5: Exposure triangle

3-way balance

Taking control, becoming a photographer.

In this chapter

You've learnt so far that exposure = aperture + shutter speed + ISO.

On auto modes (including aperture and shutter priority), your camera decides what the correct exposure is. You will remember from the first chapter that it assumes the world is made up of a single mid grey tone.

On fully auto mode, your camera decides which combination of aperture and shutter speed (and ISO, if you have Auto ISO) will be used to get the exposure it needs. And, given a chance, it will never, ever choose any settings at the extremes. You will never get the camera choosing a shutter speed of half a second; it is protecting you from camera shake. It will never pick an aperture of f2.8 or a high ISO unless it has no other option; it is protecting you from an out of focus subject and a grainy photo.

It will always pick middle of the road settings unless it is very dark or very light. You'll be stuck with f8, 1/250th and ISO200. So if you ever want to use f2.8 or f22, with a shutter speed of 1/4000th or 2 seconds, or any other combination of extreme or specific settings, you'll need to go off auto altogether.

In this chapter you'll shoot on fully Manual, take control, and you will be able to call yourself a photographer.

This is one of the most complicated chapters in the book, so please take it one step at a time. You don't need to remember everything - as long as you understand it as you are reading it, that is fine at this stage. The main concept to understand is that you can balance changes in aperture with changes in shutter speed or ISO.

What is the exposure triangle?

Imagine a 3-way seesaw (teeter-totter). If one corner goes up, the other 2 corners have to go down by an equal and opposite amount. This is exactly the same for camera settings, and it's known as the exposure triangle.

If aperture, shutter speed and ISO are the 3 corners, and one goes up (let's say you want a shallow depth of field so you pick a large aperture), then, to keep the same exposure, the other 2 need to go down to compensate. If you are on aperture priority mode, or shutter priority mode, the camera does the compensation for you. If you want complete control, you will need to shoot on Manual mode.

You don't need to shoot on Manual all the time, but to call yourself a photographer you need to know how to do it. And there will be a few occasions when you need to shoot Manual.

When should I shoot Manual?

Shoot on Manual mode when you need to control both aperture and shutter speed.

You might want both a particular depth of field (eg. you want to use f16) but you also want a little bit of motion blur, so you want a shutter speed of 1/30th. You can't afford to let the camera pick either, so you must pick both.

Or if you shooting are macro (close up), you will want to have a much higher shutter speed than normally needed, because camera shake is magnified along with everything else. The camera won't know this, and will pick a mid range shutter of 1/125 or 1/250, when you actually need 1/1000th or faster.

If you need to replicate exactly the same settings between shots (for example in studio work), you would use Manual mode to fix the settings in place. In a studio you would change the amount of light being used as required, rather than changing the camera settings.

How to shoot on Manual mode

Find the "M" setting on your dial. Now dial in all 3 settings - aperture, shutter speed and ISO (unless you are using auto ISO). Use your camera manual if you need a reminder of how to change each setting.

Don't forget to put your camera back onto your preferred setting once you've finished (Program, Auto, Shutter priority or Aperture priority). If you don't do this, and aren't used to shooting on Manual, you'll take some unexpectedly over or under exposed images the next time you go out with your camera.

Understanding stops

What are stops?

Do you remember the list of aperture f-stops? And shutter speeds and ISOs? f4, f5.6, f8; 1/60th, 1/125th, 1/250th; 100, 200, 400?

The gap between these measures of aperture, shutter speed and ISO is important, and it's called a "stop".

From f4 to f5.6 is 1 stop. From 1/60th to 1/125th is 1 stop. From ISO 400 to ISO 800 is 1 stop. Each stop lets in the same amount of light. So 1 stop on the aperture scale corresponds to 1 stop on the shutter speed scale. Knowing this allows you to compensate accurately.

If the camera picked f5.6 but you want f11, that's 2 full stops smaller. f5.6 > f 8 > f11. So, to keep the same exposure, you would need to change the shutter speed by 2 full stops larger, eg. 1/500th < 1/250th < 1/125th. Or the ISO by 2 full stops larger; ISO 100 < ISO 200 < ISO 400. Or you could change the shutter speed by 1 full stop and the ISO by 1 full stop.

Full stops, half stops and third stops

The benchmark stops are the ones mentioned so far in the book. f4, f5.6, f8, f11, f16. 1/60th, 1/125th, 1/250th, 1/500th. ISO 100, 200, 400, 800. But you may find that your camera picks an aperture like f7.1, or a shutter speed of 1/160th. That's because there are stops that fall exactly half way between the benchmark full stops, and there are also stops that fall exactly a third and two thirds of the way between the benchmark full stops. Your camera will be set to show either full plus half, or full plus third stops. You can change between them.

