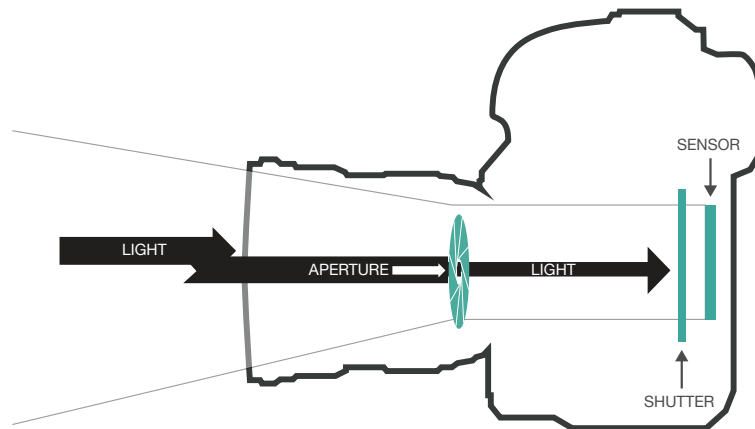


HOW A CAMERA WORKS

This is the essential first step, so many people try to understand technical aspects like **ISO** and **Aperture** without actually understanding how a camera works. Although cameras have a bunch of crazy cool tech inside them these days, they still follow the same principles as the very first cameras ever made; light enters the lens & into the camera body, how much light enters, is determined by the lens iris (**Aperture**), it then hits the shutter, which drops down when you depress the shutter button, exposing the light onto the sensor (or in the old days, film) & turning it into an image.



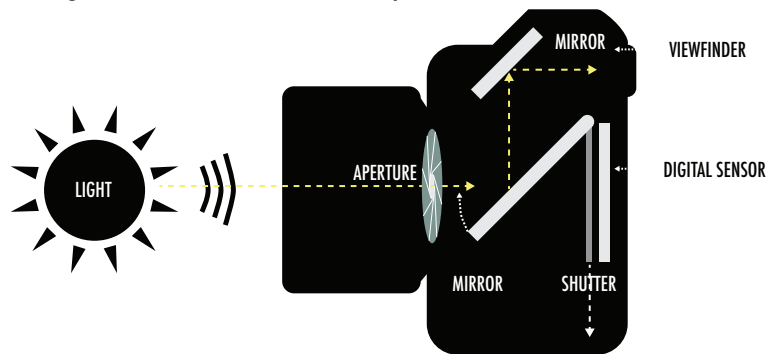
1. Light enters the lens, passing through lens iris (which looks like this )
2. Light enters camera body & hits Shutter
3. Shutter drops down when you depress button on top of camera
4. Light hits sensor & image is recorded

DSLR vs MIRRORLESS

There are two main types of cameras on the market today, the most prominent is the **DSLR** which stands for Digital Single Lens Reflex, it uses mirrors to reflect the light/image coming through the lens into the view finder, giving 100% real time view of what you're shooting. The other type is the **Mirrorless** camera, which contains no mirrors, instead, the light/image is continuously hitting the sensor and sending the picture via data to a tiny LCD screen mounted inside the view finder. **Mirrorless** cameras biggest advantage over **DSLR** is that it can be made considerably smaller & thinner due to the lack of mirrors - another advantage is there is one less moving part, making them faster & quieter.

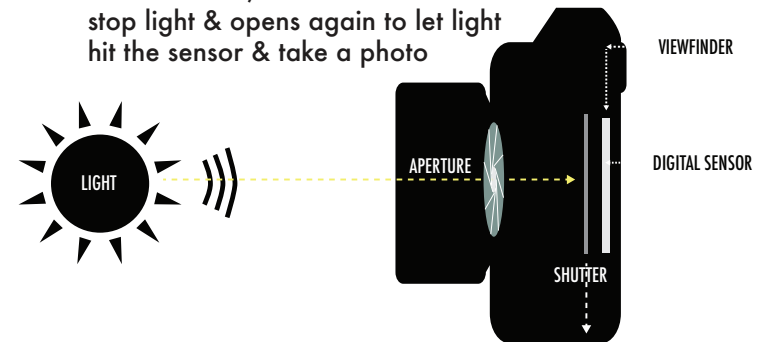
DSLR

Contains mirrors to bend light/image to the view finder - when you depress the shutter button, the mirror & shutter lifts up to let light hit the sensor & takes a photo



