

# Everyone's Guide to Sharp Pictures

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# Composition and Sharpness

*Things to think about before you adjust the camera settings.*

# Softness

What you chose to make soft is as important as what you choose to make sharp

- Soft areas provide context without stealing attention from the subject.
- If everything is sharp, the eye can be confused as to where to look.
- Soft areas in the picture make the sharp areas seem sharper

So what should be sharp?

- The subject should be the *sharpest* thing in the picture.
- If the subject is an animal or person, *the eyes must be the sharpest thing in the picture.* This is critical.
- There should always be at least one thing in the picture that is sharp.



A soft background  
brings out sharpness in  
the subject.





Did you notice the yellow center is blurry, as are the front petals and some of the top, far petals?





# Four Examples of Desirable Blur

1. Soft background draws attention to the Hummingbird
2. Falling snow portrays cold weather
3. Blur in upper wings portray the motion of trying to keep warm and dry.
4. Blur in the lower further back wings adds a sense of depth to the Hummingbird.





# Lighting's Effect on Perceived Sharpness

The size, distance, location and combined brightness of all light sources effect the perception of sharpness:

- Light directly behind you produces a flat, 2D image with little sharpness. So does an on-camera flash.
- Light directly to the side or above the subject produces crisp little shadows and highlights that increases the sense of sharpness as well as the sense of 3D shape.
- A small, or point light source produces crisper shadows, increasing the sense of sharpness. However, this also increases harshness. Soft boxes help this by increasing the light area.
- Bright light entering the camera from the front - even if out of the field of view will produce flare, which lowers contrast. Always use a lens hood, including indoors.



# Lighting's Effect on Perceived Sharpness





# Atmospheric Blurring

- Atmospheric blurring is caused when there are different temperatures of air between the subject and camera. This is the same as heat waves you see driving down a hot highway. It is also what makes stars twinkle at night.
- It's not moving air that causes the blurring, but rather that the moving air is a mix of different temperatures.
- This blur has a slightly different look than poor focus or motion blur; it looks kind of dreamy. The blur will change across the picture and from shot to shot.
- Even experienced photographers can mistake atmospheric blurring for a problem with their equipment.
- It's more of an issue when shooting distant subjects outdoors in sun with 400mm or longer lenses.



# Atmospheric Blurring - Heat Waves



7:00 am

Canon 500mm f/4 @ f/13, 1/800 sec ISO 400



8:00 am

Canon 500mm f/4 @ f/13, 1/1000 sec ISO 400

Two pictures taken an hour apart as the pasture warmed up.



# Atmospheric Blurring Up Close



7:00 am

Early in the morning, most of our pictures looked like this



8:00 am

An hour later most of our pictures looked like this, so we packed up.



# Avoiding Atmospheric Blurring



## Most Effective:

- Shoot early in the morning, right after a rain, or on cloudy days.
- Move closer to the subject.
- Move to a location where you're not shooting over warm surfaces, such as roads, parking lots, dry pastures, sand dunes.
- Don't shoot from a window or along the side of a house or barn, especially if it is in the sun.
- If moving your camera from a warm room to a cold outside environment (e.g. 60 degrees to 10 degrees), let the camera cool down for 10 - 15 minutes before taking pictures.
- Compose a wider angle picture

## Less Effective, but worth trying:

- Raise the camera as high as possible. Air next to the hot ground has greater temperature variation.
- Use a faster shutter speed.
- Use a smaller aperture
- Take many pictures and pick the sharpest.



# Other Atmospheric Effects

- Landscape pictures will always have some haze that blurs scenery in the distance. Shooting in the early morning or after a rain are times when the air can be more transparent and distant objects sharper.
- If the distant horizon is hazy and soft to begin with, don't waste your depth of field on it, but rather focus closer to the camera so that objects closer are sharper.
- On a partly cloudy day you can time your picture as clouds cover the sun to vary the ratio of direct light to diffuse light.
- Atmospheric effects aren't all evil - mist, fog, orange haze at dusk/dawn are examples of atmospheric effects that can bring feeling to a picture.



