# **LENSES**



# What are they for and what do they do?

Lenses can be grouped into 7 basic types, these are :-

•Ultra Wide (Focal length between 6mm & 24mm)
•Wide Angle (Focal length between 24mm & 35mm)
•Standard (Focal length between 35mm & 70mm)
•Telephoto (Focal length between 70mm & 400mm)
•Super Telephoto (Focal length between 400mm & 1200mm)
•Super Zoom (Normally fitted to compact cameras)
•Macro & Specialist (Including Tilt/Shift, MP-E & Macro 60-180mm)

(I have not covered Super-zoom lenses as they are normally an integral part of the compact camera)



They range from the Sublime – Nikon 6mm f/2.8 Fisheye lens, built in 1972 weighing 5.2kg it has 12 elements In 9 groups with a picture angle of 220° and costs £100,000



Image on right shows field of view of 6mm lens Nikon 6mm f/2.8 Fisheye lens, built in 1972 weighing 5.2kg it has 12 elements In 9 groups with a picture angle of 220° and costs £100,000



#### -to the ridiculous.

Canon 1200mm f/5.6 L USM – probably the world's rarest and most expensive autofocus lens costing around £79,000 and weighing 16kg.





On the left, scene with standard lens and at 1200mm on the right.

Canon 1200mm f/5.6 L USM – Probably the world's rarest and most expensive autofocus lens costing around £79,000 and weighing 16kg. Between these extremes there is a wealth of lenses for you to choose from



From - Canon





There are, of course, many lenses from independents as well as Pentax, Olympus, Sony and Panasonic and the basic functions of each are identical. I intend to look at the popular lens choices that the majority will consider purchasing. This is not a review of any particular make or quality, rather how each lens affects our picture taking.

As with all things, a more expensive lens, will by its nature offer better quality.

Additionally "faster" lenses i.e. those with wider apertures beyond f/2.8, will, due to the additional quality of the glass needed, will be more expensive.

At the end of the day, deciding factors will be dictated by your budget and your particular requirements

Lets start with <u>Ultra Wide Angle Lenses</u>. These are lenses that fall in the "Less than 24mm" bracket.





Canon EFS 10 -22m f/3.5-4.5 USM

Canon EF 16-35mm L f/2.8 USM

Both these lenses cover a similar "field of view", the lens on the left being designed for a cropped sensor camera whilst the right lens is full frame, ranging from 98° to 54° The right lens is faster at f/2.8 but as you tend to use them at f/8-11 this is not a problem normally.

What they are: <u>Ultra Wide</u> angle lenses have a focal length of around less than 24 mm (in 35 mm-format), this means they can take in a wider scene than is typical, though they're not only about getting all of a subject into a shot. Rectilinear ultra wides help keep straight lines, just that, while fisheyes will reproduce buildings with curved walls. (<u>Rectilinear</u> of a wide-angle lens - corrected as much as possible, so that straight lines in the subject appear straight in the image).

**Image characteristics:** Because of the wide field of view, shots with ultra wide angle lenses typically feature a large depth of field. Images tend to pull in subjects that are close, and push away more distant ones making them appear further apart. Perspective distortion of ultra wides can give falling-building-syndrome (where vertical lines converge) but this can be corrected in post-processing, or minimized with good technique.

What they are used for: While often seen as a specialist lens, ultra wide angles can be used in a number of ways. Typical uses include landscape, architecture and interior photography. Even the distortion can be used creatively, especially when using fisheye lenses.

Taking the 16-35mm as characteristic of our typical Ultra Wide Angle lens, The following show how our field of view changes. As I stated earlier, Because of the wide field of view, shots with ultra wide angle lenses typically feature a large depth of field. Images tend to pull in subjects that are close, and push away more distant ones making them appear further apart.

Therefore the photographer has the ability to keep much or almost all of the scene in focus, with respect to the hyperfocal distance of the lens.

Thanks to the small focal length, these lenses can shoot longer exposures without fear of camera shake in the image. (In longer lenses camera shake is multiplied by the zoom factor, but in shorter lenses it is much less apparent). This means that the photographer can afford to use a much smaller aperture if they choose, and still retain a balanced image.

