Photography 101

This is a basic primer on the key elements of photography, including exposure, metering, depth of field, composition, dynamic range, color balancing, etc. In general, these principles apply to both film and digital photography, though there are some differences that will be noted throughout this text. The article also touches on some 'not so elemental' aspects of photography, which can help you to obtain better images.

Exposure

Most digicams (consumer level digital cameras) today are of the "automatic" type, which set both *aperture* and the *shutter speed* automatically, to give the proper exposure (we hope). Some digicams, and nearly all higher end cameras, allow you to control the aperture and shutter speed manually, or with various *presets*. These controls give photographers greater control over the outcome of their image.

Whether your camera has manual or automatic controls, there is usually an 'ideal' exposure for a given scene. It is the *combination* of shutter speed and aperture that controls how much light enters the lens and strikes the film or sensor in the camera. For example, on a sunny day, with your subject being lit frontally by the sun, you (or your automatic camera) might select a shutter speed of 1/250 of a second and an aperture (lens opening) of f8. So, the lens is set to a specific sized opening for a period of time, which allows the *ideal* amount of light for a good exposure. More light will result in over exposure, and less light will result in under exposure. (Of course, sometimes, we may purposely choose to over or under expose for a desired effect, such as a silhouette, or to brighten an image. More on that later.)

Aperture

Let's begin by exploring and understanding what the 'aperture' is and how it affects the images. Every camera has a lens, and this lens (whether fixed or interchangeable) has maximum *and* minimum sized openings, called an *aperture*. The design of the lens dictates the maximum opening (aperture or f-stop) of the lens. For illustration, I will use a "standard" 50mm lens for a 35mm camera. It will typically have different apertures (also called f-stops) as follows:

f1.4 f2 f2.8 f4 f5.6 f8
f11 f16 f22

It seems counterintuitive at first, but the smaller the number, the larger the lens opening. Look at the above chart, and it will seem that the numbers are quite arbitrary at first. But, if you select every other number, starting with f1.4, you will see that they double (okay, f5.6 rounds off to f11). So, the sequence is f1.4, f2.8, f5.6, f11, f22. Each one doubles. Same with the sequence starting with f2 (skipping every other number)…f2, f4, f8, f16. I only mention this, so you will have a way of easily remembering the complete sequence. Just remember f5.6 and f8, and you will have a way to recreate the entire sequence.

The important thing is this……each number in the sequence represents either double or half the amount of light, depending on which direction you are going. For example, changing your lens opening from f5.6 to f8 (the next smaller aperture in the sequence) allows only ½ the light to enter the lens. Going from f8 to f5.6 doubles the light, since we are going from a smaller aperture to the next larger one. If you go from f8 to f4, you are quadrupling the light, (doubling the light from f8 to f5.6, then

doubling it again from f5.6 to f4). So, each f-stop represents a doubling or halving of the light entering the camera.

Not all lenses have the same sensitivity to light. We have all seen those monstrous lenses (they look like bazookas) that sports photographers use at football games. Depending on the design and magnification of the lens, some allow less light into the camera, which is a liability in "low light" situations. To help overcome this, they make the lenses longer and wider, which helps allow in more light, but it also drives up cost and weight significantly.

Some lenses have a maximum opening of f1.4 (great for low light photography), but others are limited to a maximum open of f2, f2.8, f4 or even f5.6. A lens with a maximum open of f5.6 will be fine for ample lighting situations, but will require a tripod or supplementary light source for lower light situations.

Shutter Speed

Aperture is only half the equation. The other half is shutter speed, or how long you leave the aperture open. Conveniently, shutter speeds are set up so they ALSO double or halve the time that the camera *'shutter'* remains open (ie, allowing light to enter and strike the film/sensor). Shutter speeds are also standardized, as follows:

30s, 15s, 8s, 4s, 2s, 1s, 1/2s, 1/4s, 1/8s, 1/15s, 1/30s, 1/60s, 1/125s, 1/250s, 1/500s, 1/1000s, etc.

Moving from one shutter speed to the next in the sequence represents a doubling or halving of the time the shutter is open. Some cameras have shutter speeds that are shorter (faster) than 1/1000s, which is great for "freezing" high speed trains, sports, water falls, etc. Some cameras do not have the super long shutter speeds for low light photography, but they all have the speeds in the middle of the sequence.

For normal, "hand-held" photographs, you typically want to use a shutter speed no slower than 1/60 of a second. Speeds of 1/30s, 1/15s, 1/8s or slower, can result in fuzzy photographs due to camera movement. Many of the new cameras are introducing a built in anti-camera-shake, or image stabilization feature that helps hold the camera more steady, allowing you to use one or two shutter speeds slower than normal, without losing sharpness.

As a comparison, if you have ever focused powerful binoculars on a distant subject, you know that just a little movement makes it hard to focus, since distance is amplified. The same effect is operating with long, telephoto lenses when you are zoomed in close. So for sharp photos it is often good to use a higher (faster) shutter speed when zoomed in to avoid camera blur. A good *general rule of thumb* is to use a minimum shutter speed that is the reciprocal of the lens focal length. For example, with a 50mm lens, use a shutter speed of 1/50s or faster. With a 200mm lens (telephoto) use a shutter speed of about 1/200s or faster, etc.