MIRRORLESS

Has no mirrors - light/image is always hitting sensor & the data is transferred to a tiny screen inside the view finder - when you depress the shutter button, the shutter then closes to stop light & opens again to let light hit the sensor & take a photo



APERTURE/FOCUS

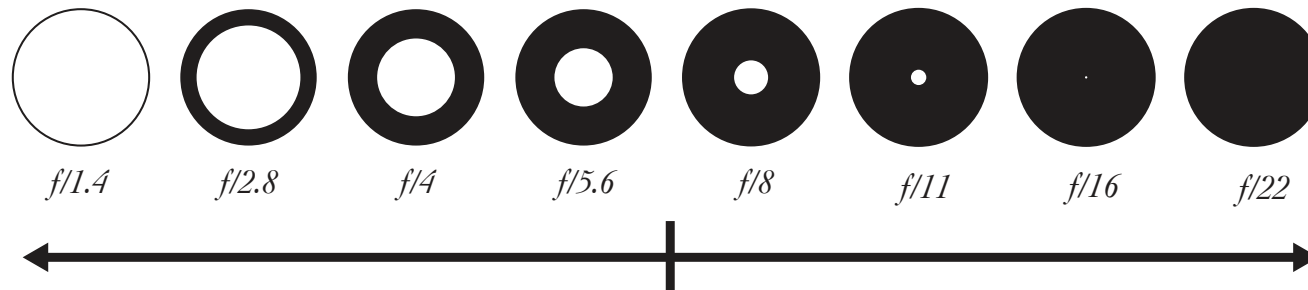
There are three elements used to manipulate light that we must balance in order to take a well exposed photo; **Aperture**, **Shutter Speed** & **ISO**. In order to find the correct balance, we must first understand each element & what they do, starting with **Aperture**.

Aperture controls the amount of light coming into the camera body which impacts 2 main things; the brightness of the image & the depth of field of the image

Aperture relates to the dialation of the lens iris, controlling the amount of light let into the camera body. The more dialated (bigger hole) the more light, the smaller the hole the less light let in. We use **f/stop** numbers to detemine the size of the hole. To make things confusing, the smaller the number, the bigger the hole and the bigger the number the smaller the hole. Lenses generally range from $f/1.2$ to $f/22$, however some lenses can go lower & some higher.

Aperture also impacts focus, we could go into all the reasons why but right now all you need to know is that the lower the **f/stop** the shallower the depth of field & the higher the **f/stop** the deeper the depth of field. Depth of field relates to zone in a photo which appears in focus. The zone is smaller with a lower **f/stop** and larger with a higher **f/stop**.

RULE OF THUMB: at $f/8$ the zone of focus is most of the image.



BLURRY BACKGROUND

- More light enters due to bigger hole
- Shallow depth of field (meaning blurry background or foreground)
- Use with faster **Shutter Speed**

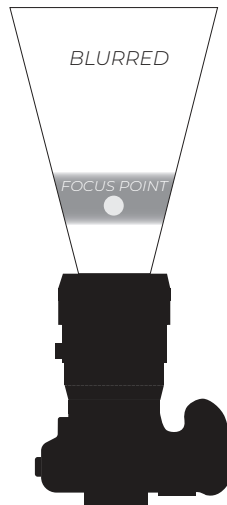
EVERYTHING IN FOCUS

- Less light enters due to smaller hole
- Deeper depth of field (meaning more in focus)
- Use with slower **Shutter Speed**



