# the white paper eBook

***Getting the most from your Sony H-Series Ultra-Zoom Camera***

**By Alan Arthur Katz, Photographer, Graphic Designer, Flash Artist**

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# Chapter 1 - Introduction

*The White Paper* started out as a compilation of messages I'd posted on DPReview's *Sony Talk Forum*. My original intent was to store some of my online replies so I wouldn't have to rewrite them each time someone posted a similar question.

Sometimes things don't work out as intended. The enthusiasm for Sony's super-zoom H-Series cameras grew exponentially as we all discovered the amazing capabilities of these small, powerful machines. *The White Paper* grew with it, until it became a reasonably robust online book, and then this eBook.

## The H-Series Cameras

Sony introduced the first camera in this series, the "H1" (DSC-H1) in June of 2005. Sony's first super-zoom was a relatively late entry in the category, beaten to the market by both Canon and Panasonic. But Sony made up for their tardiness by offering a brilliant camera with beautiful low-ISO image quality.

To be honest, I didn't expect the H1 to be much of a camera. As an owner of Sony's legendary F828 and film DSLRs, I had bought the camera as a "toy", a carry-around camera my assistant could play with during those boring times when I'm shooting and don't need much help.

I vividly remember the first time I shot the 5-megapixel H1, standing on a bridge overlooking the Susquehanna River. Reviewing my results in the LCD, I was not very impressed. The photos looked OK for a relatively inexpensive point-and-shoot.


**Figure 1-1 DSC-H1**

It wasn't until I'd gotten home and opened the H1 images in Photoshop that I realized what Sony had done. The pictures were amazing. The color curve was exquisite, better balanced through the midtones than any point-and-shoot I'd ever seen. They were sharp, beautifully saturated with lovely soft blurred backgrounds (bokeh) and near-perfect contrast. In fact, I liked them better than the 8 mp pictures I'd shot with the F828 at more than twice the price.

Take that image quality, combine it with an excellent, bright 36-432 mm Carl Zeiss lens, image stabilization and a full complement of manual controls and you've got a winner!

Which Sony did. The H1 became an instant best-seller.

In 2006, Sony followed up with two replacements for the H1, the H2 and the H5. They were each, essentially, the same camera with different sensor resolutions and LCD monitors. The H2 was 6 megapixels, the H5 was 7.2.


**Figure 1-2 DSC-H5**

There was some concern that the additional two megapixels on the H5 might compromise image quality as Sony packed those extra pixels into the same tiny real estate as the original H1 5-megapixel sensor. But Sony surprised us with a brand new CCD architecture that maintained the same size pixels by reducing the space taken up by the circuits between them.

Sony had another winner, with beautiful image quality, improved higher-ISO performance and a better-controlled flash. ISO 400 was not bad and ISO 800 usable, with appropriate noise reduction.

In 2007, Sony released another two cameras, the DSC-H7 and H9.

In some ways, these cameras (particularly the H9) were a major departure from their predecessors. They both have 8.2 megapixel sensors and are two of the fastest point-and-shoots around, at 2.5 frames/second. Burst mode had finally become viable on a consumer camera. Plus, the H7 and H9 are two of the first consumer cameras to feature Predictive Autofocus,

which tracks your subjects as they move from frame-to-frame in a burst.

The H9 sports an impressive 3" LCD that pulls out from the body and tilts up or down 180°. The flash is again improved (recycle time is measurably shorter), and I've gotten more than 800 shots on a single charge with the new Sony battery.

The new Carl Zeiss lens was a departure, too. The zoom was increased from the original H-Series 12X to 15X. The new lens had an effective range from 31 mm – 465 mm.

There were some downsides to these major upgrades to the H-Series. The choice of compression (particularly "Fine" compression) was sacrificed to performance. The extra million pixels were not accompanied by a major advance in sensor technology to prevent an increase in noise. Instead, Sony built a more aggressive noise-reduction algorithm into their new Bionz Processor. This new noise-reduction firmware has proven uneven – causing some blurring of detail in some shots, while preserving detail in others.

For some people and their style of shooting, this was a disappointment. For others with a stake in high-performance, high zoom, and the flexibility of the huge tilt LCD, the tradeoffs were worth the new and powerful features.

The other issue is the huge zoom range. My suspicion is that the new lens was extended both on the Wide and Telephoto side mostly to compete against other cameras in the same category, not to deliver state-of-the-art optics.


**Figure 1-3 DSC-H9**

There were costs to that decision, too. None of the old converter lenses (tele, wide, macro) that fit the previous H-Series model fit the wider lens barrel (74mm) of the H7 or H9. Fortunately, third parties quickly appeared with optional adapter rings that allowed H9/H7 owners to mount their H-Series tele and macro lenses. But not the wide-angle adapter, which really needs to be considerably larger to prevent vignetting (dark corners).

Despite these issues (which have generated some controversy), you'd still have to pay thousands of dollars to get the kind of zoom and speed you get from the H7 and H9 for less than $500 US.

Every camera is a compromise. The earlier H-Series cameras had excellent image quality at low ISO, the H7 and H9 appear cleaner than their predecessors at ISO 400. The flash on the H1 was overpowered and uncontrollable. All of the earlier cameras quickly exhausted their two AA batteries, while the lightweight

H7/H9 battery lasts much longer. None of the H-Series cameras was particularly good with action compared to the H7 and H9.

Some day, someone will produce the perfect camera. And when they do, I doubt it will be as cost-effective as the H-Series cameras. The amazing zoom range of these cameras requires a small sensor, and small sensors present a lot of challenges.

Despite the possible shortcomings of the H9, I'm still a big fan of the camera. I've shot more than 15,000 frames with it, and some of those shots remain among my best. The camera is particularly good at action and macros.

And I love shooting with it.

## Who is this eBook Written For?

If you're a first-time owner of an ultra-zoom, *The White Paper eBook* can help you explore the possibilities of your camera. Although I use the Sony H-Series cameras as examples throughout *The White Paper*, almost everything in here applies equally to Canon, Fuji, Panasonic, Olympus and Kodak ultra-zooms.

If you're a long-time user of Sony (or other) ultra-zoom cameras and you just want to extend your capabilities to get the best pictures you can, this eBook may also be helpful. It's time to get out of "Auto" mode, and hopefully *The White Paper* will help.

But my greatest hope is that *The White Paper* eBook may just inspire you to try new things, to improve both your photos and your options, to find new worlds to shoot and, most important, to enhance the delight that comes from using one of these incomparable cameras.