Of course, sometimes you WANT to use a slow shutter speed to introduce movement into a photo. An example would be when taking a picture of a waterfall, using a shutter speed of 1/2s or 1s to keep the rocks in sharp focus, but to show movement of the water (camera mounted on a tripod, of course). Or, you might want to show movement of a motorcycle screaming by in a race, in which case you could use 1/15s (very slow for a race), and panning (ie, moving the camera with the cyclist). This would keep the cyclist relatively sharp, while blurring the background.

Metering for "Correct" Exposure

First, let's understand that *correct* exposure depends on the intent of the photographer. In general, it means rendering the most important subjects of a photograph so they are neither over nor under exposed. People with *blown out* white faces or dark underexposed faces are usually not the desired intent. But…if your intent is to show a silhouette of a couple walking along the beach, then you actually WANT the couple to be underexposed. So, intent has a lot to do with "correct" exposure. Generally speaking, though, we want the main subject to be properly lit and exposed so tones are rendered as we *normally* see them.

No matter how expensive or sophisticated a camera may be, whether manual or auto, all those fancy *metering modes* are designed to simply set the shutter speed and aperture combination to give you the right exposure. PERIOD. Cameras have built in *light meters* to accomplish this task. You've probably seen controls on cameras, such as Manual, Aperture Priority, Shutter Priority, Portrait, Sports Mode, Landscape, Macro, etc. Those are merely "presets" that try to enforce rules to give you decent results in specific situations. For example, Sports Mode, would generally force the computer in the camera to select a high (fast) shutter speed for 'stop action' shots, assuming you want that (which you may or may not).

Light meters are dumb, and do basically one thing. They look at overall light intensity, then……*and this is important*……THEY AVERAGE THE OVERALL READING TO GIVE YOU MIDDLE GRAY.

Let's take an average landscape scene as an example. Let's say it's about 3:00pm at Gabrella Manor, and the sun is bright and in the southwest, striking the tower and staircase in the courtyard with good, even light. If we point and shoot at this scene in automatic mode, we are likely to get a good exposure. Why? First, the scene is evenly lit. Second, the scene includes dark green vines on the walls, black railings, some deep shadows, light walls, blue sky, and lots of medium tones (neither super bright nor super dark). All these objects reflect light, with the bright sky and light walls reflecting a LOT of light, and the dark green leaves, black railings and dark shadows reflecting very LITTLE light. But, being an average well lit scene, the combination of light and dark objects averages out to what we call "middle gray" (ignoring color for the moment). So, the meter passes this reading to the camera's computer, which sets shutter speed and aperture to give an exposure that averages out to be middle gray, which is a good exposure for this particular scene.

But, let's take the classic screw-up shot. You are taking a picture of the bride and groom, and to keep them from squinting into the sun, you place their backs to the sun, and you are shooting into the sun instead. First, you position yourself so you don't have the sun striking the lens directly (which causes lens flare, which we *usually* try to avoid). Now your camera meter reads the scene, but the tremendous amount of light from the bright sky and the sun flooding into the lens fools the meter and tells it the scene is OVERLY bright. Since it is just a dumb meter, it instructs you (or the camera automatically) to let in less light and you snap the shot. Then, to your dismay, the photo shows their faces very dark and underexposed. What's a poor meter to do? It saw bright light and wanted middle gray, so it reduced the amount of light for this exposure to provide a middle gray result.

Since we now know how a meter operates, we can outsmart it and use it to get a good exposure. If we had walked up close to the

couple, and taken a meter reading of JUST their faces (not allowing the bright sun and sky to skew the reading), we would have obtained a good exposure if we used that reading. Of course, the background would now be super bright, since we allowed a lot more light into the camera, but the faces (the most important part of this photo) would be properly exposed.

Another solution (which I used a lot at the wedding) would be to add light and *fill in* the shadows with a flash. This allowed me to get a good exposure of the background, but throw some additional light into the faces, which were previously in shadow.

Most of the fancy modes and features camera manufacturers have added are *attempts* to identify these non-optimal situations and give you a good (if not perfect) exposure. With the addition of on board computer chips, cameras have become very sophisticated and can be programmed to "solve" situations, such as the above backlit example of the bride and groom. The camera's computer looks for various "patterns" that anticipate back-lit or other challenging lighting situations, then adjusts to compensate. Those situations that are "properly" diagnosed by the computer can result in better exposures. As good as they are, however, computers cannot do what humans can do, and they sometimes misdiagnose a situation. As fancy and as sophisticated as they are, ALL they do is help you set shutter speed and aperture.

Built-in light meters, as mentioned earlier, generally try to set the exposure to give a scene that has the right amount of light so it averages middle gray 'overall'. A metering mode that gives equal weight to all portions of a scene is said to use "average weighting". Camera manufacturers have refined their metering systems in an attempt to get better exposures. Some meters are "center weighted", giving more weight to those objects in the center of the scene and downplaying the readings towards the edges (which would help somewhat with back-lit portraits, if your subjects occupy the center of the viewfinder). Other metering modes concentrate on a center spot and totally ignore anything outside this spot (called Spot Reading mode). There are other modes as well. More cameras have automatic sensors that read light in different parts of the scene and then try to anticipate what type of lighting situation you are facing. But none of them are foolproof. My camera gives me a choice of 4 or 5 metering modes, which are user selectable.

