MONDAY NIGHT TUTORIALS

WELCOME TO WEEK 5

SHARPNESS TUTORIAL

WHY PHOTOGRAPHS AREN’T ALWAYS SHARP

WHY WE WILL COVER SHARPNESS TONIGHT

After comments by a club judge at a competition night last year and looking at some of the general images on the club's gallery site, it is fairly obvious that there are some image sharpness issues amongst the member's images.

Please don't get downhearted about this because all of us are affected by blurred images, even the professionals get them. Also, don't think that all blurred images are bad, this can also be an artistic choice by the photographer.

However, in our galleries there a considerable number of images that aren't sharp but should be and this is a shame because some are really good and we would use them as external competition images had they just been a bit sharper.

BUT FIRST – WHAT WE CAN'T CONTROL

There are reasons for poor image sharpness that we can't easily fix and these are usually because of a technical problem or an equipment shortfall. Here are some examples of this but, this is not a exhaustive list.

The kit lenses that come with new cameras for example often produce poor quality images due to their cheaper build quality. There are exceptions to this such as the nifty fifty Canon 50mm f/1.8 lens.

Certain zoom lenses can perform poorly at their extremes especially when they try to cover too much range from wide to narrow for e.g. 18 – 300mm.

There is also broken or malfunctioning equipment.

These issues can only normally be overcome by replacing, upgrading or repairing the broken device.

There is also another issue where a lens can back or front focus but that is a very technical fix and we won't be discussing that particular issue tonight.

NOW – WHAT WE CAN CONTROL

There are several reasons for blurred shots and they will be listed below. These problems are usually caused by a lack of knowledge, experience or an outside influence but they can be overcome once identified. However, identifying the problem is usually where people fall down because if you don't know why it is happening, then you can't fix it. Some of the issues that can cause blurred images are:

- Shutter Speed Too Slow
- Camera Movement/Camera Shake
- Depth of Field Too Narrow
- High ISO & Cropping
- Focusing on the Wrong Subject
- Focusing System Set on an Incorrect Mode
- Subject moved after focus was achieved
- Focusing changed when recomposing the shot
- Camera too close to Subject
- In Some Cases Having Stabilisation on Whilst on a Tripod.

SHUTTER SPEED TOO SLOW

Just a Quick Point About Camera Shake vs Motion Blur

Camera shake is where the camera moves, motion blur is were the subject moves and they're two very different things. In this article I'm focusing just on camera shake, in other words where you photograph a static subject such as a landscape or seated portrait with a handheld camera. Getting sharp shots of speeding cars is another skill all together.

Blurred images due to a slow shutter speed normally occur when hand holding cameras and the light is low. This is likely the biggest cause of blurred shots for most photographers especially beginners. For e.g. using a 400mm lens at 1/30th second will likely cause blurred shots. This is because we cannot hold the camera steady enough for 1/30th second duration and therefore this movement or shake manifests itself as a blurred image. These images are normally completely blurred all over with nothing sharp at all. This is shown further in the two images to the right, in the left hand image the camera has moved sufficiently in the 1/80th second to cause the image to be soft (blurred). In the right image, the 1/200th second is sufficient to capture a much sharper image. Even though the camera may have moved the same as in the left image, the faster shutter speed means that the camera hasn't moved as far whilst the shutter was open therefore it creates less movement and appears to be sharp.

THE FOCAL LENGTH VS SHUTTER SPEED RULE

With longer lenses such as 100mm or greater, the movement is exaggerated greatly at the subject end. For example if you hold a snooker cue out horizontally and look at the end, it will be moving around much more than at your hand end and this same thing happens at the point of focus with the light to your camera.

In the days of film photography there was a general rule that in order to get sharp images from a hand-held camera the shutter speed needed to be at least one second divided by the focal length of the lens.

So the layman's method of using this would be if you were shooting with a 100mm lens then the shutter speed needed to be at least 1/100sec. Of course we don't have 1/100th second shutter speed on the majority of cameras so we would select the next faster speed of 1/125th second.

This rule is generally still true today but of course in film days all 35mm cameras had a film size of 35mm. Today we have cropped sensors and anti-shake systems such as Image Stabilisation (IS) in Canon or Vibration Reduction (VR) in our Nikon cameras and lenses. These have an effect on this general rule which we need to be aware of so that we can work out the shutter speed correctly.

FULL AND CROPPED SENSORS

For full frame camera bodies such as the Canon 5D series or the Nikon D800 series etc. the previous rule applies correctly because their sensor is comparable in size to the 35mm film in older cameras. However, with advent of cropped sensors the above speed calculation varies depending on the camera because the focal length changes depending on the amount of crop. What the term 'Cropped Sensor' refers to is a sensor that is smaller than the standard 35mm film or full frame sensor and just to make it more difficult, different camera types and different manufacturers make a variation of different sized sensors. The amount that the sensor is reduced from the 35mm size is called the 'crop factor'.

For example, if we use a 100mm lens as an easy reference and mount this lens on a cropped sensor camera such as the Nikon APS-C format SLR, D5200, we need to know the crop factor to work out the focal length and ultimately the shutter speed required to capture a sharp image when we shoot handheld. I happen to know that this camera has a crop factor of 1.5 and for the techs amongst you, it means that the sensor is ¾ of the size of the 35mm or full frame sensor.

The effect that the crop creates is that it multiplies the focal length of the lens. So, we multiply the actual focal length of the lens (100mm) by the crop factor (1.5) which is 1.5 x 100mm = 150mm. Therefore, the 100mm focal length of the lens fitted to a camera with a crop factor of 1.5 changes the focal length to 150mm. This means that we now need a shutter speed of 1/150th second and again as most cameras don't have this speed we use the next higher which is 1/160th second.

With Canon APS-C cameras such as the EOS 650D, they use a sensor that has a 1.6 crop factor. If we then use the same formula 100mm x 1.6 = 160mm, this means that the shutter speed should be at least 1/160sec for hand held shots.

