

Lenses Guide

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CHAPTER 1
Lens Buying Guide

When purchasing a lens for your interchangeable-lens camera consider the following factors.

1. The Lens Mount



A typical camera body with a M4/3 lens mount. Note the gold-plated electronic contacts just inside the metal mounting plate. The image sensor is just above them. (Source: Olympus.)

Each camera manufacturer has its own lens mount with proprietary physical and electronic connections. Consequently, one company's lenses won't work on another's cameras, with the following exceptions:

The Four Thirds System, which is now mainly seen as Micro Four Thirds (M4/3), is based on a 'universal' mount adopted primarily by Olympus and Panasonic.

Third-party lens manufacturers, like Tamron, Sigma, Tokina, Voigtländer and Samyang produce lenses with mounts to suit different camera brands. Some third-party lenses can match (or better) camera manufacturers' equivalent lenses, often at a lower price.

Lens Choices

Check out the range of lenses available for the camera you own (or plan to buy) when deciding which ones to invest in. Currently, manufacturers of DSLR cameras offer the widest choice, due to their long market histories. Most third-party manufacturers also cater for DSLRs.

For compact system cameras (CSCs), the choice is narrower. Currently, the M4/3 provides the widest range of lenses from both Olympus and Panasonic and a growing number of third-party manufacturers.

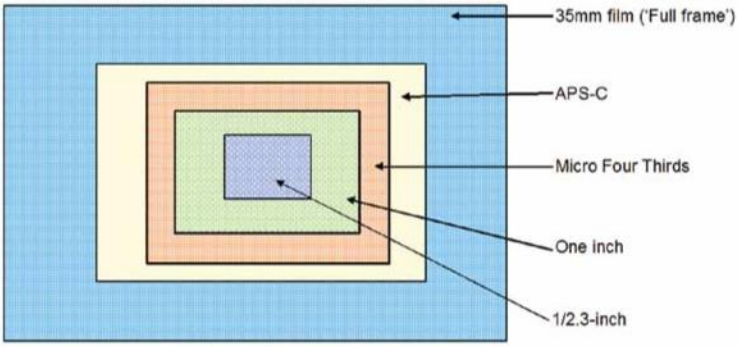
2. The Sensor Format

The current camera market is awash with different sensor formats, which vary according to area and aspect ratio. The most commonly-used sensor sizes are shown in the diagram on page 3.

Most lens manufacturers use the traditional 35mm film frame as a



The Olympus range of M4/3 lenses, a substantial part of roughly 50 lenses available for cameras using this popular format. (Source: Olympus.)



Sensor sizes.

reference point to provide equivalent focal lengths relative to the 35mm frame size. The difference between the actual and 35mm focal length is the sensor's 'crop factor'. (See Chapter 2.)

Owners of DSLR cameras can use all the lenses in the manufacturer's range. Those with 'full frame' camera bodies can't use lenses designed for the smaller APS-C bodies because they don't cover a wide enough imaging circle, and you risk damaging the reflex mirror because the shorter distance from the back of the lens to the sensor means it could be hit by the 'full frame' camera's mirror. The smaller field of view of APS-C lenses will also darken the corners of image frames ('vignetting').

The Anatomy of a Lens

Most lenses contain the same key components: optical elements (most made from glass), a barrel to contain them, and a mounting plate to attach the lens to the camera. A focusing ring enables the lens to be focused manually, with a distance scale indicating the focused distance.

Some lenses have very simple designs and don't contain all these components. Common omissions include a distance scale, zoom lock and auto/manual focus switch.



The illustration above shows the various parts of a typical zoom lens. (Source: Tamron.)

3. Subject Preferences

Lens choice should also be dictated by what you like to photograph. Happily, if you're not sure, camera and lens manufacturers provide an easy solution: kit lenses bundled with the camera, usually at a very competitive price.

Photo enthusiasts may have more specific requirements. The following general guidelines apply for popular subject types:

Portraits: moderate telephoto lenses (roughly 75-110mm in 35mm format);

Landscapes: wide-angle lenses (20-35mm in 35mm format);

Sports: telephoto lenses (at least 200mm in 35mm format);

Wildlife: telephoto lenses (at least 300mm in 35mm format);

Close-ups: if you want to take macro shots, only true macro lenses provide life-size (1:1) reproduction;



A cutaway view of a modern lens showing the position of the ring-shaped ultrasonic motor that drives autofocusing. (Source: Tamron.)

Underwater: moderately wide zoom lenses that will fit into a water-proof housing;

Travel: consider a single zoom lens that extends from moderate wide angle to telephoto.

Useful Features

Unless it's built into your camera body, **stabilisation** is recommended for lenses with focal lengths longer than about 100mm in 35mm format. When checking out lenses, look for clues like 'IS', 'OS', 'OIS', 'VC' and 'VR' in the lens name.

Many lenses provide different stabilisation settings for photographing stationary and moving subjects.

The stabilisation system in some lenses must be switched off when you mount the camera on a tripod; other lenses detect tripod mounting automatically.

Most high-performance lenses are driven by **ultrasonic motors (USM)**, **piezo-electric drives (PZ)** or **high-precision stepper motors**, which move internal elements to adjust focusing and/or change the zoom range. These technologies operate very quickly and quietly, making them ideal for use when recording movies.

Cheaper lenses use micro motors, which are noisier and slower. Noises made by autofocusing and zooming can be picked up by the camera's built-in microphones and recorded on movie soundtracks.

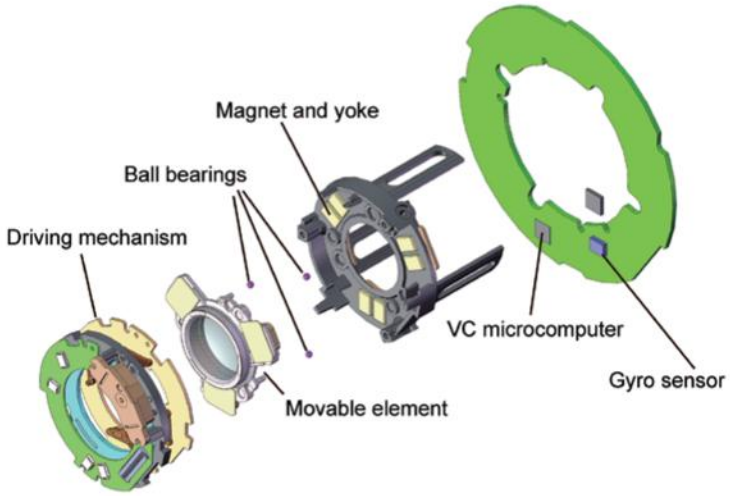


The most popular subjects for photography are shown here, clockwise from top left: portraits, landscapes, wildlife and travel.





Twin lens kits are a great way to obtain useful focal lengths in an affordable package. (Source: Olympus.)



The diagram above shows how a typical lens stabilisation system works. One element (or a small group of joined elements) is moved to counteract camera shake by altering the path of the imaging light. Modern systems can provide up to four f-stops of compensation. (Source: Tamron.)



Flare, which is shown in the above image as a coloured patch on the right side, can ruin an otherwise attractive picture. It is prevented by effective lens coatings.

Exotic elements improve the performance of lenses and allow lens designs to be lighter and more compact.

Aspherical (ASPH) elements have specially-shaped surfaces that enable lens designers to produce thinner, lighter lenses without compromising optical performance.

Low-dispersion (LD, ELD or **SLD) apochromatic** lenses make all colours focus at the same point, thereby preventing chromatic aberration.

Coatings applied to lens elements can prevent light rays from bouncing around inside the lens and degrading image quality. Most coatings are multi-layered to redirect a wide range of wavelengths and prevent flare and ghosting.

In lenses with **internal focusing** the front element does not rotate, allowing angle-critical attachments (polarisers and graduated filters) to be used without requiring readjustment when focus or focal length is changed.

Lens Terminology

The following is a guide to common terms used to describe camera lenses.

Aberrations: Defects in lens performance that can lead to:

1. Different colours being focused at different points (chromatic aberration);
2. Different focus points for rays of light entering the lens at different angles (spherical aberration);
3. Distortion of off-axis points of focus (astigmatism);
4. Radial blurring of points of focus (coma);
5. Failure to focus evenly across a flat surface (curvature of field).

Focal length: The focal length of a lens describes the angle of view and magnifying power of a lens. Wide-angle lenses have short focal lengths, while telephoto lenses have long focal lengths. Zoom lenses cover an adjustable range of focal lengths.

Aperture settings: Aperture settings are traditionally expressed as f-stops, which indicate the amount of light passing through the lens. The standard range starts at f/1 (which is considered ‘fast’) and progresses as follows: f/1.4, f/2, f/2.8, f/4, f/5.6, f/8, f/11, f/16, f/22, and f/32. Each step towards a larger number indicates the amount of light passing through the lens is halved. Move the other way and you double the amount of light the lens admits.

In modern cameras additional f-stops are also available, usually

representing 1/3 of an f-stop increment. Thus between f/5.6 and f/8 you get f/6.3 and f/7.1, and between f/8 and f/11 are f/9 and f/10.

Aperture range: The maximum aperture range is often shown as a ratio on the lens. For example, an 18-55mm f/3.5-5.6 lens will carry the ratio 1:3.5-5.6. This indicates the maximum lens apertures at the widest and narrowest angles of view for the lens.

Distortion: An ideal lens should reproduce subjects so they look like the original. Two common distortions are found in photographic lenses:

1. Barrel distortion, in which straight lines in the picture appear to bow outwards towards the sides of the frame. This type of distortion is most common in wide-angle lenses.
2. Pincushion distortion, in which straight lines in the picture appear to curve inwards from the sides of the frame. This type of distortion is sometimes found in telephoto lenses.

Depth of field: Depth of field defines the area across which the subject appears acceptably sharp. It's greatest with small lens apertures, wide-angle lenses and distant subjects.