To better understand how meters work, let's take two extreme examples. If you point your camera at a solid black wall, the meter will see very little light reflected back. Since it is programmed to give you the right amount of light for an average "gray" scene, it will instruct the camera to let in more light, resulting in a gray wall instead of a black one. This would not be a great exposure, but it isn't a disaster either. But now, let's add a small, white cat in front of this black wall. The white cat, being small, has a minimal affect on the meter reading, so your camera will let in more light that you want. Your white cat will be terribly over exposed and will end up being a blown out, white blob with no detail.

At the other end of the spectrum, let's point our camera at a bright, white wall. The meter sees a very bright object with a lot of reflected light, and since it is programmed to give middle gray, it will instruct the camera to let in *less* light so the wall we be gray instead of white. This is under exposure. If we now add a small, black cat in front of this white wall, the under exposure would render the cat as a black blob without any

detail. Just remember the meter expects to see an average middle gray scene every time, then adjusts the camera controls to give us that middle gray. For the average scene, that works fine, but it is usually a disaster with a black cat and a white wall, a white cat and a black wall, a back-lit portrait or other situations.

There are solutions, but they all involve understanding f-stops, shutter speeds, meters, and how to work with them.

Here is a simple solution to the white cat against the black wall. I will assume the white cat is the most important part of the picture. Take a meter reading on the white cat ONLY. If we used this meter reading, we'd end up with a gray cat, but we want a white one, so we need to admit more light. We could do this by opening up the lens f-stop two clicks (which would quadruple the light), or we could use a slower shutter speed (say 1/60s instead of 1/250s), again quadrupling the light.

With the black cat against the white wall, we would take a meter reading on the black cat ONLY. If we used this exposure, we'd have a gray cat, not a black one, so we need to reduce the amount of light. We could do this by using a smaller f-stop, say two f-stops smaller, or by using a higher shutter speed, say 1/250s instead of 1/60s. Both would give you $1/4^{th}$ the amount of light so the black cat is black, not gray.

If you had a gray cat against either a white OR black wall, take a meter reading on the gray cat ONLY, and then use that reading for your photo, since you WANT the gray cat to remain gray. In all these examples, I am ignoring color, and using the term gray exclusively as a term to refer to a brightness level midway between the extremes of black and white.

Dynamic Range

The human visual system can see a full range of colors, extreme brightness and darkness, and everything in between. When we look at a scene, we do NOT see as a camera sees. Our vision is not a "single snap shot", but a continuous scanning process. When we look at a bright object, our pupil (aperture) gets smaller. When we look at dark objects, the pupil opens up to let in more light so we can see the dark object and differentiate detail. In fact, when we look at a bunch of green leaves, our visual system does its best to accentuate differences between shades of green and actually "pumps up" saturation and contrast. All this happens so fast, we aren't even aware of it. It is automatic.

Unfortunately, the camera takes a single snap shot to capture the entire scene. What's even worse is that the camera cannot record the same brightness range (from dark to light, also called *dynamic range*) as human vision. In fact, the camera cannot capture all the colors that lie within the range of human vision, so we lose some color as well. Part of this is the fact that human vision is continually scanning a scene and looking at each component individually, but part is inherent in the film, sensors, monitors, papers and inks used in photography. It's just a fact of life and one the photographer must come to grips with.

We have all photographed gorgeous landscapes only to find afterward that our gorgeous blue sky ends up white, or the foliage ends up a muddy, detail-less greenish brown. That is *dynamic range* rearing its ugly head.

We can discuss this in terms of f-stops, now that we have an understanding of them. The typical digital camera has a range of about 5 to 6 f-stops. What, exactly, does this mean?

Well, remember that when you open up your lens 1 f-stop, it doubles the amount of light. Opening 2 f-stops doubles it again (so opening two f-stops effectively quadruples the light). Opening up your lens 6 f-stops means we will have 64 times the light we had previously.

Essentially, a digital or film camera can typically capture a contrast ratio of about 6 f-stops, or a brightness range of 64:1. (Color negative film can usually capture a range of about 7 f-stops, slide film is closer to about 5 f-stops, and B&W negative film can capture about 9 f-stops). We will use a 6 f-stop range (ie, 64:1 contrast ratio) for our discussion, especially since digital is the norm these days.

On a bright day, the *actual* contrast range (from brightest to darkest) might be 100:1, 250:1, 500:1, or even higher. Our eyes adjust to this super bright dynamic range automatically as we scan, but cameras cannot even come close to capturing such a wide brightness level. The film (or digital sensor) has a very limited range of about 64:1. So, anything in the scene that exceeds that range will turn to pure white, pure black, or both.

When you try to capture that gorgeous landscape, if you meter on the trees and dark objects, your bright sky may end up being brighter than the sensor/film can capture, so it "blows out" to pure white. If you meter on the sky, the dark foliage and/or the deep shadows will end up becoming dark or black. If you split the difference, some of the sky will turn white and some of the foreground will go black (if the scene exceeds a dynamic range of 64:1, or about 6 f-stops).

So, what can be done? Depending on the scene, and what is desired, quite a bit. Do you remember the "fill-in flash" we used to thrown some extra light in the faces of the bride and groom when they were back-lit by the sun and their faces were in shadow? That fill-in flash was designed to add light to the shadows, which in effect, reduces the dynamic range so the film/sensor is capable of recording it. We can do the same in *some* landscape scenes by adding flash, using a large white reflector to add light, etc.

Or, we can use what they call a "*split* neutral density filter" to reduce the brightness of the sky so it doesn't "blow out". A split neutral density filter screws onto the front of the camera lens, and the upper half of the filter is tinted gray to reduce the amount of light entering the camera lens from the sky only. Again, this reduces the ratio of brightness to darkness (ie, dynamic range) so the camera is capable of capturing it.