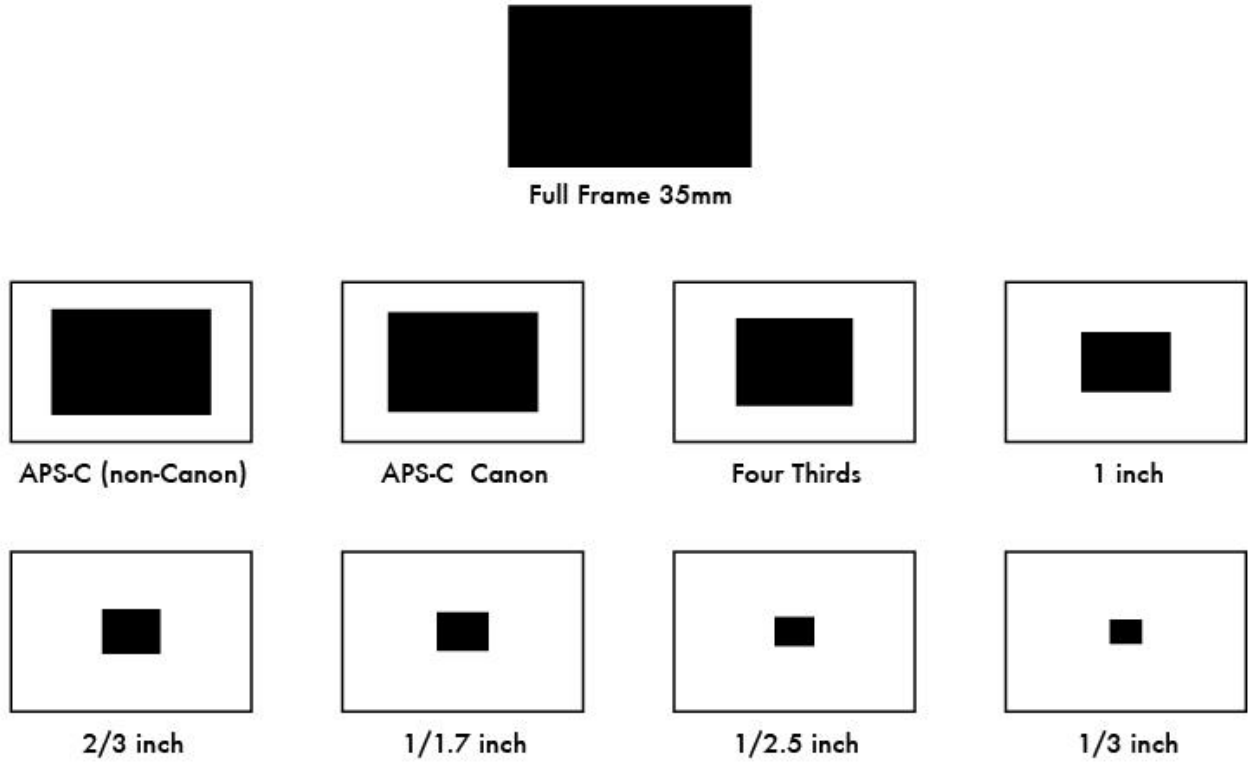
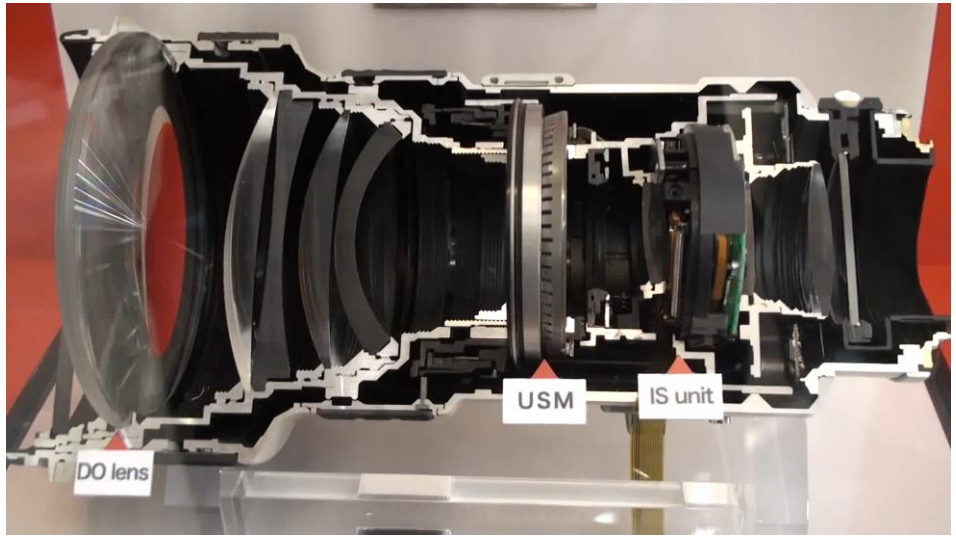


IMAGE STABILISATION

Now having worked all of that out, we can almost disregard this information if we have Image Stabilisation or Vibration Reduction in our lens or camera body. What these systems do is attempt to counteract camera shake by moving a group of lenses using gyroscopic sensors that detect movement. In earlier lenses Canon state that you would be able to shoot hand held 2 stops slower than normal. With the later lenses they claim that you can achieve up to 5 stops slower although it is likely that in reality it is 3 or 4 stops.

What this means is that you can achieve hand held shots at slower shutter speeds. For example, when using a 100mm lens without stabilisation on an APS-C camera, we know that we need a shutter speed of 1/160th second. However, if that lens has stabilisation that can reduce the shake by 4 stops then theoretically, we only need a shutter speed of 1/20th second (rounded up to 1/30th sec).



CAMERA MOVEMENT, CAMERA SHAKE

This is a very similar problem to what's defined in the previous section and it can definitely be caused by the slow shutter speed mentioned above. However, there are a number of other things that can cause movement of the camera at the decisive moment and I'll start explaining this with a story.

One night shoot in Melbourne, we were at Birrarung Marr by the Yarra River shooting night shots of The Princes Bridge. I was helping out with some of the less experienced members when I was asked by an established photographer to give them a hand. He said to me "try as I might I cannot get sharp shots, can you see what I'm doing wrong?" After checking out the camera settings and the mounts on the tripod for rigidity I asked the photographer to go through the actions of taking a shot. It only took one shot to see the problem but I asked him to take several just to ensure that this was the consistent problem. What was happening was as soon as he used the remote release and took the shot, he grabbed to tripod leg to steady himself and wait for the exposure to end. He was not aware that he was doing this and this was what was causing the camera to shake and give him a blurred image.

Other issues can be the wind blowing the camera on a tripod or the tripod stood on unstable ground such as a wooden walkway, soft vegetation or a floating jetty especially when people are moving about.

Another common cause is using the shutter button instead of a remote release on a longer focal length lens. To see why this is the case, mount your camera onto a tripod with your longest lens. Extend it to full zoom and then switch on live view. Now zoom in the live view as far as possible and then whilst watching the LCD screen touch the camera and this will show you how much movement occurs.

DEPTH OF FIELD TOO NARROW

Depth of Field (DoF) is the most technical of the focusing issues listed here and it is the amount of the photograph from front to back that has acceptable focus. This is a very common issue and it can be due to a lack of understanding regarding DoF and the relationships between distance, aperture and focal length.

If you don't have enough DoF then your subjects may not be in focus as in the image to the right. The lady is in absolutely acceptable focus but her partner is not.

Obviously we would know what settings we had used had this been taken by us however, we are not sure in this case because the image came from the internet.

What do you think is the easiest step to take to get the couple both into focus?

Answer:

Get them both onto the same focal plane

DEPTH OF FIELD TOO NARROW

Commonly, close up or macro photography creates the situation where the image has very little in focus. This is due to the characteristics of the lens, the aperture, the focal length and the distance to subject, all of these contribute to this problem. Learning to manage focus points or manually focusing is essential to get what you want in focus and therefore an acceptable shot.

This is not really a tutorial to explain how DoF works however, here is a description and some diagrams etc. At the end of it you should have a better understanding on how DoF works.

These 2 will decrease the DoF (less in focus)