Flange back: The distance from the camera's lens mount to the imaging surface (sensor). This distance in mirrorless cameras is roughly half the distance in DSLRs. Flange back distance can determine whether a lens from one system can be mounted with an adaptor on a camera body from another system.

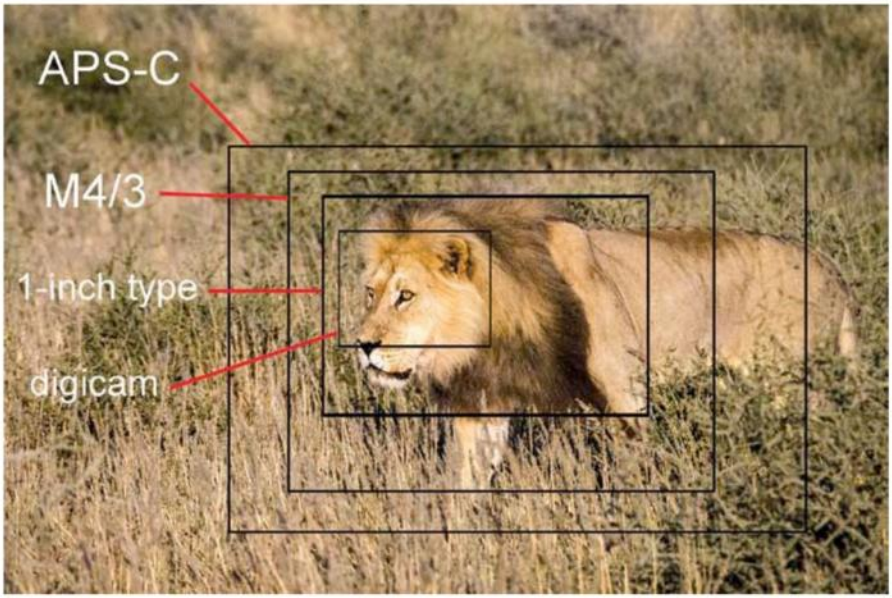
Rear focus: A lens in which the rear lens group is used for focusing. ●

CHAPTER 2
Crop Factors Explained

The term 'crop factor' arose from a need to help 35mm film SLR photographers understand how their existing lenses would perform on cameras with smaller image sensors than traditional 35mm film. It's still relevant for translating the listed focal lengths of lenses into 35mm equivalents, with respect to the camera's sensor.

'Crop' is a useful term because for a given lens and subject distance, subjects will be imaged at the same size on the sensor plane. The smaller the sensor, however, the larger the proportion of the frame the subject occupies, as shown in the illustration on this page.

The actual resolution of the image sensor is irrelevant; what matters is the



The illustration above shows how smaller sensor sizes 'crop' the image area and provide a narrower angle of view than the same lens on a 35mm camera, which is represented by the entire frame.

relationship between the sensor size and lens focal length. The smaller the sensor format, the shorter the focal length must be to capture the same angle of view as the same focal length on a 35mm camera.

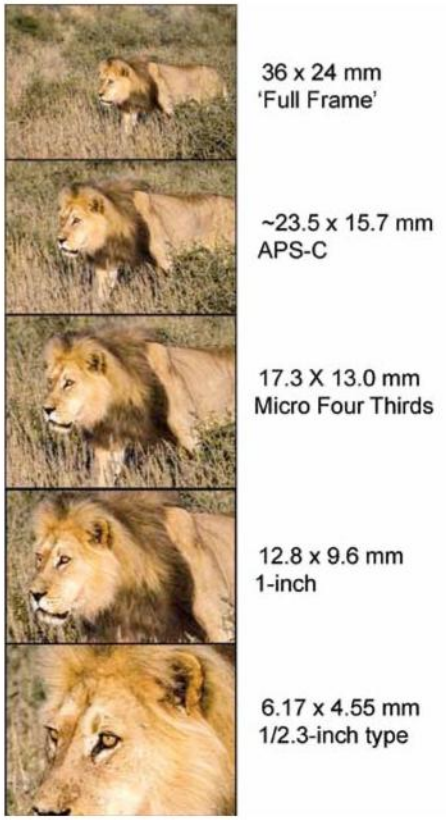
Crop Factors and Focal Length

Crop factors make telephoto lenses appear more powerful on cameras with smaller sensors because the angle of view is reduced. You can calculate the equivalent 35mm focal length by multiplying the listed focal length of the lens by the sensor's crop factor.

However, when you fit a 100mm lens onto a camera with a smaller-than-35mm sized sensor, it's still a 100mm lens. What has changed is the format of the sensor, which covers a smaller field of view and makes the lens behave like a longer lens.

For an APS-C sensor, the crop factor is approximately 1.5x, which means a 100mm lens will behave like a 150mm lens. With a M4/3 sensor, the crop factor is 2x, yielding a focal length equivalent to 200mm in 35mm format. The 1-inch sensor's crop factor of 2.8x and the digicam's crop factor of approximately 6x cover focal lengths equivalent to 280mm and 600mm, respectively.

Designing telephoto lenses with focal lengths of 200mm and 300mm is relatively straightforward for APS-C and M4/3 cameras as long as fast maximum



The areas from the different image sensor sizes, re-sized to the same dimensions, show the telephoto effect of the smaller image sensors – for a specific focal length and camera-to-subject distance.

apertures aren't required. Sports and wildlife photographers can achieve tight subject framing from a longer distance with telephoto lenses on sub-35mm sized sensors. (Lenses for smaller sensors can also be smaller, lighter and cheaper to produce.)

Crop factors help to explain why it is more difficult to produce really wide-angle lenses for cameras with small sensors, particularly APS-C DSLRs which require space between the back of the lens and the sensor for an SLR mirror.

The table below lists a range of popular wide angle focal lengths for 35mm cameras and shows the equivalent focal lengths for different sensor sizes.

Perspective is not affected by crop factors. Many people think the perspective distortion associated with wide-angle lenses is due to the lens itself; but it's actually created by the distance from the subject to the lens. Consequently, with the same camera-to-subject distances, a shot taken with a 23.3mm lens on an APS-C camera should cover the same field of view and have the same perspective as one taken with a 35mm lens on a full frame camera.

Crop Factors and Depth of Field

Depth of field refers to the range of distances that appear acceptably sharp in an image. It is determined by the size of the image sensor with respect to the distance to the subject and the lens aperture setting. If you fill the frame with a particular subject, depth of field will decrease for a given aperture as progressively larger sensors are used to record the image because larger sensors require you to move closer the subject to maintain the same size in the frame.

Focal length (35mm format)	Equivalent for APS-C	Equivalent for M4/3	Equivalent for 1-inch	Equivalent for Digicam with 6x crop factor
35mm	23.3mm	17.5mm	12.5mm	5.8mm
28mm	18.6mm	14mm	10mm	4.7mm
24mm	16mm	12mm	8.6mm	4mm
18mm	12mm	9mm	6.4mm	3mm

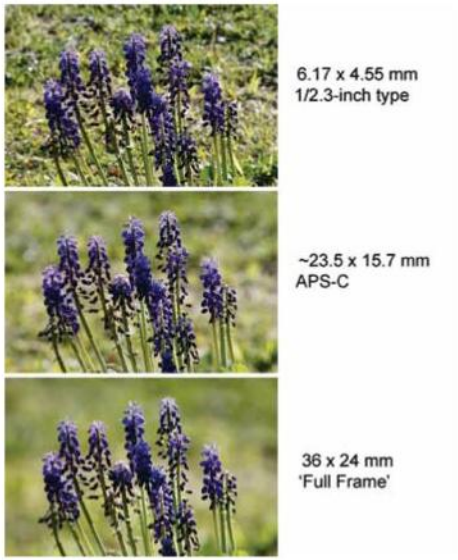
Suppose you're taking a portrait with a 100mm lens on a 35mm camera and set the aperture at f/4 to ensure most of the face is acceptably sharp. To shoot the same portrait with an APS-C camera, you would need a 66mm lens with the aperture set at f/2.6. On an M4/3 camera, you're looking at a 50mm lens at f/2 and on a digicam with a 5x crop factor the focal length is reduced to 21mm with an aperture of f/0.8 (which is not possible with consumer lenses). This is why compact cameras struggle to produce significant background blur in portraits.

A shallower depth of field may be desirable for portraits because it improves background blur. However, a wider depth of field is preferable for landscape photography.

Suppose you're shooting a landscape with a 24mm lens at f/11 on a 35mm camera. To shoot the same scene with an APS-C camera, you would need a 15mm lens with the aperture set at f/6.9. On an M4/3 camera, you're looking at a 12mm lens at f/5.5 and on a digicam with a 5x crop factor the focal length is reduced to 5mm with an aperture of f/2.3. This is why compact point-and-shoot cameras and camera-phones have almost unlimited depth of field.

Crop Factors and Image Quality

Nearly all lenses are sharpest in the centre of the frame, although many suffer from noticeable edge and corner



These simulations demonstrate the large depth of field available with small-sensor digicams (top), compared with cameras that have larger sensors. All three shots cover roughly equivalent focal lengths and have the same aperture setting: f/2.8.

softening. When a lens designed for a camera with a 36 x 24mm sensor is used on a camera with a smaller sensor, the soft edges are cropped away, so affected lenses should produce better results on cameras with smaller sensors.

Interestingly, lenses that are used on cameras with smaller sensors must perform better than 35mm lenses. Since the image is magnified when it's projected onto the smaller sensor, higher resolution will be required to match the quality of equivalent 35mm lenses.

Larger sensors can also tolerate smaller apertures before diffraction begins to reduce sharpness. However, the onset of diffraction is gradual and it may not be noticeable until a stop or so beyond the theoretical limit so it may go undetected. The theoretical limits for a range of sensor resolutions are shown in the table below.

In practice, this means you should obtain optimal sharpness over a wider range of apertures with a larger sensor camera. The theoretical diffraction limit for depth of field becomes lower as resolution increases, a factor to take into account when choosing your next camera.

