

Camera Lenses and Focal Length

In Photography, your lens is often your most important purchase. This photography tutorial outlines some important qualities of different lenses, and how each performs in identical situations.

Choosing a lens is often more difficult than choosing a camera when it comes to purchasing. One thing to remember is that **a lens will last several times longer than digital cameras**. A D-SLR has a limited lifespan of a *couple of years*, the prices on cameras just keeps on dropping and purchasing a new camera every 3-5 years is quite reasonable if you want good quality photographs & equipment. A lens on the other hand will (*if handled correctly*) last much longer than that, so a good lens will be an investment that you can use for a longer period of time. Another thing to think about is the fact that all the light that reaches the sensor needs to pass through the lens. **A low quality lens on a high quality camera will result in bad image quality, but a good lens on a low quality camera (entry level D-SLR) can still produce good results.**

It's important to realize that different lenses distort and compress the view. A wide angle lens will *distort the view and distances can seem greater than they really are*, while in contrast, a telephoto lens will *compress the view and make far away objects seem closer than they are*.

To show this effect see three photos taken with different lenses, the front object (a street sign) is kept at the same size but the background is drastically different.



18mm, Wide Angle



50mm, Normal



300mm, Telephoto

Lens Focal Length*	Terminology	Typical Photography
Less than 21 mm	Extreme Wide Angle	Architecture
21-35 mm	Wide Angle	Landscape
35-70 mm	Normal	Street & Documentary
70-135 mm	Medium Telephoto	Portraiture
135-300+ mm	Telephoto	Sports, Bird & Wildlife

Wide-angle lens



TOKINA AT-X 124 AF PRO DX
(AF 12-24mm f/4)

Lenses with a wide angle of view have become standard as kit-lenses on most low-end D-SLR cameras on the market, always as zoom lenses. These lenses are **great for landscapes, architecture and indoor photography** — but be aware of the distortion they create. The closer you are to your object the more distorted it will become, and the **distortion** is most predominant in the corners.

With such short focal length they can be useful in low-light situations, both because they take in light from a wider angle and because a little camera shake is not as visible as it is on longer focal lengths.

Be careful when using wide-angle lenses for close portraits, the distortion created by the lens is magnified at close ranges and gives the model unnatural shapes. The effect can be effective and useful in some situation but it's a technique that should be used with caution.

Normal lens



NIKON AF NIKKOR 50mm f/1.4D Normal lenses have a focal length of around 50mm; **it resembles the view of the human eye and creates a natural view** — unlike wide-angle that distort and telephoto that compresses the view. These lenses usually have a very low f-number, which makes them perfect for photographing in low light conditions.

Back in the days this was the standard lens everybody had, often a 50mm prime lens with an aperture of $f/1.2$ – $f/1.8$. The fact that they were so widely used might be one of the reasons why they have now been left behind for most beginners and amateurs — they are just seen as too boring.

Telephoto lens



CANON EF 70-200mm f/4L IS USM

These lenses have a narrow view field and a long focal length. Telephoto lenses are **great for wildlife and sport photography, and can be good to use for portrait when you want to isolate the model from the background**. Telephoto lenses **compresses** the view which can be both positive and negative depending on the situation. Telephoto lenses with their longer focal length require better light conditions or the use of a tripod. There are fast telephoto lenses, like a 400mm $f/2.8$, but these are often very expensive and out of reach when it comes to most amateurs — and most of these lenses are too heavy to be handheld.

The last decade most companies have started to produce these high end telephoto lenses with **Image Stabilizer** to make them more usable without tripods. Lately this feature has been implanted in more and more low-end lenses as well.

Macro lens



TAMRON SP AF90mm F/2.8 Di
Macro Lens 1:1

Macro photography is **close-up photography**. Macro is a word that has been severely abused lately, every photograph of an insect or flower is not macro, and many people seems to have missed the point of what macro is supposed to be. True macro photography is at the **scale of 1:1 or greater** — this means that the object you're photographing should be the same size or larger on the sensor.

