the aperture wider you get to use a faster shutter speed to get the same exposure. Conversely, as you slow down the shutter speed you get to use a narrower aperture.

Now raise the ISO to 200. We can "spend" the extra stop of sensitivity to light of the sensor in either aperture or shutter speed values—one or the other.

The exposures, within the same scene can become:

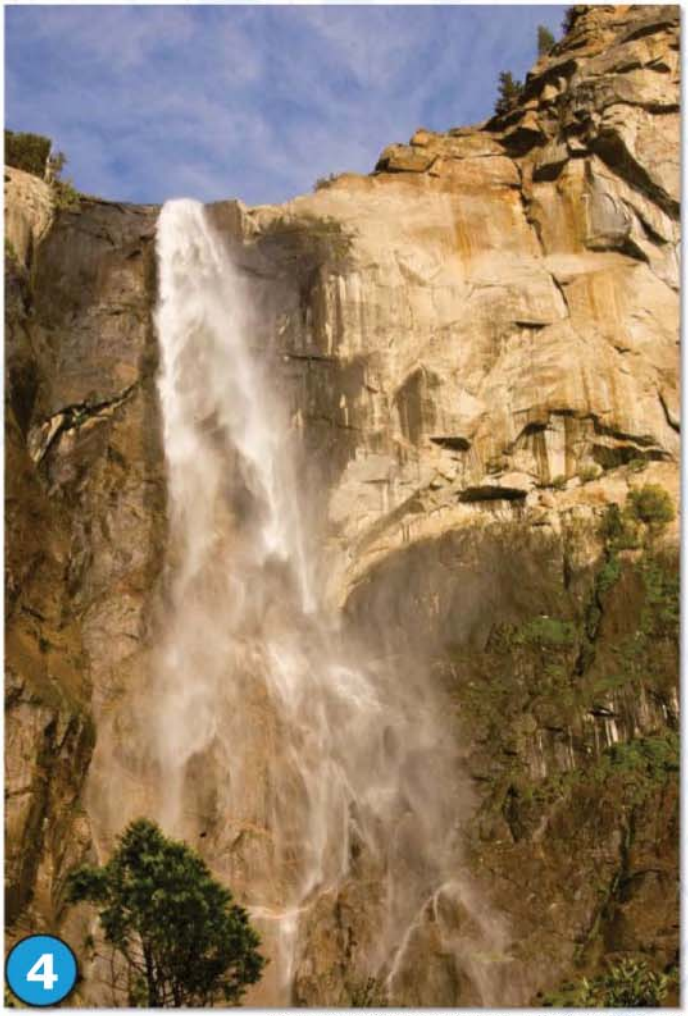
f/8 at 1/250 sec or
f/11 at 1/125 sec or
f/5.6 at 1/500 sec.

When you raise the sensitivity to light one EV step, thus double it, you gain an extra stop in either aperture or shutter speed.

So, when you go to ISO 400 for the same scene the exposure could become:

f/8 at 1/500 sec or
f/11 at 1/250 sec or
f/5.6 at 1/1000 sec.

If the light is low and you are working handheld you can raise the ISO to bring more options into play. Usually that's for getting a faster shutter speed, but at times you might raise ISO to get a narrower aperture for the shot. This sunset shot in Yosemite (2) was made at ISO 800 at an exposure of f/5.6 (the widest aperture available on the zoom lens) at 1/60 sec. At first reading, with the camera set at ISO 100, the shutter speed



was 1/8 sec, way too slow for a handheld shot.

The wonderful thing about modern exposure systems is that you don't have to do the figuring yourself—the camera's exposure and metering system does it for you. When you raise the ISO the system recalculates the values and automatically offers you another option, for a faster shutter speed or a narrower aperture. True, if you work in Manual Exposure mode you make the settings yourself, but the meter is still calibrated to the new sensitivity for you.

The ability to work with equivalent exposure means that you have creative control over image effects. In this shot of a pitcher delivering heat (3), the decision was made to try to catch the ball in midflight, which necessitated a very fast shutter speed (1/2000 sec) which yielded a wide aperture and shallow depth of field. In this shot of a waterfall (4) the decision was made to show a rich flow of water, with a shutter speed of 1/15 sec. The tripod-mounted exposure was f/29 in that bright light.

Why bother taking the time to learn this? It's just smart to know how this works because then you can make good decisions about when to raise or lower ISO to get a faster shutter speed when needed or a narrower aperture to gain more depth of field. Even that can be simplified when working in Exposure Priority modes, which we will cover next.

The light was fairly low in the chapel interior, and I did not want to be rude by shooting flash. I was working with a fairly long telephoto, about a 200mm, to get close to this Saint without intruding on the altar area. My exposure at ISO 100 was 1/30 sec at f/8. What ISO would I set to get to a shutter speed of 1/250 sec or thereabouts? (See the equivalent exposure/ISO list for a hint.)

In short, equivalent exposures allow us to make creative decisions about image effects using the various combinations of aperture and shutter speed. ■

Exposure Basics II

Now we come to how exposure and creative photography go hand in hand.

Why would you need to change the aperture or shutter speed under different lighting conditions? Why would you want to use a fast shutter speed for one shot and a slow one for another? Why change apertures or ISO?

That goes to the heart of the photographic exposure system and is one of the most important aspects of the craft. As we explore this further we'll talk about "image effects." These are ways in which you interpret the scene using the tools of the camera.

Shutter Speed

Shutter speed allows you to choose how motion will be depicted. Using a fast shutter speed of 1/1000 sec (and a fast framing rate for making a number of shots) I was able to catch the scarf in midair as it was tossed by this street performer on the promenade in Old Quebec.

In terms of image effects, shutter speed determines how motion is depicted in a photograph. In terms of picture quality, it also has a profound influence on how steady the image appears, depending on the equipment you are using and how steadily you can hold the camera without a tripod or other supporting setup.

By using a slow shutter speed of $^1/_8$ sec and "panning," or following the motion of a subject across the field of action, I was able to depict the action of this polo match.

Though the lowest hand holdable shutter speed differs depending on how steady you are and the gear you have to balance, the borderline is generally at or below $^1/_{30}$ sec (such as $^1/_{15}$, $^1/_8$ sec etc). This might change if you are using a vibration reduction or image-stabilization lens, in which case you might be able to get by with a $^1/_{15}$ sec exposure.

A $^1/_{30}$ sec is "slow" because it is probably the slowest speed at which most people can hand hold a camera without the image showing some shake, or blur caused by photographer motion.

A slow shutter speed allows you to depict interesting time/motion image effects. This waterfall behind a small stand of flowers was

photographed using a tripod with the camera set at a shutter speed of 1/8 sec.

Fast And Slow Image Effects

Given that you can steady the camera with a tripod, a slow shutter speed can also depict motion in ways the unaided eye cannot see. The flow of water, or the swift moves of an athlete, or moving traffic when photographed at a "slow speed" (below 1/30 sec) can take on an otherworldly look, in which the passage of time and motion through time are shown in ways hinted at by modern physics but rarely seen by the eye. Slow shutter speeds also come in very handy when shooting with flash, as it allows for techniques such as slow sync (more on slow sync later).

Fast shutter speeds, on the other hand, freeze motion in ways the eye cannot. Today's digital cameras have framing rates at speed such as 1/8000 sec at up to eight fps. This splits time into fractions too small to ever be seen without a camera.

It can show us a ball frozen in midair as it leaves the pitcher's hand or a diver just as he or she cleaves the water.

This photo of Emma Polgrean showing her jump-roping form was made with an exposure of 1/1000 sec at f/5.6, a speed that guaranteed catching her in midair.

Of course, not every use of shutter speed need be as dramatic as described above. In general, we use shutter speed to ensure that we have a steady shot, and usually something in the range of 1/125 to 1/500 sec will do the job, except with very unsteady hands, very strong wind conditions or when hand holding very long, heavy lenses.

F/stop, Or Aperture Settings

Aperture refers to the diameter or the opening in the lens through which light travels when an exposure is made. It works with "stops" that are variable between the maximum (widest) and narrowest (minimum) opening the lens offers. The higher aperture numbers represent the narrower openings, as the numbers are actually fractions that are represented by terms such as f/16 or f/4; think of it as, for example, $^1/_4$ being a larger value than $^1/_{16}$, thus f/4 is a wider lens opening than f/16.

Aperture is a way to control light volume, but it also plays a critical part in the depiction of sharpness through the picture space, or the visual relationship of near-to-far subjects—what is known as depth of field. A narrower aperture, all other things being equal, such as the focal length of the lens and the distance between the camera and subject, will yield more

sharpness throughout that space. A wider aperture will yield less of a range of sharpness from near to far.

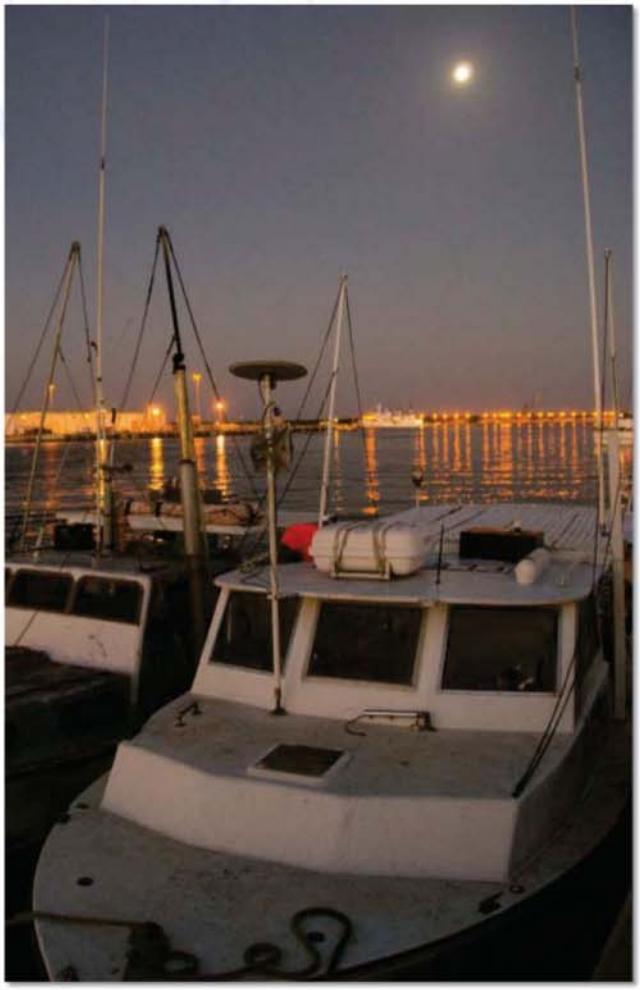
Wide angle lenses and narrow apertures combine to deliver a zone of sharpness, or "depth of field" that cannot be seen by the unaided eye. This boat and the distant building are both sharp due to use of a 24mm lens at f/22, with focus on the bow of the boat.

This ability to control sharpness, and the choices made in aperture settings, is one of the most creative aspects of photography. It has a profound effect on the image and how you depict subjects within the context of the overall scene, and can be applied critically by using the depth of field preview function on your D-SLR. It is a key image effect.

As we explore various exposure scenarios we will continually apply aperture and shutter speed values to attain different image effects.

Shallow depth of field can be used to create visual attention on the foreground subject by having the background go "soft," or drop off in sharpness. These plants would have been "lost" in the thickets of the background if a deep depth of field were used. Setting the lens at f/4 and focusing on the plants yielded this sharp/soft relationship, an effect enhanced further by using a telephoto lens.

You can play with depth



of field even more by using special lenses, such as a PC (Perspective Control) lens or, as shown here, with an optical device such as a Lensbaby. The radical shift in the sharp/unsharp relationship can make for fun and interesting effects.