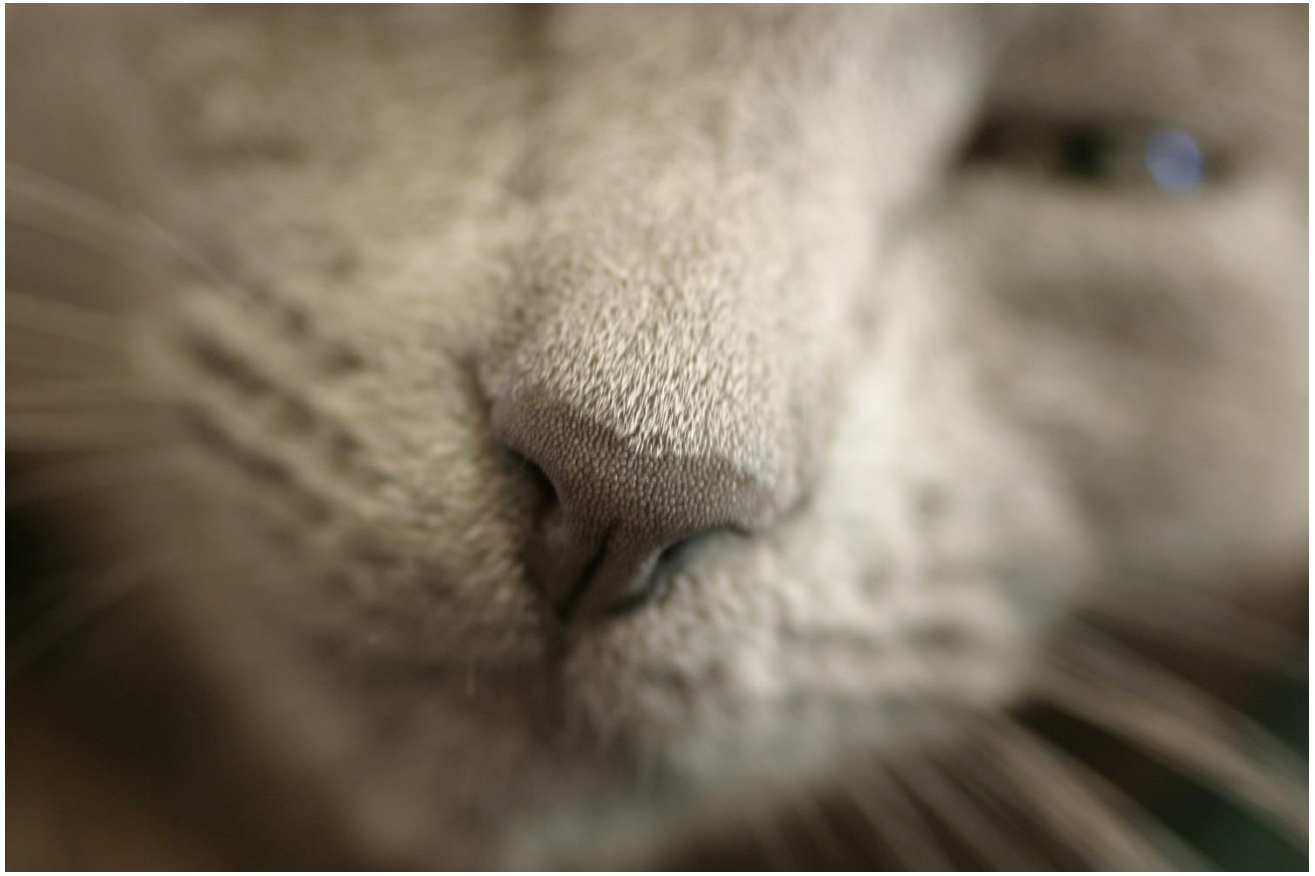
- Getting closer to the subject
- Using a wide aperture (small number)

These 2 will increase DoF (more in focus)

- Getting further away from the subject
- Using a narrower aperture (big number)

For example, a narrow aperture (f/16) and a large distance to subject will give you an enormous DoF.

In contrast to this, a wide aperture and short distance to subject will give you an extremely narrow DoF.



DEPTH OF FIELD TOO NARROW

Here are some charts that attempt to show the changes to the DoF when any of the three variables are changed. I have used a 5D with a full frame sensor to create these tables therefore, figures may vary depending on the camera used as this is only a guide to show how the changes effect DoF.

Distance to Subject Changes

Focal Length	100mm	100mm	100mm	100mm
Aperture	f/5.6	f/5.6	f/5.6	f/5.6
Distance to Subject	.5mtr	1mtrs	10mtrs	100mtrs
Depth of Field	6.8mm	2cm	3.46mtrs	See Note[1]

1. Depth of Field extends 62.9 metres in front of the subject and to infinity beyond the subject.

Aperture Changes

Focal Length	100mm	100mm	100mm	100mm
Aperture	f/5.6	f/8	f/11	f/16
Distance to Subject	10mtrs	10mtrs	10mtrs	10mtrs
Depth of Field	3.46mtrs	5.04mtrs	7.58mtrs	12.3mtrs

So why do these changes affect the DoF?

Focal Length – Does NOT changes the DoF

Please note that whilst you may have heard that focal length affects DoF it is a misconception. Focal length only changes the way we see the bokeh (blur) as opposed to changing the DoF. For e.g. if the DoF in our picture is quite shallow using a 70mm focal length and the background is blurred and we then switch the lens to a 200mm focal length the background in the next picture will be a lot more blurred. Over the years people assumed that the DoF was increasing because of the increased blur but in reality the DoF stays the same. What changes is the magnification, the 200mm magnifies the blur in the background and gives the impression that DoF is changing but it is in reality it remains exactly the same.

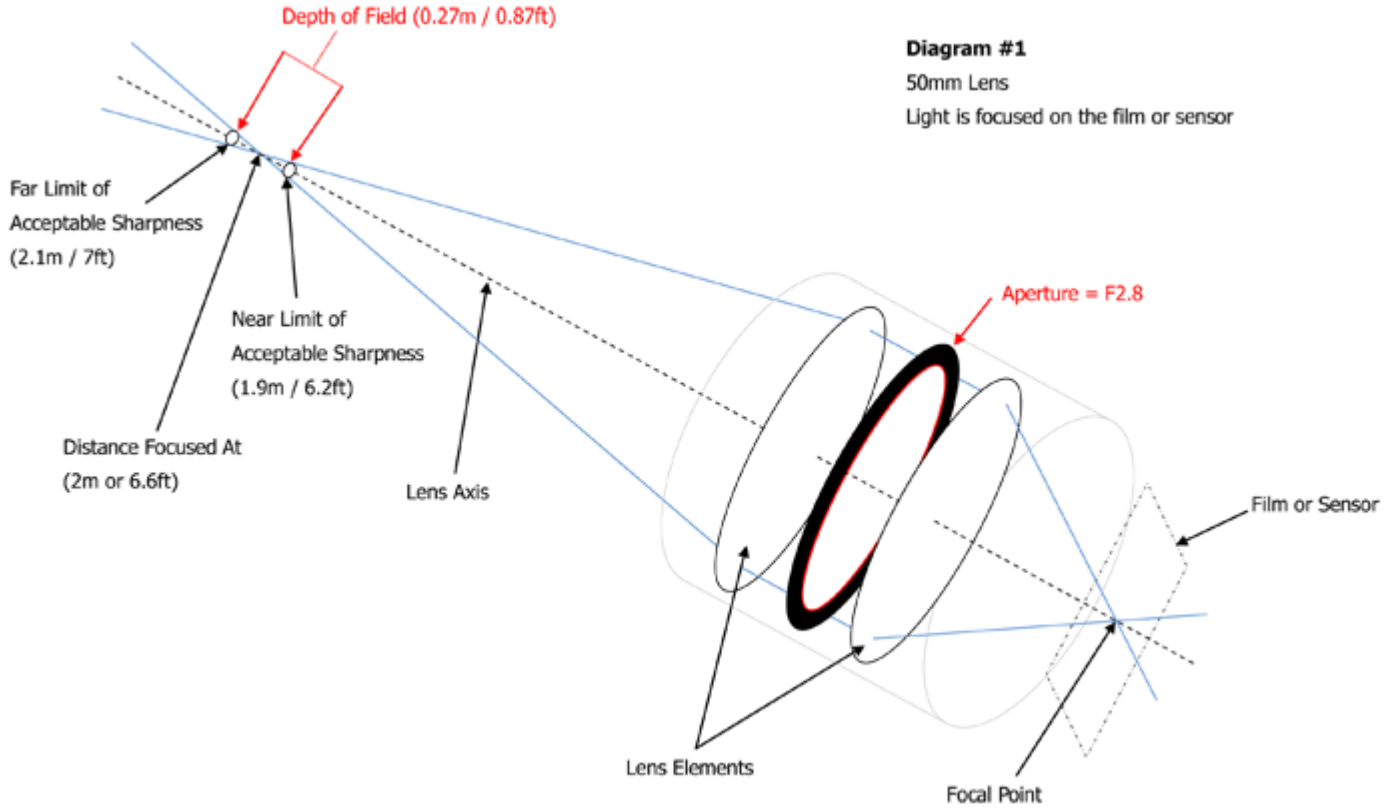
DEPTH OF FIELD TOO NARROW

I have some diagrams here courtesy of Martin Bailey Photography which I think explain the theory of DoF well and are the best I've found.

