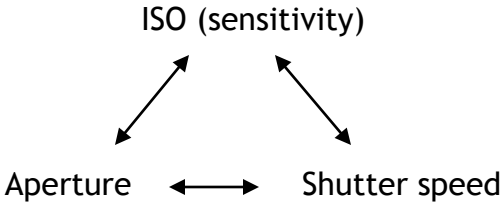
Some Photo Fundamentals

Photography is at once relatively simple and technically confusing at the same time. The camera is basically a black box with a hole in its side—"camera" comes from *camera obscura*, meaning dark room—and a light-sensitive medium capable of recording an image. But there are a lot of things you need to juggle in order to control the characteristics of the picture you record.

To start there are three key properties that you need to understand:



These are your core creative controls. Your job as a photographer is to determine what combination of ISO, aperture, and shutter speed is needed to get the photograph you want. Each choice of setting influences the others, so a change in one will affect how the other two properties can be used and how they will behave.

ISO

ISO is a measure of sensitivity to light. A low ISO means a lot of light is needed to form and image, a high ISO means very little light is needed.

Typical ISO values include:

… 100 200 400 800 1600 3200 …

Each jump (a.k.a., "stop") represents a doubling or halving in the amount of light needed. For example, setting your camera at ISO 400 means you'll need half as much light to record an image compared to ISO 200, but twice as much light as would be needed for ISO 800.

Higher ISO settings let you shoot in less light and/or with faster shutter speeds. But there is a trade-off: a higher ISO results in more noise (graininess),

especially in the shadows. Many cameras perform very poorly at high ISO settings, to the point that an image may be unusable.

ISO 200 (f/11, 1/350)

ISO 1600 (f/11, 1/3000)

To summarize:

Low ISO	High ISO
More light required	Less light required
Longer exposures (slow shutter)	Shorter exposures (fast shutter)
Less noise / more detail	More noise / less detail

Shutter speed

The shutter speed determines how long the camera will take to record an image. Traditionally a camera contains a "curtain" or "leaf" shutter; the shutter blocks light until you press the shutter release, exposing the recording medium for a fixed time.

Typical shutter speeds include:

B … 1" ½ ¼ 1/8 1/15 1/30 1/60 1/125 …

The bulb (B) setting keeps the shutter open for as long as you hold down the shutter release (note however that not every camera has a bulb setting). The remaining values are in seconds or fractions of seconds: 1 second (1" on the camera) is a relatively long exposure, whereas 1/1000 (1000 on the camera) is very fast. Each step represents a doubling or halving of the amount of light

recorded (again referred to as a "stop"). For example, 1/8" lets in twice as much light as 1/15", but half as much light as ¼".

Keep in mind that your subject and/or your camera might be moving. Faster exposures (1/60" or less) are typically needed to freeze motion—even for a model sitting relatively still—and to eliminate blurriness caused by camera shake. (As rock steady as you think you might be, your hands will almost always shake a bit when holding a camera.) Longer exposures are needed when there is less light or if you want to record motion blur for creative effect.

1/250 (ISO 100, f/8)

1/30 (ISO 100, f/22)

With digital the particular downside to long exposures (of 1 second or more) is typically an increase in digital noise, particularly in shadow area.

To summarize:

Fast shutter	Slow shutter
Requires more light	Requires less light
Freeze motion/eliminate shake	Blur motion
Less digital noise problems	Can become noisy

Aperture

The aperture is the size of the opening in the camera lens: a large aperture means more light gets in, a small aperture means less.

Aperture values are measured as “f-stops”. Typical values include:

… f/1.4 f/2 f/2.8 f/4 f/5.6 f/8 f/11 f/16 f/22 …

Low f-stop values represent large apertures, high f-stop values represent small apertures. As with ISO and shutter speed, everything works in factors of 2, doubling and halving as you go up and down the line. For example f/8 lets in 2x as much light as f/11 but ½ as much light as f/5.6.

The biggest factor with aperture is how much of the image will appear to be in focus: large apertures (low f-stop values) have less depth-of-field (DOF), so only part of the image will appear to be in focus; for small apertures (large f-stop values) more of the image will appear to be in focus. Controlling depth-of-field is one of the best ways to manage a viewer’s reception and interpretation of an image.

f/22 (ISO 100, 1/60)

f/4 (ISO 100, 1/2000)

Technically, the f-stop is proportional to a ratio between the size of the hole and the distance from the front of the lens to the recording medium. Confusing? Not to worry, what this boils down to is:

- Long lenses physically need a much larger opening to get the same f-stop as compared to short lens.
- Short lenses have more depth-of-field for a given f-stop than a long lens set at the same f-stop. (E.g. More of the image will look to be in focus for f/4 on a 22mm lens compared to f/4 on a 200mm lens.)
- As a result small cameras with tiny lenses have tons of depth-of-field, even for a relatively wide aperture, while large cameras will have less

depth-of-field. This is why most of the time everything looks to be in focus for point-and-shoot cameras but less-so on SLRs.

To summarize:

Large aperture	Small apeture
Low f-stop value	High f-stop value
Requires less light	Requires more light
Shallow depth-of-field	Greater depth-of-field

Summary of ISO, aperture, & shutter speed

In terms of how much light is recorded by the camera — a.k.a. the "exposure" — these three properties can result in **equivalent exposures for different combinations**. For example, all of the following are the same exposure as they will effectively record the same amount of light:

ISO 200	f/8	1/30
ISO 200	f/11	1/15
ISO 200	f/4	1/125
ISO 400	f/8	1/60
ISO 100	f/11	1/8

but each will have a slightly different effect in terms of depth-of-field, noise, and motion blur.