ISO, Or Light Sensitivity

The ISO number defines just how sensitive the sensor is to light. The degree of sensitivity any given "ISO" delivers is difficult to put your finger on, as it is a standard created by scientists and not something intuitive to the eye or mind. It is stated as a number, with ISO 100 being the lowest in most digital camera systems (ISO 200 in some Nikons). The term "ISO 100," for example, means nothing onto itself, but in the context of the scene, brightness, aperture and shutter speed values it is a very key element in determining exposure and exposure values. It is part of an elegant, balanced system of exposure.

When the light gets low and the shutter speed gets slow it is a good idea to ensure a steady shot by using a high ISO setting. One of the real advantages of digital is that you can change ISO on every frame. This twilight shot was made on the docks at ISO 1000.

ISO poses part of an exposure solution to a given light level. For example, at ISO 100 on a bright day the correct exposure is usually around f/16 at 1/125 sec, or the so-called "sunny 16" rule. (This says that if your meter is broken and you have to set exposure yourself and it's sunny out with the sun coming over your shoulder you can set the ISO at 100 and have a great exposure at f/16 at 1/125 sec—and it works!)

The sensitivity of the sensor is calibrated by your setting an ISO number. In round numbers, many cameras offer a range between ISO 100 and 1600, with some going up to ISO 3200 and beyond. Every time you double the speed, or ISO, you are in effect doubling the sensitivity of the sensor, or adding a "stop" of sensitivity to light. But this doubling of sensitivity only makes sense in the context of the aperture and shutter speed settings, which control the amount of light reaching the sensor.

There are times when flash

is not allowed or would ruin the character of the shot, and that's when high ISO comes into play. This photo inside a New Orleans curio shop was made at ISO 2400 handheld.

So, if for any reason you need more or less light to affect how the aperture and shutter speed are set, you simply raise or lower the ISO setting in the camera. Go to a higher number for more light sensitivity (when you need a faster shutter speed or narrower aperture) or a lower ISO for less light sensitivity (when you want a wider aperture or slower shutter speed).

You might think all shots made in low light or after sunset require a high ISO, but that's only if you shoot handheld. Mount the camera on a tripod and you can shoot at lower ISO settings, which generally yield much less "noise." That's the case with these low-light shots. The classic Las Vegas neon cowboy was photographed at ISO 200 and the fireworks at ISO 100, both on tripod, albeit with slow shutter speeds.

In general, you will usually need a higher ISO setting in low light and want a lower ISO setting in bright light. Why not just set the highest ISO for every shot? Another rule to keep in mind is: the lower the ISO setting the better the quality of the image, all else being equal. That's because to get more light sensitivity a gain, or additional charge is applied across the sensor. As you go higher in ISO this gain adds more noise to the image. ■

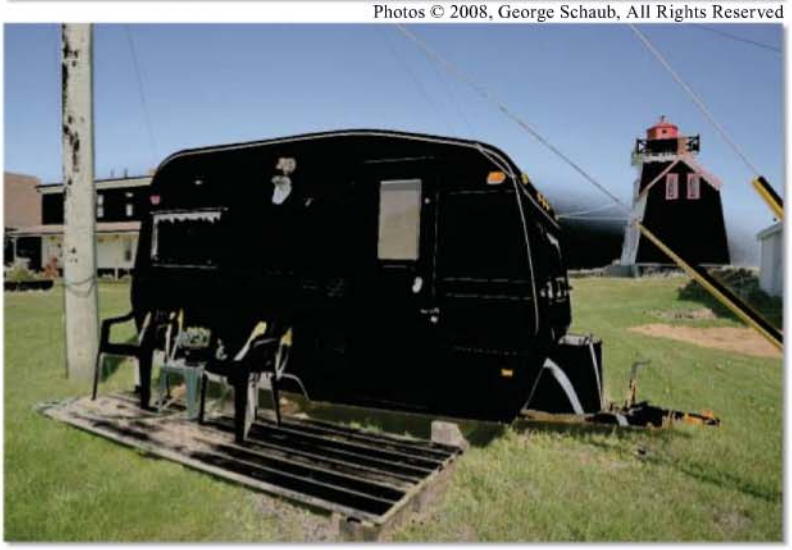
Exposure Diagnostics

The "Blinkies"

When scene contrast is high there may be a danger of overexposure, particularly when you do not take care to read the highlight values to keep them well within the dynamic range capability of the sensor. When overexposure is extreme you lose detail in the subject, cause the image to look harsh, and may eliminate the possibility of making a good print from the photo, despite your best processing efforts. One way to help avoid overexposure is to use the Highlight Warning feature in the Playback menu of your camera. This may be an option that you have to choose in the Menu or may be part of the default playback feature in your camera, accessed through toggling through the "screens" on the image playback.

The Highlight Warning feature is often referred to as the "blinkies" as it shows areas of overexposure by having a black (or in some cameras a color of your choice) blinking warning superimposed on those overexposed areas. This is a clear signal that you should get those highlight areas under control, either through making another reading that takes those bright areas more into consideration or just using minus exposure compensation on the exposure you have set.

There is no need to be concerned with small areas or dots of these "blinkies"; these



might be "spectral highlights" that actually add some sparkle to an image. You'll commonly see these "flecks of overexposure" on snow in bright light, bodies of water like lakes and rivers with directional light streaming across the surface or just on an image with lots of white surfaces with some areas catching minor reflections due to the interaction of the surface and the direction from which the light source comes.

This photo shows the effect of overexposure. The trailer and lighthouse have lost all detail on the surface and the image has a harsh overall look. This photo emulates the look of the Highlight Warning in the playback. The solution is to either compensate exposure and change the style of reading, such as using a center-weighted averaging pattern and locking exposure or using spot and adding +1 exposure compensation, as was used for this final shot.

Fleck Or Spot "Blinkies"

If your subject is dominated by light, white tones, such as this spring tree blossoms, or you have spectral highlights glinting off water there's no need to be too concerned. In fact, highlights such as that can add a nice "sparkle" to an image. ■

Objective And Subjective Exposure

Not all photos need to contain every tonal value the photographer observes or that exist in a scene. Some tunes are best played with a smaller range of notes. One technique often used by experienced photographers is to first record all the tones possible and then edit out, or obscure some later. Indeed, some of the best photographs reveal some of the tones while hiding or darkening others, thus guide the viewer's eye according to the photographer's artistic pleasure, or even whims. That's the difference between the objective exposure, which strives to gather and record all the values and colors in a scene, and a subjective, or expressive exposure, which manipulates tonal values and color for certain aesthetic ends. If you ever have a chance to look at a master photographer's negatives, such as Ansel Adams, you'll see a considerable difference between the original negative and the resultant print.

While your aim is to generally record as many of the tonal values as possible in every exposure, there are times when your intent is obvious and you need not do so. In this photo, for example, the contrast is so bright that it's obvious that in order to get detail on the commuting crowd either a strong flash or a large reflector would be needed. But here the aim is not to get detail in the crowd but to use the high contrast as a statement. This is a "subjective" exposure, one where you know absolutely what you want from the shot before you snap the shutter.

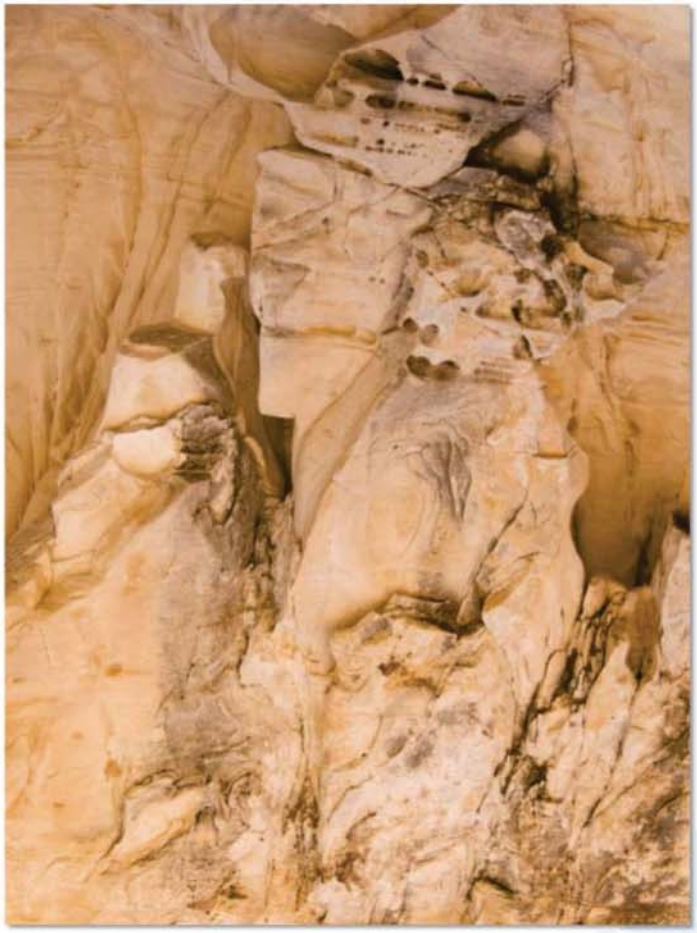
You can impart mood to an image right out of the camera, and while this might limit your options when

printing later, it "plants your flag," if you will, in a particular intent, or use of light, color, and contrast to serve a considered interpretation. While it's good to learn how to record as broad a range of brightness values as possible it's also good to know how to deliver a certain interpretation right in the camera, in the field. That way you can choose either route. Knowing I wanted to go "abstract"on this ice pond I raised contrast by exposing for the highlight (bright) areas, then converted to black and white and raised contrast further in post-processing.

Everything was done here to gather as much tonal information as possible from this document of a steam locomotive. While more subjective interpretations could be done in software later, this is a "shot of record" and thus could be considered as an "objective," or full tonal range exposure.