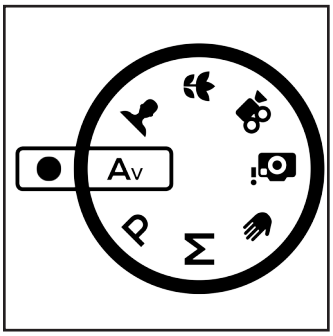
It's not critical that you remember all the half stops and third stops, but you should be familiar with the benchmark full stops for each of the 3 settings.

In Appendix 1 you'll find all the stops - full, half and thirds. Have a quick look now.

Double the light / half the light

As you move between stops, remember that each stop lets in *twice as much light* as the one before it (rather than just +1 stop). This diagram shows the concept for apertures, so you can see the huge difference between each end of the scale:

Homework - shoot on Manual



1. Select aperture priority mode, choose an aperture that's a full stop (eg f8) and take a photo.

f8
1/250
ISO200

2. Write down what settings the camera picks. Your settings might be different to these.

f8 > f5.6

3. Go onto Manual mode and change the aperture by 1 stop (bigger) to have a shallower depth of field.

1/250 > 1/500

4. Change the shutter speed by a corresponding 1 stop in the opposite direction (faster) and take another photo.

Both the photos should have the same exposure, if the light hasn't changed and you focussed on the same spot. The only difference should be a slightly shallower depth of field in the second photo.

Have another go, this time on shutter priority. Try changing the settings by 2 stops, and by using a combination of both aperture and ISO to compensate.

This chart shows the 3 settings laid out in the same direction, from less light to more light (or for ISO, less sensitive to more sensitive), to help you with this exercise. It's important that you start on a full stop setting. Check Appendix 1 if your settings aren't shown here - you may be on a third or a half stop setting.

aperture	**f16**	**f11**	**f8**	**f5.6**	**f4**
shutter speed	**1/1000**	**1/500**	**1/250**	**1/125**	**1/60**
ISO	**50**	**100**	**200**	**400**	**800**

less light — more light

TEST YOURSELF

This is a difficult test. Don't expect to get full marks on your first try, or for it to take only a minute or two. Have a go, move on, but come back to it from time to time. By the end of the year you should find it straightforward.

1. Which of these is is the only full stop aperture?

A f7.1 B f5.6 C f3.5

2. Which of these are full stop shutter speeds?

A 1/60 B 1/125 C 1/400

3. To go one full stop faster (less light) from a shutter speed of 1/125, what do you need?

A 1/60 B 1/250 C 1/500

4. To go one full stop wider (more light) from an aperture of f5.6, what do you need?

A f8 B f16 C f4

5. To go 2 stops less light than f11, 1/250 and ISO 400, which combination can you use?

A f16, 1/125, ISO 400 B f11, 1/500, ISO 400 C f16, 1/250, ISO 200

6. To go 2 stops more light than f16, 1/500 and ISO 200, which combination can you use?

A f8, 1/125, ISO 100 B f8, 1/500, ISO 200 C f11, 1/1000, ISO 200

7. To go 3 stops less light than f8, 1/250 and ISO 200, which combination can you use?

A f5.6, 1/125, ISO 400 B f16, 1/60, ISO 100 C f8, 1/1000, ISO 100

8. To go 3 stops more light than f11, 1/500 and ISO 100, which combination can you use?

A f4, 1/60, ISO 800 B f16, 1/1000, ISO 50 C f8, 1/250, ISO 200

ANSWERS

1: B 2: A,B 3:B 4: C 5: C 6: B 7: C 8: C

Stick one of your homework photos here:

In my own words...

Can you write down the full stops for aperture, shutter speed and ISO, in order from least light to most light?

Checklist for Chapter 5

▢ I know that this is one of the most difficult chapters, and that I don't need to learn it all off by heart today

▢ I understand that aperture, shutter speed and ISO are like 3 corners of a balanced triangle, and that if I change one, the other two need to change by an equal and opposite amount if I want to keep the same exposure

▢ I know that a stop of light is the amount between full increments of aperture, shutter speed and ISO

▢ I know that stops can be measured in full increments (like f5.6 and 1/60th), but also in half stops and third stops (see Appendix 1)

▢ I know that the easiest way to remember how the stops work together is to actually try to change them

▢ I have done the homework

▢ I have tried the quiz, but not felt a failure if it was really hard - I trust the fact that if I keep working through the course it will get easier

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You don't need to understand everything about stops and shooting on Manual mode right now. If you can tick off everything in this checklist, you can move on.
