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Different types of camera lenses explained pdf printable template pdf pdf

Most of the time, that would qualify as distracting bokeh, although it's kind of cute in this photo of two fake tortoises:Heart-shaped background blur, due to a heart-shaped aperture. Depth of field is the amount of your photograph that appears sharp from front to back. Most of the time, it will be the lens's widest aperture, but not always.Background blur sample from the top-left corner of the Nikon 24mm f/1.4G. Essentially, for every aperture blade in your lens, you'll end up with a sunbeam. This only happens if you photograph a small, bright point of light, such as the sun when it is partly blocked. Bokeh is the property of the lens, and some lenses have better bokeh than others. And, if your lens has nine aperture blades, you'll get eighteen sunbeams.Wait, what?That's no typo. These shapes depend on the number of aperture blades and their roundness. Instead, it's more important to know why aberrations occur, including how your aperture setting can reduce them.It starts with a simple fact: designing lenses is difficult. Depending upon your chosen aperture, the size and shape of this lens flare may change slightly. However, they both affect a photo's exposure. You'll get some subject separation at these apertures, but usually not enough to make the background completely fuzzy. If you take a lot of portraits, macro photos, or wildlife photos, you'll end up with out-of-focus backgrounds in most of your images. So, naturally, if the edges aren't the source of your problem, you won't see an improvement by stopping down.3. Starburst and Sunstar EffectsStarbursts, also called sunstars, are beautiful elements that you'll find in certain photographs. For the best results, find a lens that's known to have good starbursts, and then set it to a small aperture like f/16. For this exact reason, an aperture of f/16 is smaller than f/4. On your LCD screen or viewfinder, your aperture will usually look something like this: f/2, f/3.5, f/8, and so on. For example, the Nikon 35mm f/1.4G lens has a maximum aperture of f/1.4, whereas the Nikon 50mm f/1.8G has a maximum aperture of f/1.8. Some lenses have variable maximum apertures that change depending on focal length. You always end up with an even number of sunbeams. That's why you should always keep your camera sensor clean.Dust specks on my camera sensor, taken at f/11 (a fairly small aperture). Take a look at this chart:As you can see, an f-stop like f/16 represents a much smaller aperture opening than something like f/2.8.This causes a huge amount of confusion among photographers, because it's completely the reverse of what you would expect at first. Here are the steps:Put your camera on a tripod, and set your lens to manual focus.Find an object with small details that extends backwards, and focus at the center of it. It depends upon a number of factors, including the size of your camera sensor and the size of your final print. It's simply the quality of your background blur. Naturally, you want them to look as good as possible! Different aperture settings will change the shape of your background blur:Why is that? Let's revisit two of the most important effects of aperture: exposure and depth of field. As you move between bright and dark environments, the iris in your eyes either expands or shrinks, controlling the size of your pupil.In photography, the "pupil" of your lens is called aperture. Just right-click on the image, then select "save as," and pick the location where you want to store it.Aperture FAQWe put together some of the most frequently-asked questions related to aperture below.What is Aperture?Aperture can be defined as the opening in a lens through which light passes to enter the camera. If you need to get more depth of field, it is usually best to move away from your subject or use a focus stacking technique instead.You've made it this far, but are you willing to learn more about aperture? We simply never want the camera to select the aperture for us. For example, if you are shooting with a 18-55mm f/3.5-5.6 lens, you should zoom to 35mm, use the maximum aperture of f/5.6 and get close to your subject.What Aperture Lets in the Most Light?The maximum aperture of the lens, such as f/1.4.What Aperture Lets in the Least Light?The minimum aperture of the lens, such as f/22.SummaryAperture is clearly a crucial setting in photography and it is possibly the single most important setting of all. My aperture was f/16, which means that it's particularly visible.In cases like that, it's better just to use a wider aperture – something like f/5.6, perhaps – in order to capture the water droplet so out-of-focus that it doesn't even appear in your image. Find something spectacular to capture, and put your new knowledge into practice. On APS-C sensors (like on Nikon D3X00 series, Nikon D5X00 series, Fujl X-series, Sony A6X00 series, and many others), divide all these numbers by 1.5. On Micro Four-Thirds cameras (like those from Olympus and Panasonic), divide all these numbers by 2. Be sure not to move your focus ring, and double check