Some scenes just don't lend themselves to fill flash, reflectors or split neutral density filters. In these cases, we have a few choices. 1) We can decide which is the most important part of the scene, and allow the less important parts turn black and/or white. 2) Recognize that we have exceeded the dynamic range of the camera and choose to *exclude elements* of the photo which push us beyond the limits of our film or sensor. 3) Pick an overcast day, which normally reduces the contrast ratio and lowers the dynamic range. 4) Take 2 or 3 different exposures of the same exact image (using a tripod) and then blend them together in a photo editing program, such as Photoshop, or with a dedicated HDR (high dynamic range) application or plug-in. By taking multiple exposures of the same image, you can preserve shadow detail in one exposure, highlight detail and midtone detail in additional exposures, then combine them, but at the cost of some extra work and finesse.

We can also do things during image editing to "recover" some lost dynamic range (assuming a single exposure), but only within certain limits. Our ultimate goal is to fit the dynamic range of our scene into the dynamic range of our digital camera, final print or monitor, while still capturing the essence and feeling of the photograph.

Depth of Field (or range of focus)

Depth of field is an optics term which refers to the portion of a scene which *appears* sharp in the image. This is where f-stop (aperture) has a big impact on the final image. A photo taken with an aperture of f16 will usually have a different appearance from the same photo taken with an f-stop of f2.

If you are photographing a close up of a flower and want that flower to stand out, you can throw the background out of focus by selecting a large aperture, such as f2. The range of apparent focus will be very narrow, and if you accurately focus on the flower itself, it will appear sharp, while the background will become a blur. The further objects are from the plane of focus, either in front or behind, the blurrier they will appear.

On the other hand, if you take a landscape photo and you want the entire photo to be very sharp, you would use a smaller aperture, such as f16. While near and far objects will still be less sharp than the object you are focused upon, the effect is minimized by the use of a small aperture.

So, in general, a wide aperture (f1.4, f2, f2.8, etc) will give a very narrow DOF, with a sharp subject of focus, but rapid blurring as objects get farther from the point of focus. A small aperture (f11, f16, f22) will give a very wide DOF and objects will tend to be more focused even though they are different distances from the camera.

It is not entirely the f-stop that determines depth of field, but also the lens, as well as the *lens to subject distance*. Wide angle lenses have a greater depth of field than do telephoto lenses. And DOF diminishes the closer the camera is to the main subject.

So, depending on the result you want in your photo, you can often use different combinations. For example, let's assume a scene is properly exposed at 1/250s and f8. If you want everything to be sharp, you might choose to use 1/30s and f22 and a wide angle lens. A tripod is also a good idea for maximum sharpness, especially at slower shutter speeds. This is the same exact amount of light, since you are closing the lens 3 f-stops (ie, 1/8 the amount of light), but you are also using 1/30s instead of 1/250s (which means your shutter will be open 8X as long). So, the amount of light is the same, giving the same exact exposure, but the shot taken at f22 will give greater sharpness overall.

If you wanted to accentuate an object in the foreground and throw the background out of focus, you might choose instead to use 1/1000s at f4, which again is the same exact amount of light, but now we have a narrow DOF. The flower in the foreground will be sharply focused, but the background flowers will be out of focus. Same amount of light, but a very different result. What you choose depends on what you want to portray. In this case, where DOF is important, you will give *priority* to the aperture and let the shutter speed become secondary. Many cameras have a landscape mode or an *aperture priority* setting, which reflects this bias.

In sports photography, you may decide that the shutter speed is more important than the aperture, especially if you want to stop the action, or if you want a blur effect. So, you

will give priority to the shutter speed and let the aperture be secondary. Many cameras have a sports mode or a shutter speed priority setting, which reflects this bias.

Lens Focal Length

Most digicams come equipped with a *zoom* lens, which is permanently affixed to the camera and is not interchangeable. These lenses are very convenient and enable the user to zoom in and out, from wide angle to telephoto.

Most SLRs (single lens reflex cameras) enable the user to change lenses, though some have lenses that are permanently affixed to the camera.

Wide angle lenses, as the name implies, capture an image covering a wide angle of view. *Telephoto* lenses, on the other hand, magnify the image (similar to binoculars) and capture a very narrow angle of view. *Normal* lenses deliver an image that comes close to delivering the angle of view and perspective seen by a human observer.

The optics term used to describe this behavior is *focal length*.

Since it is fairly universally understood, I will relate focal length to a standard 35mm film camera. On a 35mm camera, a 50mm focal length lens is considered *normal*, meaning it provides the viewer with a normal angle of view and an undistorted perspective of the scene. A 24mm focal length lens would be considered a wide angle lens and a 200mm focal length lens would be a telephoto lens. A lens that has a *fixed focal length* cannot zoom, so it can capture ONLY wide angle, telephoto or normal perspective images, depending on its focal length. A lens that can capture a *range* of focal lengths, (e.g., a 28-105mm lens), is able to zoom to different focal lengths, and is therefore called a zoom lens.

Fixed focal length lenses (ie, non zoom varieties) are almost always sharper than zoom lenses. They have fewer optical components, which are optimized for a specific focal length, which makes them lighter, sharper, and usually faster (i.e., they have larger apertures than a zoom lens). Of course, they are less convenient than zoom lenses, since you must change the lens if you want a different focal length. Zoom lenses provide a quick means of zooming in or out, but they are often heavier, a little less sharp, and slower (the largest aperture is usually smaller, so they are not as good for low light situations).

