CAMERA & FLASH EXPOSURE

When you depress the shutter release button on your digital camera to take a picture, the shutter opens, "exposing" the image sensor to the light coming in through the lens. The quality of this exposure will greatly affect the look of your image. In many cases you'll allow your camera to make some (or all) of the decisions regarding exposure and flash output via its program modes and metering system. This is fine, but a skilled photographer also knows how to manage their own camera and flash settings in order to really control the look of their photos.

Here, I'll provide an overview of what I call the "light pipeline;" the logical flow of light through the camera's mechanisms of exposure control. We'll also discuss how the use of flash factors into your camera settings and exposures. If you're new to these concepts, I'll warn you now; it might take some effort to internalize these concepts. But if you do it, it's going to pay off in a huge way. You *can* learn this and it's important. So, let's get started.

HOW WE MEASURE LIGHT

We manage exposure by controlling the amount of light reaching the image sensor, taking the sensor's ISO setting into consideration. In order to manage our exposures in a consistent way we need a standard, easy-to-follow system of measurement that ties into our camera settings. In photography, the traditional unit of light/exposure measurement is the basic "stop." As we adjust an exposure control setting (e.g., shutter speed) from one major increment to the next, we move up or down a full stop. This either doubles or halves the previous amount of light, or its effect, on the exposure. First some examples, then explanations. It will all come together as you progress.

The following are examples of one-stop differences:

- If you start with an f-stop of f/8.0, and change it to f/5.6, you will double the amount of light coming in through the aperture (f/5.6 is 1 stop wider than f/8.0).

- If you start with an ISO of 200, and change it to ISO 400, you will double the sensitivity of the sensor to light (ISO 400 is twice as sensitive to light as ISO 200).

- If you start with a shutter speed of 1/60 second, and change it to 1/30 second, you will double the amount of time light is allowed to pass through to the sensor.

Going the other direction with any control "halves" the light, time, or sensitivity:

- If you start with an f-stop of f/8.0, and change it to f/11, you will halve the amount of light coming in through the aperture (f/11 is 1 stop narrower than f/8.0).

- If you start with an ISO of 200, and change it to ISO 100, you will halve the sensitivity of the sensor to light (ISO 100 is half as sensitive to light as ISO 200).

- If you start with a shutter speed of 1/60 second, and change it to 1/125 second, you will halve the amount of time light is allowed to pass through to the sensor.

APERTURE, SHUTTER SPEED, AND ISO

In the following sections we'll discuss how aperture, shutter speed, and ISO are not only useful creative tools, but also the most important components of exposure; the Big Three. They are also interdependent; any change made to one of these settings requires a reciprocal change to another to maintain the same overall exposure.

Aperture

The first exposure control in our lighting pipeline is aperture. When we think of camera lenses, we usually think of the clear optics in them that project the image of our scene or subject onto the sensor plane to create a photograph. But one of the most important parts of the lens is the built-in adjustable diaphragm that creates a hole (aperture) for the light from the scene to pass through, before it reaches the sensor (see Figure 1).

By adjusting the aperture setting on your camera, you're telling the lens how wide, or narrow, to make the hole. Because of the way the optics work, the diameter of the hole actually affects how much of the scene is in focus (depth of field or DOF). Photographers will often refer to aperture settings in increments called "f-stops." F-stops with lower numbers indicate wider apertures, whereas f-stops with higher numbers indicate narrower/smaller apertures (see Table1 and Figure 2).

As the aperture in the lens is adjusted up or down (wider or narrower) the actual amount of light moving through the lens in a given unit of time is going to change. A wider aperture will allow more light to strike the sensor in less time than will a smaller aperture.
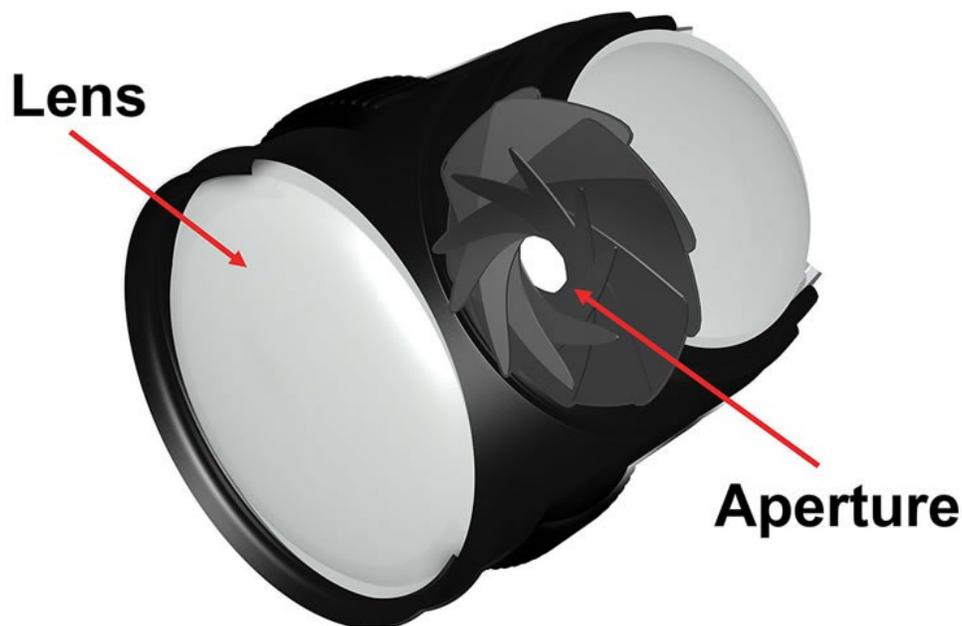

Figure 1. Cut-away view of a lens showing the aperture mechanism. The hole allowing the light to pass through the lens can be adjusted via the aperture setting. These adjustments are measured in f-stops and control depth of field and the volume of light reaching the image sensor during the time of exposure.