In this image we have a 50mm lens using an aperture of f/2.8 with a distance to subject of 2 metres.

You can see by the red text that the DoF is 27cm or 0.27mtr and that the sharp area is located where the blue lines converge.

In fact it is the convergence of those blue lines that dictate the DoF as we will see in the next slide.



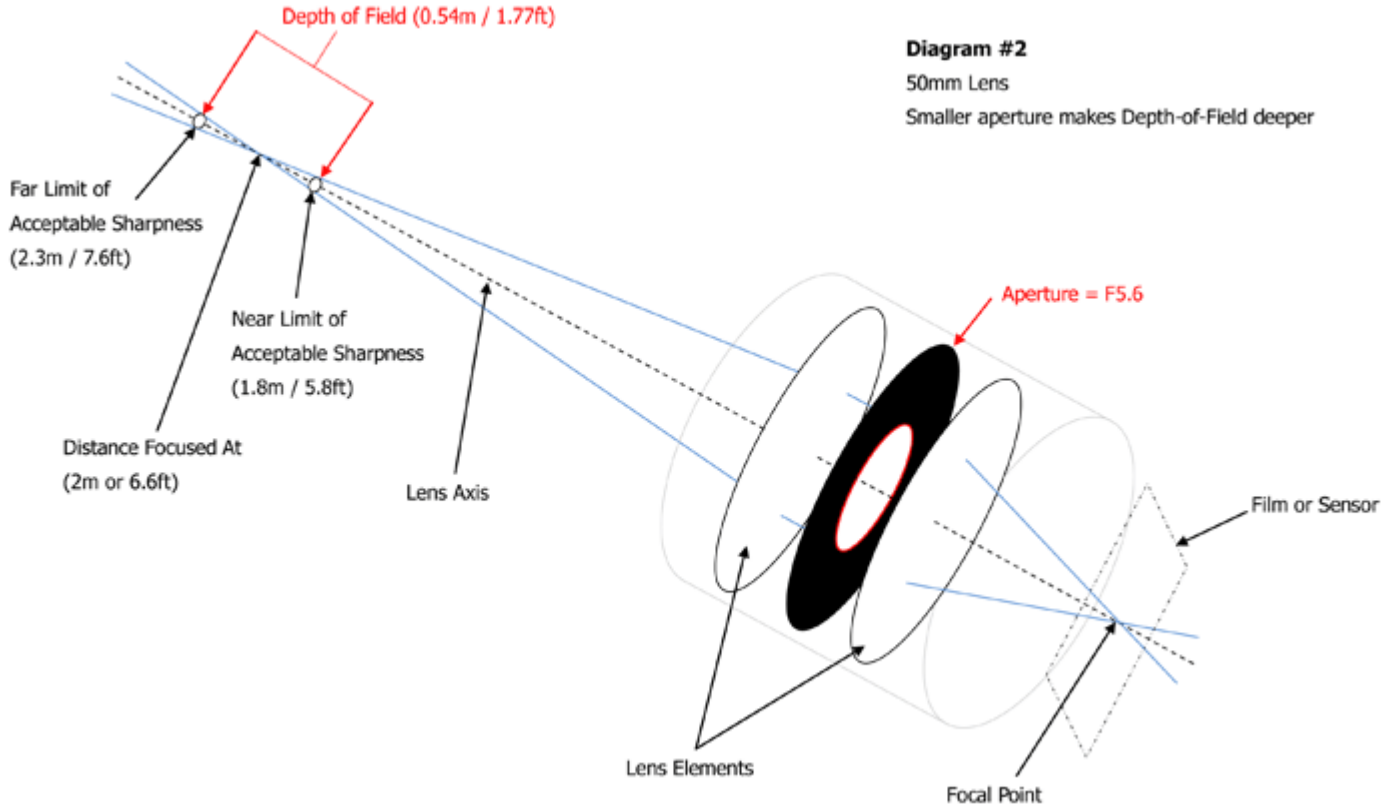
DEPTH OF FIELD TOO NARROW

In this image we again have a 50mm lens but this time the aperture is f/5.6 with a distance to subject of 2 metres.

You can see by the red text that the DoF has increased to 54cm or 0.54mtr and that the sharp area is again located where the blue lines converge.

Notice how the blue lines are now closer together when they leave the lens. Because the blue lines have a reduced angle they come together earlier and stay together longer.

On to the next slide.

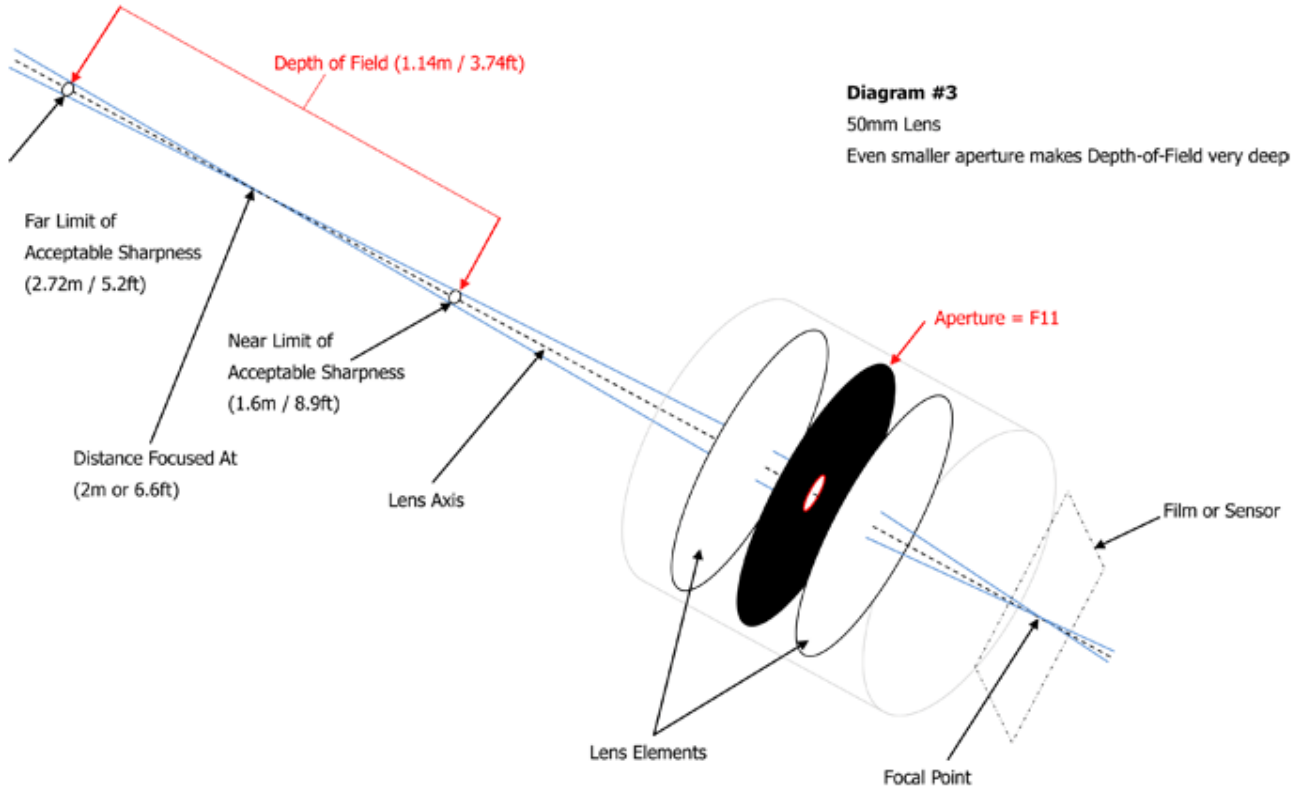


DEPTH OF FIELD TOO NARROW

In this image we again have a 50mm lens but now the aperture has been closed down to f/11 with a distance to subject of 2 metres.