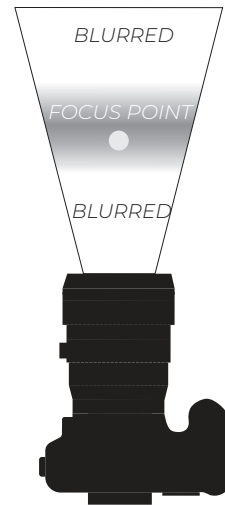
35mm f1.4

- Very shallow depth of field
- Everything immediately before & after the focus point is blurry



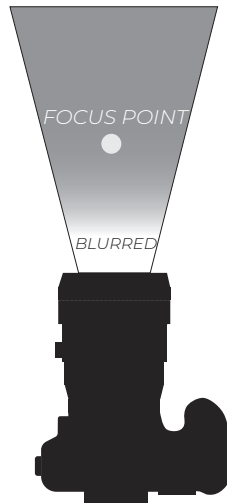
35mm f3.5

- Medium depth of field
- There is more in focus before & after the focus point.



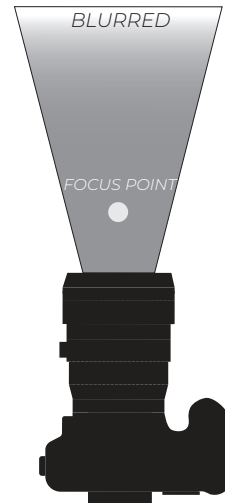
35mm f8

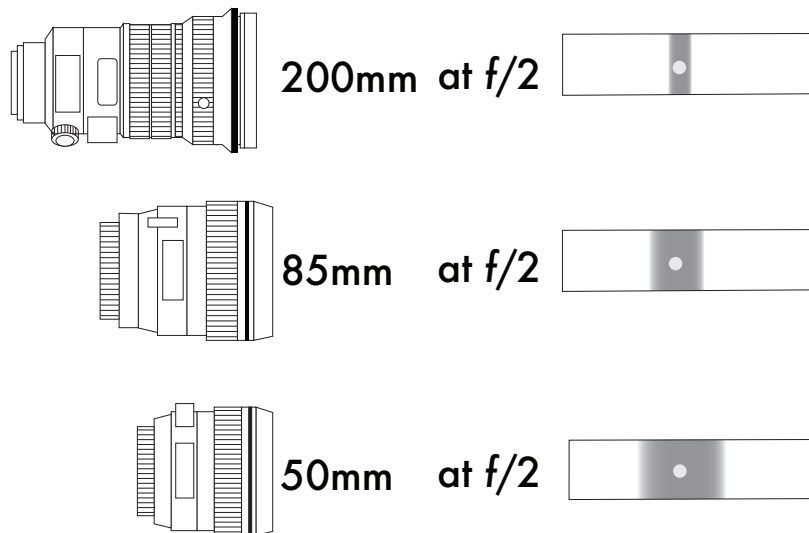
- Rule of thumb: most of the picture is in focus before & after the focus point.
- *depending on the lens you use (see below for more on this)



35mm f16

- Very deep depth of field
- 90%+ of image is in focus





Lens focal length impacts depth of field

The above shows the depth of field of each f/stop on a 35mm lens. However, different lens lengths (focal lengths) impact the amount before & after that is in focus & what is blurry. The diagram here shows different focal lengths at the same f/stop . As you can see, the longer the lens, the tighter the area in focus, giving a very shallow depth of field.

As you can see, a 200mm lens at $f/2$ has a very very shallow depth of field, making everything almost immediately before & after the focus point blurry. Sometimes it can be as short as the distance between the tip of someones nose to their eye, one being in focus & the other not.

At the other end of the scale, you can see that a 50mm lens at $f/2$ has more area before & after the focus point that is in focus.

SHUTTER SPEED/MOVEMENT

The second element to explore is **Shutter Speed**.

Shutter Speed controls how long the sensor is exposed to light, which impacts 2 main things; the brightness of the image & how motion is captured.