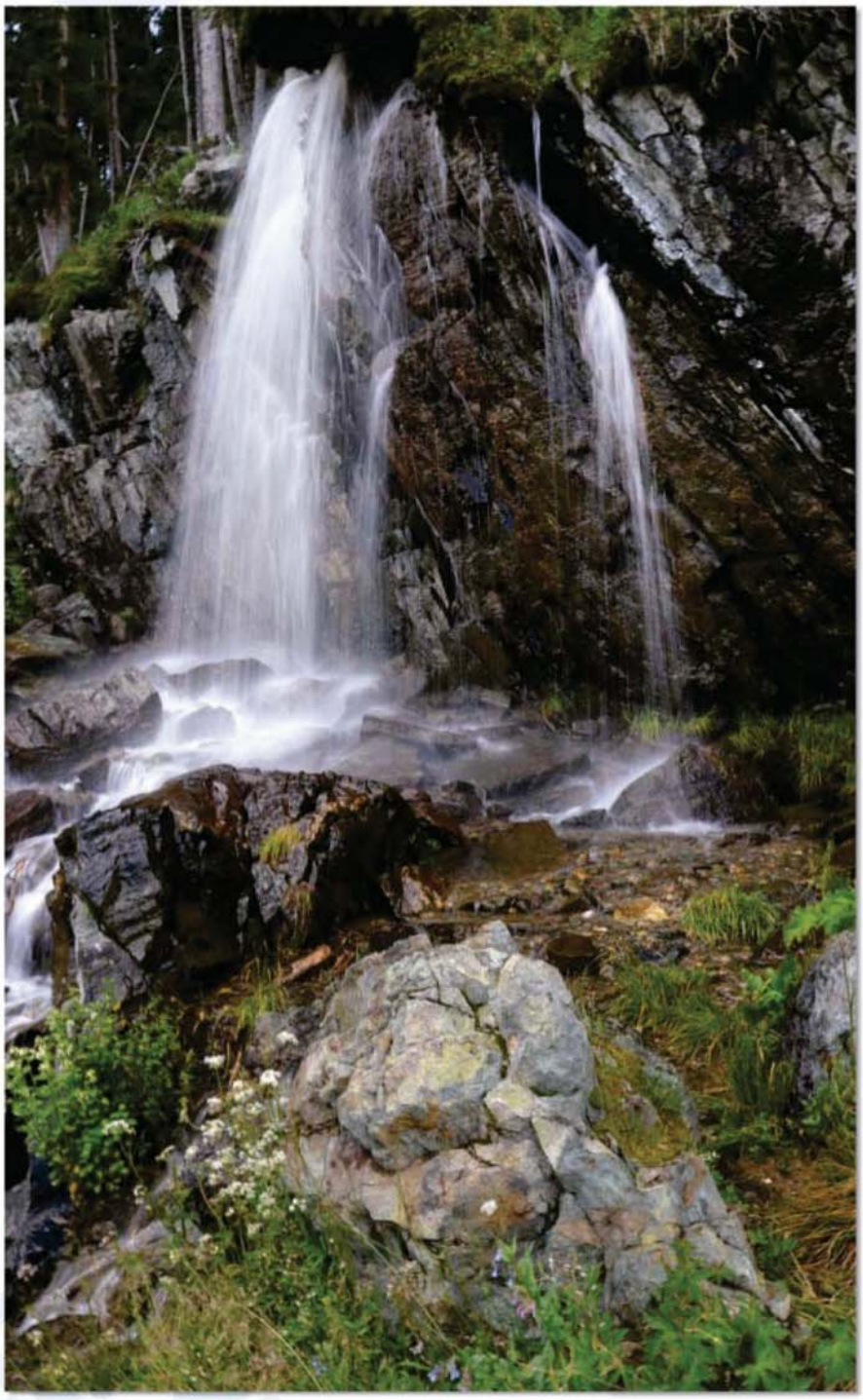
If you record a full range of values you leave many more creative options open for image editing and processing later. This photo of canyon walls was made to capture as wide a highlight and shadow tonal range as possible. This left room for later work, when the image was converted to black and white with some strong "burning in" work (selective darkening) to bring out the forms.

Like any craft, being able to employ subjective or expressive techniques requires that objective techniques be mastered first. Everyone gets a great exposure by accident once in a while; the ability to employ it whenever desired is the goal. ■



Exposure Tips

Outdoor Fill Flash/Exposure Compensation Combo



When working outdoors think of your built-in flash or auxiliary speedlight as a secondary light source that can be used to supplement, but not overpower the essential light source, the sun. Use that secondary source as a way to highlight certain subjects or reveal shadow areas that might otherwise be too dark. The main consideration is to use the flash so that it does not make the photo look untrue, or so overexposed (in relation to the main light) that it is apparent that a flash was used.

One of the ways to do this is to work with ambient light and flash exposure compensation, and to play with the two to gain just the balance and effect you want. The two outdoor scenes here illustrate the flash/compensation technique.

This entire scene was in shadow. I knew I wanted to have the slow shutter speed effect on the waterfall so I set

the Nikon D700 to Shutter-Priority Exposure mode at a shutter speed of 1/8 sec. I made a test shot to ensure the flow depiction was good. Because the scene was in shadow the Matrix exposure system overcompensated a bit and made it too light. I wanted a deeper shadow effect so I compensated -1 EV on the exposure. I then mounted a Nikon SB900 Speedlight on the camera and in iTTL mode made a test shot. This added a nice sparkle to the wet rocks but overexposed the foreground rock a bit, so I cut back to -2/3 EV on the flash exposure compensation.

When working with close-ups that have fine detail you have to be especially aware of the flash overexposing the foreground subject. That's when using minus flash exposure compensation (which essentially lessens the flash output in partial or full EV steps) comes in handy. In this shot I wanted the background to go quite dark, eliminating detail but maintaining the highlight catch on the flowing water. I set the camera to Shutter-Priority Exposure mode and a 1/8 sec exposure. I did a test shot and arrived at a -2 EV ambient light setting. To illuminate the foreground I did a fill flash exposure test and found that, likewise, a -2 EV flash exposure compensation would do the trick. I switched to a shady white balance to make the light on the flower appear as if I had caught a shaft of sunlight hitting the foreground. ■

Exposure Tips

Sunsets And Sky

There's something magical happening in the sky all the time—if we only bother to look. Whether it's sunrise, sunset, or a front passing through, the sky offers an amazing diversity of light, color, and subject matter. However, photographs of the sky sometimes disappoint—they might come out too light, too dark, or simply don't communicate the glory that inspired you to raise your camera in the first place.

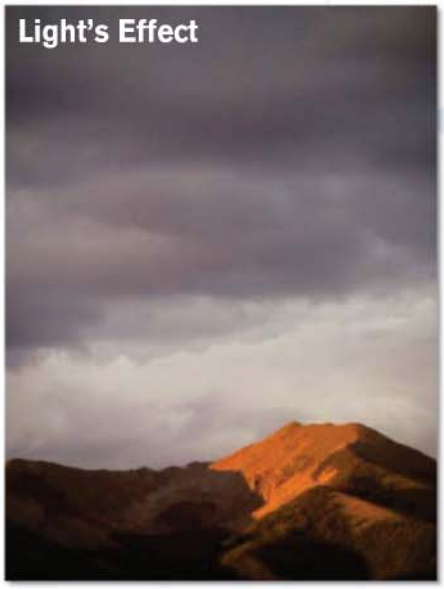
One way to ensure great sky shots is to make an exposure that gets all the color and tonal values properly recorded. In some cases this might mean working to get a full gamut of values; in others it might require you to select more restricted tonal ranges that serve the scene and how you want to depict it. From there you can enhance the photo even more in processing.

Brilliant Color: Sunrise and sunset can offer brilliant color and light. They become the subject with other parts of the scene, such as this silhouetted mountain, playing a supporting role. The best way to meter a scene such as this is to ignore the supporting actors and make a reading right from the light. In this scene a center-weighted metering pattern was used; the camera was raised to bring the bright light into the center, the exposure was locked and then the framing was recomposed to incorporate the mountain silhouette.


Brilliant Color

Panoramas: The low-hanging clouds on this flat plane were prime panorama subjects. The final photo


Panoramas



is composed of four overlapping frames. When shooting panoramas make the first shot to check exposure, then switch to Manual Exposure mode to keep each subsequent frame the same exposure. This eliminates any obvious stitching borders when the images are merged.

Light's Effect: Sometimes the best exposure is made by following the light and reading where it lands. The dark sky is not the subject; the effect of the last rays of light on the mountaintop is. Here the sky plays the supporting role. This exposure was made by spot metering the mountain and locking exposure, allowing the other values to land where they may.

Winter Mists: The issue here is not to allow the bright mists of this lifting winter storm to become overexposed. This photo, processed as monochrome, was exposed with a center-weighted metering pattern with the reading made by framing the mists in the viewfinder, locking exposure, then recomposing.

Storm Clouds: A 500mm lens compressed this stormy sky to add to the drama. But the haze caused some loss of contrast, not uncommon when using a very long telephoto lens. Exposure was made with a center-weighted metering pattern in the framing you see here, but the contrast setting in the camera was placed to +1 to try to cut down the deleterious effect of the haze.

Monochrome Rendition: If you are photographing in Monochrome mode you can alter the tonal appearance of the sky by using various Filter effects. These effects emulate what you would get if exposing black and white film and placing various color filters over the lens. Here is the same exposure with no Filter effect, a Blue Filter effect, and a Red Filter effect. ■

Exposure Tips

Bracketing And Processing Multiple Exposures

One technique to expand the dynamic range potential of an image, in other words, to overcome contrast problems, is to make a number of exposures at different settings of the same scene and combine them later to pull the best out of each exposure. There are various programs that do this automatically, each with their own foibles and charms. Another method is to use each exposure as a Layer, put one (or more) Layers on top of the other and "paint" one Layer into another using a Layer Mask. It's a simple, fun, and hands-on technique.

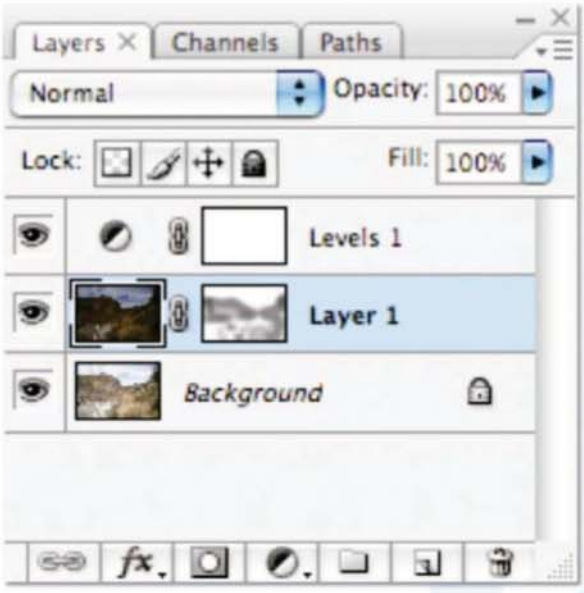
It all starts in the field when you make the exposure. To make sure the images will align properly when you layer them, shoot on a tripod to maintain framing and make sure all the shots are of the same resolution and format. Make a series of exposures plus and minus from the recommended exposure. You can do this in Manual by setting the exposures yourself, or better yet use auto-bracketing so that there's less of a chance of manual shutter release and exposure changes causing the framing to change. Make sure the darkest exposure completely eliminates the "blinkies."

As seen in Adobe Bridge, these two exposures from a bracketed series of shots range from deep shadows (and saturated highlights) to somewhat overexposed highlights (and open shadows). In other words, while neither exposure is good onto itself,

combined they will cover the full range of values in the scene. You can use more than one Layer with this technique if desired, but two will work just as well.

Once you have the two images open on the screen cut and paste one atop the other. In Photoshop you do this via Select>Select All

on one image (I usually cut and paste the darker image as the Layer) and then use the Move tool to drag it onto the other. The images will align, or snap together as you drag it closer to the frame edge.



The next step is to create a Layer Mask so you can "paint down" from one Layer to the other. In Photoshop go to Layer>Layer Mask>Reveal All. Next choose the Paintbrush tool. Set the Opacity of the Paintbrush to about 30 percent for more control, and begin to paint away the top Layer, stroke by stroke, revealing the underlying Layer. With the darker Layer on top this reveals lighter areas as you work. If you over stroke you can flip the foreground/background color box from black to white and retrace your steps. You can also change the Opacity of the Paintbrush as you work. Here's the combined image.

Here's the Layer Palette in Photoshop showing the stages of the work. Note that at the end a final Levels New Adjustment Layer was used to add snap to the entire image. ■

Pro Essay

Hands-On Exposure Control

Creative Metering For Expressive Results

When I began as a photographer, my biggest concern with metering was having an image that just "came out." That simply meant that the exposure was accurate and the image wasn't severely under or overexposed. If I had a decent exposure from which I could make a good print, that was all that mattered.

But as I've grown as a photographer (and I'll admit it—as cameras themselves have gotten better and more sophisticated), getting an accurate exposure has become easier. Increasingly, however, I've wanted to move beyond that and use metering creatively. I wanted to be able to get exposures that the automatic features of my camera just couldn't deliver. Many of us have come to rely on and trust the multi-pattern (Evaluative, Matrix, etc.) Metering modes in our cameras. The "optional" spot and center-weighted metering patterns are more "restrictive" in the sense that they emphasize smaller areas of the frame for the purpose of metering. The results with these patterns, however, can often be more dramatic, especially when working with areas of strong contrast.

Multi-Pattern Vs. Selective Metering

Multi-pattern metering did an excellent job revealing the range of detail from the highlights to the shadows of this tree. That's exactly what it's designed to do. Multi-pattern metering on any D-SLR is meant to capture as much shadow and highlight detail as possible within the camera's dynamic range.