AAK 2007-2008

# Conventions Used In This Book

## Focal Length

*Focal length* represents the amount of zoom used to capture an image: the higher the number, the more telephoto (zoom in); the lower the number, the more wide-angle (zoom out).

### Equivalent Focal Length

Throughout this book, I use *35 mm-equivalent* values for all focal lengths. The *real* focal length is the focal length built into the optics. Real focal length is important when comparing lenses in an interchangeable lens system. It provides a standard for optical manufacturers to compare and contrast their offerings with their competitors' offerings.

But in fixed-lens cameras (non-interchangeable lenses) like the H-Series cameras, real focal length is not all that meaningful. That's because digicams use different size image circles to expose their different-size sensors. The smaller the sensor, the smaller the image circle required to expose it.

If we were to use real focal lengths, a 200 mm focal length on a large-sensor camera would produce a much wider field of view than that of a small-sensor camera. The pictures would be radically different.

Therefore, in keeping with industry standards, all focal lengths mentioned in this book (31 mm, 200 mm, etc.) are 35-mm-equivalent focal lengths, not real focal lengths.

In the following illustration, note that the large-sensor image is much larger than the small-sensor image. But the composition of both images - the field of view - is exactly the same.

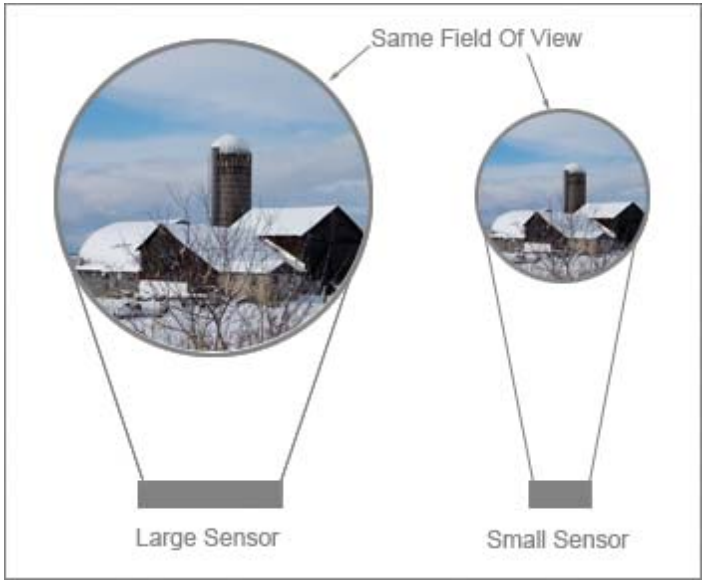


**Figure 1-4 Large Sensor vs. Small Sensor**

So the industry came up with a standard specifically designed to allow digital camera buyers to compare the zoom range of cameras based on the field of view, the breadth and reach of the photo that results from any point along the zoom range relative to the size of the sensor. They chose the 35 mm film frame as the baseline, since it was the most common film format when digital cameras first came into wide use.

The H-Series cameras have a sensor 6-times smaller than a 35 mm frame, so the real focal length needs to be multiplied by 6 to express the same field of view you'd see on a 35 mm film camera.

The H9 has a real focal length of only 5.2 mm at the wide-angle end and 78 mm at the telephoto end. However, if we multiply by 6, we get 31.2 X 468 mm. Sony calls this 31 X 465 mm equivalent. The multiple may be just slightly under 6.

## Equivalent Is Not Exactly the Same as Real

Though 5.2 mm on the H-Series Cameras may capture the same field of view as a 31 mm lens on a full-frame camera, there are some other differences. Certain calculations and effects are based on the real focal length, not the equivalent.

For example, a 200 mm equivalent H-Series focal length will have six times the depth-of-field (depth of sharpness) of a lens with a real 200 mm focal length. That's good for landscapes in which you want to see as much detail as possible, not as good for portraits where you want to gently blur the background.

A 5.2 mm lens will exhibit more barrel distortion than its 31 mm equivalent. It's very hard to get clean optics at a wide-angle focal length that low.

### Small Sensors, Big Zoom

There are tradeoffs and compromises in all cameras, and the H-Series is no exception. Its smaller sensors gather less light than cameras with larger sensors and, in general, larger sensors produce cleaner images.

On the other hand, it's the tiny high-resolution sensors that allow Sony to offer such amazing zoom ranges – to capture such

distant subjects and closer subjects with amazing detail. The H-Series cameras were designed to be ultra-zooms and it's the tiny Sony sensors that define them.

## Equivalent Used Throughout This Book

In a bow to industry standards and the overriding importance of composition, field of view and zoom range, I have chosen to represent all focal lengths in this book as *35 mm-equivalent* focal lengths rather than *real* focal lengths. It also makes it easier to compare H-Series settings and techniques to those of other cameras.

If, for some reason, you need to know the real focal length, divide any focal length published here by 6.

# Chapter 2 - Exposure: Getting Light into the Camera

*Exposure* is the term used to describe “getting light into your camera” - or, to be more accurate, getting the *appropriate* amount of light into your camera.

I can’t think of anything that will have more impact on the quality of your images than exposure. Getting it right is the single most important factor in producing great photographs.

If you have too little light, your pictures will be dark, your colors muddy, detail will be lost and you’ll have more noise corrupting your images. Your image will be *underexposed*.

**Figure 2-4 - Underexposed**

If you have too much light, your pictures will be too bright, your colors washed out, entire sections (particularly sky) “blown out”,

turning white and losing all detail. Your image will be *overexposed*.

**Figure 2-5 – Overexposed**

A *normal* exposure shows the scene as you saw it. It's not so much a matter of the image being darker or lighter, but of the image being *accura*te. A dark image can be perfectly exposed if the scene was dark. The same goes for a bright image.

***Tip:*** *You may decide you want your final image to be brighter or darker than "reality" foraesthetic reasons. The best way to accomplish this is to shoot it that way in the camera. Changing exposure in post-processing has its drawbacks. You can learn more about that in the chapters on noise and post-processing. Always keep in mind that the highest-quality image you can get is the one that comes from the camera, from the light, as opposed to one whose exposure is modified after-the-fact. You can certainly tweak your results, compensate for errors, correct color and contrast in post-processing. But each one of these adjustments takes a toll on image quality, sometimes minor, sometimes major. The work you put in to get exposure right "in*

*the camera" will pay off with the best possible image quality for any given situation or scene.*

**Figure 2-5 – Normal Exposure**

I hate to start out with a technical lecture on light and digital sensors, but it seems to me that, without a real understanding of how your camera captures and interprets light, you'll be at a real disadvantage as you try to master exposure.