Shutter Speed refers to the time (measured in seconds) in which the shutter (a thin metal curtain that blocks light from hitting the sensor) is down, dictating the amount of light allowed to be exposed on the sensor, thus making the image lighter or darker.

It also controls how movement is recorded in the image - a faster **Shutter Speed** will freeze movement, but result in a darker image, as light is exposed on the sensor for less time. While a slower shutter speed will blur movement, but result in a brighter image, as light is being exposed on the sensor for a longer period. We often use a higher **f/stop** (smaller hole) when using a slower shutter - by using the higher **f/stop** we have less light coming in but is balanced out by the light being exposed to the sensor for longer. The opposite goes for a faster shutter speed. **Remember**, it's all about using these tools to **balance** light correctly for a perfectly exposed image.

RULE OF THUMB:

Take the focal length of your lens & make this the minimum shutter speed - for example a 135mm lens would have a minimum **Shutter Speed** of 1/135 sec or a 50mm lens would be 1/50 sec - Shooting any slower than this will risk having a blurry image as most hands cannot hold the camera still enough - we call this camera shake. My advice is any lens 50mm or less should stick to a minimum of 1/60 sec.



LETS IN MORE LIGHT

- Longer exposure (shutter open for longer period)
- Blurs movement
- Often used with higher **f/stop**

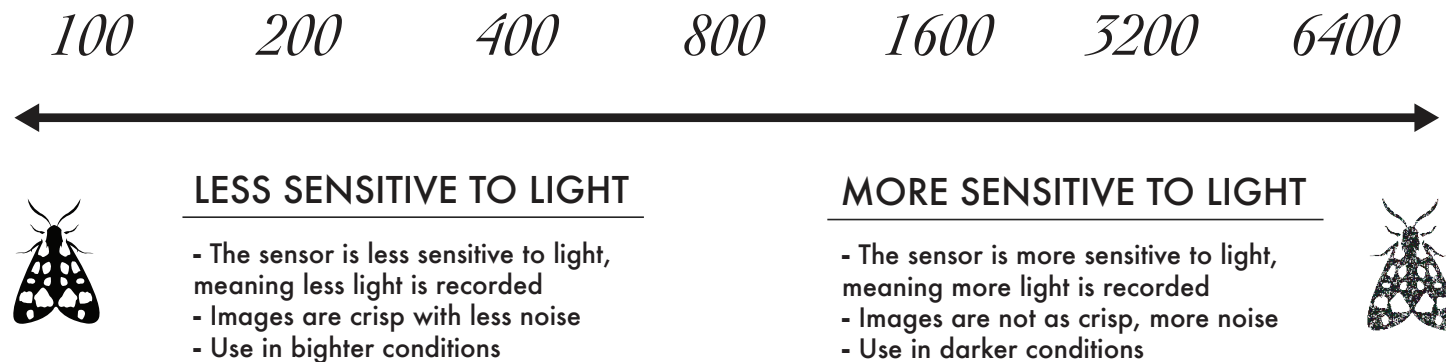
LETS IN LESS LIGHT

- Shorter exposure (shutter open for shorter period)
- Freezes movement
- Often used with smaller **f/stop**



ISO controls how sensitive the sensor is to light which impacts 2 main things; the brightness of the image & the amount of noise (grain) in the image.

RULE OF THUMB: aim for the lowest **ISO** possible.



PUTTING IT ALL TOGETHER

Now that we have understood the three major elements needed to correctly expose an image, we need to put them all together. The simplest way of doing this, is to first decide what it is that we want to achieve in our image - do we want to freeze a game of soccer or maybe take a portrait of someone in dark library. Once we have decided on this, we need to access the conditions in which we are shooting.

With this information we can correctly set each of these elements and take the shot. That said, before we dive into full manual mode, its important to look at some of the functions that modern cameras have that can help make the process easier for us. The first of which is our **Light Meter**, followed by 3 partial automatic modes; AV (**A**erture Priority), TV (**S**hutter Priority) & P (**P**rogram).

