Topic 2 - Exposure: Introduction To Flash Photography

Learning Outcomes

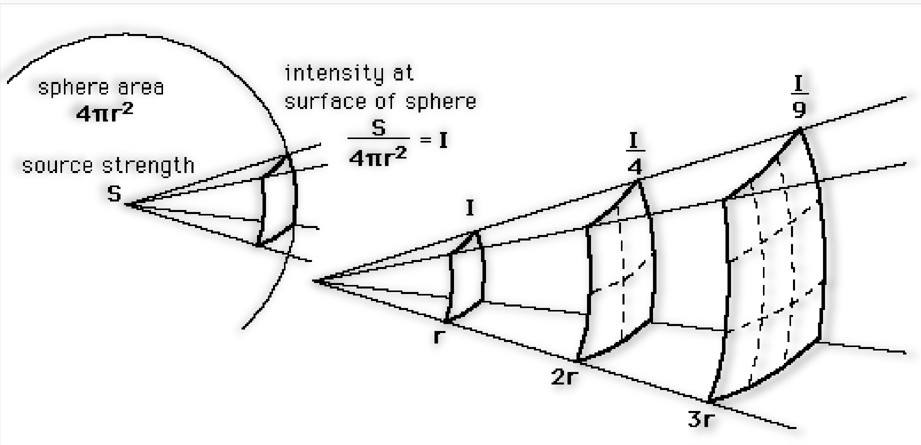
In this lesson, we will take a look at how flash photography works and why you need to know what effect you are looking to achieve before using a flash. By the end of this lesson, you will have learned about the pros and cons of using a flash in your work.

Flash Photography

Flash photography is a skill that can be a little tricky to master and it does have some unusual downsides. However, if we figure out why these negative side effects happen then we can compensate for these results.

Let us begin by talking about manual flash on our cameras. Generally, if we're talking about light, there is this concept of 'light falloff', called the inverse square law, where as you go further away from a light source, the light actually gets dimmer. Let us take an example - if you are in a room with a lightbulb and you move away from the bulb, the light appears dimmer, or rather the light that falls on you, is dimmer. The inverse square law really formalises that concept. This law states that every time you double your distance away from something, you're causing the light to decrease by ¾ so that it is ¼ intensity of the light. This is why it is called inverse square law.

So, let us assume that the sun is the point denoted s, for sun. As we move away from this, we are losing light. But if we have this distance called r from the sun, there is going to be a certain amount of light that falls with the square. If we take that same square and move it twice as far away, we are saying that we are getting ¼ the amount of light and the reason for this is due to the fact that light travels outwards in every direction.



Considering this, as we move away, that light has split apart sufficiently that only a ¼ of light falls on that same area. Thus, it requires four times as much area for us to receive that amount of light. Another way to think about this is the fact that we have this source, and the source exudes four photons. At distance r, those four photons are hitting the corners of the square. As we get twice as far away, it requires four times as many squares for us to receive the same amount of photons. Three times away, or 3 squared, is equal to nine. So, we need nine of these squares to be able to capture the same number of photons. This is primarily the reason for why flash looks the way it does.

If you're standing directly in front of a shot, you will be inundated with light, but by taking a few steps back, you will be getting a lot less light. This causes that look that you associate with flash units attached to your cameras where the subject is overexposed and the background is completely dark. There is a way in which we can measure how powerful a flash can be. There is a number associated with flash units known as the guide number.

This number is calculated by the distance times the f-number. The guide number is generally provided to you at a value of ISO 100. There is no mention of shutter speed. This means that if you are taking a photograph of a subject, that is ten feet away, and you know that your flash has a guide number of ten, for example, it's telling you what f-number you need to use at ISO 100 to properly expose a subject at that distance away. It will only properly expose the subject at that distance away. If it is half or double the distance, your exposure will completely change because of this light falloff that happens.

Let us put some numbers behind this so we can formalise this idea. Generally, this will be something that is done at ISO 100. Let us say that, at ISO 100, the guide number is 13 metres, which is about forty feet, and the subject is ten feet away, this guide tells you what you need your f-number to be in order to properly expose the subject. The answer is f/ 4.

You need to be careful when you begin to start modifying some of these values. So, imagine what might happen if you want to talk about ISO 200, and the subject is ten feet away, do you know what the f-number is going to be? It's not quite as obvious, but think of it in terms of making it one stop brighter. The new f-number, when made one stop brighter, is f/ 2.8. So, what is the distance at f/ 2.8, of a properly exposed subject? It's forty divided by 2.8, which is just over fourteen feet. We get this result because we're dealing with both light falloff and f-numbers, whereby the increase or decrease of a stop is not a doubling or halving, so we have that added complexity. This is saying that if you have something that is fourteen feet away, as opposed to just ten feet, and notice that this isn't doubling or halving the distance, then you have to use an f-number of 2.8. This is important because the more powerful the flash is, the smaller the aperture can be.