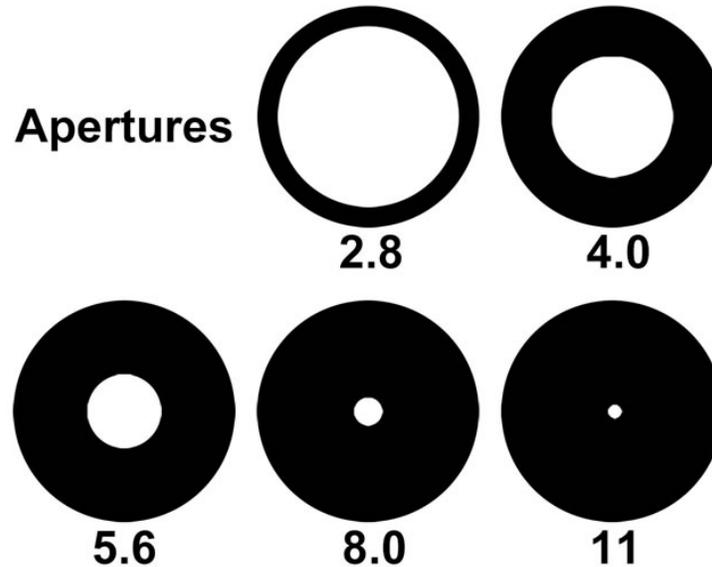| Common F-Stops									
Fast Lenses			Apertures grow smaller from left to right on this chart.						
1.4	2.0	2.8	4.0	5.6	8.0	11	16	22	32

Table 1. Common Apertures.

Figure 2. Approximation of the size of aperture openings corresponding to common f-stops.

Aperture affects two important things:

- DOF (how much of the scene is in focus) as shown in Figure 3;

- The amount of light passing through the lens onto the sensor (in a given unit of time) as shown in Figure 4.

In order to get a good exposure, your camera's image sensor must receive enough usable light from a scene while the shutter is open. By adjusting the aperture, we are able to adjust the amount of light the image sensor receives during exposure.

Aperture Setting Options

Your digital camera has modes that allow for automatic aperture adjustments. Using these modes, your camera might not always choose the best apertures according to your preferences. In cases where you'd prefer to maintain a specific aperture, or control aperture directly, you'll want to use Aperture Priority or Manual modes (see *Shooting Modes*). Aperture Priority mode allows you to control the aperture as the camera makes automatic reciprocal adjustments to shutter speed to maintain good exposures. Manual mode also allows for full control over aperture settings but requires you to make the necessary reciprocal shutter speed adjustments on your own.

Aperture Adjustment Sequence - DOF

f/1.8	f/2.8	f/4.0
f/5.6	f/16	f/22

Figure 3. With automatic changes to ISO and shutter speed to maintain proper exposure, this sequence shows how DOF is affected by aperture adjustments (we've used f/1.8 but skipped f/8.0 and f/11 to maintain a six-shot format for this sequence). Notice the background detail at different f-stops.

Aperture Adjustment Sequence - Exposure

f/4.0	f/5.6	f/8.0
f/11	f/16	f/22

Figure 4. With ISO and shutter speed remaining constant, this sequence shows how exposure is affected by aperture adjustments.

Shutter Speed

The second exposure control in our light pipeline is shutter speed. As you've already seen, your camera's image sensor must be exposed to light in a controlled way in order to properly record a picture. The mechanism that controls the duration of the exposure is called the shutter. The shutter's job is to block the light coming in through your lens until you press the shutter release button to take a photo. When you press that button, the shutter slides open, exposing the image sensor to any constant light, and/or flash, coming in through the lens, then closes to block the light from the sensor again, ending the exposure. Your camera is capable of a wide range of shutter speeds (see Table 2).

Common Shutter Speeds							
Left to right: Slower (longer duration) to faster (shorter duration).							
1/8	1/15	1/30	1/60	1/125	1/250	1/500	1/1000

Table 2. This is a range of common full-stop shutter speeds. These are fractions of a second, but shutter speeds can be several seconds or minutes long and as fast as 1/8000 second on many digital cameras.

Usually, the shutter remains open for only a fraction of a second, but the duration can be longer. We refer to the length of time the shutter remains open as the shutter speed. Shutter speed is either controlled by the photographer directly, or by the camera in some automatic modes.

Shutter Speed and Blur

Your camera's image sensor records any light projected onto it when you take a photo and the result is saved as a single still image. If there is no movement during exposure, the sensor only records stillness. However, if there is movement during exposure (either in the scene or from camera movement) it will may be recorded as overlapping areas of light in the frame. This produces blur, ghosting, light streaks, and other effects. Sometimes these effects are used creatively, as shown in Figure 5.

1/800 Second   **1/2 Second**

Figure 5. A fast shutter speed and slow shutter speed give different effects to this waterfall photo. By using a slow shutter speed creatively, we're able to get the soft, flowing water effect on the right.

To help prevent blur due to camera movement, a tripod or monopod can be used. Image Stabiliza-tion (IS), Vibration Reduction (VR) and similar technologies are lens and camera features that can also assist in minimizing this type of blurring. While these will help minimize the effects of camera movement, they will not reduce blurring caused by movement in your scene — but faster shutter speeds will.

The faster the shutter speed, the shorter the duration of exposure; the sensor will have less oppor-tunity to "see" anything move or change in the scene. Many digital cameras are capable of shutter speeds as fast as 1/8000 of a second. At high speeds, you can capture images with virtually no motion blur regardless of subject or camera movement.

Slower shutter speeds are useful, too. In low-light conditions slower shutter speeds offer the ability to capture the constant/ambient light in a scene when higher ISO and wider apertures are not practical. In other words, in dim light a slower shutter speed can allow time for the image sensor to collect enough constant light for proper exposure of that light. Again, the trade-off is that a slower shutter speed increases the potential for blur due to movement of the camera and/or the subject.

Shutter Speed and Exposure

As the shutter speed is adjusted up or down (shorter or longer durations of exposure) the actu-al amount of constant/ambient light reaching the image sensor is going to increase or decrease (given the same aperture). Slower shutter speeds allow more constant light to strike the sensor because the exposure is longer, while faster shutter speeds allow less constant light to strike the sensor (see Figure 6).

Shutter speed affects two important things:

- The amount of ambient/constant light motion blur visible in an image;

- The amount of time constant light is able to build up onto the sensor.