More pixels may not necessarily provide better resolution at smaller lens apertures. In fact, more pixels could affect image quality by increasing noise and reducing dynamic range.

Crop Factors and Camera Shake

Crop factors have no impact on the actual positional displacement caused by camera shake. However, because the viewing angle is reduced with higher crop factors, camera shake is usually more noticeable.

With a 200mm tele lens on a M4/3 camera, the angle of view is approximately six degrees. Shake the lens by only three degrees and the subject will be displaced in the frame by half the field of view.

	14 megapixels	16 megapixels	24 megapixels
35mm 'full frame'	f/14.7	f/13.8	f/11.3
APS-C	f/9.7	f/9.1	f/7.4
M4/3	f/7.8	f/7.3	f/6
1-inch	f/5.7	f/5.4	f/4.4
Digicam	f/2.8	f/2.6	f/2.1

To minimise the potential for camera shake with an unstabilised lens, use the reciprocal of the focal length as the *minimum* shutter speed. For example, the minimum shutter speed for a 200mm lens is 1/200 second.

For smaller sensors, you can calculate the applicable minimum shutter speed by applying the crop factor. In the case of the 200mm tele lens on a M4/3 camera, the crop factor of 2x means the minimum shutter speed should be 1/400 second.

Lenses that include optical stabilisation can usually provide at least two stops of stabilisation, enabling photographers to use shutter speeds of 1/100 second or slower with a 200mm tele lens on a M4/3 camera and expect a high percentage of acceptably sharp shots. ●



This shot of a leopard was taken just before sunset (which accounts for the warm colour cast). The very low light level would have required a shutter speed of at least 1/600 second with the 300mm telephoto lens but effective stabilisation provided more than two-stops of compensation and produced a sharp image at 1/160 second.

CHAPTER 3
Standard Kit Zoom Lenses

Most people buying an interchangeable-lens camera for the first time will opt for the 'kit' lens bundled with the camera. When you're buying an entry- or mid-level camera, it's a convenient way to get a lens (or two) that suits the camera. Professional and pro-sumer cameras are usually sold in body-only configurations, although some manufacturers may bundle suitable lenses with them.

Bundled lenses are usually affordably priced and they generally cover popular focal length ranges for everyday photography. The most popular kit lenses have zoom ranges that extend from a moderately wide angle of view to a modest telephoto (typically 28mm to around 85mm in 35mm format).

Kit lenses are relatively small and light, so they are a popular starting point for building a camera kit since they enable you to sample the focal lengths most frequently used for commonly-photographed subjects. Once you have a general-purpose lens, you can decide which lenses to add as you develop different aspects of your photography.



Developers of M4/3 cameras have set out to make them small, light and capable of all the functions serious photographers required. The latest kit lenses for these cameras are very compact to complement the camera bodies. (Source: Olympus.)

Limitations of Kit Lenses

Kit lenses are probably a lot better than many people give them credit for. But they do have a few noteworthy shortcomings.

1. Build quality. Many kit lenses contain a relatively high percentage of plastic because they are built to a price. There's nothing wrong with this; modern plastics are tough and durable and they're lighter than metal and glass components. Plastic lenses can be moulded with high precision and made from materials with high levels of clarity and light transmission.



Small and light kit lenses are much easier to carry on challenging trips than faster, more solidly-built lenses.

However plastic lens mounts are vulnerable to wear and impact shock. If you are hard on gear and/or like to shoot in bad weather, you will probably need a more substantial lens. (But you'll also need a camera body to match.)

2. Speed. Kit lenses are typically a stop or two slower than prime (single focal length) lenses or premium-quality zooms. This means they have poorer light transmission, which reduces the brightness of the image in optical viewfinders. They also make it more difficult to achieve smooth, out-of-focus areas when you want to isolate subjects from distracting backgrounds.

Built-in stabilisation, either in the lens itself or in the camera body, can support hand-held shooting in relatively low light levels, although it won't make the viewfinder any brighter. Nevertheless, it's worth paying more for a stabilised lens if your camera body doesn't provide stabilisation.

3. Autofocusing. The autofocusing systems on kit lenses (particularly those

for DSLR cameras) are often based on screw-drive motors. These are usually slower and noisier than the ultrasonic drives used on more expensive lenses.

4. Focal length range. You may find the zoom range is too limited for your requirements, particularly if you like to shoot landscapes or sports. There are ways around some (but not all) limitations, but it's usually better to invest in an extra lens with the coverage you want.



Examples of the zoom range of a typical kit lens. (Taken with the Olympus M.Zuiko 14-42mm F3.5-5.6 II lens at 14mm and 42mm.)

Few kit lenses are long enough to take close-ups of animals and birds in the wild, although they can be fine for photographing pets. Kit lenses are also unsuitable for close-up shots of sports action or dramatic landscape panoramas.

Photographers who enjoy shooting extreme close-ups will also find a kit lens limiting. A dedicated macro lens will probably be required, or a telephoto zoom with good close-focusing capabilities.

Sometimes, simply moving closer could solve the problem for sports shots. Shooting and stitching panoramas may provide adequate panoramic coverage. Close-up attachments can facilitate 'macro' photography. But usually a dedicated lens is preferable.

5. Flare. Kit lenses are often flare-prone. Flare is caused when light is back-scattered by the elements in the lens, resulting in veiling, an overall loss of contrast. Sometimes, bright shapes are scattered across the image.

Fitting a lens hood that excludes stray light can often prevent flare. Unfortunately, few manufacturers supply hoods so you should consider adding a hood when the lens is purchased.

Shooting Tips

Kit lenses are usually quite versatile. At the wide end they're useful for capturing landscapes, while at the tele position, they become handy portrait lenses. In between, you can



Kit lenses are often sold without lens hoods, which makes them more susceptible to stray light that produces flare, as shown in this illustration.



The moderately wide angle of view at the wide end of the zoom range introduces few distortions, making it ideal for landscape photography. (28mm focal length on a 'full frame' DSLR body.)



All wide-angle lenses introduce some distortion but you can minimise it with a kit zoom lens by shooting with a focal length that is close to the middle of the zoom range and keeping the camera as vertical as possible. Tilting the camera even slightly upwards can alter the relationship between near and more distant elements in the scene and make close elements appear unnaturally large.



The convergence of verticals is emphasised with wider angles of view, as shown in this shot taken with a 16mm wide-angle lens on a 35mm format camera. (Source: Tamron.)



A candid shot taken at a temple complex in Tokyo with the 14-42mm kit lens on an Olympus OM-D E-M10. Being small and inconspicuous this combination lets you shoot at 14mm without attracting attention.

use them for group portraits, street photography, tabletop shots and even some close-ups.

Explore the limitations of your lens by taking shots at each end of the zoom range. At the wide end, experiment to see how close the lens will focus. Try some shots of buildings to see how much it distorts vertical and horizontal lines (some cameras provide in-camera corrections for distortion to overcome such problems). Look at how perspective changes when you look up at a subject – and when you look down.

Kit lenses can be used with wide-angles for candid shots, regardless of the size of the camera. However, smaller interchangeable-lens cameras with touch screens make candid and street photography easier because they're inconspicuous and the touch shutter control lets you shoot 'from the hip' and avoid attracting attention.

Longer focal lengths create an impression of compressed perspective, which can also be enjoyed when standard kit lenses are used. Find out how much your lens compresses by photographing a fence or line of trees.

Check out the lens's bokeh (rendition of out-of-focus areas) by shooting a portrait or close-up with the widest aperture setting. Try different angles and you'll soon learn how the lens handles highlights and how to avoid 'choppy' looking backgrounds.

Experiment with different focal lengths for different types of subjects to see which ones work best. Try walking towards a subject with the lens set mid-way in the zoom range instead of just zooming in. You might be surprised at how the perspective in the shot changes with different distances.

Exploring the capabilities of your lens will help you to understand its limitations. And your photography will improve as a result.

Many photographers keep using their first kit lens for the life of the camera body. For some photographers, one or two kit lenses will cover all the shooting situations they encounter. The only reason they would consider other lenses is when they require focal lengths not covered by the kit lens or larger maximum apertures. ●

CHAPTER 4
Telephoto Zoom Lenses

The second lens in a twin-lens kit is usually a telephoto zoom lens that picks up where the range of the standard zoom lens (which we covered in the previous chapter) ends. These lenses take in focal lengths that are ideal for portraiture, sports and wildlife photography.

Like standard lenses, kit telephoto zooms are usually built to a price and typically cover 35mm equivalent focal lengths of 55-200mm. They also tend to be relatively compact and portable and make a versatile addition to a basic kit of camera plus standard zoom.



A telephoto zoom lens covering focal lengths equivalent to 55-200mm enables you to tackle portraiture, sports and wildlife photography. (Source: Tamron.)

Telephoto Zoom Characteristics

Telephoto lenses narrow the photographer's field of view and, in doing so, make distant subjects appear closer. Nearby objects also appear to be closer in size to more distant objects of the same size because the angle of view is reduced. This is the most common application for telephoto lenses.

Telephoto lenses are often described as 'compressing' perspective. However, perspective depends on where the photographer is located with respect to the subject. Using a telephoto lens



The use of a 200mm focal length reduces the sense of depth in this scene making the subjects in the foreground appear closer to the background than they really are.



It's easier to isolate subjects from their backgrounds with longer focal length lenses, particularly when wide aperture settings are used.



Fast telephoto zoom lenses are usually large and heavy. The Tamron SP 70-200mm f/2.8 lens shown here weighs almost 1.5 kg but has the advantage of a very fast f/2.8 maximum aperture throughout its zoom range. (Source: Tamron.)

'Fast' and 'Slow' Lenses

Terms describing the 'speed' of a lens have nothing to do with how quickly it can focus. Instead, the term is applied to the size of its maximum aperture. Faster lenses have larger maximum apertures than slow ones.