Most macro lenses have a focal length between 50mm and 200mm, and they usually have a large maximum aperture (low f-number) that gives them both the ability to be fast as well as totally isolate the subject. **The background and shallow depth-of-field is a very important part of macro photography and can take quite a lot of time to master.**

Many modern macro lenses can focus to infinity and are prime lenses which can make them ideal when it comes to portrait photography, so just because it's a macro lens doesn't mean it can only be used for that type of photography.

Special lenses

FISHEYE LENS



NIKON AF DX Fisheye
NIKKOR 10.5mm f/2.8G ED

Fisheye lenses are extreme wide-angle lenses, having a **180° horizontal angle of view**. There are both Circular and Full-frame fisheye lenses, the circular will create a round image in the center with unexposed (black) edges and the full-frame lens will fill the entire sensor but will only have 180° horizontal and not vertical.

TILT-SHIFT LENS



CANON TS-E 45mm f/2.8

Tilt-shift lenses are **common in architectural photography to avoid the distortion** a regular wide-angle lens creates while keeping the entire building in focus. Tilt-shift lenses have more features than just correcting the distortion, they also gives the photographer total control over the focus and depth of field. The lens can create rather odd looking photographs where the field of depth looks “unnatural”.

SONY DSC – H400 BRIDGE CAMERA with 63x Optical Zoom



20.1 M pix

63x Optical Zoom Equivalent to 24.5 mm to 1550 mm (in 35mm terms)

Prime lenses vs. Zoom lenses



There are two types of lenses, prime and zoom. A prime lens is a lens that has a fixed focal length, these lenses comes in all shapes and price classes. Zooms are more versatile. A zoom lens can be a wide-angle lens, a normal lens and a telephoto lens — all in one — where as a prime can only be what it is. High-end telephoto lenses as well as macro lenses are almost always primes.

So why choose a prime instead of a zoom lens then?

Most prime lenses are considerably sharper than the zooms in the same price class, even when you go to the very high-end lenses the primes are sharper but the difference is not as distinct. **Not only are primes sharper but they often have a larger maximum aperture which makes them faster and ideal in low-light situations.** However, the technology is moving forward at a great speed right now and the noise levels at high ISO isn't as visible as it was before which makes zoom lenses able to be faster as well.

All in all I would recommend that people have at least one prime in their camera bag, preferably a normal lens, which is the perfect lens for many situations — sharp, fast and light-weight.

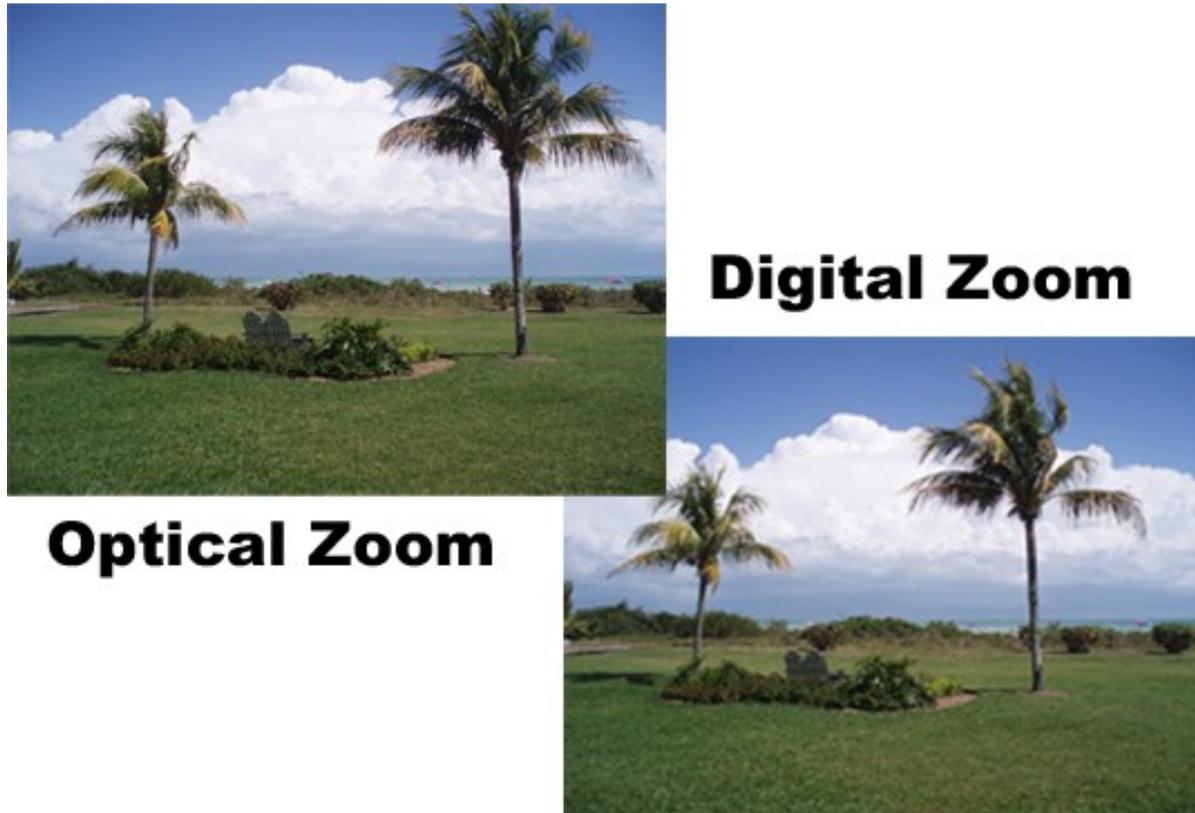
Most lenses have a “sweet spot” where the lens is performing better than on other settings. Zoom lenses are often best in the middle of their range and there can be some quality loss on both the maximal and minimal focal length, but it's different from lens to lens so your best bet is to try and see where you find the sharpest results.