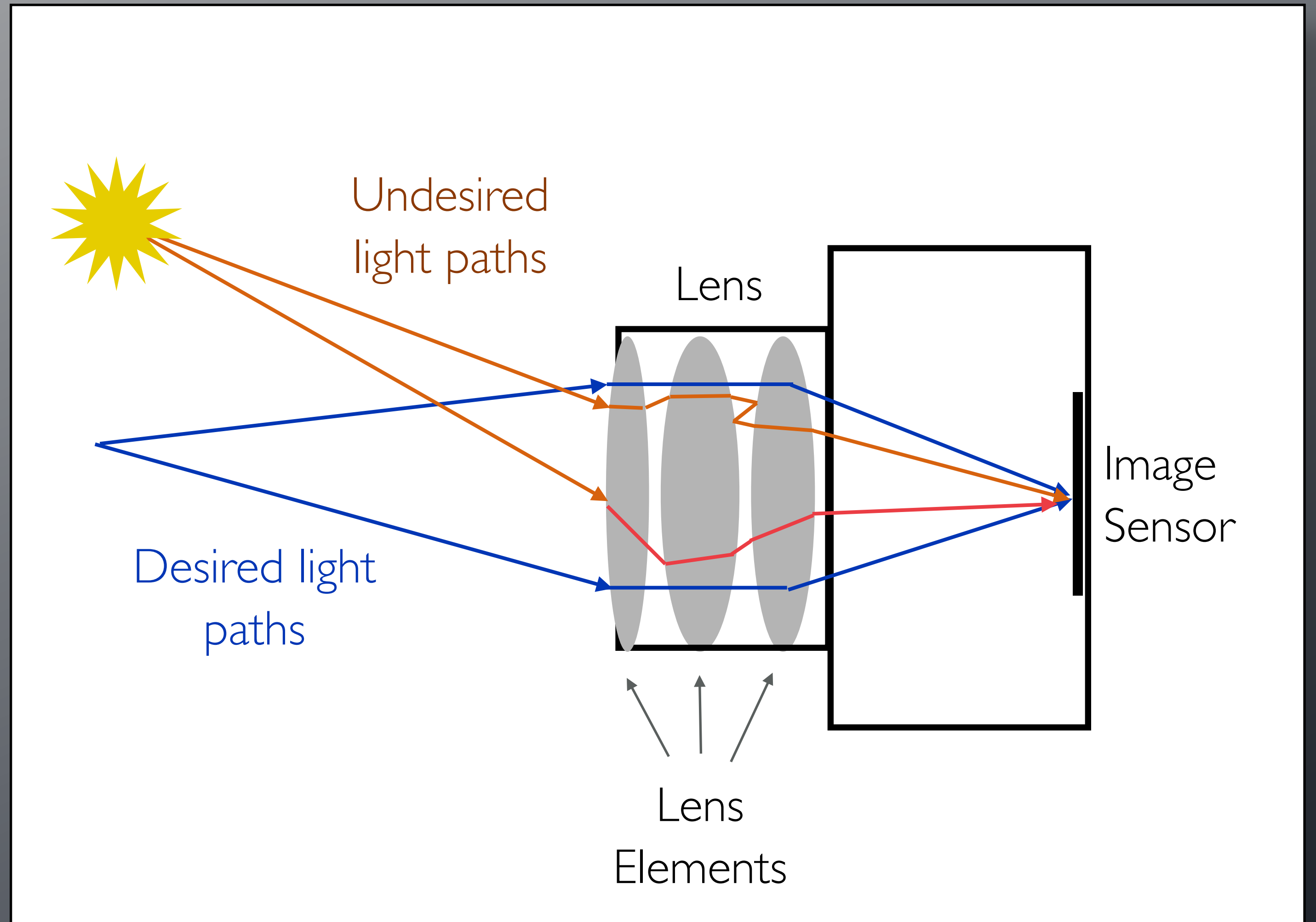
# The Cause and Effect of Flare

Lenses are not perfect. When light hits a lens, most of it goes in the intended direction but a little is scattered.

Lens manufacturers put special coatings on each lens element to reduce this scattering.

The light from *everything* that can see the lens contributes to flare, even if it is out of the picture. This includes the sun, bright clouds, room lights, and bright reflections.

Dirt on the lens can increase flare, but only if there's a lot of it.





# Reducing Flare

- Use a lens hood. If you don't have a lens hood, shade the lens with your hand. There should never be sun or a room light shining on any part of the front lens element.
- Avoid shooting into the sun, into room lights, or into reflections off water
- Blow dust off your lens using clean air (not your breath)
- Avoid unnecessary filters on your lens. A lens hood will protect your lens just as well and improves image quality rather than degrading it.
- Stand in the shade.
- For people, shoot against a dark background rather than a white wall.
- One of the benefits of a photography studio with black walls and ceilings is less flare.
- When editing, lower the black level until you see at least one small clipped region in the image.



# Building Shake

All buildings shake, whether you feel it or not.

The causes include wind, HVAC, people walking, and traffic on adjacent streets.



Fireworks time exposure from the roof of a hotel.

Tripod, remote shutter release, mirror lock up, and no wind. There should be no blur.

The red streamers in the upper left all have the same wavy pattern, caused by building vibration.



# Capture and Sharpness

*Now we're going to talk about camera settings.*



# What ISO, Aperture, Shutter Speed to Use?

## Simple technique:

1. Start with your camera in full-auto (auto-ISO, auto-aperture, auto-exposure, auto-focus zone selection), and see what the camera picks.
2. If there is nothing particularly unique about your subject, stick with the settings in (1.) !  
Otherwise, move to Av, Tv, or M and adjust the settings away from (1.) for what is unique:
  - If shooting a fast sporting event, use a higher ISO and faster shutter speed
  - If shooting a perfectly still landscape, lower the ISO and increase the shutter speed
  - If you have things both very close and very far that you want in focus, select a smaller aperture (larger f-number)



# Basics Techniques to Improve Sharpness

1. Hold the camera with both hands (one on camera, one on lens), close to your face, using the optical viewfinder.
2. Stand with your legs slightly apart. Ideally shoot at an angle to where your feet are pointing.
3. Always use a lens hood.
4. Frame the picture the way you want it rather than over-framing and cropping later.
5. Put the camera on a tripod.
6. Take outdoor pictures at a time of day when there is less wind.



# More Advanced Techniques

1. Always use the highest quality JPG setting, or better, shoot in RAW.
2. For static subjects shot with a tripod, live-view focus can be a little sharper than normal (phase) focus
3. Use a remote shutter release.
4. Use mirror lock-up.
5. Take multiple pictures hoping blur from hand motion or subject motion is less in one of them. Use AI-Servo (Canon) or AF-C (Nikon) and you'll get slightly different focus on each images, with some being sharper.



# Selecting and Using Tripods

- Tripods without a center column are a little more stable than tripods with a center column, even when the column is down. In my tests, this difference is small.
- When setting a tripod to a certain height, try to use the legs first, and then the center column.
- A center column is a convenient feature - especially for taking portraits.
- Carbon Fiber tripods are lighter dampen vibration quicker than aluminum, but are more expensive.
- Buy a good head to go on your tripod.
- On soft ground or grass, 'set' your tripod by pushing it into the ground.
- Some tripods have a hook under the apex to hang weight for stability. This weight needs to be on the ground, not swinging free.
- For exposures longer than 1/60 sec, turn off image stabilization.



# Tripod Feet for Dirt and Grass



Gitzo makes feet with rubber tips that can be removed to expose short metal spikes

- Great for dirt. OK for short grass.
- The rubber tips are very hard to pull off.



Really Right Stuff makes long spike feet that can be used on almost any brand of tripod.

- Excellent for dirt, mud, thick grass
- Use caution not to stab people or scratch floors.



# Lenses and Sharpness

- Fixed focal-length lenses are sharper than zoom lenses.
- Zooms with a smaller range (e.g. 24-70mm, or 3X) are sharper than long-range zooms (e.g. 20-200, or 10X)
- Lenses have one aperture they're sharper at, which is typically one or two aperture stops smaller than the largest aperture.
- Above  $f/13$ , diffraction of light starts to noticeably soften a picture.

THE MOST IMPORTANT RULE: Composition comes first. Select your zoom and aperture for the composition you want and ignore the rest of this slide.



# Remote Shutter Release

Even on a tripod, the camera will shake when you press the shutter.

A remote shutter release allows you to take a picture without touching the camera.

I have been very happy with the Vello FreeWave (sold under other names, too). \$36.

- Can be used as a cabled shutter release without the wireless transmitter and without batteries.
- Wireless transmitter works with antenna up (for more range) or down.
- Wireless transmitter is great for self-portraits.





# Using a Flash to Freeze Motion

**Auto vs Manual Flash:** Try full auto first to see if you need manual. I usually use manual for complete control.

**Ambient Light:** To freeze motion, most of the light needs to come from the flash, not ambient light. Take a test shot without the flash, keeping all other settings the same and see how dark the image is. The darker the test shot, the more influence the flash will have.



## Normal vs High Speed Sync:

1. Normal: Fast flash / slow shutter: In normal flash photography, there is a maximum shutter speed allowed by the camera - usually around 1/200 to 1/250th second. However, by lowering the *power* of the flash, the *duration* is shortened proportionally, and faster exposures are possible than with high-speed-sync. Good for shooting indoors or in low light.
2. High Speed Sync: Slow flash / fast shutter: Use high speed sync and a short shutter speed. Good for outdoors in brighter light, although ambient light is often enough to get a fast shutter and freeze motion in these situations. High speed sync consumes the flash batteries faster.