The chart below provides the field of view for a range of fixed focal lengths. For 35mm photography, a 50mm or 55mm lens is considered “normal”.

Focal Length	View Angle (degrees)
15mm	142^o
24mm	85^o
28mm	65^o
35mm	54^o
50mm	40^o
100mm	24^o
200mm	12^o
300mm	8^o
400mm	6^o
500mm	5^o

The size of the film (or sensor) dictates what is considered “normal”. For example, a medium format camera uses 2-1/4 inch film, and the “normal” lens for this camera is about 80mm. Most digital SLR cameras have a sensor that is smaller than 35mm film, and their “normal” lens is typically has a focal length of around 35mm. Compact point & shoot digital cameras have a much smaller “normal” lens.

You might think that photographing your subject up close with a wide angle lens would give you the same result as photographing it from a distance with a telephoto lens. Fortunately, this is not true, which I will explain.

As mentioned, a *normal* lens provides a relatively *normal* perspective, as if seen by the unaided eye. Objects photographed with a normal lens will appear to be spaced normally, size relationships will be preserved, etc.

A wide angle lens distorts the scene in a few interesting ways, which opens up many creative opportunities. A wide angle lens makes objects appear to have greater space between them. Objects close to the lens appear very large, and objects in the distance appear to be much smaller than normal. Perspective with a wide angle also causes lines to converge much more than with a normal lens. If you were to photograph a tall building, looking upward, the lines would converge rapidly and give a very distorted effect. We previously discussed how wide angle lenses have greater DOF (depth of field). The wider the angle of the lens, (ie, the smaller the focal length), the greater the effect.

A telephoto does exactly the opposite on all counts. A telephoto lens makes objects appear to have *less* space between them and can make objects appear "bunched up". Near and far objects tend to appear to be closer in size, much more than when viewed normally. Perspective with a telephoto lens also causes lines to converge much *less* than with a normal lens. If you were to photograph a tall building, looking upward, the lines would converge very gradually, much less than with a normal lens. We previously discussed how telephoto lenses have less DOF (depth of field). The "longer" or more powerful the telephoto lens, (ie, the larger the focal length), the greater the effect.

This is the real message of this section. You can select a focal length (whether using a fixed focal length lens or a zoom lens) to creative effect. Yes, sometimes you just want a wide angle or telephoto so you can get the shot, but you can also do very creative things by varying focal length.

ISO Speed

Film cameras have always allowed us to use different types of film with differing characteristics. One of those characteristics is "film speed", or its sensitivity to light. The International Standards Organization (ISO) has created standards establishing this sensitivity. ISO 100 film provides great color saturation and detail, and is a fantastic choice for daylight photography where we have plenty of light. For lower light situations, we might choose ISO 400 speed film, which is more sensitive, but gives up a little bit of detail and sharpness, and is a little grainier.

Digital cameras have retained this capability. Most higher end digital cameras allow the user to select ISO speeds of 100, 200, 400, 800, 1600, and some go higher and lower by factors of 2X. Like apertures (f-stops), each speed doubles or halves the sensitivity to light. So, a setting of ISO 200 is twice as sensitive to light as ISO 100, and thus requires half as much light for a proper exposure.

Digital cameras don't use film, so they achieve this magic by using circuitry that "amplifies" the signal. The big plus is that you can do this on an image by image basis, without having to change film. But, as you increase the ISO speed, you introduce color

and luminance noise (the digital equivalent to film grain) into the image, just as you do with film.

May consumer level digicams set not only the aperture and shutter speed, but also select the ISO speed automatically, depending on the lighting conditions. This can be good and bad. The good part is that you often get decent exposures, even in lower lighting situations. The bad part is that you may get a grainy, noisy image, since it is sometimes done automatically without your knowledge. Different *camera modes* (landscape, sports, portrait, etc) do different things, and you usually need to read the user's manual to see what features are invoked with each mode. Higher end cameras can usually do this too, which is typical of "Program Mode", but these features can usually be turned on and off via the camera menu.

When you are faced with a low light situation, you will typically want to increase the ISO speed of your camera to 400 or possibly higher. This will enable you to get some shots you would otherwise miss, but quality can suffer at higher ISO speeds (this varies by camera). Of course, you can still use a lower ISO speed, such as ISO 100, in low light situations if you use supplementary light, such as flash, reflectors, or hot bulbs.

Whenever possible, I try to use ISO 100 and ISO 200 speeds for the highest quality. But, in very low light situations, where I don't want to use flash, I will increase the ISO sensitivity to 800 or even higher. It pays to experiment with you camera to see where the quality becomes unacceptable. Again, rules are meant to be broken, and you may actually wish to obtain a noisy, grainy effect for artistic purposes in some images. But, normally, we strive to maintain quality.

White Balance and Color Temperature

OK…..Lou's lost it now (no surprise there). Isn't white……just, well…..white? In a word…No. The human visual system is incredible, elegant…..and complex. It has adapted over eons so that we can see well in incredibly bright or dark settings, at different times of day, and still see things in "*normalized*" light. I'll explain.