But what drew me to the scene in the first place wasn't the whole tree, but the shaft of morning light that was hitting an individual branch. To create the impact of what made me stop in my tracks, I switched over to the camera's Spot Metering mode and metered off the highlighted branch. I knew that it would underexpose the shadow area of the scene and I would consequently lose shadow detail, but that was fine. I welcomed the increased contrast.

Emphasizing With Light

The answer to what Metering mode to use for a given scene comes easily when you ask the question, "What do I want to emphasize in the frame?" If I want detail throughout the entire scene, I won't hesitate to use the camera's Multi-Pattern Metering mode. However, if it's a small element of the frame that I want to bring attention to, then switching to center-weighted or spot metering becomes a no-brainer.

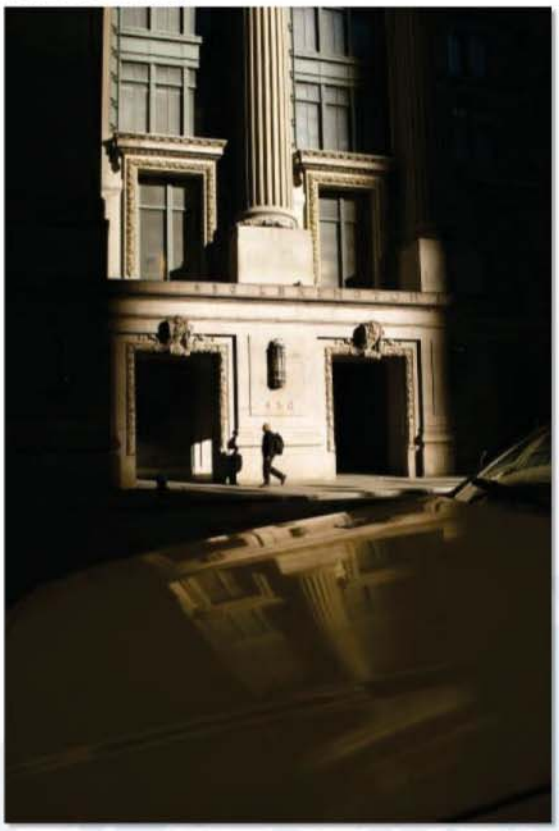
When I saw this woman reading in an airport I was struck by the illumination from the skylight overhead. It was the dramatic lighting and feeling of her isolation that caught my eye. Multi-pattern metering would have provided me shadow detail of the background. That would have been good if I wanted to show more of the waiting area, but that's not what interested me.

Instead, I switched to spot metering and metered off of her arm, knowing that much of the scene would fall into deep shadow. By obscuring much of what was around her in shadow, the image evokes the feeling of aloneness that resonated with me.

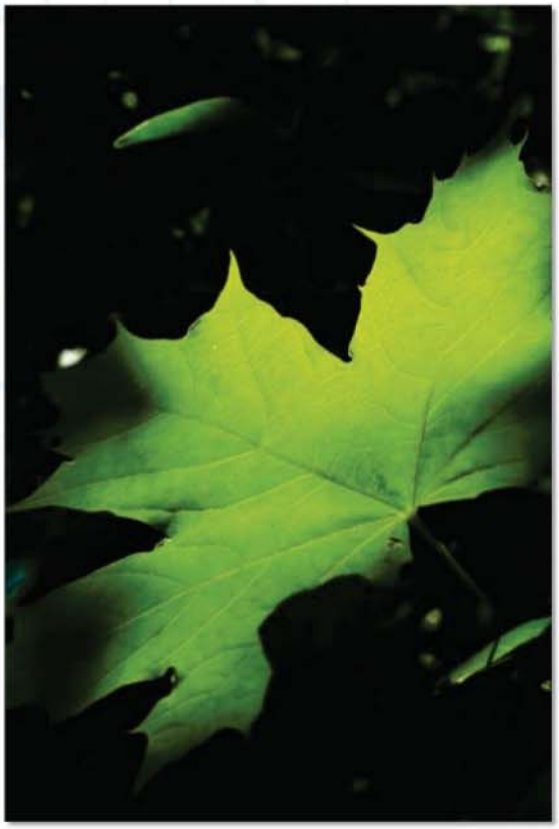
Beginning With Contrast

Expressive images often have very strong contrast, with vivid highlights and formative shadows. By exposing for the highlights and letting the shadow go completely to black, I am drawing the viewer's eye to a dramatic interpretation of a scene.

In midtown New York, I loved the shaft of light that cut through two skyscrapers and hit the façade of this classic building. The Multi-Pattern Metering mode would have provided me more shadow detail, but the image just wouldn't have the same impact.



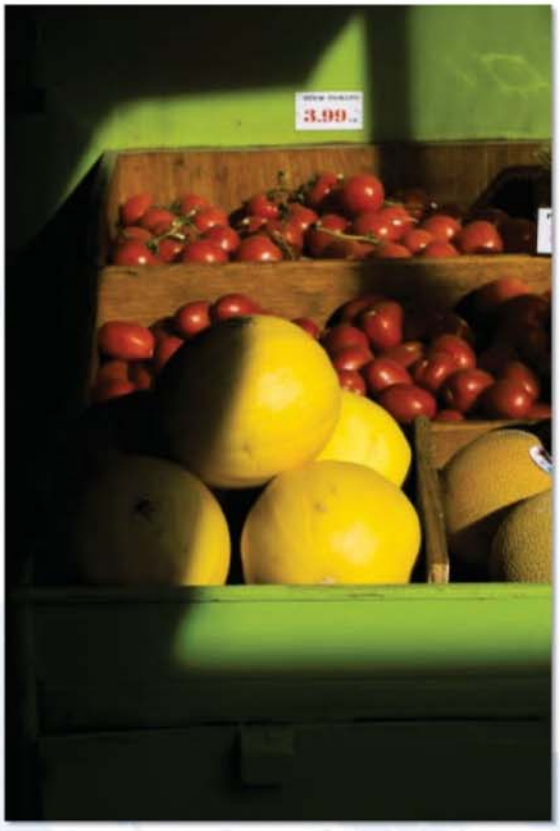
I was sitting on a park bench in Central Park, when I saw this lone leaf being backlit by the afternoon sun. There were other leaves in the shadows, which I could have exposed for, but it would have not only detracted from the main leaf, but also would have risked overexposure of what to me was the most important element in the scene.



Previsualization

My ability to use metering creatively is rooted in my awareness of light and my conscious decision as to how I want my final image to look. When I think about what makes me stop and inspires me to make the image in the first place, the choice of how to meter the scene is revealed.

Making A Creative Lighting Choice



When evaluating any scene or subject, I am always considering the light and how I want to use it. If I concentrate solely on the subject and don't consider what's happening with the light, I am ignoring one of the biggest factors that will make or break the image.

If I had photographed this fruit stand later in the day, the fruit and vegetables would have been in the shade of the canopy. Though the shapes and colors might still have been interesting, the overall shot would have been a lot flatter. By switching to center-weighted metering, I emphasized those things that were being illuminated by the sun, allowing the rest of it to go completely to black.

Working With Extremes

Though not dramatically lit, this portrait of a sailor in Times Square provides a good example when multi-pattern metering might be thrown off by the large presence of white in the frame. I loved the quality of the light that was being reflected onto his face, but knew that the image would likely be underexposed because of his uniform. The simple solution—switching to center-weighted metering and exposing for his face. Though his face was not "neutral," a quick look at my camera's histogram let me know that I was risking a slight overexposure of his uniform, which I quickly remedied by using the camera's exposure compensation feature to underexpose by $^{2}/_{3}$ stop.

Planning By Seeing

Even before I came upon this scene of a woman buying ice cream, I had become aware of how small shafts of light were illuminating the street. In anticipation of finding some subject to take advantage of this light, I switched to center-weighted metering and took a meter reading off the sidewalk itself, which was pretty close to neutral gray. I then set the exposure to Manual mode, thus ensuring that the aperture and shutter speed setting would not change.

When I saw her at the ice-cream truck, I knew I wouldn't have much time, so I quickly raised the camera to my eyes, focused and shot frame after frame. I didn't even have time to check my histogram to evaluate for exposure, but because I was confident that she was being illuminated by the same quality of light that I had metered for just minutes before, I knew that all I had to do was hold the camera steady enough to ensure a sharp photograph.

The resulting image is all about the light kissing her face and the fleeting gesture of the hands.

Images like these remind me that metering can be as important a tool in a photograph as a lens, a camera or a filter. Creative metering can help make magic. ■

– Ibarionex R. Perello

Metering Modes

Metering modes determine how light is interpreted and translated into photographic terms. The exposure meter and accompanying microprocessor measure and convert various brightness levels to aperture and shutter speed values, which are the way the camera controls light, and set them for you in the Autoexposure modes.

There are four advanced Metering modes and numerous Scene or Picture modes. The automated modes are: Program, Aperture-Priority, and Shutter Priority. In Manual Exposure mode the camera still makes readings, but you make the settings yourself. All the Scene or Picture modes you might have on your camera are derivations of the Advanced modes with other image attributes (contrast, color saturation, etc.) thrown in. Scene modes might be helpful in a pinch but I don't recommend relying on them, as they do not help you learn and master exposure. Let's start with the Automatic "Priority" modes.

These are marked as AV (Aperture Value) and TV or S (Shutter Value) on your mode selector dial. Aperture-priority means that you select the aperture for a desired depth of field and the camera selects the shutter speed for a good exposure. Shutter-Priority mode is when you select the shutter speed for a desired depiction of motion and the system picks the aperture. In both instances the system takes the ISO and the metering pattern you set into consideration—the ISO as a foundation from where to begin calculations, and the pattern as to how and from where the light information is gathered.

To get sharpness from the bow of the boats to the houses in the background I chose Aperture-Priority mode, set the aperture to f/11 and checked sharpness with the depth of field preview button. Exposure at f/11 was $^{1}/_{30}$ sec, so I raised ISO from 100 to 400 and got a shutter speed of 1/125 sec.

When deep depth of field is the primary image effect you want then choose aperture priority, use a narrow aperture and as short a focal length lens as you have in your camera bag, here a 28mm set at f/22 at $^{1}/_{60}$ sec.

S or TV mode is great for choosing shutter speeds for motion depiction, but it's also useful when working with long telephoto lenses handheld. Following the 1/focal length rule to ensure steadiness, this shot was made with a 300mm lens at 1/500 sec (for insurance), with the shutter speed set in Shutter-Priority mode.

Program Exposure mode is a bit more complex. It takes ISO, the lens mounted (and the program's interpretation of a hand-holdable shutter speed) and whether the flash is activated in order to arrive at a combination aperture and shutter speed setting. Your Program mode might also come with something called "program shift," which allows you to change the equivalent exposure if you want. For example, if the program yields f/8 at 1/125 sec you can go to f/5.6 at 1/250, f/4 at 1/500, or narrow aperture and get slower shutter speeds. Program Shift is an excellent way to work once you understand equivalent exposures and how to use them to attain the image effects you desire, and when used makes having to choose AV or S Priority modes unnecessary.

There was no flash allowed inside this church so I set Program Exposure mode at ISO 800 and worked with Program Shift to get an exposure of f/8 at $^{1}/_{30}$ sec.

Program can also be used for quick grab shots when you do not want to concern yourself with settings. This photo was made while walking from a store to my car. Note the gas prices in the background. Exposure was f/11 at 1/125 sec with a 50mm focal length lens. Left to its own, Program will generally favor faster shutter speeds to

ensure shot steadiness.