## Light and Digital Photography

Light is electromagnetic radiation. Not to belabor the physics, but electromagnetic radiation is composed of elementary particles. The particles of light are called *photons.*

In film cameras, the chemicals on the surface of the film (emulsions) consist of photo-reactive crystals which change after absorbing the energy of a photon hitting them.

Your digital camera is quite different. It has a sensor, a silicon chip that measures the quantity of light hitting specific locations on its surface.

Each location is called a *pixel*, a picture element. Each of these pixels will be seen as a single dot on the page when the image is printed or a single pixel on a display when the image is viewed at 100% on a monitor.

We tend to talk about cameras in terms of "gathering light", but in fact, a digital camera is a measuring device. The only part of a camera that "gathers light" is the lens - the optical system.

In fact, your camera doesn't really even measure light; it measures the electrical charge that results from photons hitting the light-sensitive material at the bottom of the *wells*, tiny cup-like structures at the center of each pixel.

So, the camera is really gathering information about electrons, not light. It then reads that information out to a processor that converts those measurements of electrical charge to digital form, to which it applies color interpolation, noise-reduction and user settings. The processor uses this final, modified data stream to generate machine-readable output -in the case of the Sony ultra-zooms, a .JPG file.

***Note:*** *As of the H7 and H9, Sony has named its processor "**Bionz"**. Digital image processors consist of both hardware and firmware (embedded software) and are critical to the quality of the final image. Its physical design can generate or prevent noise, its firmware decides the colors in your images, the sharpness, contrast - the overall rendering of the image. In recent years, camera manufacturers have come to recognize their processors as marketable technology and share that technology across product lines. The Bionz processor now appears in all of Sony's new consumer, prosumer and DSLR cameras.*

## There's No Such Thing as Bright Light

Light does not exist as brighter or dimmer. These words describe the brain's reaction to greater or lesser *quantities* of light.

A brighter light is simply one with more photons. A dimmer light has fewer. This is an important distinction. When you set exposure, you don't control the brightness of the light - it's not like a volume control on an audio system. What you control is the *total number of photons* that hit the wells in your sensor,

You can do this in two ways: you can open up the lens to expose the wells to large quantities of photons all at once, or you can use the shutter to expose the wells to smaller quantities of photons for a longer period of time. In either case you'll get the same exposure.

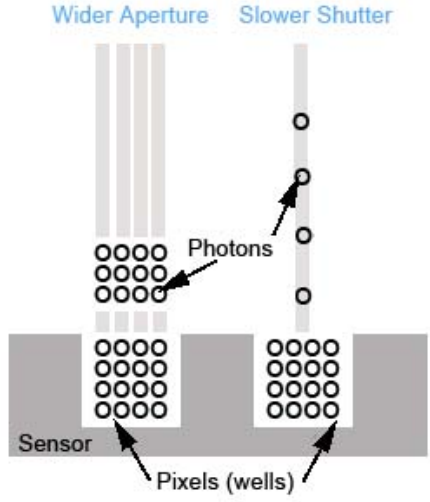


**Figure 2-6 – Same Exposure Using Two Different Methods**

***Note:*** *There are other considerations that go into choosing the best way to achieve proper exposure. Changing the aperture changes the focus depth of the image. Changing the shutter can result in motion blur if the subject is moving faster than the shutter. Balancing the two methods of controlling light is a big part of the aesthetics of photography. We'll deal with this in greater detail in later chapters.*

## Aperture

The aperture is the opening that allows light into your camera. It is controlled by the *iris diaphragm* in your lens, a shade whose multiple blades move in and out to change the size of the aperture without essentially changing its shape.

The diaphragm is opened wider to allow more photons to pass at the same time, closed down to restrict the number of photons that hit the sensor.

The measure of "wide" or "narrow" aperture is called an *f/stop*. Theoretically, each full f/stop increases or decreases the number of photons coming into the camera by double (increase) or half (decrease).

The lower the f/stop, the wider the aperture. Conversely, the higher the f/stop, the narrower the aperture.

f/8 is narrower than f/2
f/2.8 is wider than f/5.6

f/8 allows less light (fewer photons) than f/2
f/2.8 allows greater light (more photons) than f/5.6

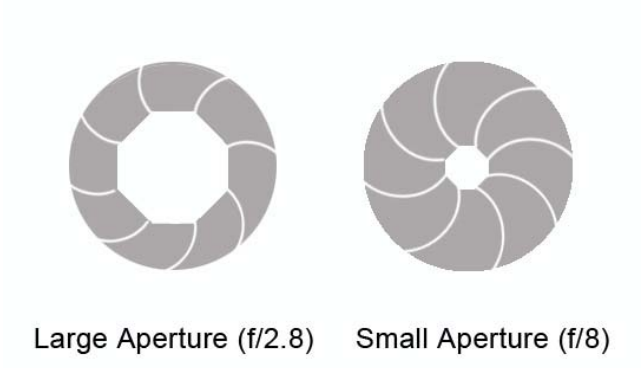


**Figure 2-8 – Larger and Smaller Apertures**

***Tip:*** *At first, the concept of "higher f-number equals smaller aperture" may seem counter-intuitive. It is. But it also makes sense. Many things in photography are based on reciprocals. For instance, ½ is greater than ¼ even though the denominator of ¼ (4) is a larger number. Don't let it confuse you. You'll run into this a lot on the path to mastering your camera. After a short time, you'll start visualizing f/8 as a small aperture and f/2.8 as a huge one without thinking about it.*

Earlier in this section, I mentioned *full f/stops*. Your camera offers both full and *fractional f/stops*. Remember, a full f/stop halves or doubles the light. But what about exposures that fall between halves or doubles? Sony's H-Series cameras offer 1/3 stops so you can fine-tune the light coming into your camera.

Aperture *full f/stops*: f/2.8, f/4, f/5.6, f/8

Aperture *1/3 f/stops*: f/2.7, f/3.2, f/3.5, f/4, f/4.5, f/5, f/5.6, f/6.3, f/7.1, f/8

You'll find fractional f/stops indispensable when trying to nail a difficult exposure.

## Available f/Stops

Different lenses offer different aperture ranges, depending on their design. For example, digital SLR lenses often feature a huge range of apertures compared to consumer and prosumer cameras.

A typical DSLR lens aperture range can stretch as high as f/32. Most prosumer cameras only go to f/8 or f/16 for their smallest aperture. That's because the tiny sensors on these cameras don't need the smaller apertures to ensure deep focus on a scene. The real challenge (and more meaningful number) is the *lowest* f/stop - the widest aperture possible with a given lens. That number determines the maximum amount of light that can pass through a lens. The more light the lens can pass through, the less likely you'll have to use a flash in low light and the less noise you'll see in low-light images.