You can see by the red text that the DoF has now increased to 114cm or 1.14mtr and that the sharp area is again located where the blue lines converge.

Notice how the blue lines are now even closer together when they leave the lens. Because the blue lines have a reduced angle even more they now come together much earlier and stay together a lot longer.



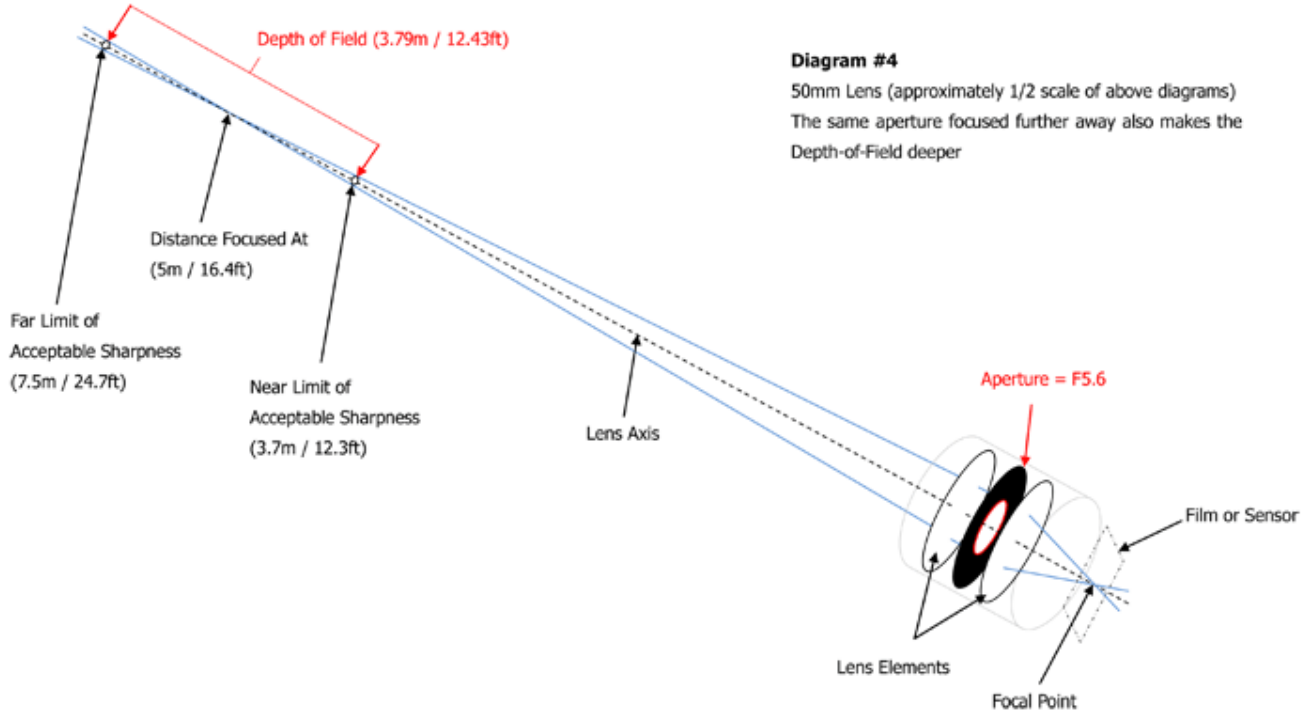
DEPTH OF FIELD TOO NARROW

This time we still have a 50mm lens and the aperture is back to f/5.6 but the distance to subject has been increased to 5 metres.

Now the red text tells us that the DoF is now 379cm or 3.79mtr and that the sharp area is still located where the blue lines converge.

In the previous image where we used f/5.6 the lines didn't stay together very long because of the wider aperture. However, this time although the aperture is wide, the lines stay together even longer.

This is because the subject is further away and the lines have to travel further to the subject making the angle shallower so the lines get closer together as they stretch out to the subject.



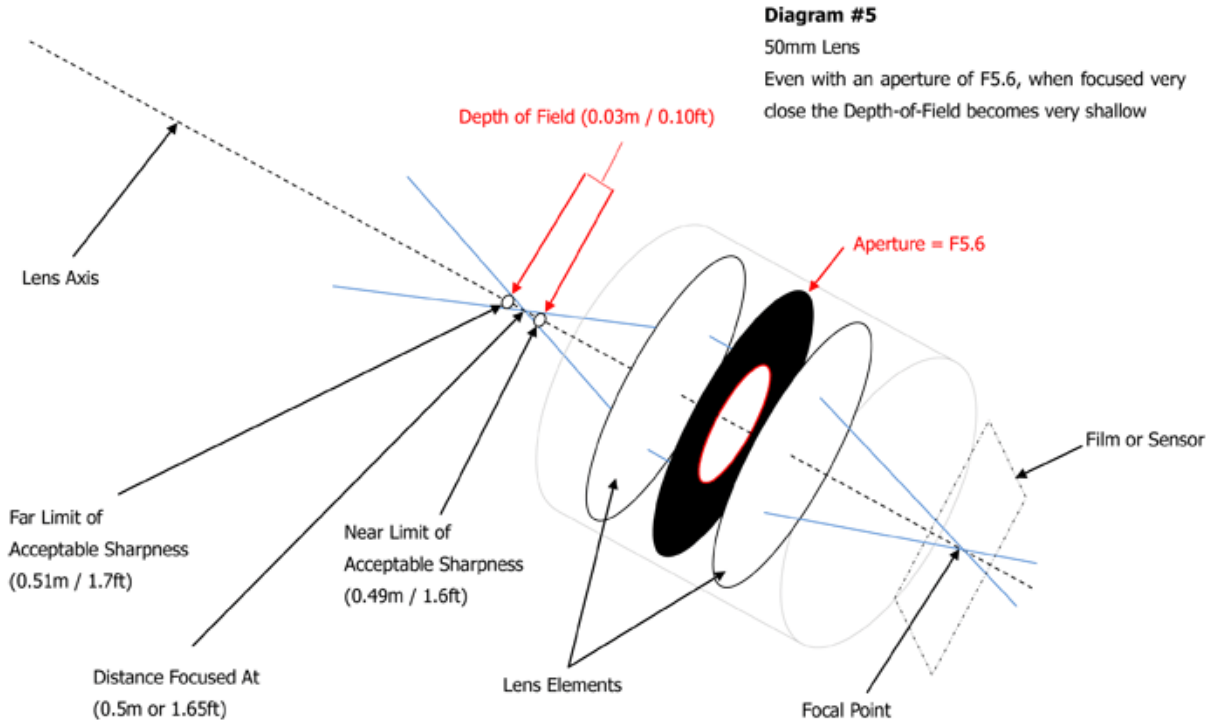
DEPTH OF FIELD TOO NARROW

In an attempt to show how this theory works , this time we still have a 50mm lens and the aperture is still set to f/5.6 but the distance to subject has been severely decreased to .5 metre.