The main advantages of fast lenses are:

1. They let more light into the camera and this will make the viewfinder image brighter (if it's an optical finder).
2. You can shoot with faster shutter speeds in dim lighting.
3. The plane of focus at maximum aperture is often very shallow, making it relatively easy to produce blurred backgrounds.

But they have their downsides:

1. Fast lenses require a lot more glass. This makes them larger and heavier than slower lenses.
2. They tend to be more expensive.
3. The telephoto zoom lenses in the 'kit' category tend to be comparatively slow, with maximum apertures of f/3.5 or smaller at their shorter ends, compared with f/2 or f/2.8 for a fast lens.



Focal lengths of 200mm or longer can emphasise a sense of layering in landscapes.



Dust in the air blurs background details, adding a further sense of depth to this scene, which was photographed with a 150mm telephoto lens.

probably means the subject is some distance from the camera – and that **will** influence perspective.

Rather than compressing perspective, tele lenses compress the sense of depth within a scene because more distant objects cover a larger percentage of the frame. In effect, objects at different distances from the camera appear closer together with longer lenses. The longer the telephoto lens, the closer different planes in a scene will seem to be.

This characteristic of tele lenses can be used creatively by photographers to emphasise the number of objects is a scene or to exaggerate the appearance of congestion. Be aware that very long tele lenses can make objects in a scene appear so close to each other that the scene appears static, flat and uninteresting.

Telephoto Zooms for Landscape Photography

On a landscape shoot, most photographers will reach for wide-angle lenses. However, telephoto lenses can produce some worthwhile results when shooting landscapes if you take advantage of the characteristics outlined in this chapter.

Whereas wide-angle lenses are often used to exaggerate the sense of depth in scenes, telephoto lenses can emphasise a sense of layering. This produces an impression of depth in a scene in a totally different way.

Scenes that lend themselves to this treatment tend to be composed of different layers at distinct and differing distances from the photographer. The closest layer might comprise nearby vegetation or a door or window frame. Beyond that there may be a hillside or the houses of a village (which in themselves may be arranged in different layers). The final layers might be ridges of hills or mountains before finally there could be the ocean and/or the sky.

Depending on the clarity of the air, you might be able to take advantage of the 'aerial perspective' created by diffusion. Particles of dust and/or moisture in the air can refract and reflect light, reducing overall contrast and colour saturation. A progressive loss of both characteristics will emphasise a sense of distance between near subjects and the horizon, recreating a sense of depth that may have been compromised by using a telephoto lens.

Telephoto Zooms for Portraiture

The 85mm focal length has been considered 'ideal' for portraiture ever since the days of film. It's still a good portrait focal length for 'full frame' cameras in the digital age because it combines a natural-looking perspective with the ability to produce blurred backgrounds – provided the lens is 'fast' enough.

On cameras with APS-C sized sensors, a 50mm focal length will provide a similar perspective, while for M4/3 cameras the closest focal length is around 43mm. Users of Nikon 1 cameras should find the 30mm focal length provides a similar perspective for head-and-shoulders portraits.

Some portrait photographers prefer the perspective imparted by a slightly longer lens, and longer focal lengths are usually required for candid portraits. Focal lengths equivalent to 105mm and even 135mm in 35mm format are often preferable for close-up portraits that fill the frame with the subject's face.



A moderate telephoto lens is ideal for both candid and posed portraits because it provides a good working distance and produces a natural-looking perspective. This shot was taken with a focal length equivalent to a 105mm focal length lens on a 35mm format camera.

Longer lenses will allow a greater distance between the camera and the subject, which may be more comfortable for subjects who are shy. But they will also compress the perceived distance between the subject and the background a little more than shorter lenses.

By 200mm telephoto lenses tend to flatten faces, which may not be flattering to some subjects. Depth compression also increases the risk of 'choppy' bokeh.

The main issue to consider when using a telephoto zoom for portraiture is the maximum aperture at the focal length you're using. The widest aperture for most kit tele zoom lenses is seldom larger than f/4 and, while this can deliver out-of-focus backgrounds on a 'full frame' camera, it may be difficult to de-focus busy backgrounds on cameras with smaller sensors.

The smaller the sensor, the greater the depth of field for the equivalent field of view and f/stop when compared with 35mm format cameras. If you can't avoid busy backgrounds in portraits, you'll obtain more pleasing blurring with a 'full frame' camera and tele lens. With 'DX' and M4/3 cameras, positioning the subject well in front of the background

and filling the frame with the subject may be the only solution.

Telephoto Zooms for Close-ups

Longer zoom lenses are often used for close-ups of flowers and small insects. Indeed, some have special 'macro' settings for this purpose – although they aren't true macro lenses. If you don't have a true macro lens (which can produce 1:1 or 'life size' reproduction) these 'macro zoom' lenses give you a taste of macro work.

Depth-of-focus can be an issue for close-up shooting with a tele zoom lens because the maximum aperture is usually quite small. Apertures of f/5.6 are common in 'full frame' lenses with the 200mm focal length and can be as small as f/6.7 for 300mm lenses on a M4/3 camera.

If you can't achieve sufficient background blurring with the widest aperture at full tele zoom, try moving the subject as far from the background as possible. If this isn't possible, change your shooting angle to ensure the background is as even in brightness and colour as you can make it. ●

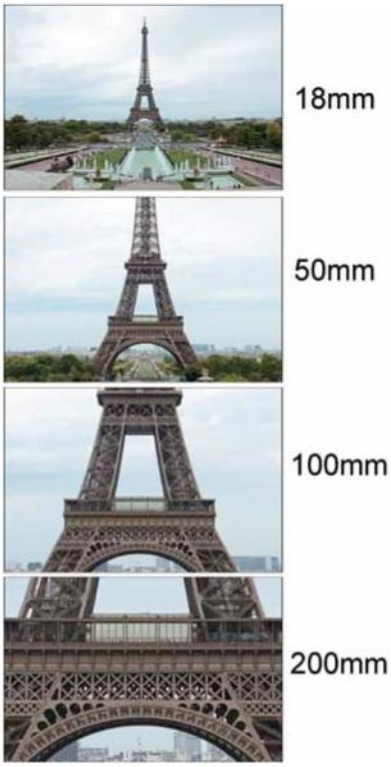


Longer focal lengths – in this case, 120mm – are often best for catching fleeting expressions candid portraits because they provide a greater working distance and subjects are less aware of being photographed.



Many tele zoom lenses can focus close enough to allow shots to be taken of flowers and small animals.

CHAPTER 5
All-in-One Zoom Lenses



This illustration shows the zoom range of a typical 18-200mm zoom lens, which provides just over 11x magnification. (Source: Tamron.)

There are many reasons to buy a camera with just one lens – and not all of them are economic. It's very convenient to have an 'all-in-one' zoom lens that covers most, if not all of the angles of view you're likely to require, particularly when you're travelling.

For travelling photographers the so-called 'convenience ' zooms provide a camera-plus-lens combination that is compact and easy to carry, yet versatile enough for most situations. It's also less likely to attract thieves in crowded areas.

Today almost all lens manufacturers have at least one convenience zoom lens in their ranges. And many of them cover a wider zoom range than the 7.1x offered by the original lenses. So-called 'super-zoom' lenses often span a range of up to 19x magnification and even larger zoom ratios have been included in the fixed lenses on some digital cameras and camcorders.

The latest convenience zoom lenses are a good match for today's entry-level DSLR and Compact System Cameras (CSCs), which usually have relatively compact and lightweight bodies. Many of them are small and light enough to fit into a smaller bag than a twin-lens kit comprising standard and telephoto zooms.

Benefits

The benefits of all-in-one lenses are easy to define. For starters, there's less weight for you to carry. You can easily pack a DSLR plus lens into a holster-style pouch and sling it across your shoulder where it's easily accessible at any time. It's kinder to your back, your shoulder and your wrists when you're shooting and usually fairly secure in city environments.

Because there's no need to change lenses, the camera's sensor is never exposed so you don't have to worry about dust getting into your camera. And you won't miss shots through having to change lenses when a less-than-ideal lens is fitted.

There's no need to worry about having multiple filters for different lenses when there's only one lens to keep track of. And you can vary your views of subjects by simply zooming in and out. Most all-in-one lenses also support macro-like focusing for close-ups, although few offer true 1:1 reproduction ratios.

Financially, the differences are not so great and a body plus all-in-one zoom lens may end up costing more than a twin-lens kit, particularly when you prioritise build quality and lens speed. Solidly-built, mid-range zoom lenses (18-200mm f/3.5-6.3 lens for an entry-level DSLR or 14-150mm f/4-5.6 lens for an M4/3 camera) can be had for between



Tamron's 16-300mm f/3.5-6.3 Di II VC PZD Macro lens has one of the longest zoom ranges on the market yet is remarkably small and light. It combines a sophisticated optical design with the latest stabilisation and autofocusing technologies.



It's convenient to use a single, all-in-one lens that allows your camera to be carried in a holster when you're engaged in physical activities. (Image © Richard Durnan.)



An example of a wide-angle shot taken with an all-in-one convenience lens. Lens stabilisation enables the photographer to use a shutter speed of 1/6 second, which accounts for the blurred images of moving subjects. (Source: Tamron.)

AU$420 and $750, depending on the manufacturer and whether stabilisation is included.

Compromises

Sadly, with convenience comes compromise. Although imaging performance has improved markedly for the better brands, some sacrifices must be accepted.

Lens speed is the first benefit you'll forgo because in order to keep longer lenses portable, manufacturers must use smaller and lighter elements. This means less light is captured, which means the brightness of the scene you see in the viewfinder is reduced – unless your camera has an electronic finder.

The reduction in light transmission makes you more reliant on effective stabilisation, which is often built into all-in-one lenses. You also require a camera that performs well with high ISO settings.

