Exposure: Part 2 – Bob Young

In part 1, we discussed the most basic of methods, AUTO, and the slightly improved option of the "P" mode. By themselves, these options provide very limited scope for you to introduce your creativity into the images you are making.

We discovered the 'scene modes' and I hope you have taken the opportunity to try these and note the differences in the 'look' of the resulting images. But even here, you are limited in how much influence you have on the end result – this is controlled entirely by the computer within your camera.

In this part we are about to start the journey which will empower you to decide the outcome (the 'look ') of the images you make.

In these few paragraphs I have referred to the 'look' of the image and to 'making images', not taking images, on two occasions. So let me explain.

The 'look' of the image is the manner in which the decisions we make, and the exposure settings we use, are reflected in the final image. Have we used a high shutter speed to 'freeze' the action or a wide open aperture to reduce the depth of field? By implementing decisions such as these, we are starting down the path of 'making ' images rather than just taking photos where someone else (the computer programmer) has determined how the resulting image should look.

While there are a number of other factors which will impact on the look of the image, such as the focal length or degree of zoom of the lense and the distance from the subject, the decisions we make in relation to exposure settings provide far more options to invoke subtle changes in the look of the image. (See article by Les Ryan in this issue). The purpose of this part is to look at the effects; the relationship between the three components of "Exposure"; and how we can control these effects through the use of the 'A' (Av) and 'S'(Tv) settings.

In part 1, we learnt that the three components to the term exposure are:

1. The ISO setting which controls the sensitivity of the image receptors and also influences the degree of detail in the image.

2. The Aperture size (A or Av) which controls how much light enters the camera and falls on the image receptors. Aperture size also influences the depth of field – the extent to which the foreground and background elements are in sharp focus.

3. The shutter speed (S or Tv) which sets the length of time that the shutter is open and allowing light to enter the camera. The shutter speed, or duration, influences the illusion of movement and the degree of motion blur in the image.

We might write the exposure as f8 @ 1/100 sec ISO = 100 where f8 is the aperture setting ,
1/100 sec is the length of time that the shutter is open, and ISO is the sensitivity setting.

We also learnt that we can change any one of these values so long as we make an equal and opposite change in one of the other two. (That is technically not totally correct: we could make partial changes in both of the other two settings so long as the combined effect was equal and opposite the change we made to the first component). Before looking at how we do this, we need a bit more of the technical stuff – sorry, but it is necessary.

On my Nikon D2X camera with its 50mmF1.4 lense and the exposure setting increments set to 1/3rd stop, there are 105 equivalent exposure settings which will result in a correctly exposed image for any given situation. That is if the exposure meter reads f8 @ 1/100th sec and the ISO is set to 100, then there are 104 other combinations

which will also result in a correctly exposed image, but there will be subtle differences in the 'look' of each image.

How can this be so? Well, the International Standards Organisation has defined a set of very complex algorithms which regulate the effect of varying each component so that an increase of 1 stop in the sensitivity of the receptors is equal to a increase of 1 stop in the length of time that the shutter is open which is also equal to 1 stop in diameter of the lense aperture. What is a "stop"? It just a term, like an inch or metre – it could be called a "Kangaroo" and it wouldn't make any difference. It is a unit of measurement which we use to define a known amount of change in any of the exposure settings.

For the remainder of this part we will refer to the "full stops" which are commonly defined on digital cameras as:

ISO: 50, 100, 200, 400, 800, 1600, 3200

Shutter speed (duration in seconds or part thereof): 8, 4, 2, 1, 1/2, 1/4, 1/8, 1/16, 1/30, 1/60, 1/125, 1/250, 1/500, 1/1000, 1/2000, 1/4000, 1/8000

Aperture: f1.4, f2, f2.8, f4, f5.6, f8, f11, f16, f22, f32

In each case the relationship between the settings ***is a doubling or halving effect***. This can be clearly seen in the ISO and Shutter settings. If we increase the ISO by 1 stop from 100, it becomes 200 and doubles the sensitivity: if we decrease by 1 stop – 100 becomes 50 and halves the sensitivity of the receptors to light. Similarly if we add 1 stop to a shutter setting of 1/500th it becomes 1/250th. So 1/250th will allow twice as much light to enter the camera than would a setting of 1/500th. You might need to think about that one for a moment, but if you are not sure that my arithmetic is correct try this; take a piece of paper and fold it in half, now fold it in half again – you should now see 4 quarters. Therefore ½ is twice as big as ¼.