Now the red text tells us that the DoF is now 3cm or 0.03mtr and that the sharp area is still located where the blue lines converge.

This time the angle on the blue lines is very sharp so they only stay together briefly, 3cm in fact.

You can test this with your own eyes. Hold your finger out at arms length and slowly bring back towards your face. As you get closer your eyes have to squint to be able to keep the finger in focus. This is the same action that the blue line has to follow.



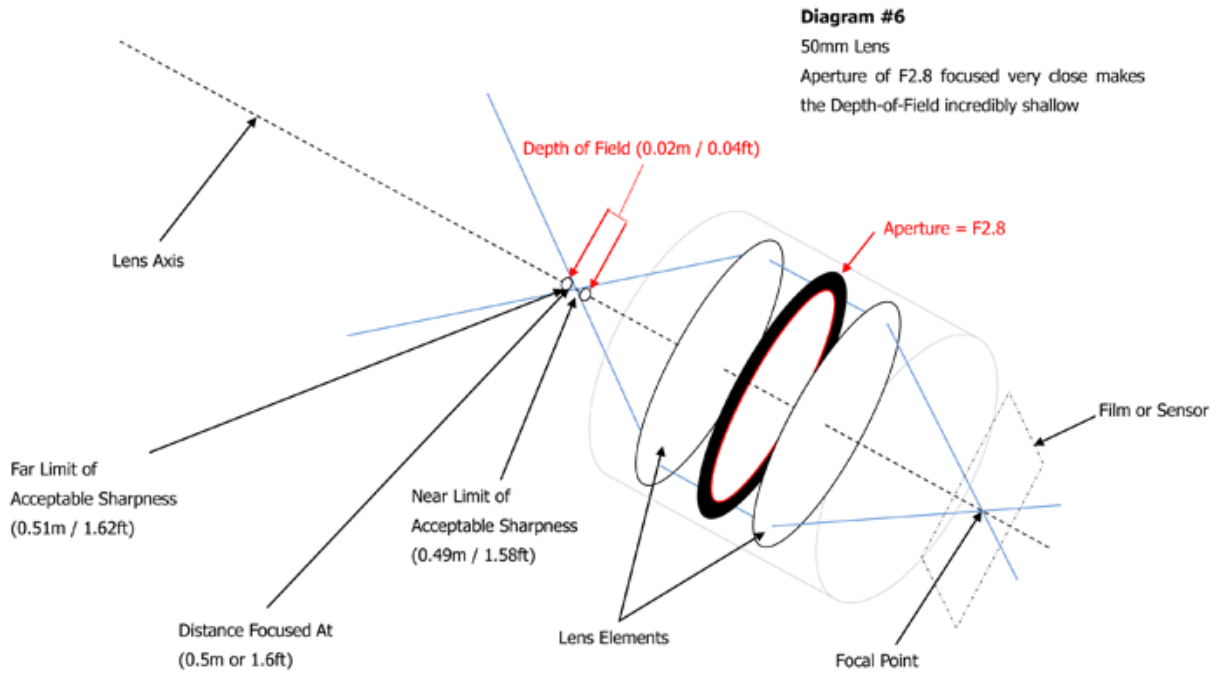
DEPTH OF FIELD TOO NARROW

In the final diagram, we have the 50mm lens and the distance to subject of .5 metre however, we have opened the aperture right up to f/2.8.

The DoF is now 2cm or 0.02mtr but this time the angle on the blue lines is extremely sharp so they only stay together for 2cm.

Having seen these drawings, you can now see what would happen here if we were to move the subject even closer. Now you know the theory of why DoF is so hard at such close distances.

I actually emailed Martin Bailey many years ago for permission to use his images, his response was “yes and good luck explaining it’.



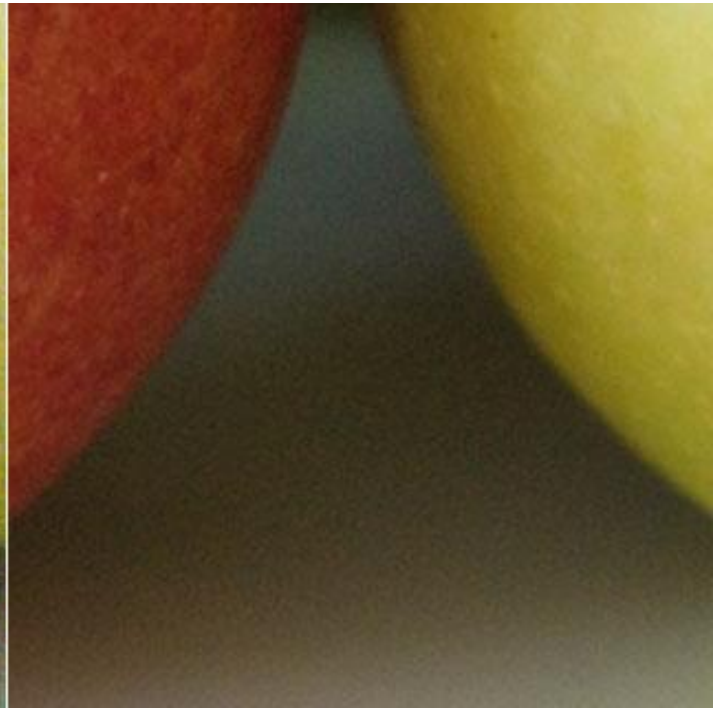
HIGH ISO AND CROPPING

Some of you may wonder why I have included ISO and Cropping into a sharpness tutorial?

However, as any wildlife photographer will testify, you often can't get close to a subject and the light is low so a higher ISO is needed to get a sharp shot.

When your images are processed and you end up having to crop an image substantially to get a favourable result, you magnify the effects noise in the image and in most cases this effects sharpness. To this end I do not shoot wildlife in anything other than ISO 100 and if I cannot use this setting I will forgo the shot rather than be disappointed later.

You can see by the two images to the right that high ISO on the left can severely affect the sharpness of an image especially when cropped into. This is a personal choice and entirely up to the photographer whether to use high ISO or not. In reality, it definitely depends on the circumstances of the shot.



MISSED FOCUS OR FOCUSING ON THE WRONG SUBJECT

This is a very common problem and is undoubtedly caused by a lack of understanding of the cameras focusing systems. Anyone who always uses their camera on multi point focusing mode will most likely have experienced this problem.

So why is this a problem?

The multi-point or all point focusing mode, regardless of how many focus points your camera has, will always focus on the closest subject that falls under one of the focusing points.

Provided that there is enough contrast for it to work. The camera will not be able to focus on subjects that have no contrast such as a white wall or other plain areas.