# Flash Speeds at Different Power Levels

	MT	Full Power	1/2 Power	1/4 Power	1/8 Power	1/16 Power	1/32 Power	1/64 Power	1/128 Power
Canon 430 EX II	t.1	1/350 s	1/1630 s	1/3000 s	1/4300 s	1/5250 s	1/5600 s	1/6500 s	
Canon 580EX	t.1	1/250 s	1/919 s	1/2066 s	1/3759 s	1/6024 s	1/9470 s	1/13966 s	1/19841 s
Canon 580EX II	t.1	1/285 s	1/1400 s	1/2800 s	1/4600 s	1/6500 s	1/7500 s	<1/8000 s	<1/8000 s
Canon 600-EX RT	t.5?	1/1000 s	1/2000 s	1/4000 s	1/9000 s	1/15000 s	1/21000 s	1/30000 s	1/35000 s
Nikon SB-24	t.1	1/231 s	1/794 s	1/1366 s	1/3425 s	1/5208 s			
Nikon SB-26	t.1	1/245 s	1/1389 s	1/2717 s	1/4902 s	1/7813 s	1/10870 s	1/13889 s	
Nikon SB-28	t.1	1/265 s	1/954 s	1/2016 s	1/3623 s	1/6313 s	1/9921 s	1/13889 s	
Nikon SB-80DX	t.1	1/258 s	1/1157 s	1/2451 s	1/4492 s	1/7396 s	1/11062 s	1/15823 s	1/21930 s
Nikon SB-600	t.1	1/265 s	1/875 s	1/2150 s	1/3500 s	1/5250 s	1/7000 s	<1/8000 s	
Nikon SB-700	t.1	1/305 s	1/1000 s	1/2300 s	1/400 s	1/5250 s	1/8000 s	<1/8000 s	<1/8000 s
Nikon SB-800	t.5?	1/1050 s	1/1100 s	1/2700 s	1/5900 s	1/10900 s	1/17800 s	1/32300 s	1/41600 s



# Keeping Your Lens and Sensor Clean

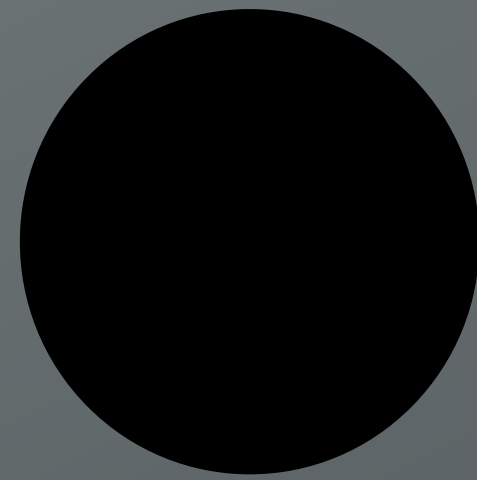
- Minimize how often you change lenses.
- Change lenses indoors in a clean area. Never change lenses outdoors if it is windy.
- Small amounts of dust on the lens will not noticeably degrade the picture. This includes dust inside the lens. Over-cleaning can cause more damage to the coatings or glass than a little dust.
- To inspect your lens, hold it in your hand and look at the reflection of a bright light off the front element.
- To clean, first blow or brush loose dust off your lens using tools intended for lens cleaning.
- Apply a small amount of lens cleaner to lens cloth/lens paper and wipe in a circular motion. Do not press hard - it's better to take more passes with light pressure.



# An In-Depth Look at Depth of Field



Inside the lens is a variable-sized hole called the aperture.  
Light passing through the aperture creates the image.



f/2.8

- Large Aperture lets in more light.
- Depth of field is smaller.
- Sharpness is limited by the lens design.



f/22

- Small aperture lets in less light.
- Depth of field is larger.
- Sharpness is limited by diffraction.  
At f/22, everything will be a little soft.



# Selecting Depth of Field

f / 4



f / 22



- Petals look soft, which matters if the whole flower is the subject
- Background is soft and pleasing