General things to keep in mind

1. Shoot in manual mode – Keep your camera in manual mode as much as possible. Using the auto modes means you will let the camera make a lot of the decisions for you, relinquishing your creative control over your photograph. This is especially important when we get to managing and manipulating our photographs using the RAW processor.

2. Have a tripod or other support handy – If you need a sharp, stable shot and the light isn't there, pull out a tripod or otherwise support your camera in some way. *A lot of the time* motion-blurred images aren't of much use, and image with camera shake are almost guaranteed to be of

little use. If you don't have a tripod then be resourceful: use a chair, lean against a wall, carry around a bean bag to rest the camera on, etc.

3. Avoid ISO 800, 1600, or "auto ISO" – Pictures shot at ISO 1600 are frequently useless. Keep the ISO setting as low as possible for your shooting situation, the lower the better. Don't leave the camera in "auto ISO" as it will tend to favour ISO 400 or 800 — even when it's not necessary for the amount of light present — resulting in more noise than you probably want.

4. Experiment – Knowing the needed combination of ISO, aperture, and shutter speed is mostly a function of experience. Experiment with different settings, changing all three values for the same shoot to see what effects will result. Photography is full of happy accidents.

Finding the right exposure :: Metering

The play between ISO, aperture, and shutter speed will determine your exposure. Figuring out the right combination is the challenge; the camera's light meter is there to help you figure it out.

The camera meter reads the amount of light coming through the lens and tells you what the camera thinks is a good exposure. The meter indicates its values on a scale, usually ranging from -2 stops to +2 stops around a centre point.

Meter indicating 1 stop under-exposed.

Getting the meter indicator to point at the centre of the scale is equivalent to the camera saying "this is what I think will make a good picture." Most of the time you will do this by adjusting the aperture and/or shutter speed to move the pointer.

Keep in mind, though, that the camera is aiming for a particular average known as "18% grey". In effect it is trying to get the overall exposure, all of the light falling on the sensor, to average out to a nice even grey tone. Most of the time this is a good thing as a typical scene will contain a variety of light and dark areas. *But*:

- If the frame contains a lot of white (or particularly bright colours like lemon yellow) then the camera will be fooled into thinking that there is more light than is really there. Remember, the camera wants to make things 18% grey on average. The result is an *under-exposure* when a lot of white is present, turning your bright whites into dull greys. You need to compensate and over-expose in this situation (according to the meter) setting your aperture and/or shutter speed so that the meter reads +1.5 to +2.

- If the photographed scene contains a lot of black or purple then the camera will be fooled into thinking there is less light which will result in an *over-exposure*. (The blacks will become muddy greys.) In this situation you need to set aperture and/or shutter speed so that the meter reads -1.5 to -2.

Lenses

Lenses are measured in millimeters, referred to as *focal length*, essentially the distance from the sensor (or film) to the front of the lens.

Some things to keep in mind about your camera lens:

1. Keep your lens clean – Dust is a major headache with photography, and keeping your lens clean is a relatively easy thing to do. Make sure you use a blower and a proper lens cloth or lens paper to remove dust and fingerprints. (Kleenex, the corner of a T-shirt, etc. can easily scratch the lens' delicate coatings and/or leave behind even more dust.)

2. Long lenses lead to more problems with camera shake – The longer the lens, the faster the shutter speed required when working hand-held. The stanard rule of thumb is that your shutter speed should be as fast or faster than 1 / focal length.

   For example, on an SLR with a 50mm lens you would want to shoot at 1/60 or faster; with a 100mm lens you would try for 1/125 or faster.

   And in fact with most medium-grade DSLRs, such as a Canon 40D or Nikon D70, you'll need to be even faster due to the property of *lens multiplier*. For one of these cameras when using a 50mm lens I would try for 1/90 or faster, and with a lens at 100mm I would try for 1/180 or better.

   For point-and-shoot cameras the lenses are smaller, so shutter speeds can safely be a bit slower than stated for this rule of thumb.

3. If you're working with an SLR and have the option to choose (or switch) between a zoom lens and a prime lens, use the prime. (A *prime* lens is

one with a fixed focal length, i.e. no zoom.) Prime lenses are generally sharper and have less problems with distortion than compared to a zoom lens set at the same focal length.

4. On most lenses the sharpest image with the least distortion will be obtained at an aperture mid-way through the lens' aperture range, typically around f/11.

5. On zoom lenses the least distortion will be typically be obtained ½ to ¾ of the way through the focal length range: barrel (round) distortion toward the wide-angle end, less distortion in the middle, and (some) pincushion distortion when fully zoomed in.

Composition

Pay attention to the formal aspects of a scene.

Do the visual elements work better when shot in a vertical (portrait) or a horizontal (landscape) format?

If you're shooting a series will it make more sense to shoot everything in the same format, all landscape or all portrait?

How will the end result be used? Does it need to cover a single page in a magazine, versus a double-page spread? Will it be used in some oddly shaped element on a web-page? Is it meant to be printed quite large as a fine-art piece? Are you shooting for a design client and will then need room for logos and text?

Should your primary subject sit in the middle of the frame or off to the side? One common approach is to use the "rule of thirds", framing your primary subject so that it is located 1/3 of the way into the image from the left or right frame edge. The same rule works from the top to the bottom of the image; for instance, avoid placing a model's eyes at the centre of the frame vertically.

Consider creating a greater sense of depth and dynamic by looking for a progression of elements, layering things into the background.

Watch the edges of the frame. Leave some negative space. Look for lines and elements that can create oddly trapped spaces near the sides. Try to avoid corners and angles intersecting at an edge, and don't cut off people at primary joints (knees, wrists, elbows) or at the neck.