that you are using manual focus.On your computer, zoom into 100% on these photos and see if the sharpest point of focus moves continuously farther back as you stop down. If you take a look at the specifications of your lens, it should say what the maximum and minimum apertures are. Let's take a closer look.Everything Aperture Does to Your PhotosEver wondered how else aperture affects your photographs aside from brightness and depth of field? Landscape photographers use this effect a lot.On top of that, the aperture you choose also alters the exposure of your images by making them brighter or darker.Aperture Explained in Videof If you prefer to understand how aperture works visually, we put together a video for you that goes through most of the basics. It's pretty easy. However, it may take a few re-reads of this article before it's all completely clear.Practice is your best friend. That's because lenses are especially difficult to design around the corners.Here's a diagram that explains what I mean.Adapted from a Creative Commons image on Wikipedia.And that brings us to aperture. Many people don't realize a simple fact about aperture: it literally blocks the light transmitted by the edges of your lens. In comparison, higher aperture numbers like f/8 block light while yielding wider depth of field. The end result is that your photos will have fewer aberrations at smaller and smaller apertures.How does this look in practice? It is an easy concept to understand if you just think about how your eyes work. It's better to choose an aperture that gives you the right artistic look to the image.Some types of aberrations don't change much as you stop down, or they may even get slightly worse. While they are not as capable as f/1.4 lenses in terms of light-gathering capabilities, they are still enough to shoot in reasonably low light conditions, especially if the lens or camera has image stabilization.

"This article explains how to get better bokeh as a photographer. I actually use even smaller apertures like f/11 and f/16 all the time when I have a close foreground in landscape photography. This is due to the fact that DSLR cameras focus at the widest aperture.At What Aperture is Everything in Focus?That really depends on your camera's sensor size, focal length of the lens, and how close your camera is to your subject. Instead, I simply wrote "brightest" through "darkest".Although this chart is intentionally simplified, it covers all the basics that you need to know. A small aperture does just the opposite, making a photo darker. In this particular case, you could simply wipe the droplet off, but that's not possible if you're shooting through something like a dirty window.You might have realized that this section is really just an extension of depth of field, and that's true! However, it's a bit of a special case, so I decided to mention it specifically.Another example of shooting through things is when a piece of dust lands on your camera sensor. In the graphic above, if I didn't allow myself to change any other camera settings like shutter speed or ISO, the optimal aperture would be f/5.6.In a darker environment, where you aren't capturing enough light, the optimal aperture would change. These are aperture-priority mode and manual mode. This article would be way too long if I explained every possible aberration in detail: vignetting, spherical aberration, field curvature, coma, distortion, color fringing, and more. It is therefore best to stop the lens down to the desired aperture before focusing. So, if your aperture blades are shaped like a heart, you'll end up with heart-shaped background blur. It's also ideal for documentary and portrait photography where you don't want a blurry background. If you use a zoom lens, you should zoom in to the longest focal length and use the widest aperture, while being as close to your subject as you can. Whenever the sun is in my photo, I almost always set f/16 purely to capture this effect.Also, the starburst effect looks different from lens to lens. Mirrorless camera users don't need to worry about that.With small apertures like f/8 and beyond, your depth of field will be large enough to hide any focus shift problems, so just focus like normal.When it comes down to it, focus shift is just another type of lens aberration. If your lens has six aperture blades, you'll get six sunbeams. For example, f/2.8 is larger than f/4 and much larger than f/11. Feel free to download and print this chart if you find it useful. A narrow aperture, on the other hand, yields more depth of field, making more of the image appear sharp. How do you tell if your lens has problematic focus shift? Nevertheless, it plays an important role. Both have their uses in photography.Does Aperture Affect Focus?Changing lens aperture can affect focus slightly due to focus shift. This chart covers the most important effects of aperture in photography, as well as common terms that photographers use to describe their settings.Note that to make this diagram easier to see, I did not darken or lighten any of the sample illustrations (as would occur in the real world). First, here is a quick diagram to refresh