Smaller maximum apertures also reduce **depth-of-field control**. Convenience lenses can make it more difficult to reduce 'busy' backgrounds to a smooth and attractive blur. You may

also obtain greater front-to-back focus depth in scenes than you would like and it can be more difficult to focus close to infinity than it is with shorter zoom lenses.

Reductions in image quality may be visible when you compare pictures from an all-in-one zoom lens with prime lenses and zooms that cover shorter focal length ranges. You will probably notice edge softening in shots, particularly at wider aperture settings.

Most lenses provide maximum sharpness between one and two f-stops down from maximum aperture, convenience zooms included. Prime lenses and short zooms will usually be sharper across the image frame at all aperture settings.

Convenience zooms can seldom match the performance of prime lenses and short zooms at any aperture setting, although differences may not be noticeable until images are compared side-by-side. Diffraction often takes effect sooner and can be more severe in these lenses.

Distortions are usually very obvious in zoom lenses that cover an extended focal length range so these lenses are best used with cameras that provide automatic correction. Barrel distortion (when straight lines become bowed outwards) is common at wide angles of view. Pincushion distortion (when straight lines are pinched in towards the centre of



Without in-camera correction, convenience zoom lenses can be prone to rectilinear distortions, showing barrel distortion at wide angles (as in the image above).



An example of uncorrected pincushion distortion, which can occur at the longest focal lengths.



Effective stabilisation and fast, accurate autofocusing are critical when using longer focal lengths to take candid shots. This shot was taken with the 300mm focal length setting on a 16-300mm lens at 1/150 second.

the frame) may be seen at the telephoto end of the zoom range. Distortion is usually least around the middle of the zoom range.

Even cameras with automatic distortion correction will find it difficult to correct when the lines aren't rendered totally straight. This can happen with cheaper lenses that cover an extreme zoom range. The central and edge areas can have different distortion patterns at the long end, with the corners being slightly pin-cushioned and the centre slightly barrelled. At the wide end, the barrel distortion may be slightly wavy.

Reliability is another factor that may be compromised. Zoom lenses are generally packed with mechanical components and electronics and the longer the zoom range the more the internal mechanisms are required to move.

Eventually the components supporting the zooming elements will wear out and the lens will have to be replaced. (Focusing elements move too, but not as much, so they tend to last longer.)

What to Look For

Built-in stabilisation is a necessity in all-in-one lenses – unless your camera includes body-integrated sensor-shift stabilisation. A good stabilisation system with three- or four-stop compensation should enable you to take sharp pictures hand-held at shutter speeds down to about 1/60 second with a 200mm focal length.

Fast, accurate autofocusing is important with longer focal lengths because depth of field is reduced. While standard micro-motor autofocus systems can usually focus accurately, they can be relatively noisy and may not be particularly fast. Lenses with ring-type ultrasonic motors (designated 'USM' , 'HSM' or 'SWM') or Piezo-electric Drive mechanisms ('PZD') are very fast, almost silent and have the added advantage of supporting full-time manual focus over-ride.

Using All-in-One Lenses

Convenience zooms require you to pay a lot more attention to the shots you're taking than other lenses, largely because they are equivalent to carrying a wide range of focal lengths. You still have to decide which focal length setting is best for the subject, even though there's no need to change lenses.

Careful shot composition is important. Think about where you are and how it affects your relationship with the subject. Use your feet; change your position, vary the difference between you and the subject.

Don't be afraid to increase the ISO setting in dim lighting. Use a tripod when necessary and be prepared to switch to manual focusing when there's insufficient light for the camera's autofocusing system to use. ●



With an all-in-one zoom lens it's easy to choose between taking a wide view of the scene, as shown in the top picture or zooming in for a closer look at one part of the subject.

CHAPTER 6
Lenses for Landscapes

Although just about any lens can be used for photographing landscapes, most photographers prefer using wide-angle lenses because they better encompass scenic panoramas. But that doesn't mean they're the only option.

Your choice of focal length will depend on how you want to interpret a particular scene – and this can vary with the type of scene, how much of it you wish to record and the presence (or absence) of objects in the foreground. There's no 'right' or 'wrong' approach.

You may prefer using an ultra-wide angle lens and moving in closer, or fit a more conservative focal length and step back. And it can pay to change your shooting position to see how the scene in the frame changes, regardless of the lens you use.

Popular focal lengths range from 10mm to 24mm for cameras with APS-C sized sensors and 16mm to 35mm for 'full frame' cameras with 36 x 24 mm sensors if you want to retain a reasonably normal-looking perspective. If your existing lenses can't encompass the scene, try shooting a panorama sequence.

Panoramas can be stitched together either in the camera or during post-production. Don't move your feet while capturing the shots; rotate at the waist as you span the scene and maintain the same exposure parameters. Overlap adjacent shots by at least 30% if the camera doesn't do this automatically.

Zoom or Prime?

Zoom lenses provide the most affordable way to encompass multiple focal lengths. Most camera manufacturers – and many specialist lens manufacturers – produce wide-angle zooms that are a stop or two faster than kit lenses and usually more sturdily constructed. Many will retain the same maximum aperture throughout the zoom range (which can be advantageous when using the longer focal lengths).

Prime (single focal length) lenses often have maximum apertures up to three f-stops wider than a zoom lens of the same focal length. This provides a much brighter viewfinder image, more flexibility for hand-held shooting in dim lighting and much greater control over the plane of sharpness in the picture.

If your camera uses an electronic viewfinder, brightness will be unimportant because the screen's gain will be automatically adjusted. But the other factors will remain relevant and should be taken into account when making purchasing decisions.



Wide-angle lenses like the 28mm (equivalent) lens used for this photograph have long been seen as ideal for landscape photography.



This panorama was created by combining seven shots, taken with the camera held vertically.



The 50mm equivalent focal length covers the angle of view most people will focus on and provides a 'comfortable' perspective for general photography.

Focal Length Analysis

This section covers popular focal lengths for landscape photography and where they can be effective. Our suggestions should be taken as hints; not rules that must be adhered to. Many creative images have been produced by stepping outside the bounds of normal practices. Note: for convenience, we have used the 35mm equivalent focal length as reference.

50mm is often seen as the focal length that best replicates the central field of view of normal human eyes (where the sharpest areas seen by both eyes overlap). Lenses with this focal length are very versatile and can be used for subjects other than landscape photography, such as portraiture and cityscapes.

35mm is usually the longest focal length that can be seen as a regular 'wide angle' lens. Typically covering a diagonal angle of view of around 63 degrees, it encompasses more of the scene than a 50mm lens without introducing noticeable distortion.

28mm is one of the most popular focal lengths for landscape photography because it can encompass a relatively



The 24mm equivalent focal length introduces some visible distortion, although it may not matter if you want to instil a sense of space in the landscape.

wide angle of view (75 degrees) without introducing obvious distortions. It's a good focal length for maintaining a balanced perspective between close subjects and the background. Almost as versatile as a 35mm lens, the 28mm is often used for architectural photography and group portraiture.

24mm encompasses an angle of view of 84 degrees, which is relatively wide. A 24mm lens can invoke a strong sense of separation between close-up elements in a scene and the background to produce dramatic compositions. This focal length can help to retain a sense of space when photographing expansive landscapes.

Perspective distortion can be noticeable so subjects must be carefully framed. Tilting the camera should generally be avoided – unless you want to emphasise inherent distortions. Rectilinear distortion is common, causing the ends of horizons to turn up or down, depending on the position of the horizon within the frame and how much the camera is tilted with respect to the subject.

20mm covers an angle of view of 94 degrees, which is classed as 'ultra-wide'. This focal length encompasses



Lenses with wider angles of view than 20mm will introduce rectilinear distortions that can be seen as curved horizons. They can be used to emphasise the separation between close subjects and the background.



This picture, taken with a Lensbaby Circular Fisheye lens (an affordable way to obtain 180-degree coverage), shows the characteristic distortion of this special type of ultra-wide lens. (© Keri Friedman.)

more of the scene than you can take in with normal vision, giving a sense of exaggerated perspective. Subjects close to the camera may appear very large, with the relative sizes of more distant subjects reducing quickly with distance. This focal length can produce a 'pan-focus' effect in which everything in the frame appears sharp, even when captured with wide apertures.

14mm covers a dramatic 114-degree angle of view, which goes well beyond the limits of human vision and creates a dramatically exaggerated perspective. It can create a strong sense of separation between close subjects and the background and produce landscape photographs that emphasise the sense of isolation. The camera angle has a strong impact upon distortion; even slight tilting can cause vertical lines to converge or taper dramatically. Keeping the camera vertical can minimise perspective distortion and produce a more natural-looking photograph.

Beyond this point we enter the world of 'fish-eye' lenses, which can extend their coverage to 180 degrees. This means that almost everything in front of the camera is included in the image – including the photographer's feet!

Fish-eye lenses are used specifically for the distortion they produce: straight lines around the centre of the frame are curved outwards and objects close to

the edges of the frame become warped. Used skilfully, these lenses can deliver some interesting pictures and develop a photographer's creative potential. But you must ensure the lens doesn't make the picture, instead of the other way around.

Telephoto Lenses for Landscape Photography

Longer lenses have a narrow field of view that gives the impression of bringing distant objects closer together, which reduces the apparent depth in the subject. This 'flattening' of perspective can suggest different parts of a scene 'belong' together.

Landscapes that work best for longer lenses generally contain interesting compositional elements that can draw the viewer's eyes into the picture. The longer the focal length, the greater the perceived perspective compression. Telephoto zooms allow you to select the focal length that gives the most striking end results.

Longer lenses make perspective compression more noticeable so it becomes an aspect of the shot's composition. Really long lenses provide minimal depth of field, even when stopping down beyond about f/8 (f/13 for high-quality). Good stabilisation will be vital if the lens is hand-held. ●



A moderate telephoto lens with a focal length equivalent to 120mm in 35mm format integrates the various parts of this scene without introducing distortions or compressing perspective.