Manual Exposure mode is pretty handy, and seems more complicated than it actually is. You frame the scene and the metering system "suggests" an aperture and shutter speed value, indicated by the scale in the finder. The setting you have may or may not agree with that. If you want to make the readings the system suggests you move the aperture or shutter dial until the arrow in the scale points to the center of that scale—it's called "nulling out" the settings.

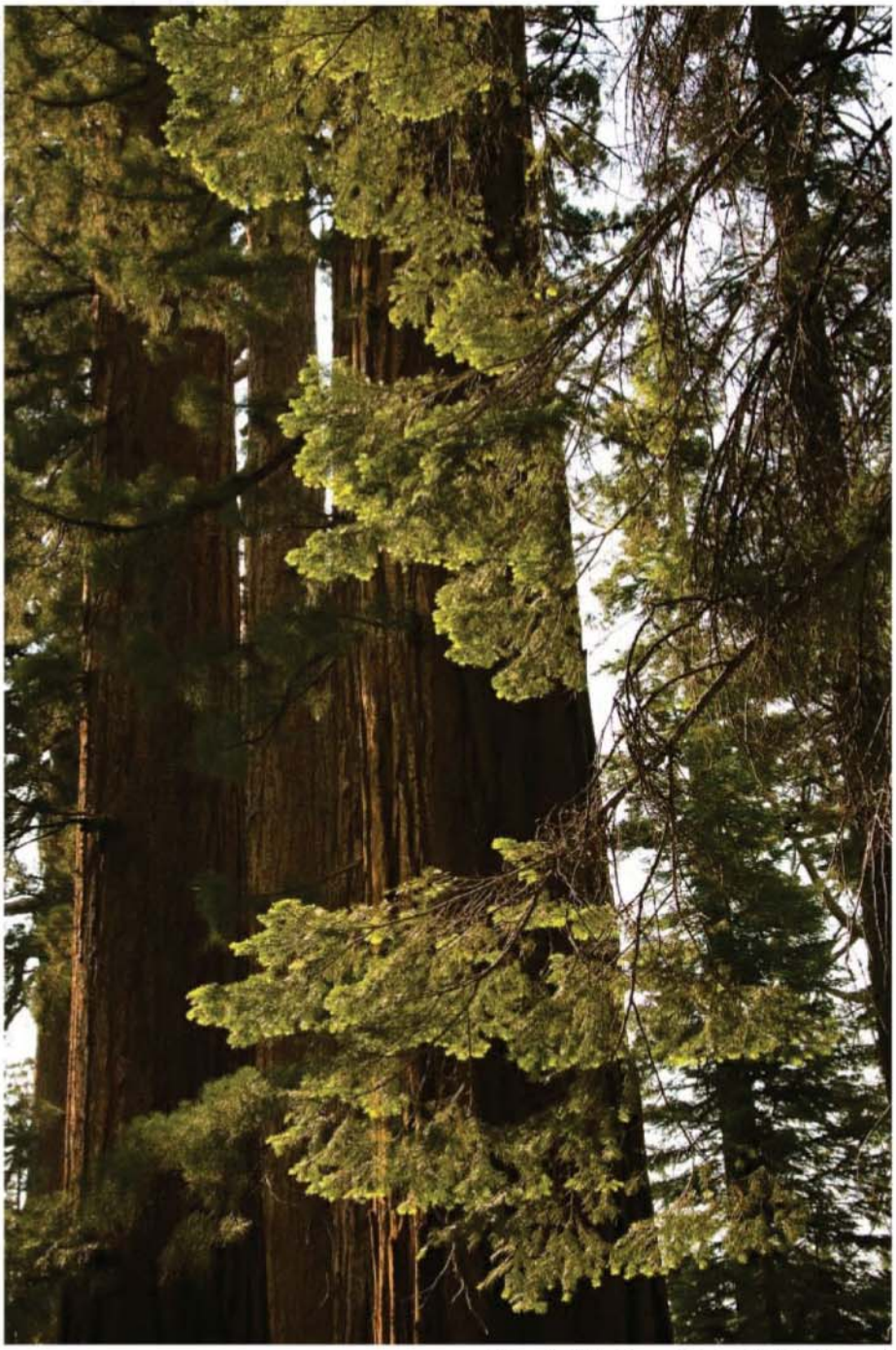
Why use manual? Some folks just like to fiddle. But on a more useful note you can use manual in two ways:

When you want to quickly change the exposure. In manual you can easily make an exposure with more or less light just by turning the aperture ring/dial or the shutter ring/dial.

Manual Exposure mode allows you to quickly change exposures in the field. I misread the first exposure; I checked the image review and the trees became quite light and the foreground branches were overexposed. A quick turn of the Command dial to the minus exposure side gave me just the exposure I desired.

When you want to keep exposure constant regardless of where you point the camera. This can come in handy when lighting does not change and you want to shoot without changing settings. I often do this when I have one scene in which the light is constant and I want to take a number of exposures without reading and locking each time.

One situation where you should always utilize Manual Exposure mode is when shooting panoramic scenes for stitching. This ensures that the light will be consistent from frame to frame and that there will not be any obvious seams in the final stitched image. This photo (next page, top) from Glacier Point in Yosemite National Park was exposed at f/8 at $^{1}/_{60}$ sec for every frame of this nine-frame panorama.



Scene Modes

Here's our thinking on Scene modes. They rely too much on automation that might or might not match the image effects you have in mind. For example, in Portrait mode the exposure system is programmed to yield as wide an aperture setting as light and ISO setting allow so that the subject is sharp and

the background unsharp (in many cameras it also alters your color and sharpness rendition as well, without telling you). That's fine if that's what you had in mind, but there are many ways to handle foreground and background in portraits, and choosing this mode is just one way.

This Scene mode on a point-and-shoot camera produces soft focus effects and overall delivers a good image. Though the effect is as advertised, it is a "set piece" that will deliver the same kind of image time after time. This preprogrammed type of shooting can be fun but you can customize your own images by working with the other Exposure modes and software even more.

Here's a quick rundown on how the choices affect aperture and shutter speed combinations:

Portrait: Wider aperture; yields shallow depth of field. Also might reduce contrast, add warmth.

Sports: Yields fastest shutter speed given light levels, ISO etc. Might also automatically raise ISO to yield faster shutter speeds.

Auto ISO: You set the aperture and shutter speed desired and system sets the ISO required.

DEP: Canon only, you choose two subjects at distance from one another, indicate both with slight pressure on shutter release and the system selects aperture to include both in depth of field. Shutter speed follows suit.

Slow Sync: (night portrait) Camera uses slower shutter speed than flash sync speed (usually 1/125 or 1/250 sec) to allow in more ambient light during flash exposure.

In short, if you want to learn about photography and apply your own personal touch to your images, just forget about Scene modes. ■

Metering Systems

Exposure Patterns

The metering system in your camera is a highly sophisticated microprocessor that is constantly fed information from the light entering the lens, the lens itself (its aperture setting and even focal length) other settings you have made on the camera (such as your focusing point and distance, whether or not you have the flash off or on) and from your preferences in how you would like to have the light interpreted to get the image effects you desire. One of the ways you input your preferences to the camera is by making certain settings on your metering system. This includes the metering pattern (how it reads light) and the Metering mode (how it interprets and translates that light to aperture and shutter speed settings for you).

Because the pupil of the camera (the lens opening) and the duration of exposure (the shutter speed) is fixed at the moment the image is recorded, one exposure has to handle the range of bright and dark in a scene. This is, as you can imagine, a delicate situation. In many cases you can rely on the fully automated exposure provided by what is called "patterned," "Matrix," "ESP," or "Evaluative" exposure pattern. These are highly sophisticated systems. In other cases you will have to have more input into the calculations and use either center-weighted averaging or spot metering patterns to deliver the best exposure possible. Knowing when to use these optional user-controlled patterns and when to rely on an automated "pattern" setup is very helpful in getting great exposures every time.

Complex exposures such as this twilight carnival scene can be a challenge, but knowing which metering pattern to choose for different lighting situations can help improve results dramatically. This photo was made with a patterned exposure on Program

Exposure mode with the built-in flash turned on. This provided an excellent balance of ambient light and flash illumination.

This scene shows the range of values we want to record from a scene, from the deep blacks of the shadows to the bright white of the post in the center. Although the exposure system in your camera is quite sophisticated you too have to do your part. In essence, the information you "feed" the brain of the microcomputer is the information it acts upon. This exposure was made using Center-weighted averaging and Aperture-Priority mode. The exposure was read by pointing the camera slightly toward the upper right, exposure was locked using the AEL button (Auto Exposure Lock button) and then the scene was recomposed.

This might seem quite confusing in the abstract, but working with the camera and making readings exclusively from certain brightness values in the scene, and observing results, will quickly show you how this system works. In fact, you can even make use of this knowledge to create very expressive exposures.

Despite what the ads might claim a meter is an instrument that does not have a mind of its own. It will behave rather well when you feed it the right information for its calculations. It will behave rather poorly if you don't.

Matrix or Evaluative or Pattern (or whatever the brand name might be for your camera) takes light readings from numerous areas around the frame, calculates these various brightness values, adds in other information such as lens focal length, then refers the calculation to a reference table in its memory and comes up with an exposure solution to the light "problem." This is all microprocessor controlled and relies on items such as look-up tables and thousands of stored exposure combinations. In other words, if area X has a certain light value and area Y another, both within the frame, the system refers this to a look-up table and brings back an exposure setting.

Your camera's "multi-pattern" metering system will deliver right-on exposures 80 percent of the time. It will generally deliver excellent exposures when the light is coming from behind you and falling onto the subject. All you need do then is use multi-pattern metering, pick the aperture or shutter speed that matches the image effect you want, aim the camera and frame the scene and you're in business. This photo was made with an exposure of f/16 at 1/125 sec with the camera set at ISO 200.

While this pattern is popular and easy to use it does not solve every lighting situation. In addition, those who enjoy having more control over their work will opt to use the other two patterns, which when used correctly offer finer exposure control that's in your hands, not the computer "brain" of the camera.

I am continually impressed with the amazing ability of multi-pattern metering to capture difficult lighting situations. This is a fairly complex scene, lighting wise, and I made this exposure to specifically test the meter's acumen. Note the complex pattern of highlight and shadow. In the past I might have read the bright white highlight and applied a +1 exposure compensation, then bracketed just to be sure. For this test I set the camera on Program Exposure mode and a multi-pattern (here Canon's Evaluative) metering and just framed and shot. The exposure system nailed it, with texture in the highlight and information in the shadows. Very impressive stuff!