A good exposure requires that the camera's image sensor receive enough usable light from a scene in a given amount of time. Your shutter speed is going to control the duration of exposure, and your aperture setting is going to control how much light the sensor is exposed to in that time. By adjusting the shutter speed, we are able to control the amount of time constant light is allowed to build up on the image sensor.

When flash photography is introduced into the mix, shutter speed has much less to do with the areas of the image affected by flash. The duration of the flash is only a fraction of the time of the overall exposure; so a longer exposure (slower shutter speed) does not receive any more light from the flash than a much shorter one.

Put this all together and what it means is when you adjust your shutter speed, the exposure of the subject receiving flash illumination stays about the same but the amount of constant light being recorded changes. For practical purposes (other than flash sync), think of it this way: **shutter speed doesn't affect flash exposure**.

Shutter Speed Adjustment Sequence

Figure 6. With ISO and aperture remaining constant, this sequence shows how exposure is affected by shutter speed adjustments.

Shutter Speed Setting Options

Your camera has modes that allow for automatic selection of shutter speed. In these cases, your camera might not choose the best shutter speeds according to your preferences.

Shutter Priority mode allows you to set the shutter speed manually as needed (for example with sporting events, it's often necessary to use shutter speeds above a certain range, say 1/500 second or faster). Aperture Priority and other modes adjust shutter speed automatically for you and are quite good choices as long as you make sure speeds remain in acceptable ranges.

X-Sync & High-Speed Flash Sync

You can use flash with your camera's native flash sync shutter speed (x-sync) or any slower shutter speed. This has to do with the way the shutter opens and closes past a certain speed. Check your manual to find out what your camera's flash sync speed is. This is usually the shutter speed you'll want to use in manual flash setups. If you need to use flash with higher shutter speeds (e.g. 1/8000), it's possible using a camera and flash combination that allows for high-speed sync (HSS).   Because of the way HSS works, the trade-off for using it with faster shutter speeds is diminished flash power; the flash pulses like a short-lived constant light source during exposure and the total output of the pulses are weaker than the power of a full instantaneous flash burst.

ISO

The final stop in our light pipeline through the camera is our sensor and its ISO setting. ISO is the camera setting we use to control the relative "sensitivity" of our camera's sensor to light. When you take a picture, the lighting conditions of the scene, as well as shutter speed and aperture settings determine how much light is striking the image sensor during exposure. ISO determines if that amount of light is enough to record a properly exposed image. If enough light strikes the sensor according to the ISO setting, adequate data is recorded for producing an acceptable image.

ISO and Exposure

The sensor has a maximum amount of light that it is capable of recording (per each pixel). If that maximum is reached or exceeded, the data can only be interpreted as being the brightest possible tone. In our images, this is often what specular highlights or pure, blown-out white areas, are made of.

Conversely, it's possible for the sensor not to receive enough light to record adequate data for all or part of a picture. It might be that the scene is too dim, or that your shutter speed and aperture settings are cutting down on the amount of light necessary to record the desired detail during exposure. Whatever the reason, less light striking the sensor can mean a darker image, or lack of detail in darker parts of the image.

If we had no way to adjust the sensitivity of our camera's sensor, we'd always have to adjust shutter speed and/or aperture to suit such a rigid constraint. This might result in slower than useful shutter speeds in low light or smaller than desired apertures in brighter light.

By having a way to adjust how the sensor reacts to the amount of light reaching it, we are given more control over our aperture and shutter speed settings. The camera's ISO setting is our convenient way to tell the sensor to act as if it is more, or less, sensitive to the light during an exposure. A normal or low sensitivity response (normal or low ISO) allows the sensor to report light information under normal exposure conditions. Whereas a more sensitive response (higher ISO) might allow the sensor to report the same amount of light under lower lighting conditions.

Just as with aperture and shutter speed, adjustments to ISO can affect exposure and will cause an image to record as darker or brighter if aperture and/or shutter speed are not adjusted as well (see Figure 7).

ISO and Image Quality

How exactly does adjusting the ISO setting make the sensor more "sensitive" to light? It might be helpful to understand that in order for our cameras to deliver enough information from our sensors, sometimes that information needs to be "turned up" just like the volume on a sound recording when the recording is too low.

For example, say that you made a recording of a distant or very low sound. The signal is stored on the recording media, but in order to clearly make out the sound, you must boost the gain (or

volume) which also makes some unwanted noise audible. With digital cameras, turning up your ISO is very similar; sometimes you need to "turn up" the signal in order to record enough useful information. The problem with amplifying the information signal is that, just like the sound recording example above, a lot of unwanted noise is also amplified. With our images, conspicuous noise (with a look similar to film grain) is a by-product of higher ISOs (see Figure 8).

Figure 7. With aperture and shutter speed remaining constant, this sequence shows how exposure is affected by ISO adjustments.

ISO Setting Options

Your camera might have modes that will automatically select the ISO setting for you. In these cases, your camera might not choose the best ISO according to your preferences. Another feature of some digital cameras is the ability to use special low or high ISO settings outside of the normal range for the camera, and/or incremental ISOs like ISO 160 or ISO 320 (as opposed to ISO settings like 100, 200, 400, etc.).