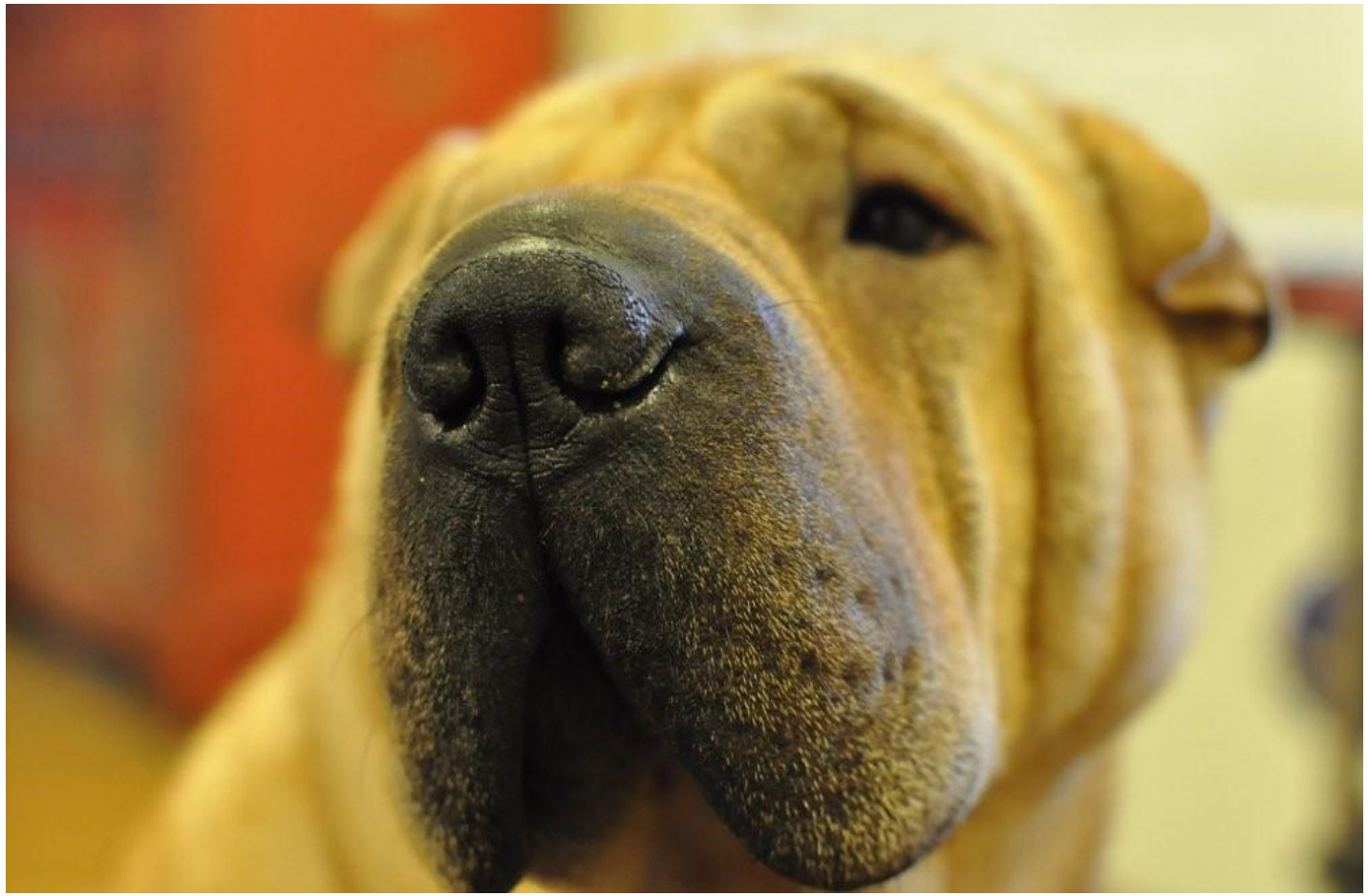
The problem with using this mode is that the camera does not know what you need to focus on so therefore chooses the closest and this may not be what you want in focus. Obviously, this becomes even more of an issue when you have only a narrow DoF to work with.

MISSED FOCUS OR FOCUSING ON THE WRONG SUBJECT

The image here is an example of what can happen when a multi-point focus is used in a situation where it doesn't work as the photographer desires. This has also been made more obvious because the dog is very close to the camera and the DoF is very small making the eye even more blurred. Obviously the dog's nose has high contrast therefore the camera has focussed on it as it is the closest high contrast object under the multiple focusing points. This has also wasted about a 1/3rd of the DoF because it extends in front of the point of focus and behind it. Because the point of focus is the nearest part of the dog the DoF behind the point of focus isn't being used to keep any part of the dog sharp effectively halving the DoF.

So, there are three options that would have allowed the photographer to focus this image correctly.

- The easiest and least sophisticated option would be to switch to manual focusing and focus on the eye. However, this may not be an easy task if the dog is moving its head around.
- The second option would be to use a single focus point and move the point of focus over the dog's eye but again difficult if the dog keeps moving.
- The third and the option that I would choose would be to enable the centre focus point only and focus that point on the dog's eye. Then whilst still half pressing the shutter button, recompose and grab the shot.



MISSED FOCUS OR FOCUSING ON THE WRONG SUBJECT

I always have my camera set with only the centre point activated but this can also create problems when you don't have an understanding of how the system works.

The two images here are taken with only the centre focus point active. The girl who was in the centre has been moved to the right third of the image to create a better composition but she has moved away from the centre focus point. Because that focus point is now on the background trees, the camera has done what it has been instructed to do and has re-focussed on those trees and now the subject is blurred.

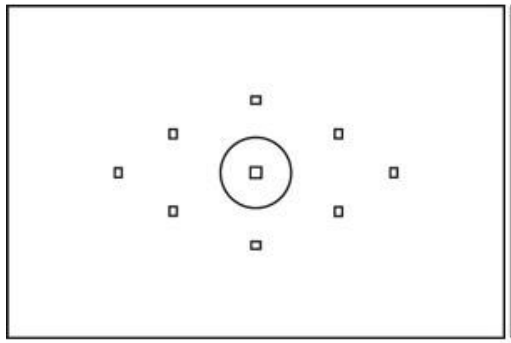
The choices to rectify this are exactly the same as the previous slide however, because the girl is more stationary than the dog then all three are viable options. It is also likely that the multi-point focus would have worked correctly in this shot because the girl is the closest to the camera and the depth of field from this distance is likely enough to keep the subject entirely in focus.

MISSED FOCUS OR FOCUSING ON THE WRONG SUBJECT

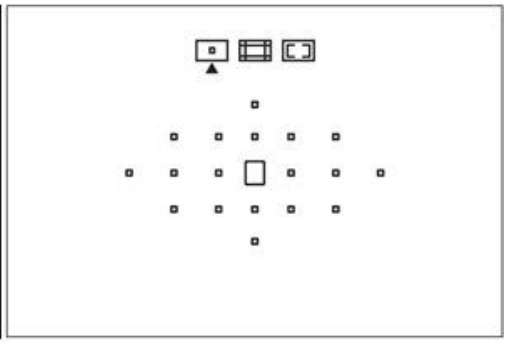
It is always a good idea to take control of the focus points in the cameras viewfinder. Cameras vary and here are the focus points from 700D and a 7D. The 700D is limited to all 9 points (multi-point) or single individual points of which only one point can be selected at any one time.

The 7D has more points which can be selected as the 700D with the inclusion of several modes which allow different patterns to be selected.

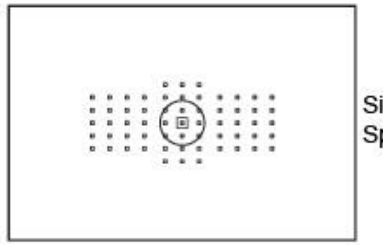
Below that is the 5D Mk3 focus points and exactly as the other two camera, each point can be set as a single point. However, the camera also has a number of modes which allow combinations of points to be active as well as a tracking option when in the 61 point auto mode.