your memory on how aperture affects the exposure of an image:If you've read the prior chapter in our Photography Basics guide covering shutter speed, you already know that aperture isn't the only way to change how bright a photo is. Dust specks on your camera sensor will show up very clearly at small apertures like f/16, even if they're invisible at something larger, like f/4.Luckily, they are very easy to remove in post-production software like Photoshop or Lightroom, though it can be annoying if you have to remove dozens of them from a single photo. If you want to find out more about this subject, we have a comprehensive article on f-stop that explains why it's written that way and is worth checking out.Large vs Small ApertureThere's a catch – one important part of aperture that confuses beginning photographers more than anything else. In this part of the article, we will go through all other ways aperture impacts your images, from sharpness to sunstars, and tell you exactly why each matters.A landscape image captured at f/16 to bring everything from foreground to background into focus. Even though it's just a subset of exposure, we wanted to include it in this section, since flash is tightly correlated to lens aperture.A Chart of Everything Aperture DoesOnce you understand the information above, you will know everything aperture does to your photos. Some aperture blades are rounded (which results in a more pleasant out-of-focus background blur), and others are straight. So far we have only touched the basics, but aperture does so much more to your photographs. With such wide f-stops, you will get very shallow depth of field at close distances, where the subject will appear separated from the background.f/1.8 – f/2.0 – Some enthusiast-grade prime lenses are limited to f/1.8, which still has very good low-light capabilities. Our full article on aperture with many examples and illustrations starts here. How Does Aperture Affect Depth?Field?A large aperture results in a large amount of foreground and background blur. However, narrow apertures also have more low-level image blur due to diffraction.Which Aperture is Best for Sharpness?Most lenses are not designed to yield good sharpness at their maximum aperture, which is why it is often desirable to stop down to smaller apertures like f/5.6 to get the best results. Hopefully, you already know that a fraction like 1/16 is clearly much smaller than the fraction 1/4. It happens because a small aperture doesn't inherently reduce aberrations; it simply blocks light that has passed through the edges of your lens. This is part of why a lot of pro photographers will use a more expensive lens like a 70-200mm f/2.8 instead.You'll also enjoy a brighter viewfinder (on a DSLR) or a less noisy viewfinder (on a mirrorless camera) if your lens has a large maximum aperture. You will rarely need anything smaller than that for day-to-day photography.With some zoom lenses, the maximum aperture will change as you zoom in and out. However, the best aperture of the lens, or its "sweet spot" really depends on its optical design.What Aperture Should I Use to Get a Blurry Background?If you want to get your subject isolated from the scene and make the background appear blurry, you should open up the lens aperture as wide as possible. Using the maximum aperture of the lens will typically yield circular background highlights of large size, whereas stopping down to highlights lookins smaller and taking different shapes such as heptagons. For example, if you are shooting with a 50mm f/1.8 prime lens, you should shoot at f/8 with your subject at a close distance. However, if the subject is too close to your camera, you might need to either move back or stop down the lens even further to get everything looking sharp.How Does Aperture Affect Sharpness?A wide aperture yields shallower depth of field, which some photographers mistake for a blurry photo. This isn't a big deal, but it still exists.The flare in this photo is shaped like my lens aperture blades.4. Small Aperture and Unwanted ElementsWhen you shoot through things such as fences, dirty windows, plants, and even water droplets on your lens, you'll probably be disappointed by photos taken with a small aperture. Small apertures like f/11 and f/16 give you such a large depth of field that you may accidentally include elements that you don't want to be in focus! For example, if you're shooting at a waterfall or by the ocean, an aperture of f/16 could render a tiny water droplet on your lens into a distinct, ugly blob:A water droplet landed on my lens while taking this picture. They tend to work fine in the center of an image, but everything gets worse near the edges. When I need as much light as possible, I set a larger aperture like f/2.8 or f/2 without a second thought. A lens like the Nikon 18-55mm f/3.5-5.6 has a maximum aperture of f/3.5 at 18mm and f/5.6 at 55mm.Which Aperture is Best for Portrait Photography?If your goal is to make an image with shallow depth of field, where the subject appears sharp while the foreground and the background appear blurry, then you should use very wide apertures like f/1.8 or f/2.8 (for example, if