In general, I recommend you start with the standard ISO numbers and adjust them in standard doubling or halving increments. It's easy to remember that ISO 200 is half as sensitive to light as ISO 400, just as ISO 3200 is four times more sensitive to light than ISO 800. Simple.
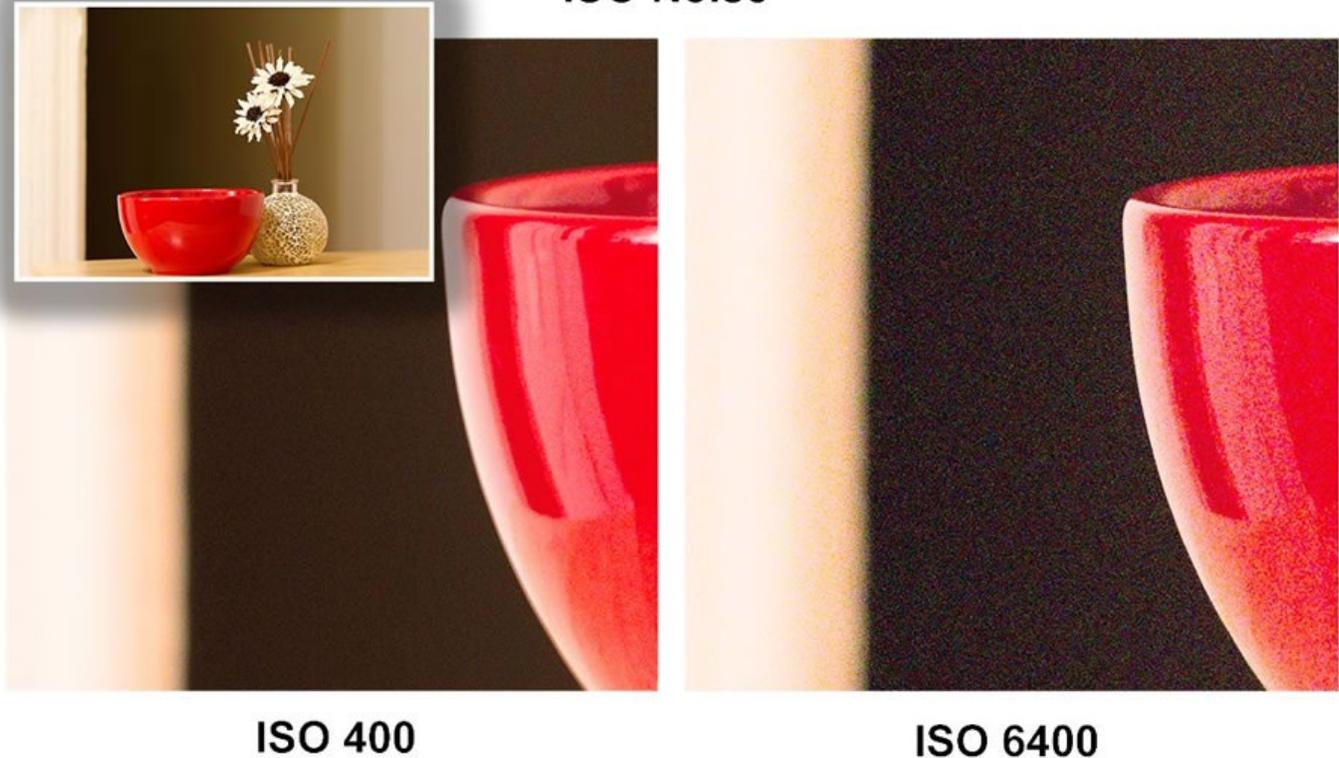
Figure 8. A close-up crop showing noise produced at ISO 400 and ISO 6400. The full-crop image is shown in the inset.

Aperture, Shutter Speed, & ISO in Balance

Given the amount and type of light we have to work with when taking a picture, finding the balance we desire of these three components: aperture, shutter speed, and ISO is always our goal. You might adjust one, two, or all three in various ways, but all three have to add up correctly to create the desired exposure. And there is more than one way to get that exposure as shown in the group of Tables 3 below and in Figure 9. For example, with regard to exposure, if we start off with the following combination for a given constant amount of illumination on our subject, all four exposure setting combinations shown will result in the same exposure.

In the case of flash illuminated subjects, shutter speed plays less of a factor and adjustments you can make for flash exposure on the camera are basically limited to ISO and aperture. There is a little more to it than that, but the takeaway right now is that **shutter speed shouldn't be thought of as a way to control flash exposure**.

So, in a nutshell, we generally measure light in "stops" and control it with aperture, shutter speed, and ISO. Within any of these components, each standard incremental change either doubles the light (or its effect), or cuts it in half. We have to balance these components and compensate for a change in one, with a change in the other(s) to get similar exposures across adjustments.

With the following settings as a starting point for a good exposure...

Aperture (F-Stop)	Shutter Speed	ISO
f/8.0	1/500	400

We can achieve a similar exposure with each of setting combinations in the following tables:

Aperture (F-Stop)	Shutter Speed	ISO
f/5.6	1/500	200
2X original light allowed	SAME	1/2 original sensitivity

Aperture (F-Stop)	Shutter Speed	ISO
f/8.0	1/250	200
SAME	2X original light allowed	1/2 original sensitivity

Aperture (F-Stop)	Shutter Speed	ISO
f/16	1/125	400
1/4 original light allowed	4X original light allowed	SAME

Table Set 3. Various exposure combinations.

ISO 400, f/8.0, 1/250   ISO 400, f/5.6, 1/500   ISO 400, f/4.0, 1/1000

Figure 9. This sequence shows how different combinations of aperture settings and shutter speeds can result in the same exposure. ISO could have also been changed between shots as long as one, or both of the other settings also changed to maintain the same exposure. Notice however, that the same exposure does not necessarily mean the same effects in the image; the changes in aperture here resulted in noticeable differences in DOF.

SHOOTING MODES

Your camera is capable of making complex exposure decisions for you. As a matter of fact, there is some highly sophisticated, computerized programming that goes into many of the shooting modes. Some of these modes take most, if not all, of the guesswork out of taking pictures and can produce interesting effects and provide special exposure enhancements. Essentially, your camera can even function as a point-and-shoot, with the benefit of creating better quality images than

you'd get with a smaller, compact camera. As you get more confident with your camera, you'll want to graduate to more sophisticated shooting modes.

Just to give you some context, shooting modes are what you use to tell your camera how you're planning to use it. There's no way we can cover all of the specific modes and terminology used by all of the different camera manufacturers, across all the models of cameras out there. But, generally speaking, a shooting mode sets up the way your camera will function in terms of handling exposure settings.

Fully Automatic Mode

More than likely, your camera has an all-encompassing automatic mode. On many cameras this full-auto mode is denoted by a green icon or label with the word "AUTO" on the mode dial. You can think of full-auto as sort of a point-and-shoot mode. Few camera settings are controlled by you, and the actual decisions about exposure are made entirely by the camera. ISO, aperture, and shutter speed are determined based on what the camera's programming thinks is best for the scene. While this might seem like a great way to shoot, it provides you with very few creative choices and not always the intended results.