The aperture will also affect the sharpness, and most lenses are softer when they are wide open (largest aperture). To prevent this you can always step down one or two f-stops, if the situation allows for it.

The Difference between Optical Zoom and Digital Zoom on Your Digital Camera

Zooming on your digital camera involves getting a closer view of far-away

subjects. Optical zoom gets up close and personal by using an actual lens adjustment and digital zoom adjusts the image in the camera itself (this figure shows the difference in the images you get):



The camera used an optical zoom for the picture on the left and a digital zoom for the one on the right.

Optical zoom: An optical zoom is a true zoom lens. They produce much better-quality images.

Digital zoom: Some cameras offer a digital zoom, which is simply some in-camera image processing. When you use a digital zoom, the camera enlarges the image area at the center of the frame and trims away the outside edges of the picture. The result is the same as when you open an image in your photo-editing program, crop away the edges of the picture, and then enlarge the remaining portion of the photo. Enlarging the “zoomed” area also enlarges the pixels and reduces the image resolution and the image quality.

If taking a lot of photos from far away subjects is important to you, be sure that the camera you buy has an optical zoom.

Some quick advice on buying a new lens

When it comes to purchasing a new lens there are a few things to consider.

- Who much are you willing to spend
- What do you need it for (sport, landscape, portraits etc)
- What lenses do you already own
- Prime or Zoom
- Image Stabilizer or not
- Filter size

The budget question is rather obvious, don't buy lenses you can't afford, period.

What you need your lens for is another very important factor, both when it comes to focal length and speed.

For instance, there are many telephoto zoom lenses on the market but many of them are not suitable for sport due to the fact that they are too slow —their largest aperture isn't letting enough light through to freeze action. Many sport situations require a lens that has an aperture of $f/2.8$ or larger (consumer telephoto lenses are often $f/5.6$).

For situations with low light, especially weddings and such, requires even faster lenses, often between $f/1.2$ and $f/1.8$.

It's also important to consider what lenses you already have in your collection and what a new lens will add. Sometimes you purchase a new lens as an upgrade from your previous lens, sometimes it's for a focal length that you do not already have. Don't worry too much about small gaps in the focal length in your collection. For example it's no problem to have a 16-35mm wide angle, a 50mm prime and a 70-200mm telephoto lens — sure you don't have lenses that covers 36-49mm or 51-69mm, but those are not big gaps and buying extra lenses to fill such gaps is not something I advice you do.

My personal opinion is that upgrading should add more than just better image quality, for a worth upgrade you should get a faster lens, or a feature such as image stabilizing. The choice between prime and zoom lenses was described earlier in this article and there's no right or wrong here, just personal preferences and also depending on the situation.