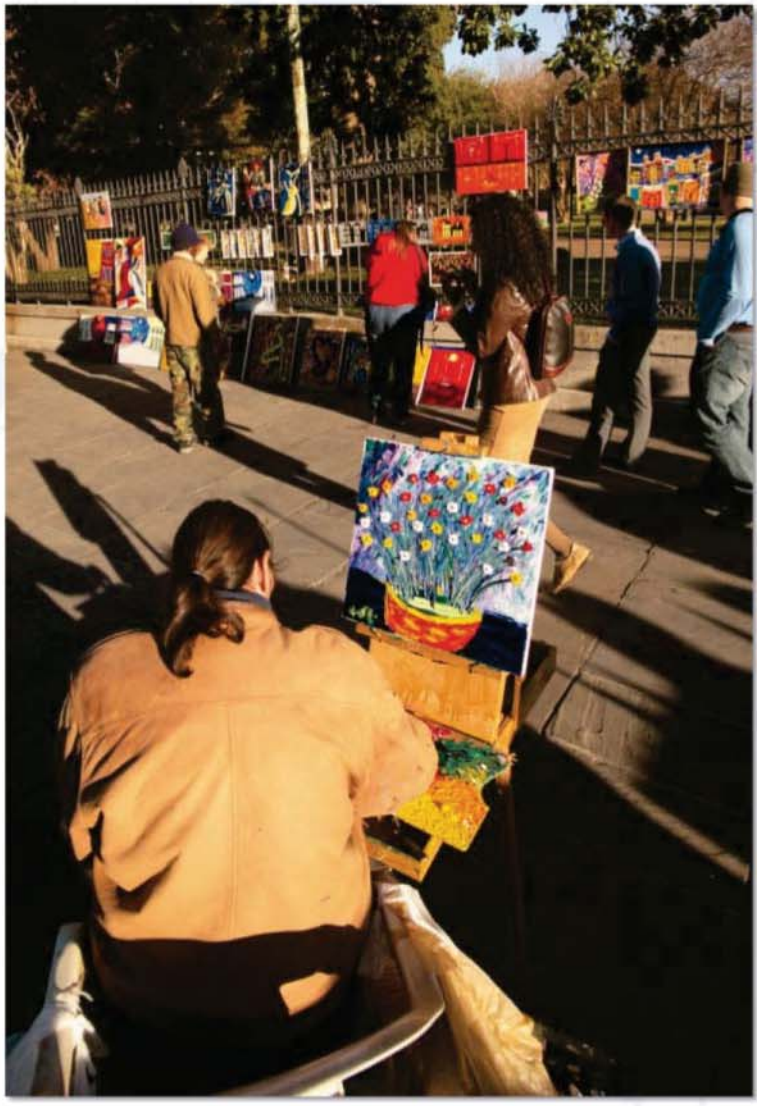
Center-Weighted Averaging is a bit more "old fashioned" in that it is how light was read, for the most part, before advanced microprocessors got into the mix. The light is read from all parts of the viewfinder, with 70 percent of the light reading coming from the center of the frame and the remaining 30 percent of the calculation from the edges of the frame. It is called "averaging" because it takes in all the various brightness levels and then averages them to what is called a "middle gray" exposure reading.

For the most hands-on control try center-weighted or spot patterns. For this portrait I used center-weighted averaging. I placed the center area of the finder over the highlight side of Emma's face, including some of the shadow area as well. I then locked the reading and recomposed for the balance of light and dark you see here.

The key to using Center-Weighted Averaging patterns (CWA) is to understand how the meter is interpreting and gathering light information so that you may point the camera at the correct area within the frame to make the reading. In most cases you will want to control overexposure, so you should always include the brighter areas within the frame when you make readings. You needn't go right up to or zoom into the bright area when making an exposure reading, but you should be sure to include that bright area toward the center of the frame.

This is called "biasing toward the highlight" and was and is common practice among slide film photographers. The key to using CWA is either working in Manual Exposure mode and setting the readings by "nulling out" the meter (making the exposure mark in the viewfinder sit in the center of the +/- exposure graph) or by making a reading and then locking that reading using AEL (Automatic Exposure Lock button) when shooting in an Auto Exposure mode such as aperture- or shutter-priority.

Center-weighted is the pattern to reach for when heavy shadows fall and both shadow and bright highlight inhabit the frame. For this photo on Jackson Square in New Orleans I made the reading by centering the frame on the painting, locking exposure and then reframing a bit. Note that center-weighted does not exclude



shadow areas from the reading, but does use the brighter areas as centers of the reading space.

Most of the time CWA is best used when the light is contrasty (deep shadows), when the subject falls within its own shadow (backlighting) or when highly directional (coming from the sides) bright light has a profound influence on the scene. If the sun is coming over your shoulder or from the side behind you onto the subject then evaluative will work fine.

Spot Reading: The third metering pattern is selective spot, also known as "spot" metering. This works on the same principal as

center-weighted (turning whatever it reads to a middle gray) except that it takes the reading from a specific and not a general area within the frame. That area can be a small circular spot at the very center of the viewfinder (in some cameras, you can control the diameter of that spot from quite small to moderately large) or from a specific focusing target that you select. With spot reading you often have to compensate exposure somewhat, but many times, if the area is not bright white but bright color, you can use it as the final exposure.

The easiest way to saturate the colors in this scene, and to ensure a deep shadow, is to spot read the bright yellow and lock the exposure.

Choosing And Using Metering Patterns

In general, choose patterns using these rules of thumb:

Matrix: (patterned) When the light comes from over your shoulder onto the scene. When contrast is not excessive (very deep shadows) and when there is a fairly even distribution of light and dark throughout the scene.

Center-Weighted: (When used in conjunction with exposure lock); highly directional light; bright light that dominates a portion of the frame, but is not necessarily the main subject (such as landscape with bright sky and darker ground); to control bright highlights that do not dominate the scene but that have a profound influence on exposure. When scene contrast is high.

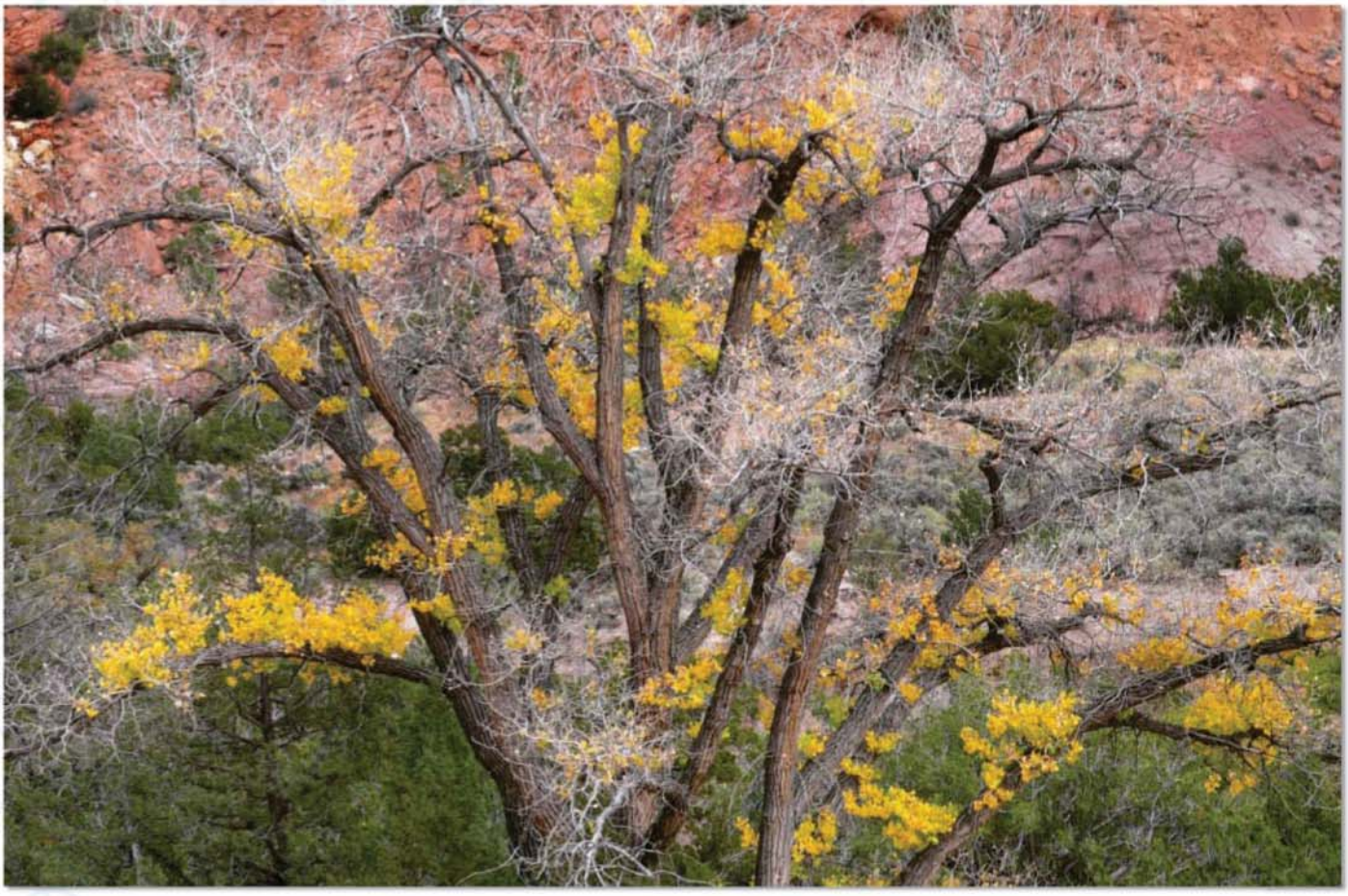
Spot: When the main subject falls within its own shadow; when you want to control and saturate highlights. When scene contrast is high. When you want to saturate a specific area within the frame.

A patterned exposure would have tried to open the shadows too much, completely voiding the effect.

The light right before sunset lit this building in Bamberg, Germany. The easiest way to expose and not lose the effect was to "spot" the bright area and lock the exposure. An easy way to do that is to work in Manual Exposure mode.

When there are "specks" of strong highlights among deep shadows the easiest way to read them to control highlights is to spot them without compensation. This is surely a subjective exposure, but it is the exact intention of the rendition of this scene. ■

Dynamic Range



Dynamic range is the ability of the sensor to capture a certain range of light and dark, or brightness values. Think of it as the number of keys on the piano the "hand" of the sensor can cover. While the sensor may offer an octave's worth of tones, this octave can be moved all around the keyboard. If the light is low the sensor can adjust through the use of high ISO and slower shutter speeds and wider apertures. If that range of notes is bright then the sensor can be adjusted to handle exposure with narrower apertures, faster shutter speeds and lower ISO settings. Though there is a wide range of adjustment the sensor and settings can be made to handle there is always a certain range of light that it can record—that's the dynamic range of the sensor. An important part of mastering exposure is understanding this and seeing light, and especially contrast, the way the sensor sees it.

When making exposures try to exploit and record the full range of brightness values in the scene. This will give you more creative leeway later when you make prints or work on the image in software. The exposure of this fall scene gets into every nook and cranny of detail, even in the dark recesses of the bark. But there are some areas it cannot properly exposure,

such as the dark shadows. But these shadows help define form as do some of the brighter highlights.

There is a software technique for combining exposures to get the most from a scene with high contrast values. This involves bracketing exposures, and it is something we will cover in detail in our Tips section. As a preview, here are two shots that have been over and underexposed, and then combined later for the final fuller range image. For most of your shots, however, that extent of exposure work is usually not practical, or even worth the trouble.

Our eyes adapt to changes in brightness because our pupils are constantly opening and closing as we look around, and the signals to our brain are integrated as we look from, say, the deep hollows of a canyon to the bright horizon. The "eye" of the camera, the pupil

in the lens, is fixed at 1 EV, so when we make a picture it is as if we have locked onto a specific brightness, and all other values have to follow suit.

So if we are making a picture of a deep canyon with bright snow surrounding it, making an exposure only for the deep canyon (the shadows) will result in the bright, snowy field recording too brightly, or becoming highly overexposed. In fact, it will be so bright that it will be "burned up" or lose detail. If we lock the opening in our eye (or camera lens) on the brightness of the snowy field we certainly won't see any details in the dark canyon.

Dynamic range defines just how bright that snowy field can be and how dark the shadows in the canyon can be and still get details in each area when you make a careful exposure reading. It is the limitation of the recording material, and is an important aspect of making good exposure decisions. As you gain experience one of the most important matters to concentrate on is developing a sense of this range and understanding what your camera can and cannot do. In short, learn how it handles different light values (contrast) within the same scene.

The ability of the sensor to

capture a range of brightness values will determine when you will be able to capture all the values in the scene (or at least all the important values) and when you might have to give up shadow detail in order to control the highlight areas. This shot was made late in the day in New York City with a bright sky and the buildings in shadow. The high contrast is part of the character of the shot, and the limits of dynamic range are exploited for a graphic interpretation of the scene.