you are using a 50mm f/1.8 lens, you should set your lens aperture to f/1.8).Which Aperture is Best for Landscape Photography?When photographing landscapes, you often want to have as much depth of field as possible in order to get both foreground and background looking as sharp as possible. This is what using large vs small apertures does to photographs.What Are F-Stop and F-Number?So far, we have only discussed aperture in general terms like large and small. It is usually expressed in f-stops such as f/1.4 and stated on the name of the lens. This is often desirable for portraits, or general photos of objects where you want to isolate the subject. Axial chromatic aberration, for example – color fringes near the edges of your frame – often work that way. It's just too important, and it is one of those basic settings that every beginner or advanced photographer needs to know in order to take the best possible images.As always, it's best if you learn all this for yourself. Aperture-priority mode is written as "A" or "Av" on most cameras, while manual is written as "M." Usually, you can find these on the top dial of your camera (read more also in our article on camera modes).In aperture-priority mode, you select the desired aperture, and the camera automatically selects your shutter speed. In the landscape photo below, I used a small aperture to ensure that both my foreground and background were as sharp as possible from front to back:Taken using a very small aperture of f/16 in order to remove background blur and achieve sufficient depth of field!Here is a quick comparison that shows the difference between using a large vs a small aperture and what it does to your depth of field.A comparison of two images shot using large vs small aperturesAs you can see, in the photograph on the left, only the head of the lizard appears in focus and sharp, while the background and foreground are both transitioning into blur. Sometimes you can frame your subject with foreground objects, which will also look blurred relative to the subject, as shown in the example below:Taken with a portrait lens using a very large aperture of f/1.4Quick Note: The appearance of the out-of-focus areas (AKA whether it looks good or not) is often referred to as "bokeh". They are fundamental, optical problems that you'll notice with any lens if you look too closely, although some lenses are better than others. For example, consider the image below:What's going on here? This is fairly common in landscape photography. If you want the strongest possible starburst, use a small aperture. Aperture is no exception.Below are some other related posts you might enjoy.Hopefully, you found that this article explains the basics of aperture in a way that is understandable and straightforward.If you are ready to move on, the next important camera setting to learn is ISO, which we explain in Chapter 5 of our Photography Basics guide. It ends up interfering with itself, growing blurrier, and resulting in photos that are noticeably less sharp.At what aperture does diffraction start to become an issue? I took the photo above using the Nikon 20mm f1.8G lens, which has 7 aperture blades. Despite the odd names – one type of candy, the other a type of starfish – I always try to capture them in my landscape photos. If your lens has an odd number of aperture blades, you'll get double the number of sunbeams.It sounds strange, but the reason is actually quite simple. In lenses with an even number of aperture blades (and a fully symmetrical design), half of the sunbeams will overlap the other half. (This doesn't lead to black corners in your photos, because the center regions of a lens can still transmit light to the edges of your camera sensor.)As your aperture closes, more and more light from the sides of your lens will be blocked, never making it to your camera sensor. The end result? More expensive zooms tend to maintain a constant maximum aperture throughout their zoom range, like the Nikon 24-70mm f/2.8. Prime lenses also tend to have larger maximum apertures than zoom lenses, which is one of their major benefits.The maximum aperture of a lens is so important that it's included in the name of the lens itself. Even though some lenses are better than others, almost all lenses are capable of a nice shallow focus effect if you use a large aperture and get close enough to your subject.On the other hand, a small aperture results in a small amount of background blur, which is typically ideal for some types of photography such as landscape and architecture. Some cameras omit the slash and write f-stops like this: f/2, f/3.5, f/8, and so on. On top of that, the crop just isn't very sharp. That's lens aberration at work! The lights didn't look this blurry in the real world. Take a look at the illustration below to see how it affects exposure: in a dark environment – such as indoors or at night – you will probably want to select a large aperture to capture as much light as possible. The Negative Effect of DiffractionSo, if you're a landscape photographer who wants everything as sharp as possible, you should use your lens's smallest aperture, like f/22 or f/32 to get