To use this mode, just set your camera to AUTO or the green icon, and you can start shooting just as if you were using a point-and-shoot. The camera will make all of the important exposure decisions for you including whether or not to trigger the internal or pop-up flash if your camera has one.

Again, just as with all of the automatic and easy shooting modes, you'll have limited creative control over your exposure settings and the camera will not always make the best decisions on your behalf. That's definitely something you should be aware of. If you want more control, you'll have to abandon these modes and move on to the ones that put more control into YOUR hands. We'll get into those modes as we progress.

Basic/Scene Modes

Besides full-auto, some cameras also have modes designed for very specific shooting scenarios like "Portrait" or "Landscape" shots, night shooting, action and other situations. Depending on the camera manufacturer, these might be called BASIC or SCENE shooting modes on your camera. These are more than likely found on consumer and some prosumer models than on high-end cameras. As you might expect, if you want the camera to attempt to make good exposure decisions for you, you'd select the BASIC or SCENE mode that matches up to your shooting scenario. I'll stress this one last time: the camera's not always going to make the best choices, and your creative options might be very limited, but these modes could make shooting a little easier for beginners.

Program or Program Shift (P) Mode

Program mode is another easy-to-use mode that gives the camera initial control over the aperture and shutter speed settings. The camera controls the balance between the aperture and shutter speed, but it allows you to shift the exposure mix in case you'd like to see one of the other settings in a different place.

For example, let's say your camera is showing an aperture at f/5.6 and shutter speed at 1/60 sec. If you'd like to open up your aperture to f/4, you can turn a dial until you see that adjustment as your camera automatically makes the reciprocal adjustment to the shutter speed (in this case, to 1/125 sec.). This is usually done via one of the adjustment "wheels" on the camera. This type of exposure control shifting is a handy way to exert a little more control over the exposure settings than you'd have with the full-auto mode.

Besides allowing you to shift the exposure settings up or down, P mode also allows you to set the ISO and dial-in Exposure Compensation, which we'll cover later.

Shutter Priority (Tv or S) Mode

Controlling things like the aperture setting and shutter speed will become very important to you as seek to gain more control over the look of your images. When you want to deliberately control shutter speed, or the duration of your exposure, Shutter Priority mode, often denoted with the symbols "Tv" (time value) or "S", allows you to select and adjust the shutter speed as you shoot, while the camera automatically adjusts the aperture to compensate for any change in exposure. If you're taking pictures at a sporting event for example, you might want to capture the images at shutter speeds no slower than 1/500 sec in order to freeze the action. As background and other lighting conditions change, your aperture will be adjusted automatically.

Of course, the camera's ability to maintain good exposures through automatic aperture adjustments is limited by the aperture range of the lens used. In other words, if the camera would otherwise adjust the aperture to f/2.8 to compensate for a change you've made to the shutter speed, it can't if the lens' widest built-in aperture is f/4. In those cases, a simple manual adjustment to your ISO will put you back into a good exposure range.

Aperture Priority (Av or A) Mode

This can be thought of as the flip side to Shutter Priority mode and can be found on your shooting mode dial under "Av" or "A." You'll use Aperture Priority when you want to have direct control of your aperture setting while allowing your camera to automatically adjust the shutter speed for you to maintain proper exposure. Although using this setting means you're less concerned about the exact shutter speeds being used, you'll want to keep an eye on the shutter speeds your camera is selecting for you. Stopping your aperture down too far can lead to slower shutter speeds and blurry pictures. Aperture Priority is the mode I recommend for most outdoor photography.

Manual (M) Mode

Manual mode ("M" on the shooting dial) gives you total control over all camera exposure settings: aperture, shutter speed, and ISO. This means you, and not the camera, are responsible for getting a proper exposure. The camera's metering system will still provide you with feedback to help you judge the potential for over/under exposure, but it won't take over to correct your exposure settings. Where lighting conditions are inconsistent, you'll have to make frequent adjustments. Since you can freely adjust aperture and shutter speed independently of each other, you'll find that you have a great amount of creative freedom with manual mode. But since you're doing all the thinking for the

camera (as far as exposure goes), you might be spending more time dealing with the settings than you'd like.

Manual mode is very useful in situations where you can take your time composing and making creative adjustments to exposure. It's also great for portrait setups using flash/strobe because in those situations the lighting conditions tend to remain consistent throughout a series of shots; few if any exposure adjustments have to be made unless there are changes made to the lighting setup and/or the ambient lighting conditions.

Note that Manual camera mode and Manual flash are not the same thing; camera and flash modes can be used independently of each other. For example, your camera can manage TTL flash metering for automatic flash output control while you operate that camera in Manual mode. Probably less effectively, you can use your flash in Manual mode with your camera set to one of the automatic modes.

Bulb (B) Mode

Another version of Manual mode is Bulb mode. Here, you can control all aspects of the camera as with manual, but instead of pre-selecting a shutter speed, the shutter simply remains open for as long as you hold the shutter release button down (or maintain the open shutter with a remote shutter release). This is a very inaccurate way to manage the duration of the exposure, but it can be useful under the right conditions. Bulb is best used with a tripod and some type of remote/cable release to prevent blur from camera movement. It's often used to photograph fireworks, the night sky, and other low-light scenes.

EASY ADJUSTMENTS WITH TWO SIMPLE EXPOSURE CONTROLS

Most professional and prosumer cameras offer very two handy camera controls (check your camera's manual for specific instructions on how to locate and use them): Exposure Compensation (EC), and Flash Exposure Compensation (FEC). These controls effectively give you on-the-fly override power of the camera's exposure and flash output decisions. They are like throttles for light control. You will use these two controls to dial-in light just the way you want it to look.

Flash Exposure Compensation

When using automatic flash control (e.g., Canon's E-TTL II or Nikon's i-TTL) which we'll refer to as simply, TTL, it's often advantageous to "ride" your camera's Flash Exposure Compensation (FEC) control. Which is to say, adjust the setting to increase or decrease the amount of light your flash pumps out, overriding your camera's flash metering decisions. For your camera this might simply be a matter of quickly pressing a button and rotating a control wheel left or right.