Zoom lenses often have built-in aperture range limits based on focal length. Not all apertures may be available under all circumstances (even with DSLR lenses), especially at the telephoto end. That's because telephoto focal lengths have such a small field of view. The more telephoto the lens, the less of the scene the camera "sees". Less scene means less total available light (see Figure 2-9).

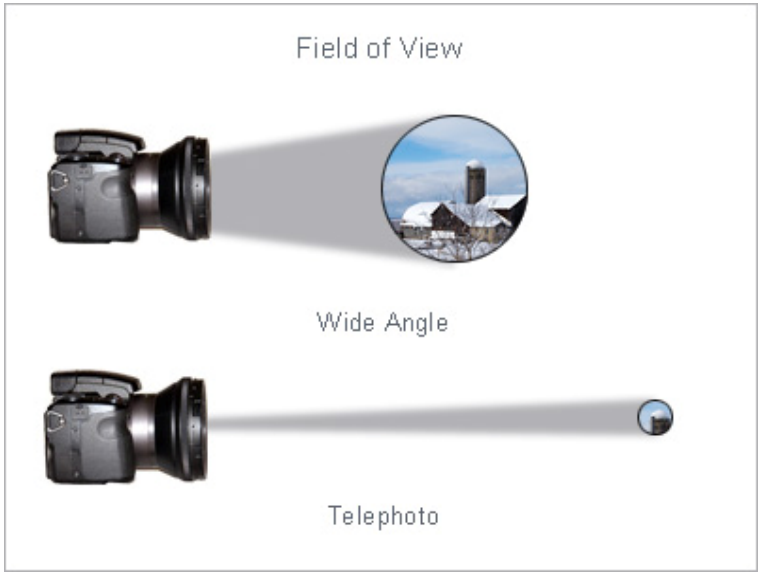


**Figure 2-9 Field Captured at Wide-angle and Telephoto**

Some DSLR lens manufacturers overcome this telephoto restriction by building lenses with very large elements and front-openings to gather as much light as possible. But I don't know of many lenses that zoom to a telephoto range like the H9's (465 mm equivalent) without limiting the widest-open f/stop. Some of the very best DSLR telephoto lenses weigh up to nine pounds, are more than a foot long, cost many thousands of dollars, and still offer only f/4 or higher as their widest aperture setting.

The H-Series cameras are no exception. Between Sony and Carl Zeiss (the lens designer), they've managed to strike a good compromise at minimum apertures for each of their cameras. The following table lists the effective minimum apertures (the widest opening allowing the most light) for the H-Series cameras to date:

| Camera | Wide-Angle | Telephoto |
|---|---|---|
| **DSC-H1** | **f/2.8** | **f/3.7** |
| **DSC-H2, H5** | **f/2.8** | **f/3.7** |
| **DSC-H7, H9** | **f/2.7** | **f/4.5** |

Note that the H7 and H9 offer a wider minimum aperture at wide-angle, and a smaller (less light) minimum aperture at telephoto. That's because these two cameras have more wide-angle and telephoto zoom range than the previous H-Series cameras.

In any case, you need to be aware when setting exposure that you will have some limitations. You can't always get all the light you want just by opening up the aperture, especially at the telephoto end of your zoom.

## Diffraction Effect

Diffraction is the propensity of light to bend when it passes through an opening. Smaller openings tend to bend the light more. The "bent light" that comes from diffraction can cause a slightly fuzzy effect which can, in turn, produce soft-looking images.

The smaller the aperture, the more diffraction. Therefore, you have to be careful to avoid the highest f/stops (the smallest apertures). The sharpness you gain by having more depth of focus can be lost to the effect of diffraction.

I generally recommend staying at or below *f/7.1* on the H1, H2, and H5 to avoid visible diffraction effect. On the H7 and H9, I'd stay at or below *f/6.3*. The pixel size of the H7 and H9 is smaller than the earlier cameras, which increases diffraction effect at lower f/stops.

For a more detailed explanation of diffraction effect and suggestions on how to deal with it, see Chapter 6.

## Shutter

A shutter is the part of a camera that controls how long the film or sensor is exposed to the light coming through the lens.

The H-Series cameras have electronic shutters. Unlike mechanical shutters, there's no physical "curtain" that crosses in front of the sensor to block the light between exposures. In an electronic shutter, the sensor is cleared, exposed to the light for a period you specify, then turned off, read out and processed (see Figure 2-10).

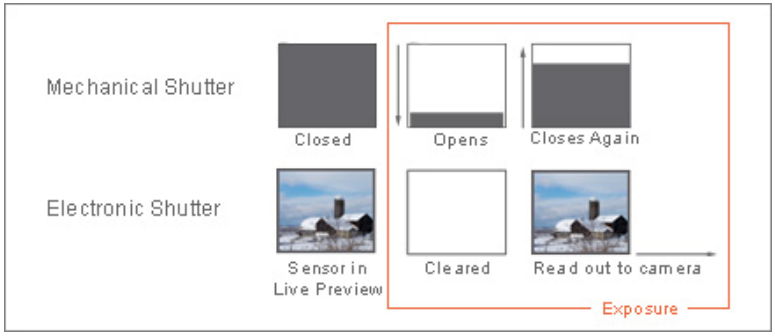


**Figure 9-10 Shutter Types**

As you can see in the preceding illustration, when we talk about "shutter speed", we're not talking about the performance of the shutter itself or the time between shots. "Shutter speed" refers specifically to the time in which the sensor actually records light. When we say "the shutter speed is 1/200$^{th}$", we mean that the sensor will record light for 1/200$^{th}$ of a second. More accurate names for "shutter speed" might be "shutter duration" or "exposure duration".

There are some very good things about electronic shutters. They're absolutely silent. With no moving parts, they don't wear out before the camera body (as they do in DSLRs and film cameras). They can synchronize with your flash at almost any speed. And they're amazingly accurate.

## Shutter Speed Display

The displays on the H-Series cameras show the reciprocal, not the fractional value of the current shutter speed.

Therefore, a display of 2 actually means ½ second.

But what if the shutter speed is not fractional? What if the shutter speed is 1 second or more? In that case, Sony appends a double-quote (“) to the number to indicate a duration of more than one second.

If you see 50, your shutter speed is 1/50$^{th}$ of a second.
If you see 1.3”, your shutter speed is 1 1/3$^{rd}$ seconds.