- Flower looks nice and sharp
- Background is distracting



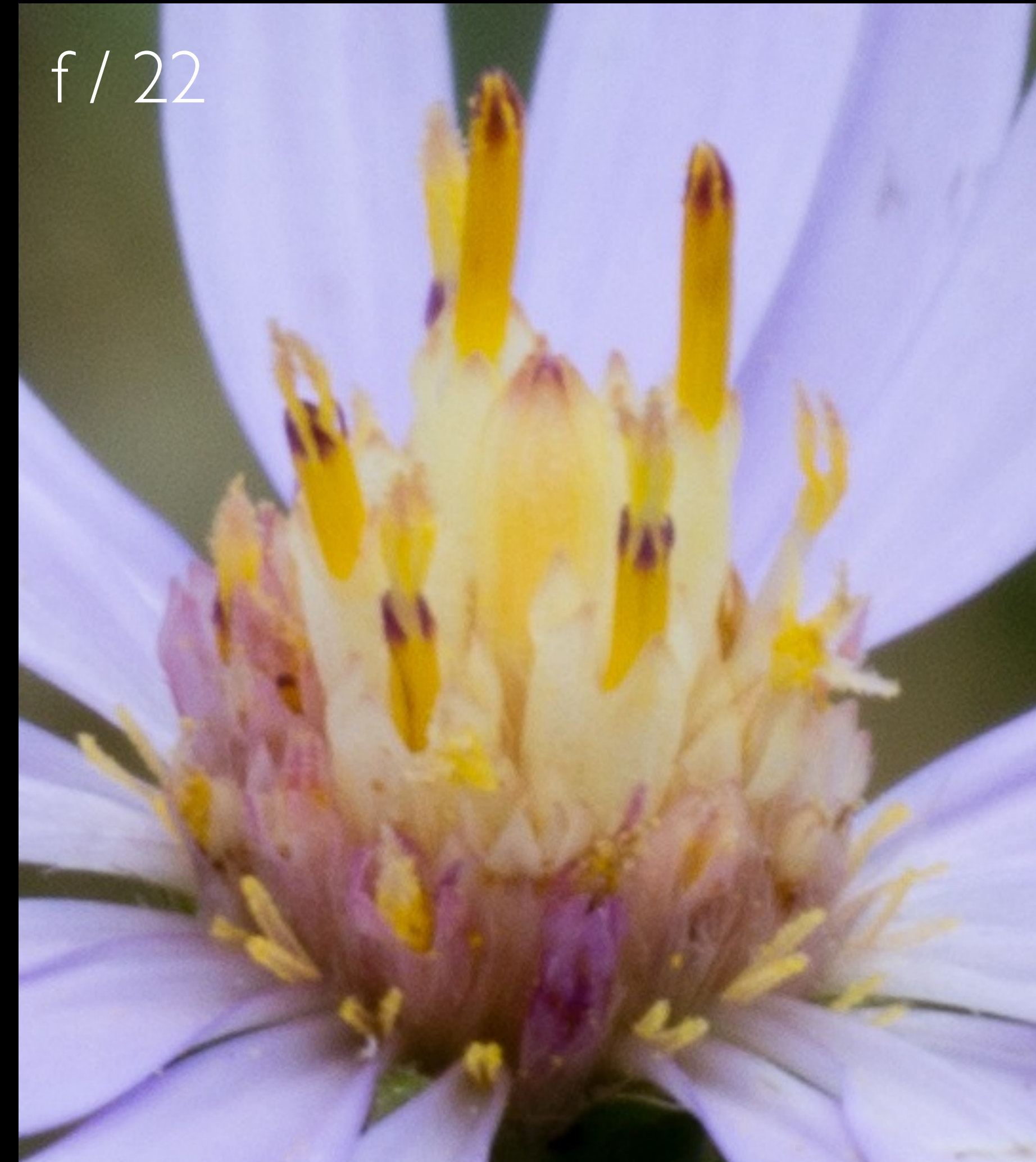
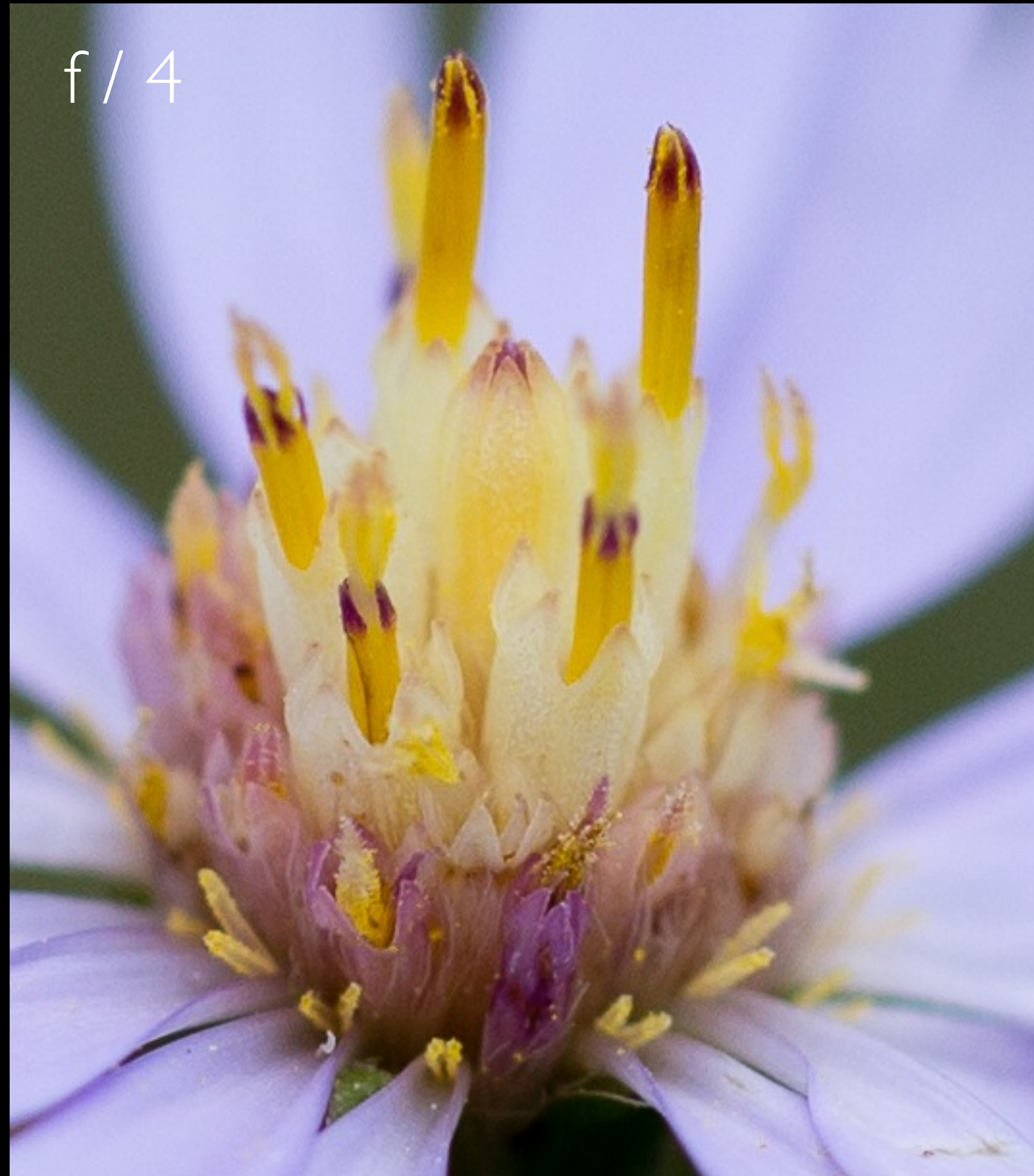
f / 8

A nice compromise





# Diffraction is limiting sharpness at f/22



- If the subject is the center of the flower, then f/4 is a good choice.



Now Let's Focus on Focus



# Two Types of Autofocus in DSLRs

Normal, or  
Phase Detect focus



Live-view, or  
Contrast Focus



# Normal vs Live-view Autofocus

Normal (Phase Detect) Autofocus	Live-view (Contrast) Autofocus
When you are looking through the optical viewfinder.	When you are looking at a live image on the rear display.
Works by comparing images from opposite edges of your lens. Requires minimum aperture (f/5.6 or f/8)	Works by measuring image sharpness, then moving lens, then measuring sharpness again and comparing the two.
Very fast. In a single focus image, the camera knows which way to move the lens and approximately how far	Slow. Camera finds best focus by trial and error.
Has many fixed location focus zones	Has one, or few movable focus zones. Some times the size of the focus zones can also be adjusted.
Requires tight tolerances in the focus optics, which may need calibration to perform as accurately as Contrast Autofocus	If subject and camera aren't moving, delivers the most accurate focus.