LIGHT METER

The light/exposure meter has been used in some form, from as early as 1890. What was once a large unit, is now built into all cameras and in some, can be read as a digital display. When we line up a shot, the light meter will read the conditions & take into account the settings we've chosen on the camera & tell us on the meter below, via a little marker, whether its under exposed (darker image) or over exposed (brighter image). Our aim, generally speaking, is to get the marker into the centre, at zero, to create a perfectly exposed image. However, there are factors, like camera model/make & creative desires that sometimes mean we shoot with the marker under zero & sometimes over zero - even with highly sophisticated technology, sometimes you just have to give it a go & then adjust the settings based on how the image turns out.

RULE OF THUMB: aim for zero. However like I said above, some camera models like to have the marker slightly above zero & some under zero.

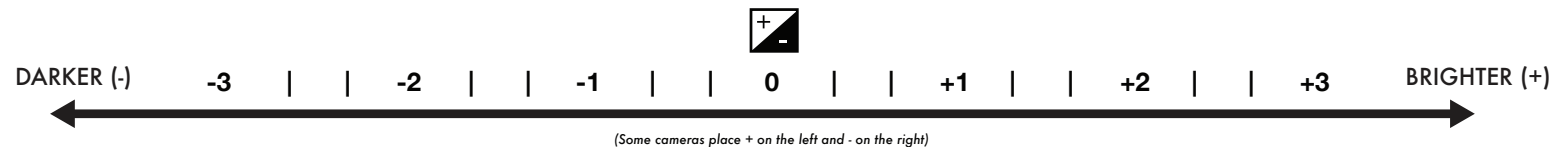


IMAGE IS DARKER

- Less details in shadows
- More details in highlights

IMAGE IS BRIGHTER

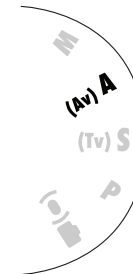
- More detail in shadows
- Less detail in highlights



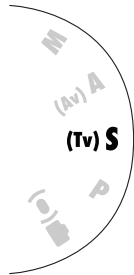
Av MODE/APERTURE PRIORITY

Av Mode or **Aperture** priority is a partial automatic mode, where the user has control over the **f/stop** & the **ISO** while the cameras computer controls the shutter speed to expose the image correctly. Some cameras will allow us to force the computer to ignore its calculations & purposely under or over expose the image, this is called **exposure compensation**.

Uses: When we want to maintain a shallow or deep depth of field. Useful for conditions at events like a wedding where you want to set the f-stop to get a really nice shallow depth of field (blurry background) and always get the shot because the computer is dealing with the **Shutter Speed**.



Tv MODE/SHUTTER PRIORITY



Tv Mode or **Shutter** priority is a partial automatic mode, where the user has control over the shutter speed & the **ISO** while the camera's computer controls the **Aperture** to expose the image correctly. Some cameras will allow us to force the computer to ignore its calculations & purposely under or over expose the image, this is called **exposure compensation**.

Uses: When we want to freeze or blur movement. Useful for photographing a waterfall where we want to blur the water to get that whimsical look - we would lower the **Shutter Speed** until we get the desired look. OR if we want to shoot a soccer match, we would bump the **Shutter Speed** all the way up to freeze the motion. Remember that in both of these modes we need to set the **ISO** ourselves.

P MODE/PROGRAM MODE

P Mode or Program mode is slightly more automatic than Av & Tv modes, where the computer controls the Aperture & the Shutter but the user still controls the ISO & can force the computer to under or over expose the image using exposure compensation.

Uses: This is great for photographers that want to take a small step away from automatic, it stops that dreaded flash from firing in the middle of the day & gives them chance to improve on their framing before jumping into semi or full manual.



FULL MANUAL

Ok, so we have looked at some of the partial manual features your camera might have, now it's time to dive into full manual. The best way to get your head around what settings to use, is to first decide on how you want your photo to turn out (the desired effect) & then assess the conditions that you're shooting in. So let's have a look at a few examples.