# The following show how our field of view changes.



#### Using Ultra-wideangle Lenses

The single most important fact is to get as close as possible, really close. If you cannot touch the subject, then you are probably not close enough.

The aim is to make the viewer feel part of the frame. Avoid using these lenses just to fit in more of a distant scene. Strong foregrounds can make or break the photo, so pay attention to what's in the foreground and where items are placed. Look for dynamically shaped or graphically strong elements, using them to guide the eye into the frame.

To avoid curved horizons, keep the sensor at 90° to the ground, tilting the camera will accentuate distortion, especially at the edges of the frame. Of course this could be used for a creative advantage should this be desired. These lenses exaggerate the relationship of near and far subjects. Distant objects seem smaller whilst close objects will be disproportionately larger. Bear this in mind when photographing people (giant noses!) Also if you are using the foreground object to lead into the main subject the main subject may not command the attention you desire or expect.

Avoid using polarising filters if you have large areas of sky as it will be uneven leading to dark areas where the polarisation is at its maximum effect. Take care with the sun, where it is either marginally out or just in the frame as these lenses suffer badly from flare. It is difficult to shade the lens without getting whatever you are using into the frame as well. Wait until the sun is more diffused or shoot away from it altogether.

How focal length affects photograph composition. Three images depict the same two objects, kept in the same positions. By changing focal length and adjusting the camera's distance from the pink bottle, it remains the same size in the image, while the blue bottle's size appears to dramatically change. Also note that at small focal lengths, more of the scene is included. Careful use of this method can allow you to control the relationship of objects to each other.





Sigma 10-20mm photographs of an interior space and people. Distortion can be seen through the rounded appearance of objects in the Left image whilst the photograph of people on the right show characteristic distortion on the edges of the image .

#### Wide Angle Lenses



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#### Nikon 28mm f/2.8D AF Nikkor Lens

## Canon EF 35mm f/1.4L II USM Lens

<u>Wide Angle Lenses</u> are covered by the 24mm to 35mm group. This is an area that tends to be served by prime (i.e. fixed focal length) lenses rather than zooms.

Most zooms covering these focal lengths tend to go beyond the range and can be covered by 18mm – 55mm (cropped format) and 24mm – 70mm in full frame.

The popular sizes in this group are 24mm, 28mm and 35mm primes.

Because they are more specialised than popular zoom lenses, they, by and large, are usually "professional" quality (e.g. Canon "L" and Nikon equivalents) and command a price premium although non-pro lenses are available at less cost.

As with all prime lenses, the quality is generally superior to zoom lenses as the need to compromise due to the changing characteristics of a zoom are not necessary.

Most of the observations regarding <u>Ultra wide-angle</u> lenses apply to Wide –angle lenses and the same effects, to a lesser extent, will apply.

## **Standard or Normal Lenses**





Canon EF 50mm f/1.2L USM Lens

# Nikon 50mm f/1.4G AF-S Nikkor Lens

Canon and Nikon prime lenses are available in 50mm (with a wide range from f/1.2-1.8), 58mm (Nikon) and 85mm.



Canon's "Nifty-Fifty 50mm f/1.8 STM lens priced at about £106 is a popular choice. Nikon's equivalent is priced at about £159.

Standard or Normal lenses are the group that most of us are familiar with.

In photography, a normal lens is a lens that reproduces a <u>field of view</u> that generally looks "natural" to a human observer under normal viewing conditions, as compared with lenses with longer or shorter focal lengths which produce an expanded or contracted field of view that <u>distorts the perspective</u> when viewed from a normal viewing distance.

For still photography, a lens with a focal length about equal to the diagonal size of the film or sensor format is considered to be a normal lens; In film photography this tended to be around 50-55mm.

Standard lenses have an angle of view of around 50 to 55 degrees diagonally. This is roughly the same as the angle that the human eye can comfortably view, which is why it gives a natural-looking perspective.

Normal lenses make great general-purpose lenses, and can be used to photograph everything from close-up portraits to landscapes. They tend to be very "fast" lenses (i.e. they have a wide aperture), making them great for indoor and low-light photography.

With cameras such as the Canon 5D or the Nikon D800 which are full frame, 50mm is still considered the norm.