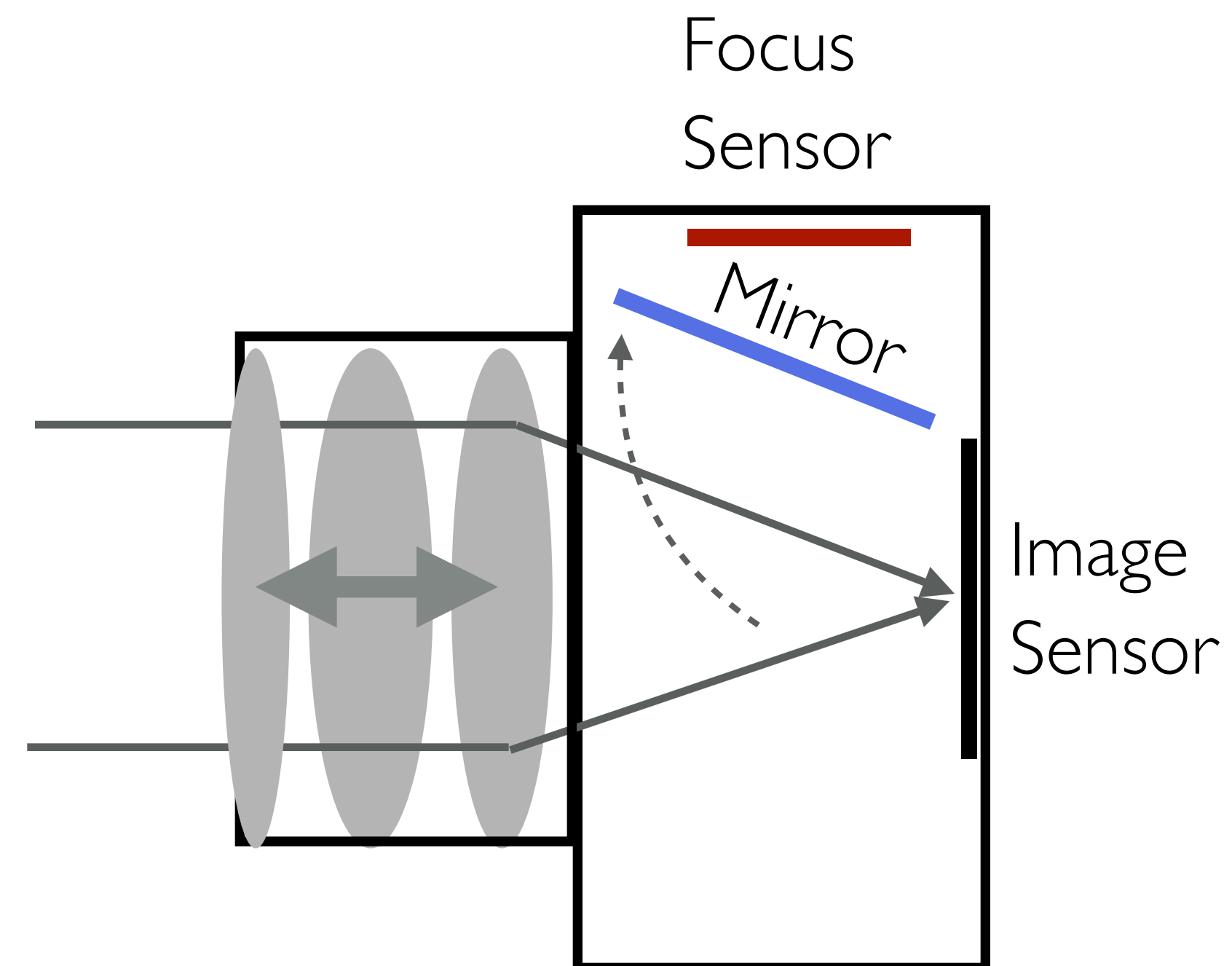
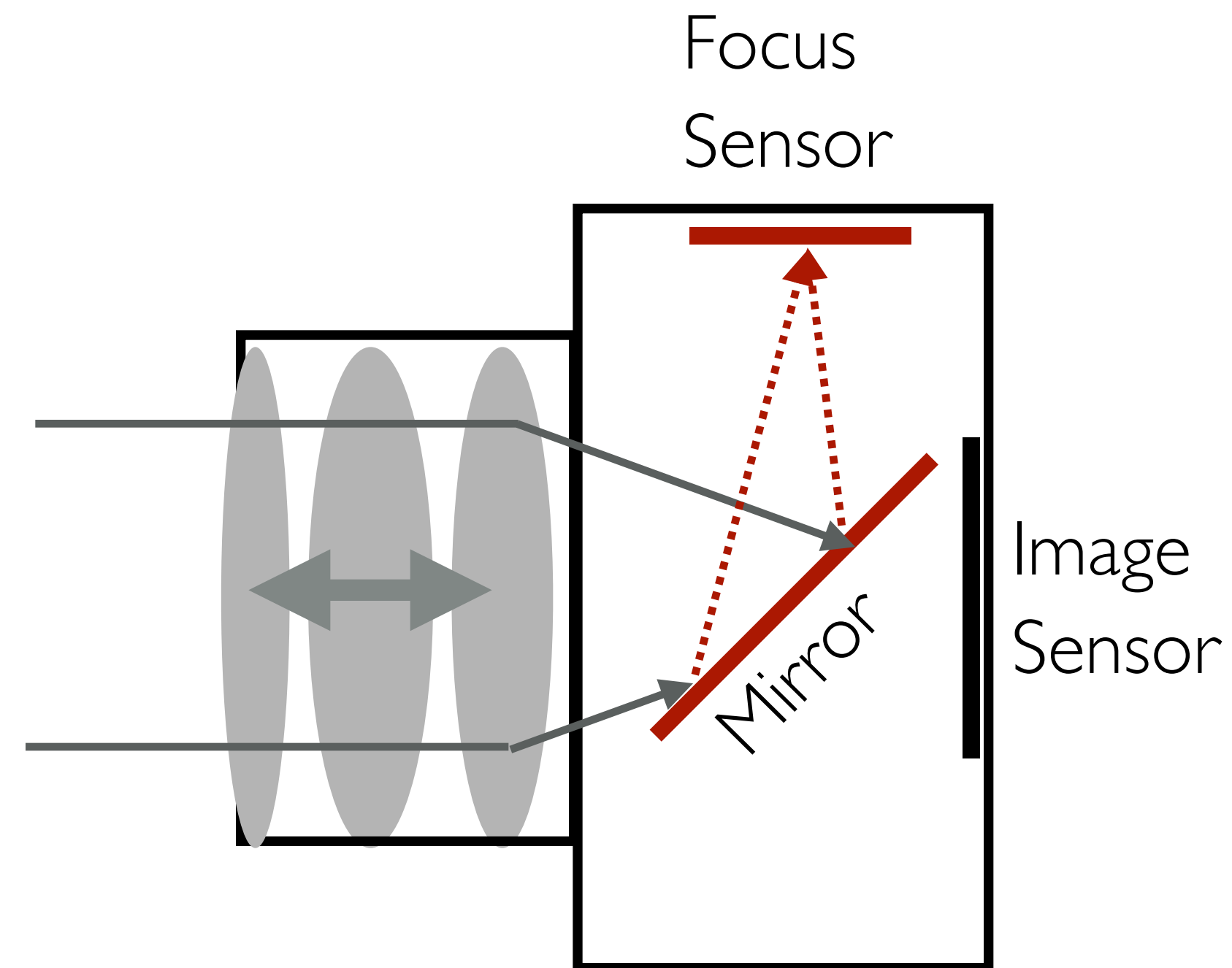
# You Only Need to Remember 2 Things:

1. Phase Focus is *Fast* - good for wildlife, people, sports.
2. Contrast Focus is *Correct* - when the camera is on a tripod, this mode is good for landscapes, architecture, still life, and macro.