The compression of perspective provided by this extreme telephoto lens (600mm in 35mm format) brings all the elements in the scene together in a way that emphasises the composition of the shot.

CHAPTER 7
Lenses for Portraiture



A portrait taken with an 85mm lens on a camera with an APS-C sized sensor, which provided the equivalent to a 135mm lens in 35mm format. This allowed a good working distance for photographing this type of subject.

Although most lenses can be used for portraiture, fast telephoto lenses with moderately short focal lengths have long been the first choice of professional portrait photographers. Focal lengths typically considered ideal range from about 70mm to 135mm in 35mm format, with a bias in favour of the 85-105mm section.

There are several reasons to choose short telephoto lenses for portraiture:

1. They provide a good working distance, enabling the photographer to fill the frame with the subject's face (or head and shoulders) without imposing on their personal space.

2. The slight compression of perspective provided by a telephoto lens is usually flattering. With careful posing of subjects, prominent noses and chins appear smaller in relationship to the rest of the face.

3. Fast maximum apertures (f/1.8 to f/4) provide optimal depth of field control, making it easier to draw attention to key features like the subject's eyes or profile, while allowing the rest of the scene to drift gradually out of focus.

However, that doesn't mean other lenses can't be used for portraiture; just that they need to be used more

thoughtfully. Longer lenses will generally be preferred for candid portraits, while wide angle lenses can produce attractive environmental portraits, particularly when the shots show people at work or engaged in an activity that doesn't require them to look straight at the camera.

Backgrounds can make or break portrait shots. Longer focal length lenses will make blurring away a distracting background easier, as will wide aperture settings. Longer lenses also make it easier to fill the frame with the subject's face, creating a sense of intimacy. It's important to achieve an optimal balance between depth of field and background blur, bearing in mind that the subject's eyes and mouth should always be in focus.



A 250mm equivalent focal length and f/5 maximum aperture have been used to isolate the subject from a potentially distracting background. The camera was focused on the subject's eyes.

Zoom or Prime?

Prime (single focal length) lenses are usually preferred by photographers who are serious about portraiture. As well as offering superior image quality, their main advantage over zoom lenses is their significantly greater speed (light transmission).

All leading manufacturers offer 85mm lenses for the 35mm format with maximum apertures of f/1.4 and f/1.8, which is considerably (two to 2⅔ f-stops) faster than the typical f/3.5 maximum aperture for a short telephoto zoom lens. Fast lenses require less stabilisation in



A 'convenience' zoom lens made it easy to compose and take this candid portrait shot without attracting the subject's attention. Photographed with a focal length of 185mm on an APS-C DSLR camera using a relatively wide f/6.3 aperture to produce background blurring.

low light levels and can be used with lower ISO settings. In addition, the faster the lens, the greater the potential for it to produce attractive background blurring ('bokeh) that makes potentially distracting objects behind the subject less noticeable.

However, prime lenses tend to be relatively large, bulky and expensive and when the focal length isn't ideal for the subject you must change to a different lens. This takes time and can create potential for dust to enter the camera. Both these problems are solved with a zoom lens.

Zoom lenses are much more versatile than primes – and usually more affordable, although their prices are dictated by optical speed and build quality. One zoom lens will take up less space and weigh less than several prime lenses that cover the same range of focal lengths.

Focal Length Analysis

In this section we will look at some popular focal lengths for portrait photography and analyse their characteristics to suggest situations where they can be used effectively.

85-105mm: Physically, lenses in this range tend to be compact and light enough for easy hand-held shooting. They're also well suited to flash photography, particularly with low-output flashguns.



Wide aperture settings (f/2.8 in this case) with a short telephoto lens provide the classic recording tools for head-and-shoulder portraits. (Source: Tamron.)



Longer focal lengths – in this case, 200mm – are often used by wedding photographers because they make it easier to isolate subjects from the background. (Source: Tamron)

Shorter telephoto lenses provide a wide enough working distance for the photographer to change position quickly without the need to move tripods and lights. They also enable photographers to get close enough to fill the frame without intruding on the subject.

105-135mm: Because they provide a greater working distance, lenses in this range can be used for candid portraits but are also suitable for posed portraits. Physically they are usually larger than the short telephotos but not so large as to require tripod mounting in adequate light levels. The additional compression of perspective they provide can be used to advantage with many subjects, as can the ability to control background blurring by moving the subject further from a distracting background.

Longer than 135mm: Medium-to-long telephoto lenses are favoured by action and sports photographers as well as photographers who enjoy taking candid shots. The longer the focal length, the greater the potential for a

shallow depth of field, which can isolate subjects from the background and create strong, pleasing portraits.

Shooting from a long distance with a high-magnification lens will make the background – and any objects in the foreground – appear much closer to the subject, giving a far more enclosed effect. It's easier for head-and-shoulders portraits than full body shots. You'll need plenty of space to fit the whole figure in the frame.

Wide Angle Lenses for Portrait Photography

Wide angle lenses force you to be much closer than you would with a standard portrait lens and this requires more interaction with the subjects. While they might not work for head shots, they work well for environmental portraits that show one or more subjects in their natural context. It's important to keep the wide-angle lens square to your subject(s) to minimise distortion.

Aside from being able to include more of a scene in the frame, wide-angle lenses are usually quicker to focus, which will enable faster shooting and make it easier to capture fleeting expressions. It's also easier to focus on subjects both close to and distant from the camera. They can also be used to



A 300mm focal length on a 35mm format camera makes it easy to isolate the subjects from the background and produces strong background blurring. (Source: Tamron.)

capture the space around the subject(s) and include items that connect the subject to the background.

Wide angle lenses are often used for group portraits, rather than shots of individuals. However, because they tend to make objects close to the lens appear relatively large with respect to the background, they can distort parts of the subject. For example, in a portrait of a person's face taken with a wide angle lens up close, the nose will look huge because it is closer to the lens than the rest of the face.

Some types of portraits can use wide angle distortion creatively. It's quite common to see portraits of comedians and other entertainers taken with wide angle lenses, using the distortion to accentuate the comedic effect.

As long as you keep the wide-angle lens square to your subjects to minimise distortion, the different perspective lends itself especially well to photographing groups of people in their surroundings, particularly at gatherings like weddings and parties.

Interestingly, portraits taken with a wide angle lens from slightly below the subject's waistline can make them look taller. However, if the camera is too low, the subject's feet and legs will appear larger and longer and out of proportion to their head.



An 18mm wide-angle lens on a camera with an APS-C sensor enables everything in the scene to be sharply focused, providing a context for the subject.



An environmental portrait taken with a wide angle lens. In this case, a 17mm lens on a DSLR with an APS-C sized sensor, which covers an angle of view equivalent to 25.5mm on a 35mm camera. (Source: Tamron.)

With the camera above the subject's head, the opposite effect is achieved; the subject's head is large and their body converges down to a point at their feet. This makes them look rather childlike. You can also use the distortion created by the lens to exaggerate foreground objects or to create an interesting frame for the subject. ●

CHAPTER 8

Lenses for Sports and Wildlife Photography

Whether it's photographing your kids on the sports oval, taking pictures of animals in a zoo or wildlife park or venturing off on a birding expedition, in each case, there's likely to be a considerable distance between the subject and the camera. To fill that gap, you need a longish telephoto lens.

Choosing the right one requires you to allow for the shooting situations you can expect. Fortunately, there are plenty to choose from, depending on your requirements and budget.

Unlike wide angle lenses, where a small difference in focal length can make a large difference in angle of view, for



The photograph on the left was taken with a 300mm focal length, while a 200mm focal length was used for the one on the right, illustrating the relatively small differences between them in coverage and background de-focusing.



Longer focal lengths are required for close-ups when you can only shoot from a restricted distance. For this shot of a leopard in a tree, a 75-300mm lens used at 300mm on a M4/3 camera provided the equivalent of a 600mm lens on a 35mm camera.

telephoto lenses the opposite is the case. Jumps of 100mm or more in focal length deliver relatively small changes in angle of view.

You can get a rough idea of what focal length you need to shoot different sized subjects at different distances by holding your thumb up at arm's length and seeing how much of the scene is covered. Then use a zoom lens to cover the same area and work out the equivalent focal length.

Each person's coverage will be slightly different because we all have different sized digits. But, once you have worked out your own parameters, you will have a shortcut that allows you to estimate what focal length you'll need without having to change lenses.

Balancing Size, Weight, Speed and Cost

Suppose you decide you really need a 600mm f/4 lens to photograph a tennis



A fast telephoto zoom lens can make it possible to get action shots like this when you're in the right location. Shooting data:1/1600 second at f/2.8 with a focal length of 121mm on a Canon EOS-1D Mark III camera. (Photographer: Mitch McMillan.)

match or birds in bushes? Several questions arise from this choice:

1. Can you afford the high price tag?
2. Can you manage the additional 3.9 kg it will add to your kit?
3. Do you have a strong enough tripod to support camera+lens?

If you answered 'no' to any of these questions, some kind of compromise will be required.

If cost is the only obstacle you could consider a secondhand lens. If you make sure its optical performance is tested, you could end up with the lens you want at a price you can afford. And you'll need a sturdy tripod to support camera and lens.

If weight is the main consideration you could consider swapping to a camera with a smaller sensor format. Changing from 'full frame' to APS-C allows you to reduce the lens focal length to between 375mm and 400mm and still cover roughly the same field of view as a 600mm lens on a 'full frame' camera.



A 75-300mm lens on a M4/3 camera can cover the same fields of view as a 150-600mm lens on a 35mm camera in a format that is considerably smaller and lighter, at the expense of lens speed. (Source: Olympus.)

The shorter lens will almost certainly be smaller and lighter. It will also be roughly half the price of the 600mm lens because less glass is used in its construction.

Drop down to M4/3 format and you reduce size and weight dramatically. But you'll have to accept a loss of lens speed (expect a maximum aperture of f/6.3 or smaller) and you may find a zoom lens is the only option available. You can still cover almost the same field of view as the 600mm lens, although the M4/3 coverage is a little wider.