maximum depth of field, right?No! If we go back and take a close look at the photo of the lizard from earlier in this article, where I used apertures of f/4 and f/32, you can see how diffraction is making the second shot less sharp. On the other hand, a small aperture results in a wide depth of field that can give you a sharp foreground and background for landscape photography.How Does Aperture Affect Shutter Speed?Aperture and shutter speed are controlled separately. In the video, we go through what aperture is, how it works, and every effect that aperture has in photography. It all depends upon your aperture blades. Looking at the front of your camera lens, this is what you'd see:So, if photographers recommend a large aperture for a particular type of photography, they're telling you to use something like f/1.4, f/2, or f/2.8. And if they suggest a small aperture for one of your photos, they're recommending that you use something like f/8, f/11, or f/16.How to Pick the Right ApertureNow that you're familiar with large vs small apertures, how do you know what aperture to use for your photos? That's why the image has 14 sunbeams.It's not just the number of blades that matters, though – their shape is also important. Sometimes, it will be written with a colon rather than a slash, but it means the same thing (like the Nikon 50mm 1:1.4G below).Examples of Which Aperture to UseNow that we have gone through a thorough explanation of how aperture works and how it affects your images, let's take a look at the situations where you'd want to use various f-stops.f/0.95 – f/1.4 – Such "fast" maximum apertures are only available on premium prime lenses, allowing them to gather as much light as possible. At one extreme, aperture gives you a blurred background with a beautiful shallow focus effect. Sharpness suffers greatly at f/22 and smaller apertures because of diffraction, so you should avoid using them when possible. This is very popular for portrait photography.At the other extreme, it will give you sharp photos from the nearby foreground to the distant horizon. Aperture priority mode is great for everyday photography, where you rarely need to worry about any camera settings other than aperture. For example, with the Nikon 16-55mm f/3.5-5.6 AF-P lens, the largest aperture shifts gradually from f/3.5 at the wide end to just f/5.6 at the longer focal lengths. Nevertheless, this is a fact of photography. This is normal. If you shoot a lot in low light, this can make it much easier to focus and compose your images.8. Flash ExposureWhen using speedlights or any kind of strobes, it is important to remember that aperture takes on a whole different role of controlling flash exposure. Go outside, take some photos, and get a feel for aperture yourself.If it helps, I compiled the main information in this article into a chart. For example, the Nikon camera below is set to an aperture of f/8:Aperture is labeled in f-numbers, and in this case, I'm using f/8. So, f-stops are a way of describing the size of the aperture for a particular photo. Aperture affects several different parts of your photo, but you'll get the hang of everything fairly quickly. Even though these apertures offer more depth of field, they do lose some low-level sharpness due to the effect of lens diffraction.f/22 and smaller – Only shoot at such small apertures if you know what you are doing. Focusing in dark conditions may be impacted. Such apertures are great for travel, sports, and wildlife photography.f/5.6 – f/8 – This is the right starting point for most landscape and architectural photography. Wide apertures also show the weaknesses of the lens optical design, often resulting in visible lens aberrations. However, there is a reasonable and simple explanation that should make it much clearer to you: Aperture is a fraction.When you are dealing with an f-stop of f/16, for example, you can think of it like the fraction 1/16th. My choice of aperture played a big role here. So, what is it?Diffraction is actually quite simple. (ISO can again be manual or auto.) Manual mode takes more time and usually gives you the same results as aperture priority anyway. Other images have a "large" or "high" depth of field, where both the foreground and background are sharp.For example, here is an image with a shallow depth of field:This photograph has a thin depth of field – a "shallow focus" effect.In the image above, you can see that the girl is in focus and appears sharp, while the background is completely out of focus. Those "medium" apertures are small enough to block light from the edges of a lens, but they aren't so small that diffraction is a significant problem. Unfortunately, as you change lenses, this is very common. You can shrink or enlarge the size of the aperture to allow more or less light to reach your camera sensor. So, you don't enjoy.Hopefully, you found that this article explains the basics of aperture in a way that is understandable and straightforward.If you are ready to move on, the next important camera setting to learn is ISO, which we explain in Chapter 5 of our Photography Basics guide. 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