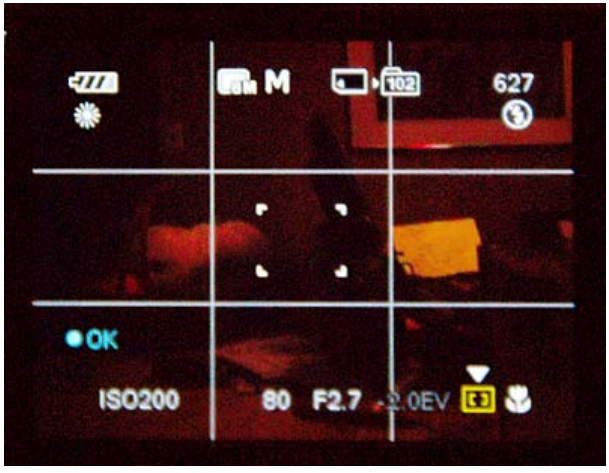


**Figure 2-11 Shutter Speed Shown is 1/80$^{th}$ Second**

***Note:*** *Like their mechanical cousins, electronic shutters also black out during exposure. Mechanical shutters black out viewfinders to move parts out of the way. Electronic shutters black out viewfinders because they use the same sensor for live preview that they do during exposure. Remember, the sensor*

*was cleared. There's no image to display. So they set the display to black while the sensor grabs the light and the camera creates the image.*

## Available Shutter Speeds

Shutter speed works in concert with aperture to control the light hitting your sensor. Like aperture, there are both practical and built-in limits to the shutter speeds available under various circumstances.
The shooting mode you select has a major impact on the available shutter speeds. Automatic Mode usually offers the least range, both for long exposures and fast exposures, while Program Mode and Manual Mode (in the H7 and H9) offer the greatest.

The following table lists the full shutter speed range for each generation of H-Series camera. Note that not all speeds are available under all circumstances.

| Camera | Slowest | Fastest |
|---|---|---|
| **DSC-H1 Auto Mode** | **1/8th** | **1/2000th** |
| **DSC-H1 Program Mode** | **2"** | **1/2000th** |
| **DSC-H1 Manual Mode** | **30"** | **1/1000th** |
| **DSC-H2, H5 Auto Mode** | **1/4** | **1/2000th** |
| **DSC-H2, H5 Program Mode** | **1"** | **1/2000th** |
| **DSC=H2, H5 Manual Mode** | **30"** | **1/1000th** |
| **DSC-H7, H9 Auto Mode** | **1/4** | **1/4000th** |
| **DSC-H7, H9 Program Mode** | **1"** | **1/4000th** |
| **DSC-H7, H9 Manual Mode** | **30"** | **1/4000th** |
| **DSC-H7, H9 Aperture Priority** | **8"** | **1/4000th** |

**Figure 2-12 Available Shutter Speeds (Built-In)**

I wish I could tell you why Manual Mode on the H1-H5 cameras is more limited on the fast side than Auto or Program Mode. It doesn't make much sense. Manual Mode is the one that's

supposed to give the photographer the most control, yet Auto Mode offers more shutter speed range at the fast end. In any case, this issue was addressed in the third generation H-Series cameras, the H7 and H9, which supports the fastest shutter speeds in all modes.

There are other built-in limitations to shutter speed. For example, on the H1, you can only get the fastest shutter speeds at apertures of f/5.6 and above.

The H7 and H9 have a sliding scale of available shutter speeds based on aperture setting and zoom. See the following chart from the H7/H9 Handbook by Sony:

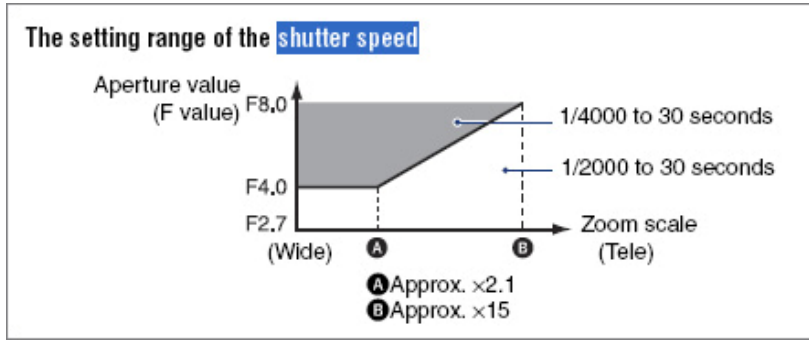


**Figure 2-13 Shutter Speed Limitations © Sony 2006**

This chart probably needs a little bit of explanation.

At wide-angle (up to 2.1X zoom), the H7 and H9 support shutter speeds up to 1/4000$^{th}$ at apertures of f/4 and above. If you zoom in any closer than 2.1X, you'll get up to 1/4000$^{th}$ only if your aperture is set to f/5.6 and above.

At any other focal length, the fastest shutter speed available is only 1/2000$^{th}$, regardless of aperture..

There is a technical reason for these limitations. Unfortunately, extensive searches have produced no articles or other information on point to date. Apparently, Sony is keeping this information close to the vest However, if your scene and lighting require your aperture to be wide-open (f/2.7), you shouldn't need 1/4000$^{th}$. 1/2000$^{th}$ should be more than sufficient. The times when you really want to maximize shutter speed (like shooting into the sun) also call for high f/stops (smaller apertures).

There may be aesthetic reasons why you decide you need 1/4000$^{th}$ and wide apertures (shallow depth of field for a macro shot of a bee in flight, perhaps), but they are few and far between. It's nice to have the possibility of 1/4000$^{th}$ even if you rarely need or use it.

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## Shutter Speed – Managing Blur

Like your selection of aperture, your selection of shutter speed is not without consequences. These consequences supply the *practical* limitations on shutter speed. Shutter speed can be severely limited when it causes *blur.*

Blur is caused when the shutter is open long enough for something to move before the exposure is complete. The sensor registers more than one image. The more motion, the farther apart these partially exposed images can appear, resulting in anything from a slight blurriness at edges to ghost images – recognizable duplicates some distance apart.

Blur can come from motion of the camera, in which case, it's called *camera shake*.

Or Blur can be caused by the motion of the subject, in which case, it's called *motion blur*.

Either can ruin your pictures unless you intended the blur as part of the artistic intention of your image.

## Motion Blur

Let's look at subject motion first.

Check out Figure 2-14. This is a classic case of motion blur. The deer in the foreground and the branches behind are sharp, indicating that the image was focused correctly. The deer in the background, however, is seriously blurred. The foreground deer was still. The background deer was moving. The shutter speed on this low-light dusk shot was just too slow to freeze the moving deer.