For example, if your subject is wearing a light-colored outfit, your camera might determine the scene requires less flash output than it actually needs, underexposing the scene. This is an easy correction for you, because you'll simply dial in a little more flash power for your next shot

with the FEC control as shown in Figure 10. This compensates for the way your camera wants to underexpose the shot.

Similarly, if your subject is wearing a dark-colored outfit, your camera might overcompensate by applying too much flash, overexposing the scene. Again, you'll simply dial in a little less flash power for your next shot with the FEC control.

Figure 10. TTL flash metering underexposed the shot on the left but dialing in a little more flash power with FEC corrected it.

Exposure Compensation

Exposure compensation (EC) works in nearly the same way as FEC. However, it's not used to control flash output, but rather controls overall exposure (of constant/ambient lighting), overriding your camera's metering decisions.

In Aperture Priority mode, moving the exposure compensation dial really just changes your shutter speed. This is because your aperture is set by you, and your camera automatically sets the shutter speed. In order to shift the exposure up or down, your camera must adjust the shutter speed accordingly.

This is why exposure compensation doesn't really have a place when your camera is in Manual mode. In Manual, you are already in full control over both aperture and shutter speed. So, to adjust exposure, you'd simply adjust one of these settings directly.

When not using flash, EC simply allows you to dial in more, or less, light for the whole scene. Again, useful for times when metering in modes other than fully manual, and your camera isn't quite capturing the scene the way you'd like. But, when using flash with Aperture Priority mode for example, EC is quite a useful control, especially outdoors. It will allow you to adjust the ambient light independently of the flash exposure. Useful, for example, if you want a darker background than the camera's metering gives you, while maintaining the same exposure on the subject with the flash (see Figure 11).

Of course, setting your camera to Manual mode will give you complete control over the ambient lighting (while your flash, under TTL control, maintains an independent output). But, it's good to know that EC is there if you want to adjust things without slipping out of one of the priority modes.

When To Use These Controls

When using TTL-controlled flash: you'll ride the FEC both indoors and outdoors. Manual flash does not require FEC adjustments because the flash output is controlled directly. You'll use EC outdoors when your camera is in Aperture Priority mode. Again, this is the mode I recommend for most outdoor photography. As for indoor flash photography, I recommend you use the camera's Manual mode. In that case, there's no need for the EC control. You'll just adjust shutter speed for the ambient light, and use FEC to control the way the TTL-controlled flash illuminates the subject (or use Manual flash for more precise control).

Outdoors, use the camera's Aperture Priority mode for speed and simplicity. Again, FEC helps you adjust the way the TTL-controlled flash illuminates the subject (I usually like to dial the flash down a bit outdoors to create a subtle fill light effect). EC can help you adjust the back-ground light.

For most practical purposes, however, your camera's metering will likely give you a good ambient exposure without any EC adjustments. So, the FEC might be your main adjustment control outdoors (if using TTL).

Note: Different manufacturers implement and limit the use of FEC and EC in different ways. Be sure to check your camera manual carefully to make sure you have your preferences set correctly to take full advantage of EC and FEC controls.

Figure 11. Flash exposure remains the same, but the image on the right has a darker background with EC dialed down.

STANDARDIZATION

We've covered the lighting theory and camera controls that are most important for good flash photography. Later, you'll see examples of common lighting scenarios that should cover most of what you'll want to do when starting out. But here is where I'll present a working methodology that you can apply to just about everything when working with flash. I strongly believe this approach can make you more confident and capable.

By standardizing your basic camera and flash settings, and the way you work with your light, you will find a simplicity and consistency that will allow you to become a master of your preferred techniques. Working under a standard method doesn't have to be a constraint. As a matter of fact, it can be more freeing to your creativity than having too many choices and technical concerns to deal with. Giving yourself fewer options to worry about will keep your focus on the subject of your picture, and that's always a good thing. You'll naturally start to think in ways that bend your situation to your method instead of the other way around.

When time permits, stretch the self-imposed limits of standardization to further your technique. Doing this at a reasonable pace will allow you to expand your skill set over time. But, it's still going to be your core techniques and standardized settings that will provide the consistent magic you can depend on. No more walking into a situation without knowing where to start. And when it counts the most, standardization will save you.

How Standardization Works

At its essence, standardization, as it pertains to our discussion, is all about simplicity and consistency. It's about empowering yourself by eliminating the things that create uncertainty and waste valuable time when you need to step up and get the well-crafted shots that are expected.

Have you ever been amazed by a friend's ability (or even your own) to get great pictures with a simple camera phone? Have you been surprised to discover that one of the photographers you admire uses only one lens, or one type of film, or a single light setup that rarely varies? All of these are examples of success via simplicity and consistency. With fewer options you are forced to simply work with what you have. And human nature drives the incremental improvement over a process that uses simple, relatively unchanging tools. Mastery is an eventual outcome.

To put it another way, it's easier to become really great at your photography when you keep it simple. While I'm not proposing you do all of your work with a iPhone from now on, I am suggesting you commit to a methodology that involves creating just TWO default starting points that you will use for virtually ALL of the situations you'll encounter.

The following are examples of how you might do this. You'll see that the main idea is to bring the number of settings you have to think about to a minimum. Where ON-CAMERA flash is concerned, I want you to virtually reduce your camera and flash to one simple tool. You'll have only one or two controls to adjust, while still giving you the option of full creative control of your exposures. This works, so let's put it to use.

Default Flash Settings

Your flash unit is a powerful and dependable source of light. Use it however it will work, on or off the hot shoe of your camera. The only thing that matters is that you get the results you want. If you have little time, little space, or just don't feel like carrying around extra gear, keep your flash unit attached to your camera and make some great pictures that way.

We'll assume, for the purposes of the following examples, that your flash will remain on your camera and that you'll have your camera set to an overall metering mode using TTL for automatic flash exposure. So, let's run through the gear and settings for both indoor and outdoor flash pho-tography:

Indoors

Here are my suggestions for getting great results when using flash indoors.

Always Start with these Settings:

- Camera in Manual mode

- Use the highest ISO possible that will result in acceptable noise for your purposes. Example: ISO 800

- Use the fastest normal sync speed (x-sync) for your flash. Possibly 1/200 or 1/250 depending on your camera.