A big plus is that the M4/3 lenses are light enough to use hand-held and either the camera body or lens will include stabilisation. In addition, almost any tripod will be able to support the camera+lens combination.

Lenses for Shooting Sports

Different sports have different requirements and your choice of lens(es) will depend on how close you can get to the action and what types of pictures you want to take. Longer lenses are needed for most sports action close-ups, although shooting motor sports, cycling and children's team games can sometimes be done with shorter lenses and even wide angle lenses can be used in some situations.

Available light can influence your requirements and so can the types of shots you want. Lens speed is important in dim lighting (e.g. indoor sports) and when you need fast shutter speeds to freeze action. But there may be times when some blurring can lend a sense of speed to the shot.

Most modern cameras, particularly those with larger sensors, produce negligible image noise at ISO 800 and very little up to ISO 6400. Even M4/3 cameras can do well up to ISO 3200. So photographers can start balancing their need for range and speed against the advantages of shooting with smaller sensor cameras.

Lenses for Birders

Bird photographers usually lean towards the longest lens they can afford and handle, even when shooting from a hide. This is often because their subjects can be very small and easily spooked.



Wide angle lenses, in this case a focal length of 35mm, lend a different perspective to sports photographs and allow more of the ambience to be captured.



Location can be critical for obtaining close-up shots, even when you use a long focal length like the 300mm lens used for this shot. Bright conditions allowed an exposure of 1/1000 second at f/11, which 'froze' the spray and provided plenty of depth of field.



Tamron's SP 150-600mm f/5-6.3 Di VC USD, which can be used on both 'full frame' and cropped sensor bodies provides plenty of reach for bird photographers who shoot from hides or vehicles.



A 300mm focal lens on an Olympus OM-D camera provides a lightweight combination that is easy to carry and can provide the reach you need to photograph birds like this falcon.

Although in the past many birders invested heavily in fast super-tele lenses, improvements in high-sensitivity performance and image stabilisation make this less necessary today. Dropping from 'full frame' to APS-C sensor size yields big benefits when range is critical. You gain a 1.5x or 1.6x (for Canon) crop factor extension of the focal length plus a slightly smaller, lighter camera and lens with little or no loss of imaging performance.

Moving from DSLR to M4/3 CSC provides greater portability without significantly compromising imaging performance. The equipment is light enough to carry all day yet capable enough to use in any situation that suits a DSLR.

While some noise may be visible in high ISO shots, lower sensitivities should provide similar performance to larger cameras and produce excellent prints.

Lenses for Safari

If you're going on a genuine safari in Africa, you can manage with modest telephoto lenses because the 'game' is generally observed from vehicles. Native wildlife is so accustomed to vehicles it tends to disregard them so you can get close relatively easy.

The ideal focal length range is 70-200mm or 70-300mm in 35mm equivalent. Shorter focal lengths are ideal for photographing larger animals, while

longer focal lengths will be excellent for extreme close-ups. They also provide scope for taking action shots of animals hunting or shots of creatures that are easily spooked, such as some of the smaller antelopes.

Convenience zooms allow scope for taking some landscape shots but some photographers prefer to take a second camera with a wider zoom attached for this purpose. The standard 18-55mm kit lens works well for APS-C cameras, while 14-42mm provides an equivalent for M4/3. ●



Springbok and sand grouse near a water hole, photographed from a vehicle with a convenience zoom lens set at 200mm, using an aperture of f/8 to optimise depth of field.



Sparring gemsbok (oryx), photographed from a vehicle with a 300mm lens on an M4/3 camera. Rapidly changing action presents a chance to take a sequence of shots, either with the camera's continuous shooting function (if changes are very quick) or at the photographer's discretion.

CHAPTER 9
Macro Lenses

There's a lot of misunderstanding about what constitutes a 'macro' lens. True macro capabilities require the lens to be capable of 1:1 or 'life size' reproduction. Lenses that provide a 2:1 reproduction ratio (or greater) also qualify as macro lenses but they are usually highly specialised and not widely available.

Macro lenses are designed to focus much closer than a normal lens. This can create some problems photographers need to be aware of with respect to camera-to-subject distances and the risk of blocking light from reaching the subject.

Many zoom lenses claim to have 'macro' capabilities, although this is more of a marketing term than a true description of their capacities. Some digicams include ' macro' focusing modes that can capture sharp images of subjects as close as one centimetre from the front of the lens. But few of these can achieve reproduction ratios greater than 1:4 (one quarter life size).

Using macro lenses successfully requires an adequate working distance between the front of the lens and the subject. As a rough guide, the longer the focal length of the lens, the greater the working distance it provides.



True macro lenses can reproduce subjects at life size on the image sensor. (Taken with a 60mm macro lens on an Olympus OM-D camera.)

Working Distance

The closer you get to the subject, the more likely you are to encounter the following problems:

The subject gets 'spooked' and disappears. (Scientists often chill their subject before a shoot – but it requires just enough cold to slow the creature down without making it torpid or killing it).

The lens shadow interferes with the subject and there's not enough room to introduce additional lighting.

Focusing is difficult because depth-of-field is very restricted. The autofocusing system will probably hunt for focus and, if you're hand-holding the camera, it's difficult to keep it steady enough to lock onto the subject. A tripod is useful for manual focusing but, even then, finding the focus point becomes more difficult the closer you are to the subject. If your subject is very mobile it will probably have moved on before you've set up the camera.

Choosing Macro Lenses

Specialised macro lenses are available to suit all DSLRs and some compact system cameras (CSCs).



This shot illustrates the very shallow depth of focus that characterises true macro photography. (Taken with a 180mm lens on a camera with a 35mm sensor; 1/250 second at f/4.)



This picture of a small, colourful lizard, illustrates the shallow depth of field that comes with close-up shooting, even outside the true macro range. (Taken with a 60mm macro lens on an Olympus OM-D camera.)

Options for DSLRs with 36 x 24mm sensors include:

30-60mm – typically used for product photography (e.g. jewellery) and small, non-mobile objects;

65-105mm – the standard macro focal length range; ideal for photographing flowers, insects and other small objects;

150-200mm – a better option for mobile insects and other small animals because it provides more working distance.

For DSLRs with APS-C sized sensors, the range of dedicated macro lenses is restricted to focal lengths between 40mm and 100mm. Allowing for the typical 1.5x and 1.6x crop factors, the following options are available:

40mm for product photography and small, non-mobile objects;

60mm for flowers, insects and similar small objects;

85-100mm for mobile insects.

Owners of M4/3 CSCs can only choose between 45mm and 60mm lenses, which provide the equivalent of 90mm and 120mm in 35mm format, respectively.

Macro lenses need not be particularly fast because they are used at camera-to-subject distances that produce a restricted depth-of-field with normal aperture settings. In fact, many photographers stop down to f/5.6 or smaller apertures in order to have enough of the subject sharply imaged. It's more useful to concentrate on working distance, ergonomics and stabilisation, and whether the lens is easy to hand-hold and adjust on the camera you have in mind.

Alternatives

There are other ways to achieve similar magnifications to true macro lenses, although they aren't necessarily as easy to use and they may compromise image quality.

You can increase the distance between the lens and the sensor by attaching either extension tubes or extendable bellows to the back of the lens. This enables the lens to focus closer and provides greater magnification of the image. However it also reduces the amount of light transmitted to the sensor and may make accurate focusing difficult. Higher ISO settings will probably be required.



Tamron's SP AF 60mm f/2 macro lens combines extended depth of field control with low-light shooting capability and a good working distance on DSLRs with APS-C sized sensors. (Source: Tamron.)



The Olympus M.Zuiko Digital 60mm f/2.8 macro lens can focus to 19 cm from subjects. It is also weather sealed, an advantage for outdoor photographers.

Fitting a close-up lens to the front of the camera's lens is another, relatively inexpensive, option. Unfortunately most such lenses suffer from chromatic aberration and reduced sharpness.

Reversing rings, which allow lenses to be fitted wrong way round, can also produce up to 4x magnification. But they may be difficult to find for modern cameras that rely on electronic contacts for focusing and metering.

Shooting Tips

The closer you shoot and the more the subject is magnified, the smaller the depth-of-field in the subject. The size of the sensor can also influence depth-of-field. If you photograph the same subject so it occupies the same percentage of the sensor's height with a 36 x 24mm DSLR camera and a M4/3 camera using the same lens aperture, the camera with the smaller sensor will produce noticeably greater depth-of-field. Some subjects require as much of the subject as possible to look sharp. For others, it's best to have the main subject differentiated from a blurred background. The subject usually dictates which strategy to adopt.



An example of the creative use of the shallow depth of field of a 60mm macro lens on an APS-C DSLR. (Source: Tamron.)

Stopping down the lens is the best way to maximise depth-of-field. But since all lenses are diffraction-limited, a point will come where image sharpness will deteriorate. Avoid using the smallest aperture settings.

Make sure you focus on the most important part of the subject. For shots of insects and other small animals, the eye is usually the key point of focus; for flowers, the entire flower head works best for moderate close-ups, while the reproductive parts (stamens, pistil) are best for extreme close-ups.

Lighting

It can be difficult to ensure close subjects are evenly – and adequately – lit when shooting close-ups. This is particularly true with shorter lenses, where on-camera flashes can have their light interrupted by the lens barrel.

While artificial lights can be used, they introduce a few problems. Flash units can be too harsh, while studio lights can be cumbersome and difficult to set up. Ring lights, which encircle the front of the lens with white LEDs or tiny flash tubes, can provide evenly-balanced lighting at close distances. But they tend to 'flatten'



An example of the use of the shallow depth of field to isolate a subject, taken with a 90mm macro lens on a 35mm DSLR. (Source: Tamron.)



A diffused flash was used with -0.7EV exposure compensation to balance the light on this close-up shot, taken with the 300mm focal length on a 'macro zoom' lens.