Sometimes you have to make a choice between high and low ranges, sometimes referred to as high-key and low-key effects. You make that decision by choosing an exposure range, or making an exposure that saturates the highlights (thus sacrifices shadow detail) or opens up the shadows, which might overexpose some highlights. This bracketed shot shows both high- and low-key effects.

The dynamic range of digital cameras will vary according to the camera and its sensor, but it is not especially broad. It can also be affected by how you program the camera when you shoot, and by what format (JPEG or raw) you choose. There are, however, ways that you can jump this hurdle and make a series of images of the same scene that allow you to break the dynamic range rules, something we

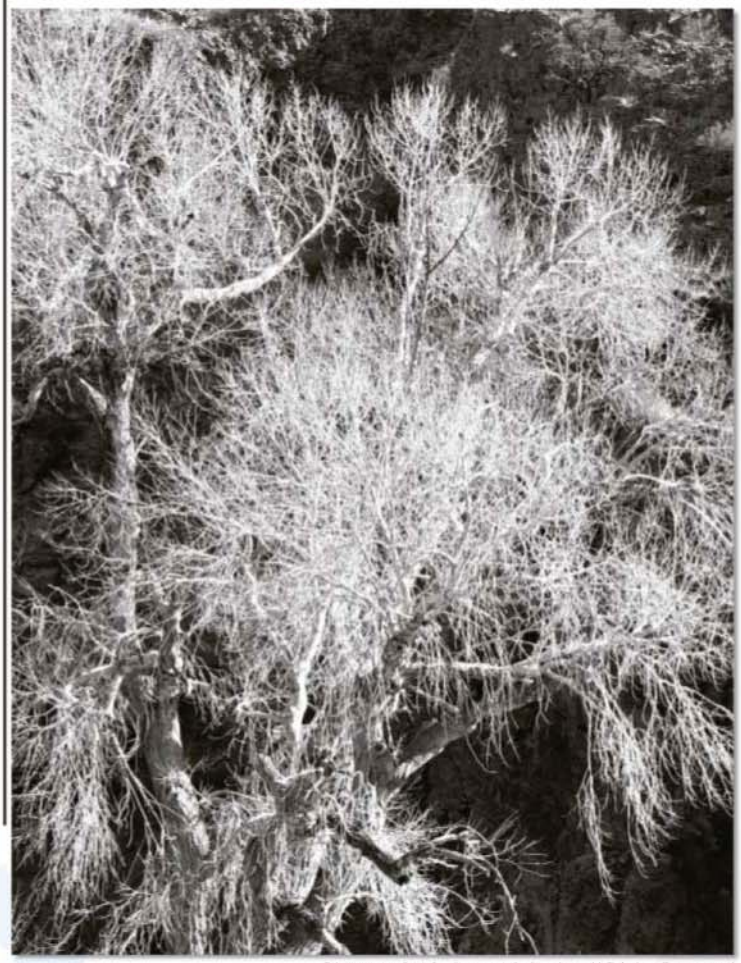
will cover in the Tips section.

Tied in with dynamic range is something called exposure latitude. This is the ability of the recording material to deliver useable images when they are over or underexposed. The best quality of course comes from making a good exposure every time. But in general, if there is a mistake you'll find that if you underexpose by a stop or a bit more you will have no problem salvaging the image in processing. Overexposure, however, or having too much light hit the sensor can create problems that are hard to fix as easily; if you overexposure badly the image is usually irretrievable.

While excessive underexposure will render an image useless, due to the amount of noise generated during correction, slight underexposure is no problem. This photo is about 1.5 stops underexposed, but some easy software work brings back a nice range of values. While still dark overall it has enhanced color and contrast.

Overexposure is problematic, as once the pixels are too "hot" it is very difficult to correct them with anything but a darker tone, with no detail. This overexposed shot resulted from reading the background and not the bright light off this tree. While the image can be worked on to bring out a better tonal value it will not be as effective as one that was correctly exposed.

To repeat, your biggest enemy is excessive overexposure. So, exposure latitude on the highlight (bright or overexposure) side is fairly narrow. If you have photographed with negative film in the past this is counter-intuitive, but is an important fact to keep in mind when shooting digital. We'll discover how to diagnose for overexposure as you shoot later. ■



Pro Essay

Using Handheld Meters In The Digital Age

Expanding Your Exposure Options

Camera metering systems are great. No doubt about it. But there are times when you might want to expand your metering options, such as for flash or strobe studio and outdoor photography, for really tricky light and when you want to make a number of measurements within a scene, that a handheld meter will come in, well, handy.

Metering Options: Reflected Light Readings

A typical handheld exposure meter actually provides you with two ways to meter. First, there's reflected-light, or reflectance, measurement. That largely works the way the camera's metering system works. Point the metering sensor at the subject and take a reading of light reflected off the subject. Typically, a handheld meter uses a sensor that reads an area roughly equivalent to a 50mm lens on a full-frame D-SLR. But increasingly handheld meters are designed with spot metering, usually a very well crafted, very precise measuring angle of 1°. You'd need an extremely long lens to even approach that degree of precision when metering through your camera (depending of course on subject distance).

Benefits

You can easily target a subject tone, taking readings of a key highlight, key shadow value, or midtone value. That way you can "place" a certain tonal value at middle gray and make very expressive, and/or very precise decisions about exposure and tonality.

Incident Light Readings

Most handheld meters also sport a plastic, white hemispherical dome. Thisreads light falling on the subject, or incident light. Thedome reads light gathered from an area covering 180°. And the way we use incident metering is, we hold the meter at the subject position and point the dome at the camera.

Benefits

This is something the camera meter cannot do and the technique largely avoids undue tonal/brightness influences (which might make you use exposure compensation to get a good reading) and the influence of reflections. It is surprising how easy getting great exposures can be when you eliminate those two variables. And many digital photographers have found that using handheld meters ups their success rate considerably.

Electronic Flash, and More

When using studio strobes or flash, a handheld meter always makes a big difference in results. Many meters can trigger flash remotely or via a sync cord to make readings, again from subject position. There's no question that a handheld meter is a necessity for studio or home monolight and flash work, especially when more than one light is being used in the setup.

And once the reading has been made you can lock it in on Manual Exposure mode and not worry for the rest of the shooting session. Of course you would have to make new readings when rearranging lights or, say, swapping out an umbrella for a softbox.

Multiple Readings

A handheld meter also lets you take multiple readings, thanks to the built-in memory found in numerous models. I find this invaluable when confronted by tricky exposure situations or unusual contrast in ambient, low light, and even outdoors under harsh lighting conditions. I'll take separate readings for a key highlight and key shadow and check the contrast ratio. More readings can be taken if needed. This helps determine if the contrast can be handled by the dynamic range of the sensor; if not I'll take steps to control the highlight accordingly.

So while there's no question that your in-camera meter is an amazing light reading instrument, handheld meters still have a very useful part to play in a digital photographer's life. ■

– Jack Neubart

Glossary

Ambient Light: The light in the scene, as opposed to the light provided by the flash, photofloods, etc.

Angle of View: The maximum angle a lens covers in the field. Measured in degrees, and qualified by terms such as wide angle, normal, and telephoto. A wide angle lens has a wider angle of view than a telephoto lens.

Aperture: The opening of a lens, the size of which is controlled by a diaphragm. The term is commonly used to designate f/ stops, such as f/2.8, f/4, f/5.6, etc. The wider the opening, the lower the f/number—and more light is let through the lens. Each step in aperture represents a halving or doubling of light. Thus, f/8 allows in half as much light as f/5.6, and twice as much as f/11.

Aperture Priority: An Autoexposure mode in which, after the photographer selects the aperture, the exposure system selects the appropriate shutter speed for a correct exposure. Sometimes referred to as AV or simply A on Exposure mode controls.

Artificial Light: Any light not directly produced by the sun. Can be tungsten, flash, household bulb, sodium vapor street lamp, etc. In many cases, the color produced by artificial light is deficient in the blue end of the spectrum, thus white balance settings are required to render "true" or perceived color.

Aspect Ratio: The relationship of height to width.

Autoexposure: A method of exposure where aperture and shutter speed settings are first read, and then set, by the camera's exposure system. Various Autoexposure modes allow for customizing or biasing the readings.

Autoexposure Lock (AEL): A push button, switch, or lever that locks in exposure after the initial reading has been made, regardless of a change in camera position or light conditions after the lock is activated. Useful for making highlight or shadow readings of select portions of the frame, and an essential feature for critical exposure control with automated cameras.

Autofocus Lock: A pushbutton or function of the shutter release that holds focus on any subject even if the camera is pointed in another direction.

Auxiliary Flash: In cameras with built-in flash, a larger, more powerful flash that is dedicated to the camera exposure system.

Available Light: The light that's normal in a scene, although the term is generally used when the light level is low. Available light shooting usually involves high ISO settings, low shutter speeds, and apertures, and/or the use of a tripod.

Averaging: In light metering, where light is read from most of the viewfinder frame and then averaged to yield an overall, standard exposure for a scene.

B Or Bulb: A shutter setting which indicates that the shutter will remain open for as long as the shutter release is pressed. The term originated with the rubber air shutter bulbs used to operate shutters in the old days. B settings are generally used in nighttime and time/motion study photography.

Backlighting: Based on camera position, light that comes from behind the subject. Usually, a backlit main subject will be underexposed unless the metering system is set to read selectively off the subject, or exposure on a center-weighted meter is compensated accordingly. Extreme backlighting can be exploited to create silhouettes.

Black And White: In digital-imaging programs, the most common usage is "grayscale," to denote a traditional black-and-white image.

Blur: Unsharpness caused by movement of the camera or subject during exposure. Blur can be used for many creative effects.

Bracket: Making exposures above and below the "normal" exposure, or overriding the exposure suggested by the camera's autoexposure system. Useful as a fail-safe method for getting "correct" exposure in difficult lighting conditions. Bracketing can also be used to make subtle changes in the nuance of tone and light in any scene. Can also be used for HDR or merging two or more exposures to expand dynamic range of recorded image.

Brightness: The luminance of objects. The brightness of any area of the subject is dependent on how much light falls on it and how reflective it is. Brightness range is the relationship we perceive between the light and dark subjects in a scene. Brightness contrast is a judgment of the relative measure of that range, such as high, low, or normal. Brightness values are sometimes referred to as EV (Exposure Values), a combination of aperture and shutter speed. Brightness values in the scene are translated to tonal values in the image.

Burnt Out (Up): Jargon that refers to loss of details in the highlight portion of a scene due to overexposure.

Center-Weighted Metering: In a metering scheme, an exposure system that takes most of its information from the center portion of the frame. Most center-weighted systems also take additional readings from the surrounding areas, but weight the reading toward the center.

Color Balance: The setting that matches the available or artificial light and faithfully renders color.

Color Temperature: Described by the Kelvin scale, which is defined in degrees. It is used as a standard for judging the effect a certain light source will have on color rendition.

Continuous: The shooting mode that allows for continuous firing without lifting the finger from the shutter release button In tonality, a smooth range of tones from black to white.

Contrast: The relationship between the lightest and darkest areas in a scene and/or photograph. A small difference means low contrast; a great difference, high contrast. High contrast scenes usually cause the most exposure problems; however, their "difficulty" can mean they hold the potential for more expression. Though contrast is often linked with scene brightness, there can be low contrast in a bright scene and high contrast in dim light. Contrast can also describe attributes of color, composition, and inherent qualities of film.

Correct Exposure: The combination of aperture and shutter speed that yields a full-toned image and the best possible representation of the scene for the sensor. The constants in an exposure calculation are the ISO or speed of the sensor and the brightness of the scene; the variables are the aperture and shutter speed.