**Figure 2-14 Motion Blur**

How do you prevent motion blur? By "stopping" or "freezing" your subject. If your shutter speed is equal to or faster than the speed of your subject's motion, you will capture a thin slice of time in which the subject appears to be still, even if she's in the midst of

a pirouette on the ice, or he's in midair, about to dunk the ball through the hoop.

Kids at play, sports, pets in action, performers onstage and birds in flight are just a few of the subjects that challenge your shutter speed.

**Figure 2-15 Motion "Stopped" at 1/640th**

Here are some rough recommendations for shutter-speeds likely to "freeze" a few typical moving subjects. They're intended just as a starting point – there can be a huge difference in speed even within a category. For instance, an eagle in flight can be "stopped", without blur, at a significantly slower shutter speed than a tiny sparrow darting from place to place.

| Subject | Speed |
|---|---|
| Soccer Game (action) | 1/500$^{th}$ – 1/1000$^{th}$ |
| Children At Play | 1/250$^{th}$ – 1/500$^{th}$ |
| Birds In Flight (large) | 1/800$^{th}$ and above |
| Animals (deer) | 1/500$^{th}$ – 1/800$^{th}$ |
| Ducks and Geese On a Pond | 1/200$^{th}$ – 1/640$^{th}$ |
| Rock Concert | 1/160 – 1/500$^{th}$ |
| Race Car or Airplane | 1/640$^{th}$ – 1/1250$^{th}$ |

**Figure 2-17 Sample Shutter Speeds To Stop Action**

***Tip:*** *You can't always use the ideal shutter speed to freeze your subject's motion, particularly in low light. So, if you're going to shoot moving subjects in low light, you'll need to become adept at predicting "stop" moments. If a rock star jumps in the air, there is a point at the top of his arc, just before gravity brings him back to earth, in which motion is stopped, and you can shoot at much lower shutter speeds. With experience, you'll come to anticipate these moments and capture great "frozen" shots.*

## Camera Shake

Except for the very young and extremely well-coordinated, most of us will have a problem holding a camera up against our eye without any motion whatsoever. Breathing can move the camera. Your pulse can move the camera. Clicking the shutter almost invariably moves the camera.

When the camera moves, the edges in your image may be blurred, depriving them of the detail and sharpness you'd like to see in all your pictures.

Unless, of course, your shutter speed is fast enough to freeze the camera's motion, the same way it freezes a subject's motion.

**Figure 2-18 Camera Shake**

It's difficult to recommend a "safe" shutter speed that avoids camera shake. There are too many variables. How shaky are your hands? What's your focal length (zoom)? The impact of camera shake is much greater at telephoto than at wide-angle. How far away are you from your subject? The farther away, the more noticeable camera shake will be.

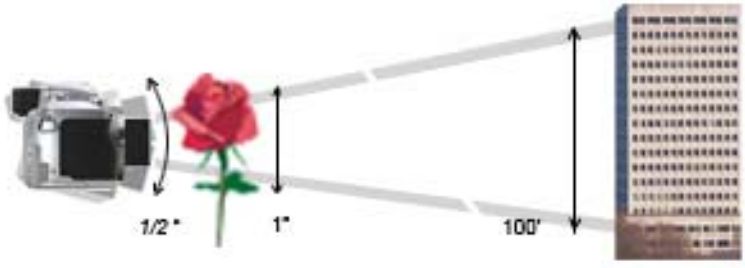


**Figure 2-19 Effect of Distance on Camera Shake**

Look at the illustration in Figure 2-19. A slight movement of the camera may result in only 1" motion on the closer subject (the rose). But the same motion can be magnified up to 100 feet on a 4-mile distant building. Your telephoto zoom is like a huge lever, and the further out you focus, the more you amplify even a small motion into something potentially disastrous for your photos.

I find that I can avoid blur at a minimum shutter speed of 1/125$^{th}$ second at full telephoto, while I can hand-hold as slow as 1/20$^{th}$ - 1/40$^{th}$ when shooting close in. You need to experiment to find your own particular limits.

The bottom line is that you need faster shutter speeds to combat camera shake at the telephoto end of your zoom than you do at the wide-angle end. The same applies to distant subjects vs. close subjects. Or you need some other method of combating camera shake.

## Image Stabilization

All of the H-Series cameras feature *image stabilization (Super Steady Shot)*, which has grown a bit better with each new release.

Image stabilization employs tiny, but powerful, piezo-electric gyros and a moveable lens element to counteract camera shake.

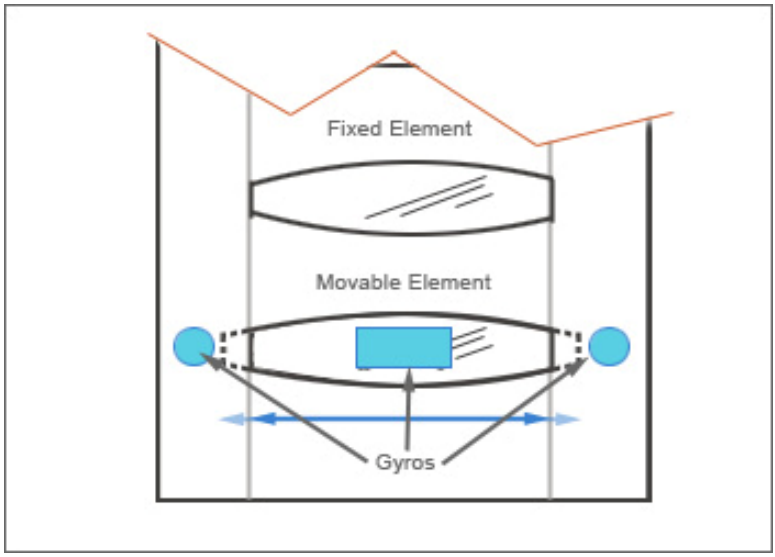


**Figure 2-20 Cross Section of Lens with Image Stabiliztion**

The H-Series image stabilization is very effective. In tests, it improved hand-held performance by as much as three full stops. That means you can hand-hold the camera without visible camera shake at shutter speeds up to three stops slower than you can without it.

But even image stabilization has its limits. Don't expect miracles. The motion of the compensating lens element is only fractions of an inch. If you shake the camera more than that, the image stabilization won't help. You still have to be careful hand-holding the camera at lower shutter speeds. Image stabilization doesn't allow you to be careless. It allows you to shoot carefully and thoughtfully at shutter speeds lower than you have before.