AP-C cameras such as Canon 70D, 750D etc and Nikon D7100 the equivalent would be around 30mm.

Because the "ideal" focal length depends on the sensor size, cameras which are less than full-frame will require lenses with shorter focal lengths. For example, a camera with a 1.5x "crop factor" will require a lens which is 1.5 times shorter than the standard 50mm, which works out at 33mm. A number of manufacturers produce 35mm standard lenses to meet this requirement.

Most SLR cameras used to be sold complete with a standard lens (another reason they became known as "standard"). They were a very versatile, cheap, and commonly used lens, and most photographers started off with one.

Over time, manufacturers began bundling their cameras with cheap zoom lenses instead. These gave a greater range of focal lengths, making them a more flexible lens for most beginner photographers. However, their optical quality was generally inferior, and so standard lenses remained a popular choice among the more serious amateurs and professionals.

These days, standard lenses are sadly not nearly as common as they once were, but they still make an excellent addition to any photographer's kit. They can be used for a wide range of shots, and tend to be cheap and fast, making them well suited for indoor as well as outdoor environments. Although 50mm lenses are not nearly as popular as they used to be, there are still many people who want one of these in their kit.

Two other lenses falling in this group are the 40mm and the 85mm.

The 40mm could be considered as being too close to the 50mm. The wider angle lens will emphasize what is closer to the camera in relation to the background. The wider angle lens will also emphasize human subjects' closest parts - often noses - making them noticeably larger in relation to the rest of bodies if used at a close distance. 40mm is not a good head shot portrait lens. But, step back and your subjects will be happier with their portraits. Portraits (not framed tightly) are but one of a huge range of uses for a 40mm lens. 40mm is a focal length that you could leave mounted for general purpose needs.

The 85mm is still popular for portrait work where a zoom is not such a big requirement. Generally, as a prime lens, the quality will be higher with less distortion, a fair degree of cropping can be undertaken.

Reviews have also suggested that the 85mm, due to fast aperture, can be used in some sports photography again with cropping being a strong feature.

By definition, a standard lens produces images whose perspective is very similar to that seen by the human eye. This gives their photos a pleasing, natural feel, and helps focus attention on the subject, rather than distracting the viewer with an unusually distorted image. Because of their ability to accurately reproduce a scene, standard lenses are an excellent choice for photographing people. They are particularly good when shooting candid photos, where you want to include some surrounding scenery to put the subject in context. By definition, normal lenses are "prime" (i.e. they have a fixed focal length). This can deter some photographers, who think that they will be less versatile than zoom lenses. However, they more than make up for the lack of zoom by having superior optical quality and wide apertures. This means they can capture stunning images in a wide range of situations and lighting conditions.

Of course, there are a number of zoom lenses which include the "standard" focal length, typically around the centre of their zoom range. These can be useful as they also give you the option to capture slightly more or less of the scene as desired. However, you should be aware that this flexibility comes at the cost of image quality, sharpness, and aperture size.

Standard lenses are generally quite inexpensive and of high quality. Look for one which offers a wide maximum aperture, as this will give you the ability to use it in the widest range of shooting conditions.

Where possible, choose a lens by the same manufacturer as your camera. Canon and Nikon (Nikkor) lenses are very high quality and can picked up cheaply. Other good manufacturers include Sigma, Tamron, and Tokina, and their lenses are available for a wider range of cameras and fittings.

#### **Standard or Normal Zoom Lenses**



Canon EF 24-105mm f/4L IS USM Lens



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Nikon 24-120mm f/3.5-5.6G AF-S VR Nikkor Lens

These are two examples of the most popular mid zoom or "Normal/Standard" lenses that are in current use. They represent the best compromise between quality and price.

Although the range extends beyond the 70mm covered by the definition of a Standard zoom, The offer a good working range for general photography.

Most if not all of the points mentioned in relationship to Standard Lenses apply to these "midzooms" The next group is the <u>Telephoto Lens</u>. These always look good on your camera, partly because They are **BIG** and of course, by definition, **EXPENSIVE**.

This is of course true where expense is involved. A long focus lens with fast front elements and other features such as Image Stabilisation can set you back a considerable sum.