Dedicated Flash: A flash that coordinates with the camera's exposure, and sometimes focusing systems. Dedicated flashes may, among other things, automatically pick up the camera's ISO setting, set the camera sync speed, and "tell" the camera when it's ready to fire. Flashes dedicated to autofocusing cameras may also vary their angle of flash throw (coverage) according to the lens in use (even with zoom lenses), and contain autofocus

beams that aid focusing in very dim light or even total darkness. For outdoor work, dedicated flashes may provide totally automatic fill flash exposure. In short, a dedicated flash can make flash photography as simple as automated natural light photography.

Depth Of Field: The zone, or range of distances, within a scene that will record as sharp. Depth of field is influenced by the focal length of the lens in use, the f/stop setting on the lens, and the distance from the camera to the subject. It can be shallow or deep, and can be totally controlled by the photographer. It is one of the most creative and profound image effects available to photographers.

Depth Of Field Preview Button: A switch, button, or electronic push button on digital SLRs that allows the photographer to preview the depth of field of a selected aperture in the viewfinder. During composition the lens is wide open, thus the depth of field in the viewfinder is always that of the maximum aperture of the lens. Preview is very useful for critical selective focus shots.

Dynamic Range: The ability of a sensor to record a certain range of light.

Electronic Flash: Known as a flashgun, strobe, or speedlight, a device consisting of a gas-filled tube that is fired by an electrical charge. It can be mounted directly on the camera hot shoe (which links the shutter release to the flash firing), or on a bracket or stand, and be connected to the camera via a sync cord.

Equivalent Exposure: Recording the same amount of light, even though aperture and shutter speeds have shifted. For example, an exposure of f/11 at 1/125 sec is equivalent to an exposure of f/8 at 1/250 sec.

Exposure: The amount of light that enters the lens and strikes the sensor. Exposures are broken down into aperture, which is the diameter of the opening of the lens, and shutter speed, which is the amount of time the light strikes the film. Thus, exposure is a combination of the intensity and duration of light.

Exposure Compensation Control: A camera function that allows for overriding the automatic exposure reading. The bias, or shift, can be set in full or partial stops. Used in difficult lighting conditions, when the reflective meter might fail (that is, dark or bright value dominance), or for deliberate under or overexposure of a scene. Can also be used to bracket exposures.

Exposure Meter: Light-reading instrument that yields signals that are translated to f/stops and shutter speeds.

EV Numbers: A system of expressing exposure that combines apertures and shutter speed. Scene brightness translated to aperture and shutter speed values. For example, EV 15 at ISO 100 might mean 1/1000 sec at f/5.6, or 1/500 sec at f/8. EV numbers are often used as shorthand for the combined aperture and shutter speed value combinations and are used for making exposure compensation, when doing autoexposure bracketing or for readouts of exposure.

f/stops (f/numbers): The number that designates the aperture setting, or opening. The higher the f/number, the narrower the aperture. For example, f/16 is narrower (by one stop) than f/11—it lets in half as much light.

Fast: A term used to describe a sensor set at a relatively high light sensitivity, a lens with a relatively wide maximum aperture, or a shutter speed, such as 1/1000 sec, that will freeze quick action.

Fill Flash: "Fill-in" flash. Flash used outdoors generally to balance the exposure of a subject that is backlit. Can also be used to control excessive contrast, add light to shadows, or brighten colors on an overcast day.

Flat: Low in contrast. Flat light shows little or no change in brightness value throughout the entire scene.

Focal Length: The distance from the lens to the film plane or sensor that focuses light at infinity. The length, expressed in millimeters, is more useful as an indication of the angle of view of a particular lens.

HDR: High Dynamic Range. Refers to a technique for combining bracketed exposures to overcome scene contrast and/or to get the widest possible range of brightness values in the final image.

High Contrast: A scene where the range between the brightest and darkest areas is extreme, or is such that it may cause exposure problems. An image where the tonal values have been compressed to create a graphic effect.

High Key: An image that relies on the lighter shades of gray or pale colors for its effect, or one that is overexposed to yield an ethereal look. Often used in fashion, glamour, nature, and portrait photography.

Highlights: The brightest parts of a scene that yield texture or image information.

Image Effect: The effect of aperture on sharpness within the image space and/or the effect of shutter speed on motion depiction.

ISO: An acronym that stands for International Standards Organization, the group that standardizes, among other things, the relative speed of sensors. ISO numbers indicate the relative light sensitivity of sensors; a higher number indicates greater light sensitivity.

JPEG: Acronym for Joint Photographic Experts Group. A type of graphics file format that is often used for compressing large image files for transmission or display.

Landscape Mode: Orienting an image so that it is wider than it is tall. As opposed to Portrait mode, which describes an image that is taller than it is wide. Also, an Exposure mode that favors a narrow aperture and/or infinity focus setting.

Low Key: A scene with no bright tones or highlights. Usually imparts a somber, moody feeling.

Luminance: The brightness of a signal or scene.

Manual: An exposure "mode" where the exposure system recommends a setting that is then used by the photographer to select aperture and shutter speeds manually. (The booklet one doesn't read before using a piece of equipment.)

Matrix Metering: A type of metering system that reads various parts of the scene and then calculates exposure using a built-in microprocessor. The system, also known as Evaluative, Pattern, or Intelligent metering, often compares the data with information stored in the microprocessor's memory to arrive at an exposure setting.

Maximum Aperture: The widest opening, or f/stop, a lens affords. An f/1.4 lens is referred to as fast because it has a relatively wide maximum aperture; an f/4.5 lens is slow because of its relatively narrow maximum aperture. Fast lenses come in handy for handheld low-light photography.

Metering Pattern: The way in which the meter gathers light information. Generally, all cameras have a pattern (Matrix), Center-Weighted Averaging, and

Spot metering pattern option.

Microprocessor: A combination of transistors that performs specific operations. Microprocessors are found in computers and all digital cameras.

Minimum Aperture: The smallest opening a lens affords.

Mode: A way of doing things. Exposure modes are pre-programmed, user-selectable ways of controlling the readings from the exposure system to meet certain subject or picture conditions. Modes include Aperture-Priority, Shutter-Priority, Portrait, etc.

Noise: A random pattern of pixels that interferes with an image. Also called artifacts. Noise most commonly occurs when shooting at high ISOs or in very low light without flash or when using long exposure times (greater than 1 sec).

Overexposure: When too much light strikes the sensor for a proper rendition of the scene. Minor overexposure may cause a loss of details or texture in the scene highlights; severe overexposure will cause a serious deterioration of picture quality.

Panning: A shooting technique where the subject is followed during exposure; generally exposed using a slow shutter speed.

Panorama: A series of images that are overlapped so that they may be "stitched" together to form a very wide angle of view.

Perspective: The relationship of objects near and far, or impression of depth when a three-dimensional scene is rendered on a two-dimensional plane.

Plug-Ins: Software that "piggybacks" on the main architecture of another software product that expands the use of or enhances that software's functionality.

Portrait Mode: Orienting an image so that it is taller than it is wide. As opposed to Landscape mode, which describes an image that is wider than it is tall. Also, an exposure mode that favors a faster shutter speed and wider aperture.

Program Exposure Mode: A preset arrangement of aperture and shutter speed that is programmed into the exposure system of a camera to respond to a certain level of brightness when the camera is set at a certain ISO. Program Shift is the ability to maintain exposure while altering the combination of aperture and shutter speed.

Raw: A proprietary image file format that records the most amount of image information. Raw formats are considered the "digital negative" and holds image instructions in a "sidebar" file that accompanies the image.

Resampling (Interpolation): When image size is changed, the process by which the computer adds data. Generally, when raising image size, the computer averages adjacent pixels and adds data.

RGB: Red, Green, and Blue. The color components, or "channels" of a digital image.

Saturation: In color, a vividness, or intensity.

Scene Mode: Matching an automatic exposure program with the type of scene at hand, such as portrait, landscape, night scene, etc. The system responds by choosing settings that can enhance the chances of making a more successful picture. In general, this works fine, but, being a program, cannot always handle every situation, and will not always deliver the desired image effects.

Selective Focus: The creative use of focus. This can be set so that one plane or subject in a crowded scene emerges, or for total sharpness (near to far) in a scene that covers miles. Selective focus is achieved through the use of various focal length lenses, by altering camera-to-subject distance, and by changing f/stop settings. See also, depth of field.

Shadow: In photography, usually defined as those details or image information contained in the darker areas of a scene.

Sharpness: The perception that a picture, or parts of a picture, are in focus. Also, the rendition of edges or tonal borders.

Shutter Priority: An Autoexposure mode where the shutter speed is user selected and the exposure system chooses an appropriate aperture for correct exposure.

Shutter Release Button: The button that releases the shutter and "fires" the camera. Many shutter release buttons work in two stages—slight pressure actuates the meter or autofocus system (or both), then further pressure fires the shutter.

Shutter Speed: An element of exposure; the duration of time in which light is allowed to strike the film.

Slow: A term used to describe an ISO setting with a relatively low sensitivity to light, a lens with a fairly narrow maximum aperture, or a shutter speed at or below $^1/_{30}$ sec.

Speed: With a shutter, the duration of time in which light strikes the film. With a sensor, the sensitivity to light. With a lens, the maximum aperture. All can be described as fast, medium, or slow.

Spot Metering: Taking an exposure reading from a very select portion of the frame. Cameras with built-in spot metering indicate this portion with a circular ring in the viewfinder screen. Some spot meters have coverage as broad as 8° (this might also be called selective field metering) or as narrow as 1°, or can be varied with a Custom Function.

Stop: A relative measure of light that can be used to describe an aperture or shutter speed, although it is more commonly used with aperture settings. A difference of one stop indicates half or double the amount of light. To stop-down means to narrow the aperture; to open up means to expand it.

Stopping Down: Jargon for making a photograph with less exposure than previously used. With apertures, using a narrower aperture; with shutter speed, using a faster shutter speed.

Sychronization Or Sync: The timing of the firing of the flash to coincide with the opening of the shutter so that the maximum light from that flash records on the film. Reference in image filing and archiving programs.

TIFF: An acronym for Tagged Image File Format. An uncompressed file format.

Tone: When used to refer to the grayscale, a step in the gradual movement from black to white. The quality of light in a picture. Tones are the range of dark to light that make up the recorded image, and may or may not match the original brightness values in the scene. Tones can be altered through exposure or later when prints are made; they can also describe a certain overall cast, or hue. Like many terms in photography, "tone" comes from music, and can be described as high or low, resonant, or discordant.

TTL: Through The Lens metering.

Underexposure: Failure to expose correctly because not enough light has struck the sensor to faithfully render the color and brightness values. Underexposed pictures are dark; the more the underexposure the darker they become. Color also suffers.

Washed Out: Jargon for seriously overexposed highlight areas. It's as if the colors have been diluted to the extent that all pigments have been "washed out." ■

"When you're photographing kids, you've got one shot at it.

You have to be ready for the serendipity that kids do. It's terrible to try to get great shots with a camera in front of your face. That's why I use the PocketWizards all the time. They free me…not just from tripping over wires, which you have to be very careful about with kids… they let me have the interaction that gets the natural poses I want. I have a PocketWizard built into my strobes. I have a Plus II on my camera. And I can fire both from the PocketWizard in my hand."

Jack Reznicki on the PocketWizard Plus II Transceiver

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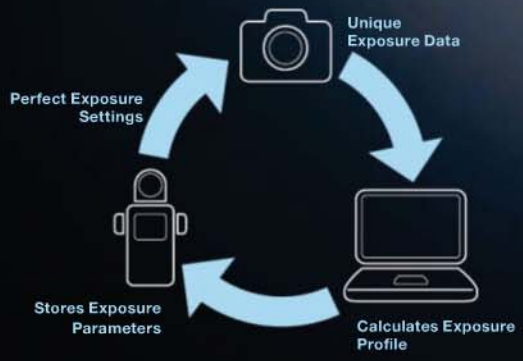

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