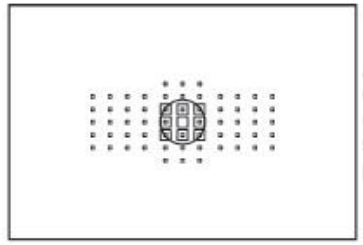
EOS 700D AF array



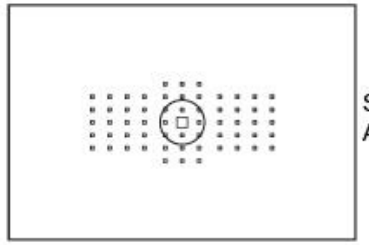
EOS 70D AF array



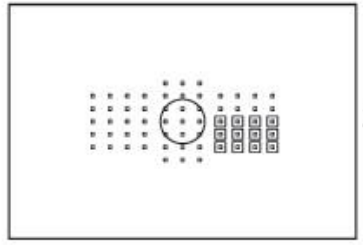
Single-point Spot AF



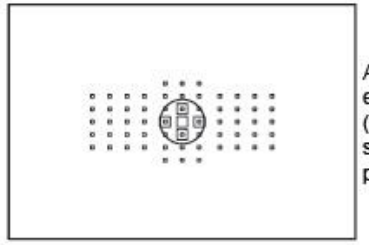
AF-point expansion (eight surrounding points)



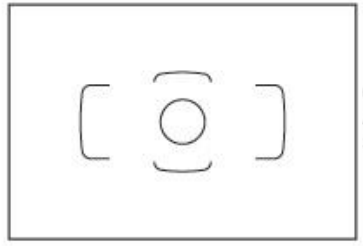
Single-point AF



Zone AF



AF-point expansion (four surrounding points)



61-point Automatic Selection AF

FOCUSING SYSTEM SET ON THE WRONG MODE

So the previous section leads us nicely into this section where we will look at the focus modes. Focus modes are different from focus points but they work together to achieve a successful shot. The focus points are where the camera will focus, the focus modes are how those points work.

Separate from the focusing point settings is the focus modes and in Canon cameras they are One Shot, AI Focus and AI Servo. Most cameras have something similar and here is a quick description of what they do.

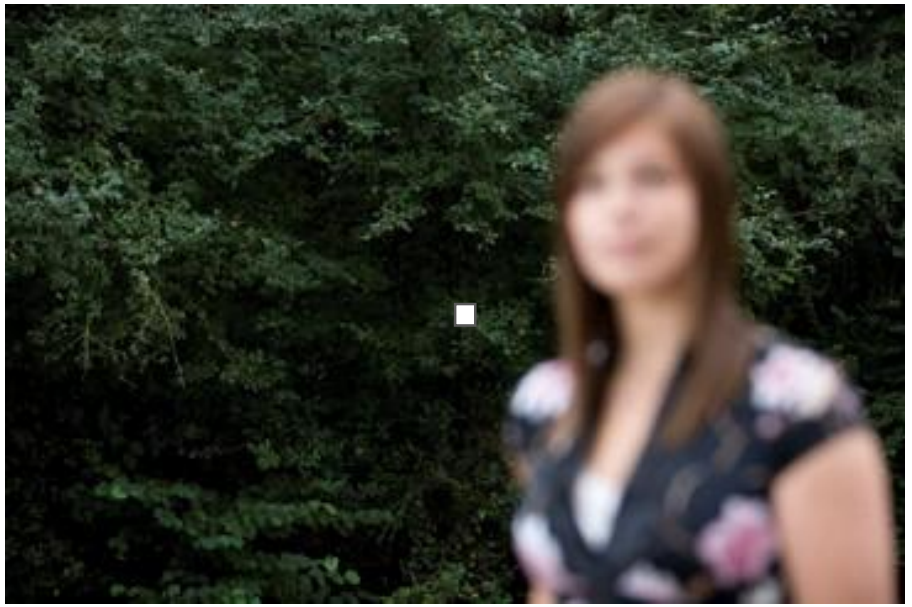
- One Shot – This is a static mode that retains the focus even if the camera is moved away from the original focus point provided that the shutter button remains half pressed. This mode is useful for static subjects that won't move after focus is achieved such as portraits and landscapes.
- AI Focus – Best used with a single focus point, this is the first of two dynamic focus modes and it is chiefly used for subjects that may move around in the same area such as a bird hopping around the branches of a tree. The focus will stay on the object provided that the point that achieved the original focus is kept on the subject.
- AI Servo – Again, best used with a single focus point this is a similar mode to AI-Focus but is used where the subject may be moving around with the addition of being able to track the subject if it moves towards or away from the camera as long as the focus point is kept on the subject.

So why can these modes get you into trouble when they are used incorrectly?

FOCUSING SYSTEM SET ON THE WRONG MODE

Let's take the photograph we looked at previously with the girl and the trees in the background. If we have the girl positioned in the centre of the shot and the focus mode on the camera set onto 'One Shot' with just the centre point active. If we then half press the shutter to lock the focus and then ask the girl to move slightly to the right to get a better composition and take the shot all is well and as long as the shutter is kept half depressed the girl remains in focus.

If we change the settings slightly so that the camera is set on 'AI Focus' or 'AI Servo' instead of One Shot and re-run this scenario, we find that as soon as the girl steps away from the focus point, the camera re-focusses on the trees in the background.



FOCUSING SYSTEM SET ON THE WRONG MODE

As an alternative scenario to the one above, let's look at a photograph of a person running towards the camera.

If we imagine the girl positioned in the centre of the shot and the focus mode on the camera set onto 'One Shot' with just the centre point active. We then again half press the shutter to lock the focus but this time ask the girl to run towards the camera she will run out of the depth of field of the focus point and we will no longer have focus on her resulting in a blurred subject.

However, if the camera setting is changed again to 'AI Servo' and the girl again runs towards the camera, the focus mode will keep the focus on the girl as long as the focus point stays on her and the shutter remains half pressed.

CAMERA TOO CLOSE TO THE SUBJECT

On the odd occasion usually during close up or macro photography we can have a scenario where the camera cannot attain focus because it is closer to the subject than the minimum focusing distance for the lens that is in use.

Normally this isn't a problem because there is a setting in the camera that says that the shutter cannot be released without first attaining focus. However, in some DSLR's this setting can be overridden and the shutter can be released without first achieving focus on the subject. Once the setting is over-ridden then it can apply to all scenarios because the shutter can be pressed whilst the lens is still acquiring focus resulting in a blurred image.

Always check the minimum focus distance of your lens and make sure you can attain focus before pressing your shutter. If you can't get close enough, use an extension tube or a different lens.

A WORD ON IMAGE STABILISATION AND TRIPODS

Many camera lenses come with some kind of lens stabilisation technology. It's usually called something different by every camera manufacturer for e.g. Nikon calls it "vibration reduction" (VR) and Canon calls it "image stabilisation" (IS) but they all have the same goal which is helping to stabilise your lens and reduce shake. Some manufacturers choose to place it in the camera body and this has the advantage of working with all of your lenses.

It works great for those times when you're forced to hand-hold your camera, but you should always make sure you turn it off when your camera is on a tripod.

The stabilisation technology works by unlocking part of your lens, which allows the lens to "correct" movements. The in camera systems work by moving the sensor around to stabilise the image. But, when your camera is sitting still on a tripod, the stabiliser will often look for movement that isn't there, resulting in a blurry photo.

To illustrate this, take a look at the two photos. For both shots, the camera was locked onto a stable tripod. In the image on the left, the lens stabilisation is turned OFF. Then it simply turned ON for the image on the right.

However, a word of warning. Canon state that they use IS in the lens and not the camera body because every lens is different. It allows them to tune the IS for different lenses. What this means to you and I is that not all lenses will behave the same way so some may work on a tripod whilst others may not. The best way to find out is to try it yourself.

That is the End of the Sharpness Tutorial

Any Questions?

THANK YOU FOR ATTENDING WEEK 5