The relationship between the diameter of the aperture and the value of the aperture settings is no so readily visible. Firstly the smaller the value, the larger the aperture diameter – f1.4 denotes an aperture which is opened to its maximum diameter while f32 would denote an aperture where the opening is not much greater than a pin-hole. But never-the-less the relationship of 1 stop between values is enforced, such that changing the setting from f4 to f2.8 will double the amount of light entering the camera, while changing the value from f11 to f16 will halve the amount.

OK, that's the end of the technical stuff.

Loosely speaking, the word photography comes from the Greek word "phos" – light and "graph" – draw and is interpreted as meaning a painting or drawing made with light. The aperture, shutter and ISO settings are our tools which we use to make our image. So although my camera can technically produce a correctly exposed image using up to 105 different combinations of the 3 components for any given scene, it is my choice of which combination I use to reflect the look of the image I desire.

Shutter Speed

Let's start by looking at Image 1. My in-camera exposure meter suggested an exposure setting of f8 @ 1/500th sec with ISO set at 200. Considering that the water skier was travelling at about 35kph, 1/500th second was not going to stop the action. Not only would we see motion blur around the skier, but the water spray behind her would be more like a 'Yarra River' brown curtain with little definition. I needed a shutter speed of 1/2000th second to stop the action.

Image 1: Water-skier

By using the "S" option, you are able to set the shutter speed to 1/2000th second The camera's computer will then sort out whether to increase the sensitivity of the image receptors (ISO setting) or to increase the aperture diameter (A or Av setting).

In my case I chose to manually reduce the shutter speed and increase the ISO setting. This gave me the result that I wanted in respect to controlling the motion blur, but if you were able to look at the original image at full size you would notice that I have compromised on the image detail.

The point that I want to make is that although we have a large number of possible solutions which will result in a correctly exposed image, making changes to one component, in this case shutter speed to control motion blur, will inevitably result in compromise with either of the other two.

So how can you make that decision?

Firstly we need to understand what effects are going to be rendered by changing each setting. Images 2 and 3 clearly show the effects that can be achieved by again just changing the shutter speed.

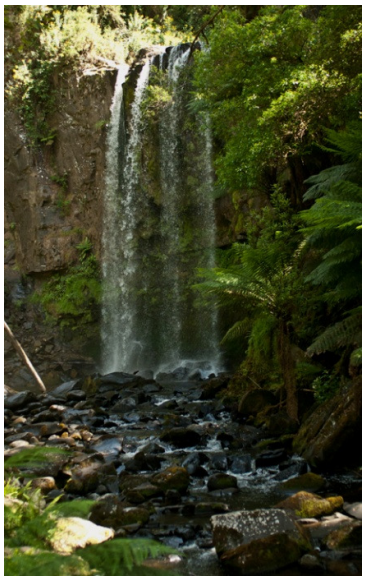

Image 2: Hopetoun Falls Otway Ranges Shutter speed 1/60th second

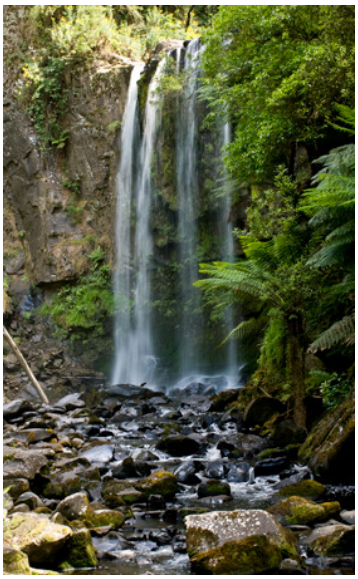

Image 3: Hopetoun Falls Otway Ranges Shutter speed 1 second

Image 3 is the more typical rendering of a waterfall where the slow shutter speed creates a ribbon effect in the water.

If it had been possible to increase the shutter speed to say 1/500th second, the stopping effect in Image 2 would have been greater and the transparency of the falling water increased. With the "S" or "Tv" mode and with ISO set to AUTO, you are limited in the control which you can exercise – you can only change the shutter speed and the camera's computer will determine the other variables. Taking lots of images with different settings is the only way to learn the effect that you can achieve with your camera. So next time you go to a national park, take a little bit more time and take several shots at different settings so that you can compare the results. You should be able to achieve these effects with your point and shoot camera as well as any other camera using the "S" or "Tv" settings .

Image 4: Pink Lake - Murray - Sunset National Park.

Aperture is the tool for controlling depth of field. In a landscape you will probably be looking for the greatest depth of field – all elements from the foreground to the background should be in focus.

Image 5: Little Desert

In Image 4, the aperture value was set at f16 resulting in a very small aperture which restricted the amount of light entering the camera. But at the same time it had the effect of creating the greatest depth of field.

