What is ISO?

We've already looked at aperture and shutter speed in the previous tutorials. In this one, we are going to look at the third element of the exposure triangle: **ISO**. We will learn how the ISO setting works and how it affects your photograph.

ISO is a tricky one to explain without getting into some very technical jargon. In this chapter, I will do my best to avoid this jargon.

Let's get technical…… not.

I've written tutorials online about ISO before and received long, detailed and even angry messages from certain photographers who took serious issue at my explanation of ISO!

One such person told me that this was in fact the correct definition:

> "ISO works by having amplifiers in the image sensor's circuitry increase the gain before sending the analogue voltage read from the photon well to the A/D converter to be digitised. E.g.: If at ISO 100 the signal is 100 mV, we can get ISO 200 by using an amplifier to boost it to 200 mV. For ISO 1600, we can five-double it to 1600 mV, and so on."

So….. eh, what he said. I mean he's not wrong but talk about taking the fun out of photography! I'm going to try to explain ISO in much simpler terms. Also, knowing the above does not necessarily make you a better photographer.

So…. what is ISO?

Increasing the ISO creates the impression that your camera's sensor is more sensitive to light. It is in fact a little more complex than this.

Most cameras have an ISO range that starts at a base of 50 or 100. This can then be increased into the thousands on most cameras.

Increasing the ISO value on your camera is bit like using an amplifier and microphone to make your voice sound louder.

The loudness at which you actually speak doesn't change but the amplifier takes the sound of your voice and makes it louder or "amplifies" it.

ISO works in much the same way. When you increase the ISO value, the amount of light entering your camera remains the same.

However, your camera now amplifies this light in the same way the amplifier amplifies sound. This means that less light is now required in order to make the correct exposure for the scene you are photographing.

This allows us to use much faster shutter speeds than if we were just using the base/lowest ISO of 50 or 100.

The higher the ISO, the faster the possible shutter speed is. This can be useful when we are shooting in low light and don't have a tripod.

This could be at a location where tripods are not allowed for example. In these cases we have no choice but to shoot handheld.

We saw in previous tutorials that low light can mean that the shutter speed becomes too slow to shoot handheld without risking camera shake. Increasing the ISO is a way around this.

As we also learnt in the last tutorial, using a wider aperture is another way of allowing us to use a faster shutter speed. If it's too wide however we risk running into issues with not having enough depth of field to keep everything sharp enough.

Increasing the ISO can be used in a number of situations:

- If you are shooting in a location that doesn't allow tripods and the light is too low to shoot handheld.
- If you simply don't have a tripod with you in a low light situation.
- If you need to increase your shutter speed significantly in order to freeze motion in a low light situation.
- When using a wider aperture to increase shutter speed is not an option due to depth of field issues.

So why not just increase your ISO all the time to ensure fast shutter speeds?

In theory this sounds great. I can finally ditch the heavy tripod! The thing is that while increasing the ISO amplifies the light entering the camera and allows for faster shutter speeds, there is a trade off in terms of image quality.

Let's go back to the sound amplifier analogy from earlier. The amplifier will certainly make my voice sound louder but if I increase the volume settings too much, the sound quality will begin to degrade.

The same principal applies to ISO (not flatulent geese). As you increase the ISO value, the image will become "noisier" or grainier. Random specks of colour will begin to appear and degrade the image quality and detail.

Take a look at the following photos of a wine bottle photographed with different ISO settings:

The first one above was taken with the lowest possible **ISO setting of 100**. The **shutter speed** in this case was **1/40 of a second**.

This would actually be too slow to handhold without risking camera shake. I used a tripod so this was not an issue.

In this second photo, I've increased the **ISO setting to 3,200**. Now my **shutter speed** is a much faster **1/1250 of a second**. I would have no problems handholding the camera at this speed.

However, if you look very closely at the photo, you will see that the image quality has degraded somewhat. There is a lot of digital noise visible especially in the background. There is also a noticeable loss of clear detail.

Increasing the ISO is a balancing act. Sometimes, I'd rather have a reasonably sharp but slightly noisy image than a shot that is completely unusable due to camera shake.

Digital noise can also be reduced to some extent in post-processing. Lack of sharpness due to camera shake however cannot be fixed afterwards.

ISO 50   ISO 200   ISO 800   ISO 3200   ISO 12800

The chart above shows the effect increasing the ISO setting has on the digital noise levels in a photograph.

Does this mean I should avoid using very high ISO settings?

Absolutely not; a lot of modern cameras actually handle high ISOs very well and produce high

quality images with minimal digital noise. This is especially the case with full frame cameras.

Take a look at the following photos taken with a high ISO setting:
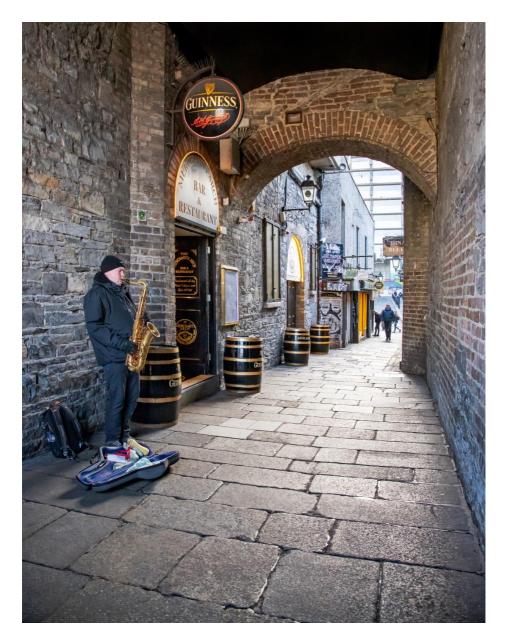

Belfast City Hall Staircase

Belfast City Hall has a stunningly beautiful interior. Tripods are forbidden inside the building however.

By increasing the **ISO** to **1,600**, I was able to achieve a fast enough **shutter speed** of **1/100 second** to be able to take this photo handheld. The full frame camera handled the high ISO very well with very little digital noise visible.

On the next page is a photo I took while walking through the Temple Bar area of Dublin. I saw this musician playing under Merchant's Arch and though he would make for a good subject.

The area he was standing in was quite dark. It was one of those times when setting up a tripod may have meant missing the shot altogether, so I just increased the **ISO** to **3,200** and took the photograph handheld.

This enabled me to set a **shutter speed** of **1/400 second** and avoid camera shake. As with the previous photograph, the full frame camera meant that the image quality suffered very little.

Merchant's Arch in Temple Bar, Dublin