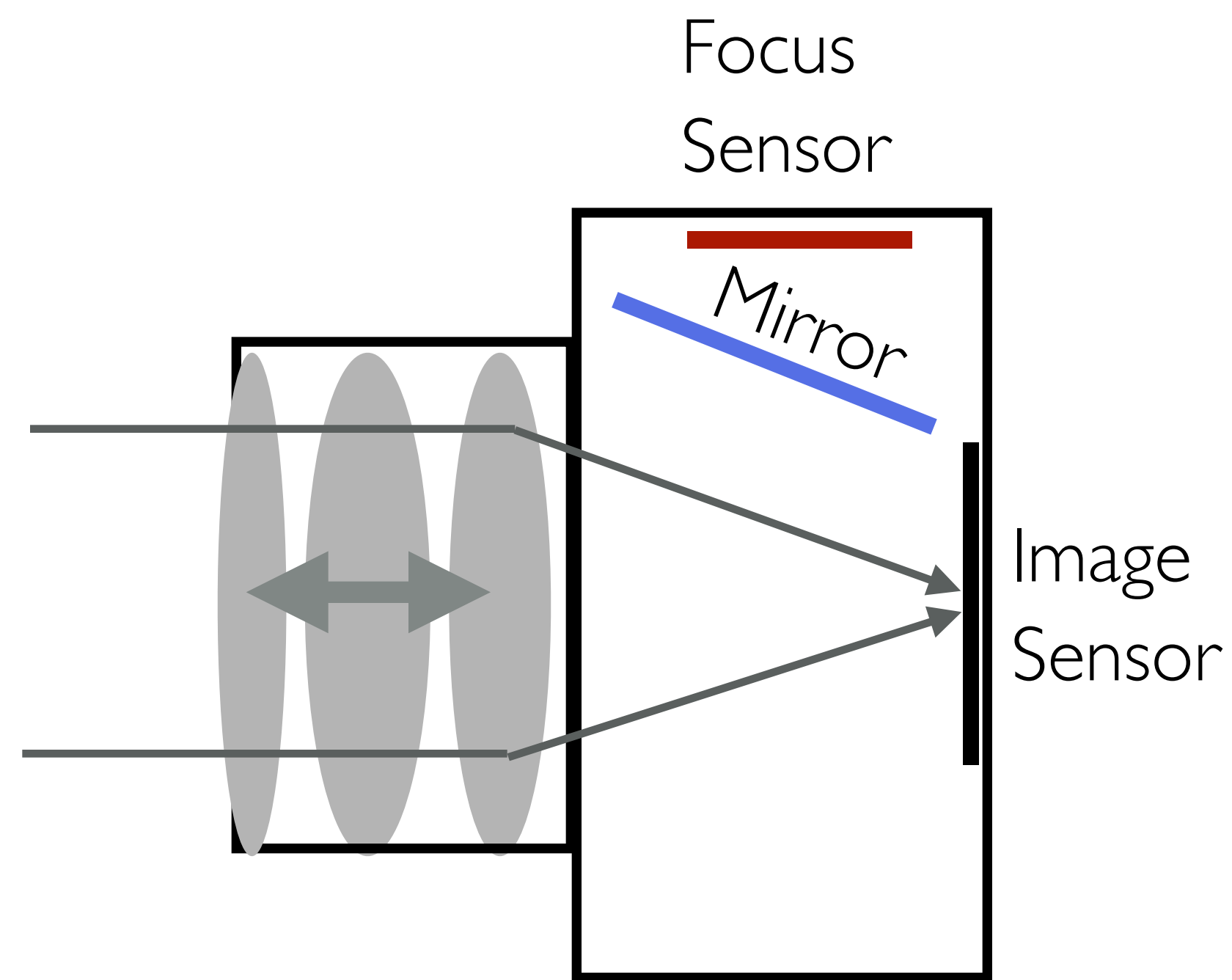
# What Happens in the Camera During Phase Detect (Normal) Autofocus



1. Light through the lens is directed to a focus sensor, which compares the view through two sides of the lens, much like you use your left and right eyes to guess distance.
2. When you press the shutter or focus button, the camera reads the focus sensor and moves then lens.
3. Once the lens is focused, the camera flips the mirror out of the way so that the light falls on the image sensor for the exposure.