What we call daylight is a constantly moving target. The color of light at sunrise, at noon, at 3:00pm and at dusk is different. The color of light varies with the amount of cloud cover, the amount of atmosphere through which it travels, and even depending on the amount of pollution and moisture in the air. Even altitude affects the "color" of light. If you place a pure white sheet piece of cardboard in the sun at noon, it appears, as expected…white. On a cloudy day, it appears white. At dusk, it also appears white. It even appears white during your candle-lit dinners or under your incandescent or fluorescent bulb.

This is very interesting, because each of these light sources is totally different spectrally, and each measures a different color of "white" or what we call *"color temperature"*. The human visual system is very sophisticated and the brain senses what is "supposed" to be white, then color corrects everything before you *see* the image in your mind. Wow! That makes Photoshop seem pretty wimpy in comparison.

Let's try to understand enough to help us take better photographs. When you photograph an object, you are not taking a picture of the object itself, but of the light reflected from that object (the word photography actually means *writing with photons, or light*). What the brain does (greatly over simplified, of course) is to find

the brightest, lightest object in the scene, then set it to be white. It also looks at the darkest parts of the scene (deep shadows, true blacks, etc) and sets them to be pure black. So, when you see your white cardboard in candle light, (and candle light is very warm, reddish-yellow), the human visual system works its magic and presents a color corrected image when displayed in your mind. Without this brain induced color correction, it would appear extremely reddish yellow. The same card under standard fluorescent lighting would appear a sickly greenish color, and under heavily overcast skies, it would appear a cold bluish color. So, the brain "color corrects on the fly" based on the lighting, the scene and preconceived notions of what certain colors *should* be. Scientists are still trying to understand it all and have a ways to go.

You might be prompted to ask…..if the brain automatically color corrects, then why do I have to worry about it at all? Won't it color correct my image on the monitor and my printed image on paper? The simple answer is, "Yes and No". It will color correct up to a point, but these artificial situations are not a part of hundreds of millions of years of evolution. Here's basically what happens.

Let's say you took a photo under greenish-yellow fluorescent light and just printed it. The brain color corrects to a certain extent. But….when you view that print (as opposed to the actual scene), there are other elements within our eyesight. If the print has a white border, the brain will say, "Hey, I know that border is white……it's paper!". So, it calibrates itself to see the border as white, and your subject's grinning face remains a sickly greenish yellow color. Now, if you move that print from one light source to another, such as daylight to incandescent, the brain will try to force the white border to be white each time, but the faces will continue to look greenish. If there are white elements in the print (which take on the white color of the paper base), the brain will know they are white and the faces will still look green. Even if there are no white borders, you will still have other things lying in your field of vision, and the brain will latch onto them and calibrate itself to them.

To deal with this problem in the old days of film, most film was *balanced* for "daylight", so that it would look correct when photos were taken during "normal" daylight. Of course, photos taken with that film under incandescent lights appeared warm, reddish yellow. And photos taken on heavily overcast days appeared "cold" and blue.

Manufacturers also made a film that was *balanced* for "tungsten" (incandescent bulbs). Professional photographers who used "hot" artificial lights used this film, since it was expecting a light source that was warmer than normal daylight.

So, basically, there two different types of film, but they were only balanced for "normal" daylight, or tungsten. If shooting on an overcast day, a professional photographer would *warm up* the cool daylight by using a color correction filter on the front of the camera lens. They understood color temperature and that lighting varied tremendously from one situation to the next.

Today, with digital cameras, the chips inside camera are designed to *sense* the color of the light source and automatically correct (like the brain does) so white appears accurately white. The problem is that it is far from perfect and can be fooled by the scene. Nearly all digital cameras have what they call automatic white balance (AWB) which does its best to get the color correction right.

They may have other manual white balance settings, such as Daylight, Cloudy, Overcast, Tungsten, Fluorescent, etc. If you are shooting in one of these light sources, (and you don't have competing sources, such as daylight, fluorescent and incandescent all at the same time), then it usually makes sense to set your white balance (WB) to one of these presets. It will usually get you pretty close and often gives better results than using AWB (Automatic White Balance).

If your images regularly look too cool or bluish, that is due to an incorrect white balance. The good news is that digital is much better than film in this regard. You can adjust the WB on an image by image basis, and you can correct the white balance within an editing program, such as Photoshop, Photoshop Elements, or whatever graphics application you use. But, as with exposure, it is best to get it close initially.

One thing to watch out for is "mixed" lighting. If you have daylight, incandescent and fluorescent lighting all contributing to an image, parts of the image may look "normal", parts may have a greenish yellow cast (fluorescent) and parts may have a yellow orange cast (incandescent). This is usually undesirable and can be tough to correct later, but like all rules, is meant to be broken. Just know that different light sources have a different color, and this WILL show up in a photograph that mixes more than one.

Composition

Hundreds of books have been written on composition, so this will merely scratch the surface and give some helpful guidelines. (again, *all* guidelines are meant to be broken.)

First, move in close on portraits. Many amateurs shoot portraits where people are the size of ants in a gigantic frame. Moving in close provides more intimacy and eliminates extraneous details from the image. The same is often true when photographing objects. Try moving in close. Of course, if the background is a critical element of a photo, (like Gabrella Manor is in some of the wedding photos I took), then include it. But, include only those elements that are crucial to your image or statement. Unlike artists, who start with a blank canvas, photographers start with a completed canvas (the scene) and must create compositions by including and excluding picture elements, changing angles, using depth of field, creative exposure, etc.

In general, try to *keep your compositions simple*. Most weak photos have too many objects in them and the subject or statement gets lost. Exclude those elements that do not add to the image or balance of a photo.