To compensate, the shutter speed was reduced to 1/125th second. An alternative would have been to increase the sensitivity of the image receptors by increasing the ISO setting.

As with the "S" setting which we discussed in the preceding section, when we use the "A or Av" setting, we only have to set the aperture value and let the camera's computer look after the other values.

Image 6: Working Horses - Yarra Valley

Compare Image 5, which was taken with an aperture of f5.6, with Image 4 and you can easily see the reduction in the depth of field. The Mallee trees in the background are only 3 or 4 metres behind the mound. You will notice that this has the effect of really separating the bird from the background, but the downside is that we are not showing anything of its native habitat

In the previous two images, we have looked at the two extremes – maximum depth of field and very shallow depth of field.

Image 6 was taken with an aperture value of f8. Here the cypress trees in the middle ground are starting to blur, but are easily recognisable. This is a great way to add a feeling of depth to your image without allowing the background to become 'busy' and compete for the viewer's attention.

ISO is, generally, not changed as often as either of the other two components. This may be because to do so when using film, meant having to rewind the film back into the cassette – and load a new roll of film with a different ISO rating. Rewinding a partially exposed roll and then subsequently reloading and getting back to the same position so that you didn't "over-write" previous images was not easy. So unless there were only 1 or 2 shots left on the roll, the tendency was to 'use what you had in the camera'. The digital age has removed this impediment, and we now able to using the ISO setting as an active option in determining the exposure statement.

Look back to Images 2 and 3, if we had just used the "S" option and set its value to 1/60th without changing the ISO value, the camera would have changed the aperture to compensate. This would have meant that the depth of field would have been reduced and the rocks in the foreground in Image 2 would have been blurred. Most cameras will allow you to set the ISO value as well as the aperture or shutter speed when using the A (Av) and S (Tv) modes. By changing the ISO by an equivalent and opposite value to the change in the shutter speed (50 to 1600), the camera will not change the aperture value. The reason is that we decreased the shutter speed by 6 stops and increased the sensitivity (ISO) by 6 stops.

Let me illustrate this in a different way. Picture yourself at the garden tap filling a bucket The tap contains a valve which regulates the flow of water: when just turned on there is very little flow, but when fully turned on the water flows with great force and will fill the bucket more quickly. This represents the camera's aperture control.

We can control how long the water flows by switching the tap on and off, which is analogous to our shutter speed on the camera.

The bucket captures the water which flows from the tap and we can equate that with the image receptors which capture the light entering the camera through the lense.

If we adjust the tap so that there is just enough water flowing to fill the bucket in 20 seconds, then we could equate this with the proper values for the aperture, shutter speed and ISO calculated by the exposure meter in the camera.

Now, if we are impatient and only wish to wait for 10 seconds to get a full bucket, we have to either open the tap valve further to allow more water to flow or get a smaller bucket. Translating this to our exposure settings:

If we reduce the shutter speed (length of time the shutter is open), we must increase either the aperture or sensitivity vales. Increasing the aperture allows more light to enter the camera, while increasing the ISO means that we need less light to achieve the correct exposure.

One more example – Suppose we open the tap valve further to allow more water to flow, but do not change either the time the tap is on or the size of the bucket: the bucket must overflow. In the case of our camera, if we opened the aperture (changing the value from f11 to f8), and we do not change either the shutter speed or the ISO values, then there will be too much light entering the camera and our image will be overexposed. On the other hand, if the aperture was reduced in size (f11 to f16), then there would not be enough light entering the camera and the image would be under exposed or you could say our bucket is only half full.

How you set the values for the aperture if you are using the A (Av) setting will depend on your camera. If you are using a point and shoot or one of the cheaper DSLR cameras, it will probably be achieved as a menu option. On more advanced cameras there will be a 'command wheel', usually built into the hand grip, which makes the task much simpler. S (Tv) and ISO values will be set in a similar manner. Since the actual process varies from manufacturer, and often model to model, you must go to your user manual for the instructions for your camera.

On this little FinePix point and shoot, the procedure to change the ISO is:

1. Press the black "F" button on the right
2. Use the < > arrows on the joy-stick to move the cursor to ISO
3. Use the up/ down arrows on the joy-stick to select the value you require.
4. Press the Select button.

In the next part we will look at how the exposure meter works and how, and when, to use the exposure meter modes of Program/ multi-segment, Centre-weighted and Spot. In the meantime, I recommend that you become familiar with setting and changing the exposure values on your camera. There are many correct exposure combination, but only one combination will give the creative the result which you visualised.