Macro lenses can also be used to shoot close-ups outside the macro range. This shot was taken with a 90mm macro lens on a camera with an APS-C sensor using an aperture of f/14 to maximise depth of field.

the subject, even with a good working distance. LEDs on adjustable arms let you control the angle and intensity of the light very precisely.

Diffusers and reflectors can be used to re-direct the light onto close subjects. 'Bouncing' the flash light off a reflector softens its effect and reduces the chance of specular reflections. Some experimentation is required to achieve success.

Other Applications for Macro Lenses

Macro lenses aren't just for close-ups; many photographers prefer them as portrait lenses, particularly those with focal lengths in the 80-105mm range (35mm equivalent). All macro lenses are fully functional at their prime focal length, which means those with shorter focal lengths can be used for landscape photography, while longer focal lengths can work well for capturing sports action.

Many macro lenses have very low levels of rectilinear distortion, which makes them useful for some kinds of architectural photography. Stabilisation is also common in recently-released macro lenses, which extends their use in poorly lit situations when short exposure times are required. ●

CHAPTER 10

Lens Accessories

The main accessories for lenses are hoods, filters and adapters and all have benefits and drawbacks. Some manufacturers supply lens hoods with lenses; others offer them as options. Filters and adapters are always sold separately.

Lens Hoods

Lens hoods help block stray light from entering the lens. They vary in size and shape and are usually short and rectangular or petal-shaped for wide angle lenses. Longer lenses normally use cylindrical hoods. Hoods for zoom lenses are often petal-shaped, with cut-out sections to cater for the wider field of view covered by shorter focal lengths.

To be effective, the internal surface of a lens hood should be non-reflective. Most hoods have matte surfaces, sometimes achieved by flocking. Hoods for zoom lenses must be correctly orientated in order to block stray light without interfering with shots.

Lens hoods are most effective when the sun is at an angle to the camera and out of view of the image frame. They can't block stray light when a bright light source is inside the shot.

Aside from minimising the effects of stray light, a lens hood will act as a buffer between the lens and the environment, preventing fingertips from straying onto the delicate front element and leaving greasy marks that will degrade shots. Hoods on longer tele lenses will also provide some protection against rain, spray and dust (although lenses that aren't weather-resistant shouldn't be exposed to the former).

Filters

Digital sensors are much less affected by UV radiation than film, so the traditional reasons for using these filters no longer apply. Unless they're made



Rectangular lens hoods are often used on wide-angle lenses, such as this 12mm M4/3 lens from Olympus.



Even effective lens hoods can't prevent flare when the bright light source is inside the frame. But they can maintain image contrast with the aid of effective lens coatings.



The UV and haze filters required for shooting with film are no longer necessary with digital cameras. But they can provide a useful protective barrier against sticky fingers, salt spray and dust.

of high-quality glass and properly fitted, filters can actually degrade image quality. They may also produce ghosting due to reflections between the internal surface of the filter and the front element of the lens.

Fitting a protective filter (UV or skylight) is wise in places where there is salt spray, blowing sand or dust, all of which can etch the surface of the lens. It's also advisable when photographing small children and pets, particularly if the subject might touch the lens.



A polarising filter will darken blue skies and make white clouds more prominent, as shown in this picture. But they require careful adjustment in alpine areas to prevent the skies from appearing unnaturally dark

Some filters are used for exposure control, examples being polarisers, neutral density (ND) filters and graduated filters. Polarisers are mainly used for suppressing reflections and reducing atmospheric haze.

Polarisers: There are two types of polarising filters: linear and circular. Both types can achieve the same objectives but circular polarisers shouldn't interfere with autofocusing and metering, whereas linear polarisers may.

Correctly used, a polariser will increase dynamic range and make it easier to record scenes containing a bright sky with a relatively unreflective land by decreasing the glare from reflective surfaces while darkening the sky. It can also increase contrast in scenes containing clouds and skies, although if the subject is highly reflective, it can reduce contrast.

Being highly angle-dependent, polarisers are best used with normal and telephoto lenses. Wide angle lenses can produce uneven results because parts of the scene facing into the sun will be strongly polarised, while the rest will not.



A popular use for neutral density filters is to enable slow shutter speeds to be used to record blurred water. A three-second exposure at f/11 with a 30mm lens on a M4/3 camera.

Polarisers have a number of disadvantages:

1. They normally reduce the light reaching the image sensor by between two and three f-stops.
2. They can reduce image quality if they are made from inferior materials and are not kept perfectly clean.
3. They require greater care with camera positioning and it can take longer to compose shots as the filter has to be rotated to the appropriate position.
4. It's almost impossible to use a polariser successfully with stitched panoramas due to variations in the intensity of the polarisation as the angle of the camera to the sun is changed.
5. It may be difficult to record the ends of rainbows because of uneven polarisation when using a wide angle lens.
6. When the reflection makes the picture, a polariser is undesirable.

ND filters reduce the amount of light reaching the sensor without affecting the colour of the image. Their main use is for exposure control by providing greater flexibility to select wide lens apertures and/or slow shutter speeds in bright ambient lighting. They're available in a wide range of densities from one f-stop to 13 f-stops, the latter being rated as 'extreme'.

A popular application for ND filters is enabling slow enough shutter speeds to be used to capture motion blur, particularly with water. A three-stop

ND filter can be used for photographing waterfalls or cascades in normal daylight because a couple of seconds' exposure is enough to create an attractive blur. For seascapes, longer exposures will be required, typically 20 seconds or more, and denser ND filters will be required.

ND filters can also be used to eliminate human subjects from streetscapes and architectural photographs. Exposures of two minutes or more can make people 'vanish' when they move through the scene.

Another use for ND filters is to enable wide lens apertures to be used to obtain a shallow depth of field on bright, sunny days. They are ideal for blurring distracting backgrounds in portrait shots.

Graduated filters have variable light transmission with roughly half being optically clear while the remainder is of neutral density or has a colour that changes the hue in the areas it covers. The transition between these zones can be abrupt ('hard edge') or gradual ('soft edge').

ND graduates are mainly used to bring an overly-bright part of a scene within the dynamic range of the image sensor and prevent highlight clipping. Hard edge filters are used when there is an abrupt change in brightness; for example, between a dark area of land or sea and a bright sky.

Soft edge filters are used when the light and dark portions are not distinctly



Graduated neutral density filters can bring out details in bright skies that would otherwise be difficult to see.



Coloured graduated filters are mainly used to add drama to shots by altering the colour and intensity of part of the image frame.

separated and when horizons aren't totally straight.

Like regular ND filters, ND graduates come in different densities, the most popular being ND2, ND4 and ND8. Most photographers tend to buy a set of graduates to handle different lighting conditions. Coloured graduates introduce colour, while also reducing the light level in the filtered part of the scene.

Adapters

Adapters allow you to fit lenses from one manufacturer on a camera with a different brand or older lenses on new camera bodies. Before buying an adapter, it's important to understand the following:

1. Adapters aren't covered by the camera's warranty so any damage they cause is your responsibility.

2. Most adapters require you to use your camera in manual mode, which means manual focusing and metering at the shooting aperture.

3. Using lenses designed for film cameras on cameras with smaller sensors will almost certainly reduce image quality

4. Using lenses from different manufacturers on cameras with the same sized sensors should not compromise image quality.

5. Adapters usually reduce the amount of light entering the lens, sometimes by as much as one or two f-stops.

The exception is the Metabones Speed Booster, which increases the maximum aperture by one stop and makes the lens faster by a factor of 0.71x.

Special Effects Lenses

Although many modern cameras include special effects, some effects can only be achieved with specially-designed lenses. Two types are available: lenses that are added to existing lenses and those that replace the lens.

Popular add-on lenses include wide-angle and fish-eye converters that extend the angles of view of regular wide angle lenses. There are also telephoto converters that extend the range of telephoto lenses and macro converters that enable closer focusing to increase subject magnification.

Conversion lenses are usually labelled with the degree of magnification they produce. For example, a 0.50x wide angle converter expands the coverage of a 50mm lens to the equivalent of 24mm, while a 2x tele converter effectively doubles the reach of a 50mm lens to 100mm. Most types of converter



This picture of a Lensbaby Spark special effects lens in use was taken by Craig Strong using the Spark lens. (Source: Lensbaby.)



A fisheye lens gives everyday subjects a radically different perspective. This shot was taken with a circular fisheye Lensbaby lens which replaces the camera's lens. (©Victoria Hederer Bell.)

lenses will reduce the amount of light that reaches the sensor by between one and two f-stops.

For DSLR and CSC cameras, Lensbaby produces a range of creative lenses that replace the normal lenses and allow photographers to select an area in the frame that will be sharp while the remainder of the frame is blurred. Most have a fixed focal length and relatively small, fixed aperture (typically f/5.6).

The range includes lenses that can produce fisheye, soft focus and pinhole effects. Details can be found at **www.lensbaby.com** ●

For more lens tips see **www.lensadvice.com**
For lens reviews see **www.photoreview.com.au/reviews/lenses**

{Photograph what you love}



Deciding what lens to buy is complex: What are the 'pros and cons' of choosing a zoom lens over a series of single focal length (prime) lenses? Is a long zoom lens a better choice than two shorter zooms? Is it worth paying more for a lens with a wider maximum aperture? Can third-party lenses be a good choice? How about lens adaptors and teleconverters?

Lenses Guide outlines some of the technological basics of today's lenses – the varying mounts and formats, image stabilisation and focusing systems, image sensor size – and their impact on lens performance. It then looks at various categories of lenses: standard kit lenses; telephoto kit lenses; and 'all-in-one' extended zoom lenses. This is followed by a series of chapters exploring lenses and different types of photography – landscapes, portraiture, sports and wildlife, and macro photography – along with techniques to improve picture-taking.

With lenses at anything from $300 to $3000 and beyond, this guide might be the best lens investment you ever make!

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