## Canon EF 400mm f/2.8L IS II USM Lens

In photography, a **telephoto lens** is a specific type of long-focus lens in which the physical length of the lens is shorter than the focal length.

This is achieved by incorporating a special lens group known as a *telephoto group* that extends the light path to create a long-focus lens in a much shorter overall design. The angle of view and other effects of long-focus lenses are the same for telephoto lenses of the same specified focal length. Long-focal-length lenses are often informally

referred to as *telephoto lenses*. Although this is technically incorrect: a telephoto lens specifically incorporates the telephoto group.

Telephoto lenses are sometimes broken into the further sub-types of **medium telephoto**: lenses covering between a 30° and 10° field of view (85mm to 135mm in 35mm film format), and **super telephoto**: lenses covering between 8° through less than 1° field of view (over 300mm in 35mm film format).



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Basically what this means is – in a long focus lens such as was available in the 70's, which typically had both manual focusing as well as manual aperture settings, relied on a straight path for the light to travel down to the film. They were usually relatively cheap and had few elements in Their construction, perhaps only four in a couple of groups. (For those who revel in a bit of technical they would have a large positive lens and a smaller negative telephoto group which combined would create a much longer focal length – but still longer than today's lenses).

Modern lenses incorporate many more elements and groups which make a smaller – but not necessarily lighter, lens. Advanced technology also makes for high quality zoom lenses, particularly in the 70 - 400mm range.



# A 500 mm lens of a non-telephoto design

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Canon EF 100-400mm f/4.5-5.6L IS USM Lens

#### Effects of long-focus lenses

Long-focus lenses are best known for making distant objects appear magnified.

This effect is similar to moving closer to the object, but is not the same, since perspective is a function solely of viewing location.

Two images taken from the same location, one with a wide angle lens and the other with a long-focus lens, will show identical perspective, in that near and far objects appear the same relative size to each other.

Comparing magnification by using a long lens to magnification by moving closer, however, the long-focus-lens shot appears to compress the distance between objects due to the perspective from the more distant location.

Long lenses thus give a photographer an alternative to the type of perspective distortion exhibited by shorter focal length lenses where (when the photographer stands closer to the given subject) different portions of a subject in a photograph can appear out of proportion to each other.

Long lenses also make it easier to blur the background more, even when the depth of field is the same; photographers will sometimes use this effect to defocus the background in an image to "separate" it from the subject. This background blurring is often referred to as boken by photographers.

The main use of a telephoto lens is NOT to "bring things close." In fact, professionals often use their long lenses when they could easily get much closer to their subjects and use a different lens. Yes, telephoto lenses do appear to bring things close, but that's the blunt end of the instrument.

The two most common uses of a telephoto lens by a professional photographer would be:

- Put backgrounds out of focus
- Change the perspective of the picture

Here's how to use a telephoto lens to put a background out-of-focus:

The out-of-focus effect of f2.8 on a background is much greater with a 200mm lens then with a 50mm lens.

So if you wanted to dramatically put a background out-of-focus, and you had the choice, it would be best to use a 200mm lens. And the tighter you get on the subject—just head and shoulders, for example—the more pronounced the effect.

So if you wanted to do everything you could to put a background out-of-focus for a head shot you would:

- Use your largest aperture. That's the smallest number.
- Use the longest lens you have.

• Get as close as you can to your subject to fill the frame. The closer you get the more out-of-focus the background.

Every major league baseball field has a place for a television camera that's hidden in the centre field wall. This is a great angle to see the pitcher and the batter in one shot. The problem is that centre field is a long way from home plate. They are forced to use a major-league telephoto lens. This completely changes the perspective of the picture.

The pitcher and the batter appear to be standing next to each other —they look exactly the same height despite the pitcher being 90 feet closer to the camera than the batter. The long, telephoto lens has totally compressed the scene and exaggerated how close they are to each other.

Depending on what is your longest lens, you can do the same thing to your advantage. You can make backgrounds look closer to your subjects than they really are.

This photographer could have gone closer to this flock of Snow Geese, but decided to hang back and use the longest lens he had—300mm. He knew that when they finally flew, the long lens would exaggerate the density of the flock and it certainly did.