- Use the widest aperture that your lens will allow while still delivering acceptable sharpness. Example: f/4.0.

Adjustment Controls To Use

Flash Exposure Compensation (FEC) and shutter speed should be the main controls for adjustments for indoor on-camera, TTL-enabled flash.

- **FEC.** If you need more, or less, power from your flash.

- **Shutter Speed.** If you want more, or less, ambient light to show in a scene.

Putting It To Use

When using flash indoors, use your camera's Manual mode. You probably do not want to use Aperture Priority mode because if you do, the camera will dictate shutter speed based on its assessment of the ambient light, causing long shutter speeds resulting in blurring and sometimes unwanted ambient light effects.

In practice, you'll be all set with your indoor default settings when you walk into a room, ready to go. If you take a couple of shots and notice you'd like to have a little more warmth or ambient light appear in the photos, just slip your shutter speed dial down to 1/60. Want more? Try 1/40 or 1/15. Just ride your shutter speed dial to get the ambient lighting to look the way you want it to. Just remember that as the speeds get slower, the potential for noticeable blur increases. Depending on the look you're going for, some creative blur can really work for you, too! But, it's all up to you and that one little shutter speed dial. There's a lot of power there.

If you need to make any adjustments to the amount of light you're getting from the flash, that's when you use FEC. You won't need it often, but if your subject is wearing light colors, you might have to dial the FEC up a bit, otherwise your camera might underexpose the shot. If your subject is wearing dark colors, you might have to dial down the FEC to compensate if your camera is overexposing the shot. Your camera controls the flash output based on what it thinks the best exposure is, so sometimes you have to force it to accept more or less light from your flash to get things to look right.

That's it for indoor shooting. Shutter speed and sometimes FEC.

Outdoors

Indoors, your flash is usually the predominant light where your subject is concerned. But, when shooting outdoors during daylight hours, your flash usually serves as a fill light. Here are my suggestions for how to approach outdoor flash photography.

Always Start with these Settings:

- Camera in Aperture Priority mode.

- Use a lower ISO setting. Example: ISO 100.

- Use normal sync speed for your flash if possible. Example: 1/200 or 1/250 depending on your camera. But have High-Speed Sync (HSS) ready.

- Use the widest aperture that your lens will provide while still delivering acceptable sharpness and being suitable for daylight. Example: f/5.6 or f/8.0.

Adjustment Controls To Use

Flash Exposure Compensation (FEC, with TTL-enabled flash) and Exposure Compensation (EC) should be the main controls for adjustments. Adjust aperture for changes to DOF.

- **FEC.** If you need more, or less, power from your flash.

- **EC.** If you want more, or less, ambient/background light to show in a scene.

- **Aperture.** If you want to change depth of field.

Putting It To Use

You should realize that in Aperture Priority mode, by adjusting EC what you are actually doing is overriding the camera's shutter speed selection. If you were shooting in Manual mode, you'd simply adjust shutter speed directly for the same effect. And, in Manual mode, you'd have a much wider range of control. The EC offers a limited number of stops over or under normal exposure. The trade-off is that Manual mode often requires more thinking and attention to your gear outdoors than does Aperture Priority. So, that's why Aperture Priority is the right choice for outdoors when speed and simplicity are desired.

With your default settings in place, there are just two controls to think about now: EC and FEC. EC dialed down -1 stop or more will give you deeper sky colors and darker backgrounds. This is a starting point, but by no means do you have to keep it there. EC is your tool for easily adjusting overall exposure. Dial it down for darker, dial it up for brighter. Simple.

FEC dialed down -2/3 of a stop or so keeps it from looking too "flashy" on your subject. Again, this is only a suggestion. You'll have to do some testing to determine what you like best as a starting point. Realize that FEC serves to make your flash more of a fill light as you dial it down and more of a main light as you increase flash output.

That's pretty much it. Unless you want to adjust the aperture, too.

Aperture adjustments are good for changing DOF, without affecting the flash exposure on your subject (because with TTL, flash output will automatically adjust itself). The more you close down your aperture, however, the harder your flash will have to work, possibly not being able to put out enough power at smaller apertures. But, you can always make up for that by bumping up your ISO.

Now, various factors might cause your shutter speed to increase past 1/250 sec. (e.g., higher ISOs, wider apertures, brighter ambient light scenes). This will cause your flash's high speed sync (HSS) mode to kick in, if you have it set to automatically do so. That's fine. That's why it's there. When this happens, your flash has to work in such a way that it may not produce enough light to meet the needs of your shot. One solution for this is to move in closer to your subject. Take test shots to make sure things are looking right.

Note: Outdoor flash photography at night can essentially be approached the same as indoor flash photography. Just set your camera to Manual mode and use FEC for flash control and shutter speed for ambient light exposure. In other words, use indoor settings.

Making Standardization Work For You

The examples above may be good starting points for you, but I suggest you test them out for yourself. See if you can find better settings for your camera and flash combination. **Once you find something that works, write it down and stick with it!** Learn to do good work without altering your default settings. Use EC, shutter speed, and FEC and stick to just one or two lenses. I believe maintaining simplicity and consistency will work well for you. You should be able to rely on the standardized settings you have determined work best for your gear and shooting style.

Standardization takes the guesswork out of the equation so you won't have to doubt yourself or spend time considering what the best settings are for a given situation; you'll already have something that you KNOW will work. Then just use FEC and EC/shutter speed as needed!

Off-Camera Flash

Standardization can also work for you when you move your flash away from the camera position, whether in TTL or as manual flash. When using manual flash, just create a separate set of standardized settings for your go-to lighting setups. This is what I do; I keep it so simple that I really don't have to think much about it when I'm on assignment. I know what my settings are going to be on my camera and flash, and I know where I like to place my lights (see Figure 12). Easy!

Figure 12. This head shot was easy work with my standardized setup. This allowed me to focus on the posing.

MANUAL CAMERA & FLASH

We've already discussed how using your camera in Manual mode indoors can give you a great amount of control when it comes to capturing ambient light. I think it's fair to say that full manual control of aperture, shutter speed, and ISO puts the most powerful components of in-camera exposure in your hands. Couple that with intelligent lighting and you're virtually unstoppable!