Don't expect every shot to come out crisp and blur-free. Your "keeper" rate will improve with image stabilization, but nothing will prevent blur in every shot except a fast shutter speed. To avoid camera shake, always try to get your shutter speed as fast

as you can within the limitations imposed by conflicting settings, such as aperture and ISO (more on this at the end of this chapter).

***Tip:*** *The Steady Shot warning icon (a shaking hand), appears in the middle of your display whenever the camera decides that the shutter speed or zoom are too much for a hand-held shot. It's very rare that I suggest ignoring a warning, but this is one of those times. The camera doesn't seem to know or care if you've got image stabilization turned on or even if you're on a tripod. It is not a well-informed warning. So pay it some heed, so that you're aware, at least, that there may be an issue, but don't rely on it. It's not one of Sony's smartest implementations.*

## Steady Shot Settings

The cameras' setup menus all offer an option to engage image stabilization full-time (continuous), or only when taking a shot (shooting). I always set it to "shooting".

Stabilizing the image while composing a shot strikes me as a waste of battery power. Your eye doesn't need stabilizing and it's almost impossible to blur the viewfinder or LCD while composing a shot. To the contrary, I find seeing my subject freeze and un-freeze while composing a shot quite annoying. It can actually cause a "jerky" pan across your scene.

When using a tripod or any other kind of stabilizing device, *turn Steady Shot off.* Sony's image-stabilization doesn't know if you're on a tripod, so it's going to keep trying to move that stabilizing element even if there's no possibility of camera shake. Leaving Steady Shot on while your camera's mounted on a tripod can actually *cause* shake. Don't do it. The option is easily accessible through the context-sensitive Shooting menu.

Don't use Steady Shot when you don't need it. A high shutter speed cures all kinds of blur. If you're shooting at about 1/500$^{th}$, or so, image stabilization doesn't bring anything to the table

except a small delay while it settles in. That's the main reason I try to keep my shutter speed high and avoid Steady Shot when shooting fast-moving subjects in burst mode.

## Avoiding Camera Shake with a Tripod.

One of the best ways of avoiding camera shake is to use a tripod. A good tripod provides a stable base for your camera. It doesn't breathe, it doesn't lean, its "arms" don't get tired, it just holds your camera steady.

***Note:*** *I intentionally used the phrase "good tripod" in the preceding paragraph. A tripod needs to be sturdy enough, steady enough and portable enough to do the job, or you might as well hand-hold the camera. Avoid cheap, lightweight tripods. They move in the wind, they bend, they can fall over and damage your camera. There's nothing worse than watching your tripod and camera blow over the ridge and down the hill! You can lose a lot more than the shot with a flimsy tripod.*

The downside of a tripod (at least for me) is that it's not conducive to shooting a wide variety of angles at a reasonable tempo. The tripod must be reset, leveled and tested at each location and angle before you take the shot.

If I could handhold all my shots, I would. I like the personal relationship with the camera that comes from moving around with it as though it were an extension of my eye. But reality intervenes and I often end up with a tripod strapped to my back at performances, sporting events sunrises and sunsets.

For certain kinds of photography, a tripod is absolutely required. If you shoot a fireworks display without a tripod, the streaks of light are likely to show a bad case of the "jaggies". Formal portrait shoots are another great occasion for tripods. The tripod retains the camera's position and angle between shots. This can be critical when you walk out from behind the camera to correct a model's pose.

## Avoid Blur with a Remote


**Figure 1-21 H7/H9 Infrared Remote**

If you have an H7 or H9, you've got Sony's excellent infrared remote-control unit. Use it when your camera's on the tripod. One of the major causes of camera shake is the motion of your finger on the shutter button. The tripod does not mitigate this in any way. However, the infrared remote does. Once you've done your settings, you never touch the camera again until the shot is done. A tripod without a remote is only half of a solution for camera shake.

***Tip:*** *For the H-Series cameras that don't come with a remote (H1 through H5), use the built-in timer to trigger your shutter. Anything that keeps your hand off the camera at slower shutter speeds will help you get sharp, shake-free images.*

## Avoiding Camera Shake with a Monopod

The monopod is a radically different device from a tripod. The tripod is designed to provide a stable platform. The Monopod requires a lot more "human engineering" to stabilize your shots at lower shutter speeds or high zoom.

The primary job of the monopod is to take the weight of the camera out of your hands and to transfer it into the ground. With only a single leg, there's nothing to prevent lateral motion. That's where technique comes in. There are two ways in which you can lock down the monopod and prevent camera motion. The first is to lean the camera against a stable surface (such as the body of your car, or a theater seat or even a wall – whatever's available.

**Figure 2-22 Triangulating the Monopod**

The second, and more flexible, method is to use the camera's strap or your own body to create three stable points. To do that, don't hold the tripod straight up-and-down. Hold it with the base at an angle away from your feet, then either lock your arms or

pull the camera strap tight to your neck and shoot (see Figure 2-22)

Image stabilization, tripod, remote control and monopod – these are all effective aids in avoiding camera-shake and getting the best possible exposure, especially under challenging light conditions.

However, always keep in mind that sufficient shutter speed, as an integral part of exposure, is the best cure for the "blurries". Keep in mind, too, that a tripod won't slow down the motion of your subject. A remote control will not make your child or pet stand still.

## ISO

The third tool for nailing exposure (after aperture and shutter) is *ISO*.

In some ways, ISO is very different from the other tools, since it doesn't involve light. Shutter and aperture determine how much light hits the camera's sensor. ISO, on the other hand, acts on the *output* of the sensor, on the image data itself, not the light that creates it.

ISO is often referred to as the "sensitivity" of the camera. In film, the emulsions on the negative actually have different sensitivities - thresholds above which they register light.

Your digital sensor has a similar threshold, and that's called its *base ISO*.
You can't switch your sensor for a more sensitive one, as needed, as you one film for another. However, you can "dial up" the sensitivity using mathematical means, rather than changing the chemistry or physical characteristics of your camera.

Any ISO, other than the base ISO, is simply amplification. It's a mathematical multiplication of the number of photons counted by your sensor.

Each full stop of ISO, just like full stops of aperture or shutter speed, doubles the *apparent* light processed by your camera. Not the real light, but the *value* of the light the camera will use to build the final image.

ISO amplification is critical to low-light photography.

Even with a bright f/2.7 or f/2.8 lens like those of the H-Series cameras, there is often insufficient light for a really good exposure. You'd be surprised how many scenes appear perfectly "visible" to the naked eye, but don't provide enough photons to fully-fill the wells in the sensor in the brightest parts of a scene.