# What Happens in the Camera During Contrast Focus

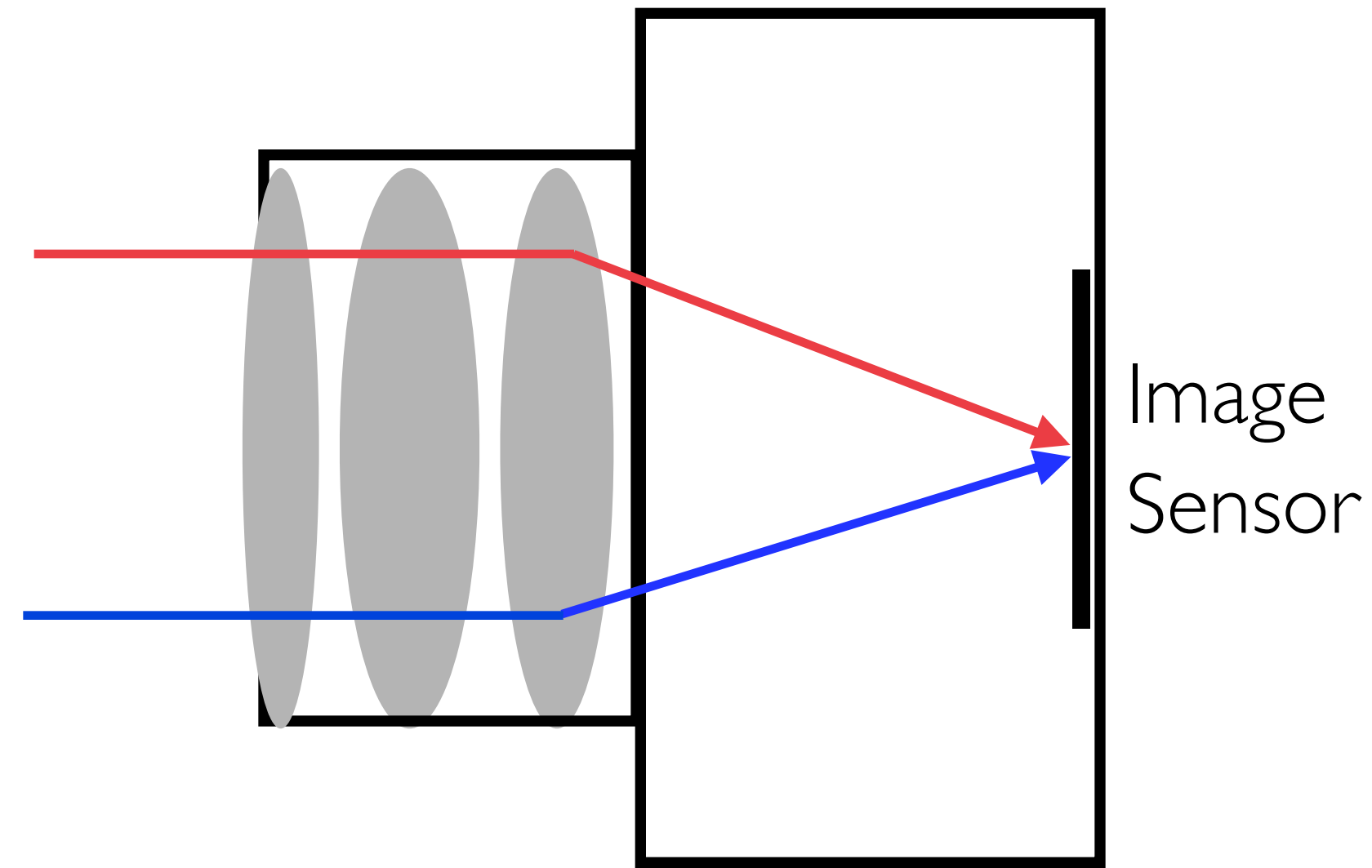


It's basically trial and error:

1. The camera measures the sharpness of the image on the image sensor.
2. The camera moves the lens
3. The camera measures the sharpness again.
4. If the new sharpness is better, keep moving the lens in that direction.
5. If the new sharpness is worse, move the lens in the other direction.
6. Repeat (2.) through (5.) until the best sharpness is found.



Some newer DSLRs, like the Canon 70D have phase focus directly off the image sensor.



This has the potential of providing the best of both worlds - the speed of phase focus and the accuracy of contrast focus.



# The Camera Uses the Largest Aperture of the Lens to Focus

- No matter what aperture you're taking your picture at, the camera always uses the largest aperture to focus.
- Lenses with larger apertures focus faster, more accurately, and work better in low light.
- This means there is a focussing advantage to an f/2.8 lens over an f/4 lens, even if you never take a picture with an aperture larger than f/4.





# Center vs Spot Focus

- Center focus zone is usually a little faster, more accurate, and better in low light than the other focus zones on a camera.
- Spot Focus let's you pick a small object out of a busy background

Center Focus



Spot Focus



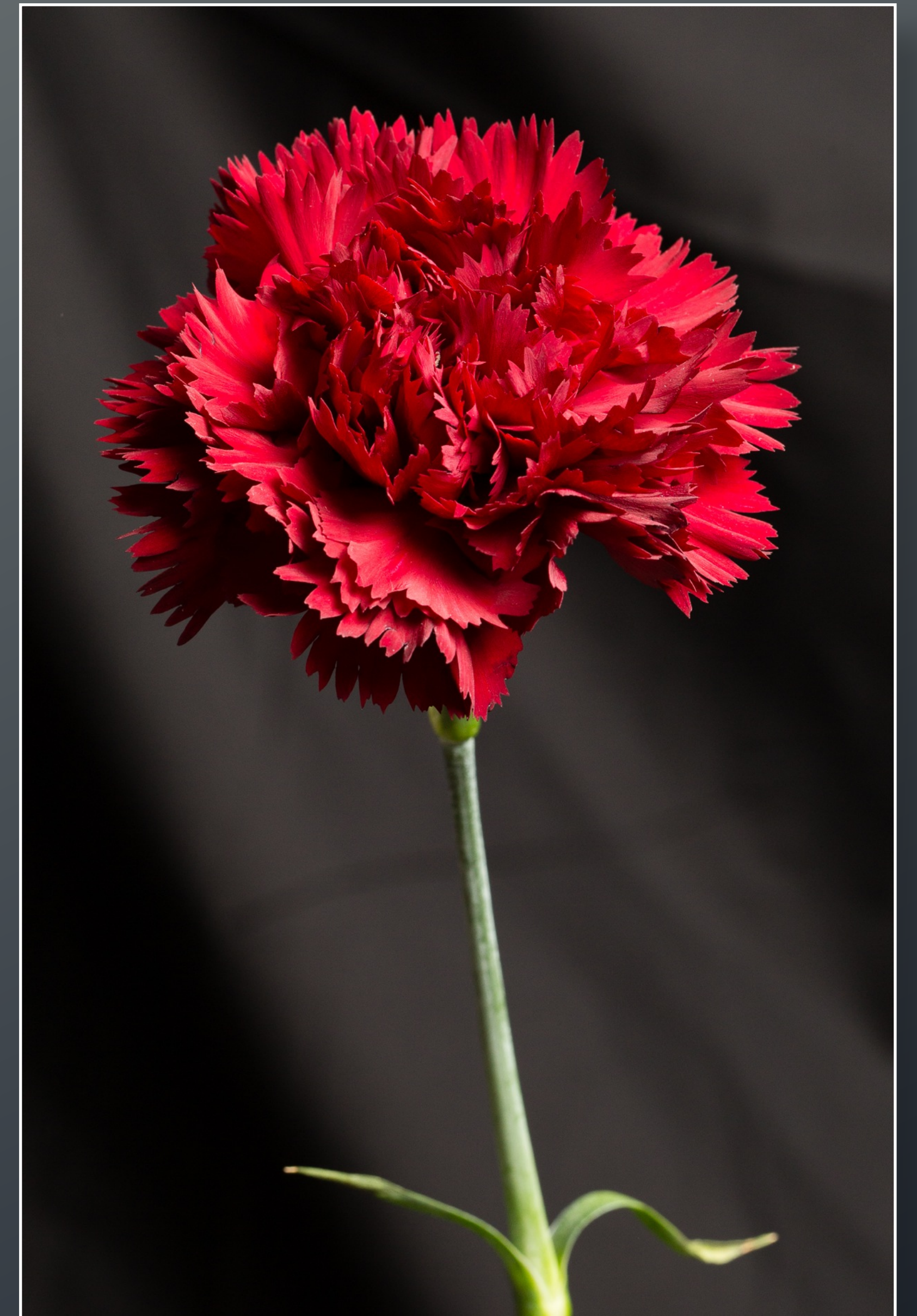
- On some Canon Cameras, the default is to only enable a subset of the focus zone selection modes. For example, the Canon 7D doesn't enable the center spot focus mode by default, which is very useful for bird photography.