But if manual control of your camera is so powerful, why are there so many other modes to choose from? Why do even the best professional photographers often shoot in Aperture Priority or other modes? Speed and simplicity is the reason. Camera modes other than Manual allow the photographer to focus his attention on the control(s) most important to them at the time, while letting the camera's metering system call the shots on the other controls to maintain good exposures. For example, in Aperture Priority mode, the photographer can make adjustments to the aperture setting while the camera adjusts the shutter speed automatically. While in Shutter Priority mode, the photographer can select different shutter speeds and let the camera decide the best aperture for proper exposure for each one.

Similarly, if the photographer changes the ISO setting, the metering system will, in Aperture Priority mode, adjust the shutter speed, or in Shutter Priority mode, adjust the aperture accordingly. And as we discussed earlier, there are camera modes that seem to do ALL of the thinking for you. An automatic mode like Program (P), or a fully automatic mode, might control, from shot to shot, DOF (aperture), areas of focus, shutter speed, ISO, flash usage and output, and even the format or quality your images are recorded in. These offer the photographer the least amount of control over the camera, but can be good to use for quick point-and-shoot situations. For the most part, I'd suggest you stay away from the fully automatic modes.

Any modes that maintain the proper balance for good exposures can make life easier for you, while manual control will give you all the rope you need to hang yourself. Because, in Manual mode, any adjustments to aperture, shutter speed, and ISO are on you (in Manual mode, some cameras might automatically select ISO for you. I'd suggest you turn that feature off so you can fully control the ISO adjustments yourself). The camera won't automatically correct your shutter speed to compensate for an aperture adjustment you make, for example. Sure, the camera will give you feedback on your settings via the exposure level indicator, but that's all. You're still free to take all the pictures you want, good exposures or bad.

So, why use manual at all? Simply put, manual camera and flash settings can produce very good, consistent results (see Figure 13). There are several situations where Manual mode is going to be your best choice:

Figure 13. Jennifer's head shot was created with a single shoot-through umbrella setup. Manual everything, 50mm, f/4, 1/250, ISO 100.

Indoor Flash Photography

When using flash indoors, the ambient light tends to be very dim compared to the light your flash emits. If you are NOT in Manual mode, your camera will make its own decisions about how to handle this. Sometimes this will result in acceptable images, and sometimes it won't. Either way, in one of the automatic modes you have little control over the outcome.

If your camera is set to Aperture Priority mode for example, you will have no direct control over your shutter speed. While TTL will give you a proper flash exposure, the camera will make its own shutter speed decisions to try to correctly expose for the ambient light. Sometimes this means the camera will default to its slowest standard flash sync speed (e.g., 1/60), and sometimes it means you'll get shutter speeds that are just too slow to work with.

Without the ability to control your shutter speed, you can end up with blurry images, light streaks, and other effects you might not want. Using Manual mode in this situation, however, gives you full control over how much ambient and/or blur you would like to record. TTL will adjust your flash's output for good exposures of your subject, while you simply ride the shutter speed dial for the ambient, to your liking.

With regard to the above examples, you might be wondering why Shutter Priority mode isn't a good option, since it gives you direct control over the shutter speed. The problem is that Shutter Priority mode gives the camera full control over aperture adjustments, a side-effect you probably don't want. Using your camera in Manual mode when using flash indoors is easy. TTL takes care of flash exposure, leaving you with just the FEC and shutter speed dial to adjust as needed.

Outdoor Flash Photography

As you know, daytime outdoor ambient light is much brighter than the ambient light you'd find indoors. Recording ambient light outdoors during the day doesn't require extremely slow shutter speeds. As a matter of fact, the ambient light usually provides enough illumination for your subject that you can do without flash entirely. Outdoors, your flash is often regulated to the role of "fill light" or "fill flash" rather than main light.

Outdoors, it's often easiest to set the camera to Aperture Priority mode to take advantage of the camera's automatic shutter speed adjustments. Here, as with indoors, your flash exposures will generally take care of themselves with TTL. Your camera will likely balance out the ambient light nicely. The light is bright enough outdoors so properly exposing for ambient won't mean slow shutter speeds; you don't have to worry about blur or light streaks as you would indoors. If your particular camera system allows it, you can even adjust ambient exposure with the EC dial while maintaining the same flash exposure on your subject.

If you would like full control over your outdoor exposures, Manual mode is the best choice when you have time to mange adjustments, or your lighting and other conditions are sufficiently constant and static. Since your camera isn't managing exposure for you in Manual mode, you have to keep an eye on exposure variables at all times, so watch the exposure level indicator. Doing so is harder when things are moving quickly.

For outdoor work, Manual mode is a good choice for low-light, or nighttime situations. In these cases, you're essentially dealing with the same issues as with indoor photography. You can

handle them the same way. Let the flash (now your main light) do its job, while you adjust shutter speed for the ambient light as you see fit, and FEC if necessary. Also, there may be times when you'd like to go for a special effect like overpowering the sunlight with flash, or blowing out the background light around your subject, etc. Manual mode on your camera may be the best choice in these situations, as might manual flash control.

Manual Flash

Switching your camera to Manual mode allows you to fully control aperture, shutter speed, and ISO settings independently of each other. But, your flash and camera are smart enough to work together to allow you to control these components, while keeping the flash exposure of your subject on target with TTL. What happens when you go the final step, and put your flash under manual control along with your camera?

Manual flash power settings simply allow you to set your flash output power from lowest to highest in varying increments. As with your exposure controls, these increments indicate either halving or doubling of the light involved. Power settings range from 1/1 (full power) down to 1/64 or 1/128 power with most flash units. This is useful when your flash is used on a light stand or when multiple lights are used (so you can manually setup lighting ratios).

For editorial and portraiture work (see Figure 14), where time allows, I will often use a one- or two-light setup with everything set to manual. However, I've standardized my camera settings, manual flash unit settings, and light-to-subject distances so there is little guesswork involved. Just a few small adjustments here and there as I fine-tune the settings based off some test shots. Do the same and you can make short work of most portrait jobs.

Figure 14. Justin's head shot taken with my typical two-light setup using my standardized manual settings.