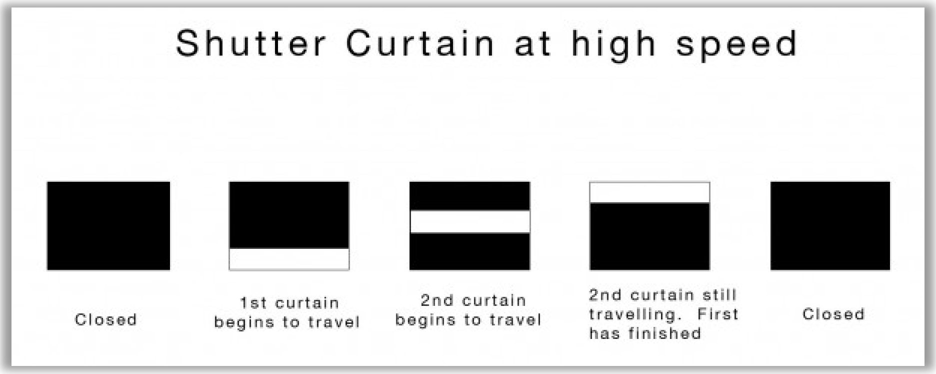
All of the maths that we have been talking about involves one flash unit that has this guide number of forty feet. What if we want to modify this exposure or we want to photograph someone who is further away? This means that we have to open up the aperture. However, if we are at the limit of our aperture and we needed to increase the ISO, this tells us precisely what settings we need to use for a specific distance.

Now, as we get further and further away, it will become more and more difficult to properly expose the subject because of this inverse square law. Even as we double this distance from ten feet to twenty feet, we need to use quite a big change in f-numbers. The f-number at this distance is f/ 2, which you will recall, is two stops brighter, which means that there is ¼ of light at that doubling of the distance. This guide number calculation is useful when you are using a manual flash and you want to figure out how far away you need to be.

Shutter Speed & X-Sync Speed

Up until this point, there have been two things that impact flash photography and that is this assertion that only the f-number and the ISO matter. The reason that the shutter speed isn't taken into account is because when a flash goes off, it gives off its light very quickly. No matter how fast your shutter speed is, it will not be faster than that initial burst of light from the flash. If your shutter is open longer, then your flash won't give off any extra light either.

However, there is a shutter speed that you need to use and it is specific to your camera. This is called the x-sync speed. X-sync speed is defined by the shutter itself. There are two types of shutter curtains. There is a specific speed at which both will be open, for a brief amount of time, before the second one closes. At a certain speed the first curtain will open, before the second one closes, and this is called the x-sync speed. The x-sync speed is the fastest shutter speed that the camera is capable of opening that first curtain completely and exposing the entire sensor.



This is important because that flash is so instantaneous and those curtains need to be completely open, otherwise, you're going to get bands as one shutter will be partially obscuring the sensor. Most cameras will have an x-sync speed of about 1/ 250th of a second or 1/ 500th of a second. So, if you exceed the x-sync speed and you want something like 1/ 1000th of a second, all you will have is a half-exposed scene because that second curtain, or the first curtain, depending on how you sync it here, will be obscuring half of the sensor and as that flash illuminates, only half the scene is lit.

So, for this reason, if we are taking photographs with this specific guide number, you set the camera's shutter speed to the x-sync speed because having it any faster you will have this obscuring problem. Flash units fire very quickly, some fire at 1/ 2000th of a second. It's almost counter intuitive in that you can use a long shutter speed but will still be able to capture something that is very brief. This is similar to the way in which some photographers use a long shutter speed to capture lightning strikes during a storm. Flash photography also works very well when you want to achieve a stroboscopic effect in your work and some photographers have achieved some very interesting results. If this is a style that you would like to achieve or experiment with, there are some great examples on the internet.

Problems With Flash – Red Eye

The reason we get red eye is that the flash happens faster than the iris can react to closing down the pupil. Light enters in through the iris, reflects off the back of the eye and into the camera. Because the back of our eyes is red, due to the natural colour of our blood, this causes the red eye effect. How can we counteract this problem? Well, this problem usually occurs because the flash is very close to the lens and the direction of light is nearly straight even as it is reflected towards the camera. So, if you moved the flash unit up, just a few inches, this would combat the problem. Red eye reduction does not work very well and you still get some red eye as a result. This will also help with shadows and light falloff.

What have we learned in this lesson? A Summary

We have learned about flash photography and how it works, depending on how far you are away from your subject. We have also learned about the x-sync speed and how important it is in flash photography. The key thing to remember is that when you are using a flash that doesn't support high-speed sync, such as a generic flash, you cannot use shutter speeds faster than your camera's X-sync speed. The X-sync speed is the fastest shutter speed at which the camera's shutter fully exposes the entire sensor at once, giving the flash the opportunity to fire and brighten the entire picture evenly. X-sync speed on camera bodies varies very little and it is only important if you are using a generic flash.