# Getting Closer for Sharpness

Frame the picture as close as possible to the final crop.

- Move Closer
- Zoom in or use a longer focal length lens
- Use a teleconverter  
(also called an extender)
- Use an extension tube
- Use a closeup Lens  
(also called a closeup filter)





# Teleconverters (also known as Extenders)

- Teleconverters magnify the image by 1.4X or 2X.
- Better on prime lenses than zoom lenses.
- Provides a sharper image than cropping on most lenses
- Lowers the maximum aperture of your lens, which can make autofocus slower or impossible if the effective aperture is smaller than allowed by your camera. For example, The Canon 7D requires a minimum  $f/5.6$  aperture to autofocus. If you put a 1.4X TC on a 400mm  $f/5.6$  lens, the new aperture is  $f/8$ , so the Canon 7D will not autofocus.
- Picture will usually be sharper if you back off one stop from the largest aperture, assuming you have enough light to do this.





# Extension Tubes

- Intended for Macro photography, extension tubes let you get closer to the subject.
- There is no lens in an extension tube; it is simply a tube that positions the lens further from the sensor.
- Extension tubes work with prime lenses and zoom lenses.
- Make sure you use an extension tube that passes the electric signals from your camera to your lens (most do).
- When an extension tube is on, the lens will no longer focus at infinity.





# Do You Need to Calibrate Your Lens ?

**Probably not.** Only if your camera consistently focusses in front of the subject, or consistently focussing behind the subject. This is rare, but it does occasionally happen.

**Calibrate each lens/camera combination separately.**

Some Cameras offer a single calibration to apply to all lenses, but this is not as accurate.

**There are many good ways to calibrate your lens.** They should all give you the same result. Some require you to purchase special hardware. You can also send your camera and lens to the manufacturer.

**I have a simple technique for lens calibration that is easy,** can be done in the field, and requires no special hardware. You can find it on the Resources page in the Advanced Digital Photography section of the FCDCC web site.





# Bokeh

- Bokeh is a Japanese term that refers to the look of the out-of-focus regions of a picture.
- The Bokeh in a picture is determined by six things:
  1. The optical design of the lens
  2. The number of blades in the aperture and their shape (more is better, circular shape is better)
  3. The aperture setting (higher f/# is better)
  4. The focus distance, and it's relationship to other things in the scene.
  5. The zoom setting
  6. Any extenders or extension tubes added to the lens



## Unnatural Bokeh

Canon 500mm II, f/7.1 with 1.4X Extender III



Remember this picture  
from earlier?

It has pleasing Bokeh.

Canon 100mm f/2.8L macro on Canon 5D III

f/2.8

1/8000 sec

ISO 200





# Why You May Care About Bokeh

- The relationship between a soft, pleasing background and a well-focussed subject can be rattled if the out-of-focus regions have un-natural bokeh.
- If you aren't familiar with any unusual bokeh artifacts of your lens, you can mistake the bokeh for a defect in your lens, motion blur, or a camera malfunction.
- If you understand the conditions that cause undesirable bokeh, some times you can avoid them.
- Being aware of the bokeh in your pictures can help when selecting which ones to keep, publish, sell, or enter in contests.



# Bokeh can be complicated

- Every lens has different bokeh, and the bokeh varies with just about every setting except shutter speed - aperture, zoom, focus distance, and distance to the out-of-focus objects in an image.
- Bokeh is effected by so many parameters it's not practical to describe it in a spec sheet. Reviewers often simply say a lens has nice bokeh or say nothing at all because it is so hard to describe unnatural looking bokeh.
- The shape and contrast of out-of-focus objects in your picture effect how the bokeh looks. Very fine, highly contrasting features that are moderately out of focus show the strongest effect. Examples include Christmas tree lights, street lights, specular reflections off waves on a lake, sunlight peeking through tiny holes in a forest canopy, dark tree twigs on a bright blue sky, or bright dry grass stems against a dark green pasture or dark forest.



# What do do about Bokeh...

- The most important point is what *not* to do about bokeh: don't obsess over it. Most of the time it's not that big of a deal and most of the time you can't do much about it.
- If you want more natural looking bokeh, here's a few things you can try
  1. Smaller aperture settings tend to produce more natural looking bokeh.
  2. There are usually only a few combinations of distances and apertures that have funky bokeh. If you can avoid those, you can improve your pictures. Moving closer or further from the subject (and thus change the distance to out-of-focus things in your picture) can help.
  3. Add blur to your background in your photo editing program to create a more pleasing bokeh.
  4. Remember that you, as the photographer, are likely the only person that will notice the bokeh unless it is unusually strange, unusually pleasing, or you are entering the picture a photo contest.



# Editing and Sharpness



# Things That Effect *Real* and *Perceived* Sharpness

- Sharpness settings
- Noise filter settings
- Local Sharpness relative to the rest of the image
- Saturation / Vibrance
- Brightness
- Tone curve, contrast
- Clarity



Original Image

Canon 5D

ISO 1600

1/1000 sec

f/11

500mm + 2X Extender





No Sharpening done yet.

Lightroom adjustments:

- Tone Curve: Med Contrast
- Vibrance +13
- White +45
- Black -35
- Exposure +0.55





Slightly Darkened Grass

Noise filtered Grass

Sharpening on Owl:

- Sharpness: 50
- Noise Reduction: 40

Color on Owl:

- Saturation: +10
- Clarity +12





# Printing and Sharpness



# Printing for the sharpest possible image

- Use glossy paper - you get higher contrast and a wider gamut, both of which effect the *perception* of sharpness
- In printer settings, use more than 600dpi if possible.
- Use paper and inks of the same brand as your printer. This is important. Inks and Paper are designed as a system. This applies to HP, Canon, and Epson.
- When framing, use anti-reflective glass. The best is called Museum Glass, which has an anti-reflective coating on both sides. It has almost no glare. It is tricky to clean.
- Printers with more colors of ink, including multiple shades of grey will produce sharper prints because the printer can render colors with less dither/half-toning.



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