Shutter speed plays a big part in this. I often hear or read complaints from people who can't shoot their children or pets indoors, successfully, even with the aperture wide open. That's because their subject is alive. The child or dog or cat moves, breathes, blinks – all of which require a fast-enough shutter speed to freeze these actions. Children and pets at play, in motion, make matters even worse.

There are, once again, two solutions: you can either turn up the ISO which, in turn, allows you to increase your shutter speed; or you can add more light by virtue of a flash.

However, like aperture and shutter speed, there are potential problems in turning up the ISO.

## Available ISO

Remember, ISO above base doesn't add any light, it just doubles the numbers. And when it does, it doesn't discern between

image and noise, meaning that your noise goes up when your ISO goes up.

The cleanest, most noise-free image you can get from any digital camera is one shot at "base ISO". The following table lists the base ISOs and highest available built-in ISOs of the H-Series cameras;

| Camera | Base ISO | Highest ISO |
|---|---|---|
| **SC-H1** | **64** | **400** |
| **DSC-H2 and H5** | **80** | **1000** |
| **DSC-H7 and H9** | **80** | **3200** |

**Figure 2-23 Base ISO**

Unfortunately, Sony did not see fit to provide 1/3 ISO stops as they did for aperture and shutter speed – at least in modes other than Auto. In Auto Mode, you may be surprised to see ISO levels in your finished images that aren't selectable in the camera.

The standard ISO stops in the H-Series are:

ISO 80 (or 64), 100, 200, 400, 800, 1600, 3200 (higher ISOs only available on some models).

As with aperture and shutter speed, there are both built-in and practical limitations to the ISO levels you select.

The practical limitation to ISO is *image quality*. In general, base ISO, ISO 100 and ISO 200 produce pretty clean images in all the H-Series cameras. You'd be hard-pressed to identify any of those ISO settings through visual inspection of a printed image.

ISO 400 seems to be the "breakpoint" in many of these small-sensor cameras. ISO 400 in the H1 is barely usable. It's just too "noisy". In the H2, H5, H7 and H9, ISO 400 is cleaner and I wouldn't hesitate to use it, as long as I'm exposing the image properly as a result.

***Tip:*** *You need to be careful not to underexpose at ISO 400 or higher, on any of the H-Series cameras. If you have to brighten the image in post-processing, the noise will become visible as color blotches and wiped-out detail. It's always best to get the most accurate exposure - in the camera. It will produce the cleanest image.*

ISO 800 is borderline. You can use it (if it produces the right exposure), but you should expect to do some noise-removal in post-processing, as the camera's processor simply cannot keep up with the amount of noise generated at ISO 800 and above.

**Figure 2-24 Noisy H1 Image at Higher ISO (320) 100% Crop**

As for ISOs above 800, well… they're just wishful thinking. Either the noise or the camera's noise-reduction will produce muddy pictures with limited color saturation and poor detail These ISOs may be usable for web sites or very small prints, but it's just not

realistic to expect any kind of serious image quality at these highest ISOs.

ISO is the parameter you change when you have no choice. When no combination of aperture and shutter speed produces enough light for a great photo, you start dialing up the ISO. Try to stay within ISO 64-200 for the best possible quality, ISO 400, if that's what's required to nail the exposure, and go above that only in emergencies, when you just can't get enough light and are willing to spend some time post-processing your images and are willing to sacrifice some color and detail.

**Figure 2-25 H5, ISO 800 Image, Brightened.** Note the Loss of Color Saturation and Hair Detail to Noise Reduction

**Figure 2-26 H5, ISO 400 Image, Well-Exposed**

## The Endless Challenge: Aperture vs. Shutter Speed vs. ISO

Getting exposure right, balancing aperture, shutter and ISO, is the real challenge of digital photography. Of all photography.

There is an essential tension between these elements. If the light is low, you have to shoot wide-open and still probably not capture enough light to properly expose your sensor without lowering your shutter speed. Which then results in blurred subjects. So you raise the ISO, which lets you raise the shutter speed, but now you have to deal with the concomitant noise and noise-reduction issues.

The only real solution to this challenge is light. You have lots of options when you shoot in bright daylight. You can raise the

aperture to get a really deep depth of field and still shoot at high-enough shutter speeds to avoid camera-shake and motion blur.

But even shade can be challenging. Your options diminish as the light does: less depth of field, whether you want it or not; slower shutter speeds, even though your edges or subjects may be blurred; or higher ISO, with noise speckled across your subject's face.

I don't have answers for you. This tension is built into photography (even film photography, where "noise" was known as "grain"). You have to find your own solutions for your own shooting style.

Or you have to find more light. One way is to use the built-in flash or an external unit to get enough light for a good exposure. Many of us avoid this because we don't like the flash "look", the distorted colors and harsh shadows.

Fortunately, there are techniques you can use to make your flash images look a lot more like natural light (see the flash chapter later in this book).

There's also a host of compromises you can make in selecting your exposure settings. Use a higher ISO and then use post-processing tools to clean up the resultant noise. How large are you going to print? Losing a little detail to noise reduction won't matter much in an 8X10. In a 24X32, the same artifacts may ruin the picture. Shoot at a lower shutter speed, but catch the action at the moment of least motion.

Learning to make the right compromises for the kind of shots you take comes only from experience – from failures, in particular.

I recommend, as I will endlessly throughout this book, that you experiment over and over again. Don't get discouraged; don't let all the options daunt you. Find your own ideal settings and make them part of your camera kit, every bit as valuable as your camera and accessories.

Just keep one thing in mind as you struggle to achieve perfect exposure: today's cameras are, in many ways, far superior to what photographers had to wrestle with in the past. How many film photographers shot color film, regularly, at ISO (ASA) 800 or above? How many photographers, even a decade ago, had access to the zoom range you get in the H-Series cameras, without changing lenses?

Use the remarkable capabilities that these H-Series cameras present to expand your horizons and your techniques. Anything you learn using these cameras will be of benefit to you through a lifetime of photography.

## Summary

Nothing is as important as getting light into your camera and setting up your camera to use the available light to produce a great image.

There are three tools for achieving good exposure: aperture, shutter speed and ISO. Each has its own limitations.

Aperture changes depth of field.
Shutter Speed, if too low, produces blur
ISO, if too high, produces noise.

Your job is to find a balance for your scene, your light and your esthetic intentions. Work within the camera's and the scene's limitations to produce well-lit, detailed, sharp and colorful images with your H-Series camera.