Too many amateurs place the object of interest in the dead center of the frame every time. Boring! Experiment with placing the center of interest so it is off center, at an angle, etc. If you are shooting a person in profile, try placing them off center, leaving some space in the direction they are looking. Experiment.

The "Rule of Thirds" is another way of placing objects (search the internet for this term and you will be buried by advice on composition). In nature scenes, don't always place the horizon in the middle of the frame; decide if the sky or the foreground is more important and try moving the horizon to reside approximately 1/3 from the top or bottom of the frame. Like all rules, this should not be followed rigidly. Sometimes dead center is the best composition. Just be open to other possibilities.

Try doing macro photography, getting ultra close to capture the essence of an object or person. Don't be afraid to cut off a portion of a body, the top of someone's head, or to focus on a component of an object, person or architectural detail. Try different angles, looking up, down, etc. Also, it can be very effective to crouch, lie down, etc, when photographing. So many people take all their pictures from eye level, approximately 5 feet off the ground. When photographing kids, try getting down so your camera is at *their* eye level. You'll be amazed.

Photos are two dimensional, and it sometimes provides a greater illusion of 3D if you can include near and/or far objects to frame your subject. For example, leaves of a tree close to you can frame a portrait and provide depth. Shoot through a doorway and include a part of the door frame, etc. Rocks in the foreground can lend depth to a river scene. Cool colors imply distance and warm colors tend to seem closer, (part of our brain programming), so if you want to accentuate depth, position blues/greens into the background and place the warm colors closer to the camera. Landscapes tend to have a greater sense of depth due to "haze" in the atmosphere, which makes distant trees and skies appear lighter, slightly bluer, and even a bit out of focus.

You can add impact to some images if you place someone in light clothing against a dark background, especially if you don't care if the dark background loses detail. The light object will stand out since the dark background provides contrast. Of course, dark objects can be highlighted against light backgrounds too.

Look for angles and elements that have patterns, lines, or shapes that lead to your subject (they can be great subjects all unto themselves). Roads with "S" curves, the hidden surprise around the bend, etc, all add interest. Angles tend to add action and a dynamic quality, whereas, horizontals and verticals generally imply more of a feeling of peace and calm. Use these elements to say what YOU want to say.

Back lighting can be gorgeous, though you have to be careful with your exposures. Backlit leaves of trees on an autumn day can glow and give a gorgeous, luminescent quality. Back lighting behind a person's head can provide a silver lining and an extra sparkle. When taking these types of shots, it is a good idea to "bracket" your exposures. In other words, take 3 or four different exposures, some darker and some lighter. When you get home, delete the losers and hopefully one of them will be capture the essence you were looking for.

Experiment a lot. Try different angles, perspectives, get closer or farther. Include something in the foreground; then eliminate it. Move a step to the left, right, forward or backward, a foot or two up or down. Sometimes moving a few feet in one direction or another can make the difference between a ho-hum picture and a true masterpiece. Take lots of pictures (one of digital's advantages). Have fun!

Don't forget reflections off water, glass, mirrors, windows, sky scrapers, etc. And speaking of water, try taking photographs during or after rain storms. Rain washes foliage and acts almost like a lens to bring out greater saturation and depth. When you get late afternoon sunlight after a rain storm, be prepared for some fantastic photo opportunities.

Quality of Light

As mentioned earlier, photography is essentially *writing with light*. The quality of light has a **huge** impact on the final photo.

What do we mean by "quality" of light? Quality of light is a catch-all phrase which includes the color of light, the spectrum, hardness or softness, direct or indirect, front light or back light, etc.

When photographing the wedding at Gabrella, I needed to use flash, since the light was getting dim, and besides, I needed it to fill in shadows. Using a straight, on-camera flash tends to give that "deer in the headlights" look and is very flat and unflattering. The closer the flash is located to the center of the lens, the worse the effect. It is also responsible for "red-eye", which is nothing more than a reflection of the flash bouncing off the retina of the eye through a wide opened pupil. So, I used a camera mounted flash, but pointed it 90 degrees from the lens orientation, and used a large piece of cardboard at a 45 degree angle as a reflector. This did two things…it softened the light somewhat, and it also moved the light source further from the center of the lens. This gave more flattering light and it also provided a little "modeling" for more form, instead of giving that flat, cut-out look.

This lighting certainly was not optimal, but the need for mobility, speed and portability prevented using other lighting.

You also noticed that I had an umbrella and a flash mounted on a light stand in the bride's dressing area. The flash was aimed into the umbrella, which then reflected a huge, soft light back at the subject. This light is much softer and tends to "wrap around" the subject, which provides more modeling (emphasizing form), less distinct shadows, and is much more flattering. In fact, I used my on-camera flash (bounced off the ceiling) in conjunction with the umbrella to give a much nicer light. I was able to do this when setting up some portraits because my environment was more under my control, I had time, etc. I stopped using the umbrella when I needed to capture candids.

When I am using just an on-camera flash, and have a white ceiling available, I tend to aim my flash angled at the ceiling, instead of aiming it straight at the subject. When no ceiling is available, or if it is painted green, brown, black, etc, you have to use something like the 45 degree angled reflector, which is an improvement, but not ideal.

The usual goal with artificial lighting (whether using flash or hot lights) is to simulate natural daylight, but soft daylight, such as on an overcast day, or in shade. This light is soft and flattering for portraits and avoids harsh shadows. (of course, you now know you will need to set the appropriate white balance and/or color correct for the overly blue colored light from overcast or shade).