It also appeared to bring the dark trees in the background closer to the white birds so we could see their individual shapes.





## To change the perspective of a picture with a telephoto lens:

- Position your subject against the background and then use the longest lens you have to compose the picture.
- This time you need to carefully consider your f-stop.
- Using a large aperture (small number) may actually put the background out of focus too much.
- •And using a smaller aperture may force you to use a shutter speed that will be difficult to hand hold without camera shake.
- •Turning up your ISO or using a tripod would both be ways to prevent camera shake



28mm



50mm





210mm

70mm

The above photos were taken using a 35 mm camera, using lenses of the given focal lengths

#### Constant object size

The photographer often moves to keep the same image size on the film for a particular object.

Observe in the comparison images below that although the foreground object remains the same size, the background changes size; thus, perspective is dependent on the distance between the photographer and the subject.

The longer focus lenses compress the perception of depth, and the shorter focus exaggerate it.

The perspective of the so-called *normal* lens, 50 mm focal length for 35 mm film format, is conventionally regarded as a "correct" perspective, though a longer lens is usually preferred for a more pleasing perspective for portraits.



#### **Telescopes as long-focus lenses**

From the invention of photography in the 19th century, images have been captured using standard optical telescopes including telescope objectives adapted as early portrait lenses. Besides being used in an astronomical role in astrophotography, telescopes are adapted as long-focus lenses in nature photography, surveillance, machine vision and long-focus microscopy.

To use a telescope as a camera lens requires an adapter for the standard 1.25 inch tube eyepiece mount, usually a T-mount adapter, which in turn attaches to an adapter for the system camera's particular lens mount. Controlling exposure is done by exposure time, gain, or filters since telescopes almost always lack diaphragms for aperture adjustment. The 1.25 inch mount is smaller than many film and sensor formats so they tend to show vignetting around the field edges.

Telescopes are normally intended for visual use, so they are not corrected to produce a large flat field like dedicated camera lenses and tend to show optical aberration.

Since the late 1990s compact digital cameras have been used in afocal photography, a technique where the camera lens is left attached, taking a picture directly through the telescope's eyepiece lens itself, also referred to as "*digiscoping*."

#### Super Telephoto Lenses 500mm – 800mm

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#### Canon EF 800mm f/5.6L IS USM Lens

The Super Telephoto lens is not for mere mortals, more for the wildlife fanatic. Priced from £7,000 for the 400mm to just shy of £9,000 for the 800mm, they offer superb image quality, image stabilisation and a good maximum aperture. Both Nikon and Canon lead the pack in producing superb optics, but it is worth remembering that others such as Sigma produce good lenses at a more modest cost. The-Digital-Picture.com

#### **Specialist and Macro Lenses**



#### Canon EF 100mm f/2.8L IS USM Macro Lens (Also available at 180mm non-IS)

The-Digital-Picture.com Reviews



Canon TS-E 45mm f/2.8 Tilt Shift Lens (also available at 45 & 90mm)



#### Canon MP-E 65mm 1-5x Macro Lens (extreme macro lens for scientific work)



**Canon EF 1.4x III Extender** (also available as 2x)

#### **Specialist and Macro Lenses**

The selection of Lenses shown on the previous slide show those specialist lenses which are used for particular applications.

The Tilt/Shift Lens is particularly useful in architectural work to avoid converging verticals. It also has applications in landscape photography due to its ability to increase depth of field in the tilt position.

Macro lenses allow extreme close up photography to be accomplished. Additionally the flat field of view ensures that distortions at the edge of the frame are minimised. Also handy for portrait work (100mm in particular).

The Canon MP-E macro is a highly specialised lens. Canon lists the focal length for this lens as 65mm. It is, but **disregard this number** for all intents and purposes. Think 1x to 5x magnification. Think 1:1 to 5:1. This lens starts where typical macro lenses stop. Manual focusing, this lens is not for the faint hearted although not as expensive as you might think at around £700

Finally, the 1.4 and 2x extenders. These can only be used on Canons "white" lenses due to part of the internal elements fouling with normal lenses.

There are, of course lenses from other manufactures offering their own unique take. As Canon And Nikon are the most common, I have used them as the basis of this review into using Lenses.



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