WATERFALL

DESIRED EFFECT:

To make the water in the waterfall look blurry & whimsical & for there to be a deep depth of field (everything in focus)

CONDITIONS:

- Fast moving water
- Far away from the waterfall
- Dusk (dark light)

SETTINGS TO USE

SLOW SHUTTER SPEED:

Our priority is shutter speed, we want to blur motion, so we want the light entering the camera to be exposed on the sensor for a long time, recording all the moving parts of the image for longer, creating blur. So we set that to around 2" seconds. REMEMBER our rule of 1/60 sec, you can't shoot handheld, so you will need a tripod to get this shot.

APERTURE (F-STOP):

Next we want to have a deep depth of field, so we need to set our f-stop to at least f8 (remember our rule) to get most of the image in focus.

ISO:

So now that we have set our shutter speed & our aperture we need to adjust the ISO until we get our image exposed correctly. We can either use our light meter to help us adjust the ISO or we can take a shot & adjust.

FULL MANUAL CONT.

PORTRAIT

DESIRED EFFECT:

Portrait of a face with everything else in the background to be blurry & out of focus.

CONDITIONS:

- Still Subject
- Close to subject
- Bright light

SETTINGS TO USE

APERTURE (F-STOP):

Our priority this time is aperture. We want to get a very shallow depth of field. So we need to set our f-stop to as wide (as low a number) as we can to get a very blurry background & so the subjects face to be very sharp & in focus.

ISO:

So I know I said that ISO is usually the last element to adjust, but when the subject is still and in bright light, we can usually set the ISO to as low as possible first & then adjust the shutter speed to suit.

SHUTTER SPEED:

So now we have the aperture set wide open, allowing lots of light in and giving us that blurry background & set our ISO to as low as possible to ensure we have the least amount of noise as possible, we can start to adjust the shutter speed up and down until we get the right exposure. Just remember our shutter speed rule of 1/60 sec, if we need to go below that, we have to bump our ISO a little bit until we get above that 1/60sec. That said, for portraits we really want a faster shutter than 1/60 sec, so just play around with it & learn the limits of your camera when it comes to ISO & noise.

WHITE BALANCE

You've probably seen these icons before, but perhaps not known what they mean. Well they relate to preset white balance values. White balance relates to the cast of your image - it ranges from warm to cool or blue to yellow.



This icon **K** on the other hand, may be less recognisable. It stands for Kelvin, the value in which white balance is recoded in. The kelvin scale ranges from 1000 - 10,000, with 1000 being a cool blue cast & 10,000 being more warm, yellow cast. Why is this important? Well setting your white balance correctly is important for ensuring that you have accurately captured the colors of the scene youre shooting. Furthermore, unless you shoot in RAW format (look it up if you dont know about it) it can be difficult to repair an image with the wrong white balance when editing. Even if you do shoot in RAW, its good practice to get your white balance close to correct, to help with editing.

RULE OF THUMB: DO NOT USE.....**AWB**.....(Auto White Balance), the biggest issue with this, is that the computer in the camera will constantly be adjusting the White Balance, and it can leave every single photo looking different, making editing painfully hard.

THINGS TO CONSIDER

- Avoid using Full Auto, give P-mode a go & work your way up
- Be careful not to over expose your images too much as you risk blowing out your highlights, which are unable to be recovered in editing.
- Once you get started with the semi manual options you might be tempted to jump straight into Manual mode, but remember that you still need to frame the image properly to get a good a good shot, so take it slow!
- Dont always rely on the light meter or the computer inside your camera, sometimes you need to take a shot, check the shot & readjust your settings accordingly.
- Dont turn on auto ISO, this is a tempting option when using the above modes, leaving you just one element to think about, but the computer in your camera will generally adjust ISO first, sometimes creating very noisy images by boosting the ISO before changing something else like the shutter speed.