A bright, sunny day is often good for landscapes, but can be tough for portraits, since it is very contrasty and harsh. If you must shoot in bright light, you can use simple reflectors (white cardboard works) or fill-in flash to help fill in the shadows and reduce the overall contrast. Just remember that adding flash increases the overall lighting level, so you may need to adjust the exposure. Then again, sometimes, harsh light (especially from the side or back) can give you some striking effects. Sometimes hard, contrasty, direct light is just what the doctor ordered. It depends on the subject and the intended effect.

The angle of the lighting can also make a difference on the final photo. If you want the "ghoul look", simply place harsh lighting below your subject, pointed upward, to bring out your husband's true character!

We've talked mostly about softening *hard, contrasty* lighting so far. But the color of light is another quality we can play with. Photographers often refer to the *"golden hour"* which is the hour or two just before sunset each day. The light is soft, warm and casts long shadows and can be very dramatic. Normally, we correct our white balance so white appears truly white, but like all rules, they are meant to be broken. If you want to elicit a sense of warmth, peace, romance, etc, you can choose to use this late afternoon light to your benefit. You can even choose to make the light appear warmer than it actually is to enhance the effect. People generally prefer "warm" lighting over cool lighting.

As you do more photography, you begin to "see the light" and find ways to use it to your advantage. On bright contrasty days, I look for shade when I want to take portraits. Overcast days are surprisingly good for portraits and even nature photography, since contrast is lower and the light is softer. It is easier to add contrast during editing than it is too remove too much contrast (which exceeds the dynamic range of the film/sensor). Sometimes the quality of light is so exquisite (usually early morning or late afternoon) that you will be compelled to run and find your camera, then find *anything* to photograph. It can be THAT good.

Let's talk about the direction of light for a moment.

Frontal Lighting

When we talk about frontal lighting, the sun (or light source) is behind us and our camera is pointed exactly opposite the sun. This means the front of our subject is fully lit and there are not many (or any) side shadows. This lighting can be rather two dimensional, thus emphasizing shape rather than form, since it casts few shadows. But, colors are generally bright and saturated. While not usually flattering for portraiture, it does have its appeal, and exposure determination is usually easy. On-camera flash, by itself, provides frontal lighting. If you want to emphasize shape and color, frontal lighting is a good choice.

Side Lighting

When a subject is lit from the side, you have side lighting. Your camera is pointed at a 90 degree angle to the direction of the sunlight, so light sweeps across your subject from right to left or vice versa. Side lighting shows surface texture and emphasizes form, so if you want that texture and form to stand out, some degree of side lighting is desirable. Side lighting typically casts long shadows and results in higher contrast situations, and this *harder* light can be softened by using reflectors, fill flash, additional lights, etc. Side lighting tends to emphasize the 3D aspects (form) of an image.

Back Lighting

When light is behind a subject, and you are shooting toward the light source, you have backlighting. With the sun or light source shining directly into the camera lens, exposure determination can be difficult, so careful metering is required. It is often a good idea to take a few different exposures (called bracketing) so you get the best one. Another thing to guard against is *lens flare*, where the sun refracts off the lens elements and causes flaws, or light rays, in the image. A lens hood (or a hand, piece of cardboard, etc) can block light rays from striking the lens directly to minimize this effect. (Flare can also be used to creative effect, so like all rules, it is meant to be broken). Back lighting can be very exciting on some images. It can create that 'silver lining' effect, make leaves on trees glow and

sparkle, etc. Opaque objects tend to fall into shadow and thus lose color and saturation, since light is behind the object. Again, if desired, flash, reflectors or additional lights can be used to fill shadow areas to a greater or lesser extent.

Overhead Lighting

Midday lighting is directly overhead, or nearly so. Sometimes this can be just want you want, but often the middle of the day is not a great time for great photographs. But, that overhead lighting may emphasize the texture of an interesting wall (from above instead of the side this time). You can also take advantage of shade under trees for portraits.

In truth, most lighting is not on a 90 or 180 degree axis to the camera. Besides, that is not usually the goal. By describing the directionality of light it this rigid, geometric manner, you get a sense of what is emphasized when using light at these angles. Most lighting is not on a 90 degree axis to the camera, such as the lighting below.

Rembrandt lighting

The great painter, Rembrandt, often used a style of lighting in his portraits that now bears his name. This lighting comes at the subject from about 45 degrees to one side and above the head. One side of the face is fully lit and the other side is mostly in shadow, but typically, the shadow side has a small triangle of light on the cheek. If the light is too hard, reflectors, umbrellas, or fill flash can be used to soften the effect. This light is somewhere between side and frontal lighting, so it is a compromise between the two and is often very attractive, with lots of modeling and form.

Photographers (and painters) have come up with dozens of names for lighting configurations and combinations. The above represent only a few. But the names don't matter….it is getting a feel for the characteristics that each type of lighting that matters so you can take advantage of it.

Lighting is what makes the difference between a fair photograph and a great one. So, experiment with different lighting angles and techniques. When the "quality of light" is extraordinary, take advantage of it and find something to photograph. Keep your eyes open during the Golden Hour (that hour or two before sunset) and also during the early mornings (morning mist off a lake can be spectacular).

Some great photos can be captured during those times. Most important of all, have fun!

Next stop…..image editing and printing.