

A Bazillion Ways
to get Sharper Pictures

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Things that have changed over the last several years:

- Mirrorless camera technology has become mainstream with some nice improvements:
 - Full electronic shutter
 - Face, eye, animal, subject detection
 - Focus stacking support
- Sensors with higher resolution
- Sensors with low noise at high ISO
- Dual sensor + lens image stabilization
- Sharper lenses
- Sharpening software that uses artificial intelligence
- We're viewing pictures on larger screens (e.g. 4K) with higher resolution and more dynamic range.

Things that haven't changed:

- The amount of light in the world
- How light interacts with air, lenses, and sensors
- Subjects move
- Cameras shake
- How our eyes work
- How we perceive sharpness

A Sharp Agenda

1. Perception
2. Camera Settings
3. Photographic Technique
4. Equipment
5. Editing
6. Printing

Things that Effect Sharpness

1. Resolution – amount of finely spaced detail that can be seen
 - Driven by lens quality, aperture setting, sensor pixel size, focus accuracy, subject motion, camera motion, noise
 - Measured in lines-per-mm, pixels-per-inch, lens MTF plots, etc.
 - In general, not recoverable in editing. An exception is the newer artificial intelligence sharpening tools. These aren't recovering detail but rather substituting detail that was likely there, based on training on millions of sample images.
2. Acutance – how quickly the brightness changes on edges
 - Driven by lighting, haze & flare, tone curve, contrast, sharpening, black level, white level.
 - Most editing techniques that improve sharpness are improving acutance.
3. Visual Perception
 - Sharpness relative to other things in the picture
 - Brightness of viewing conditions (brighter = sharper ... like turning on a light to read a book)
 - Surround brightness (darker surround -> sharper subject ... like a movie theater)

<https://www.photoreview.com.au/tips/shooting/sharpness-acutance-and-resolution/>

Sharpness vs Softness

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

- Soft areas provide context without stealing attention from the subject.
- If everything is sharp, the viewer may not be sure where to look.
- Soft areas in the picture make the sharp areas seem sharper.

What should be sharp?

- The subject should be the *sharpest* thing in the picture.
- If the subject is an animal or person, *the eyes should be the sharpest thing in the picture.*
- 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 flower isn't that sharp?

- Yellow center has no detail.
- The only sharp petals are about 2/3 of the way back.



A soft background
brings out sharpness
in the subject.



Examples of Desirable Blur

1. Soft background draws attention to the Hummingbird and is not distracting.
2. Motion blur in falling snow portrays cold weather.
3. Blur in upper wings portrays motion.
4. Blur in the lower further back wings adds a sense of depth to the Hummingbird so it doesn't look like it was pasted on the background.



Effect of Light Direction on Perceived Sharpness

- Light behind you (directly on the subject) produces a flat, 2D image with less perceived sharpness. So does an on-camera flash.
- Light to the side or above the subject produces 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 can get the best of both worlds.

Effect of Lighting on Perceived Sharpness



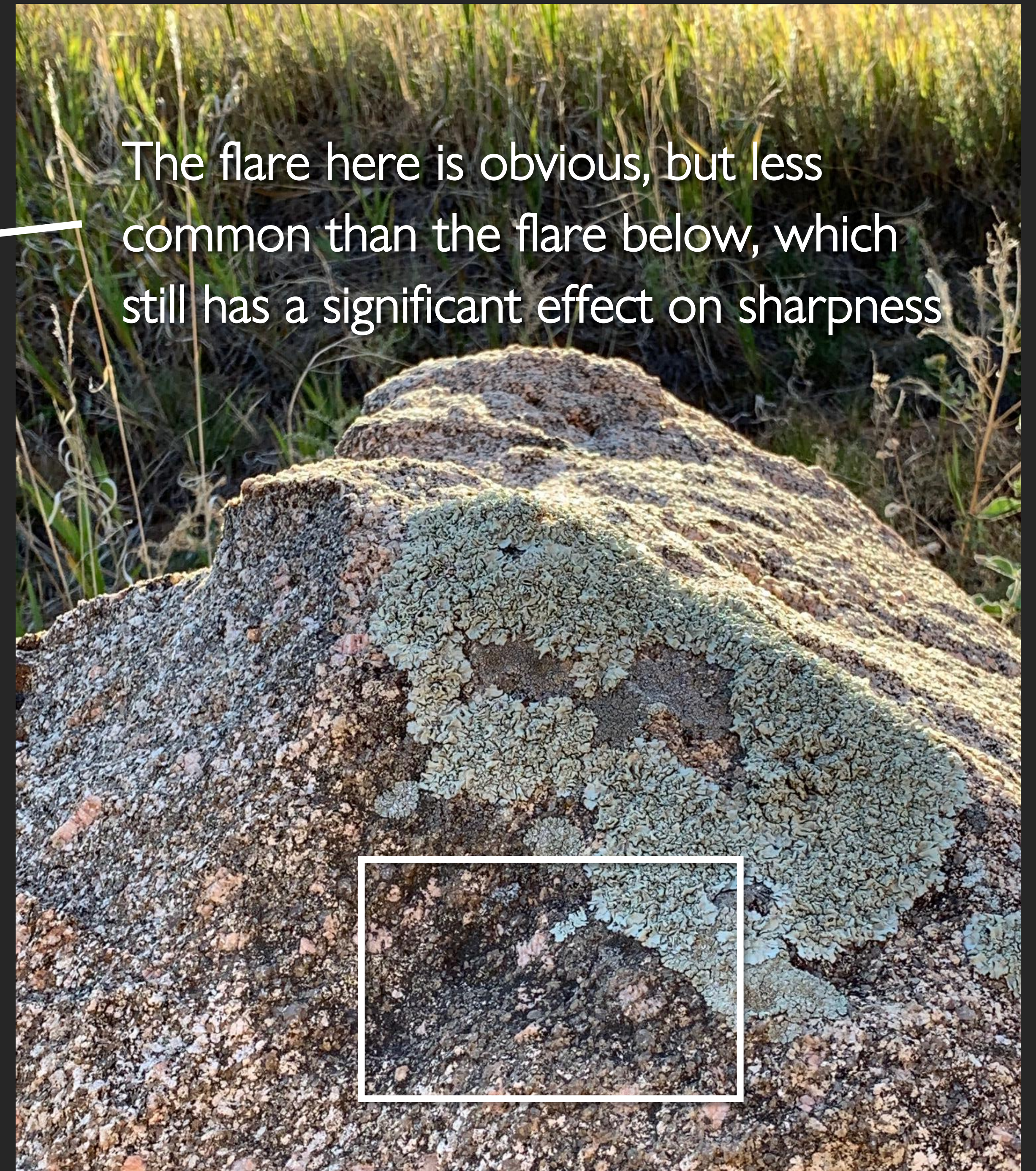
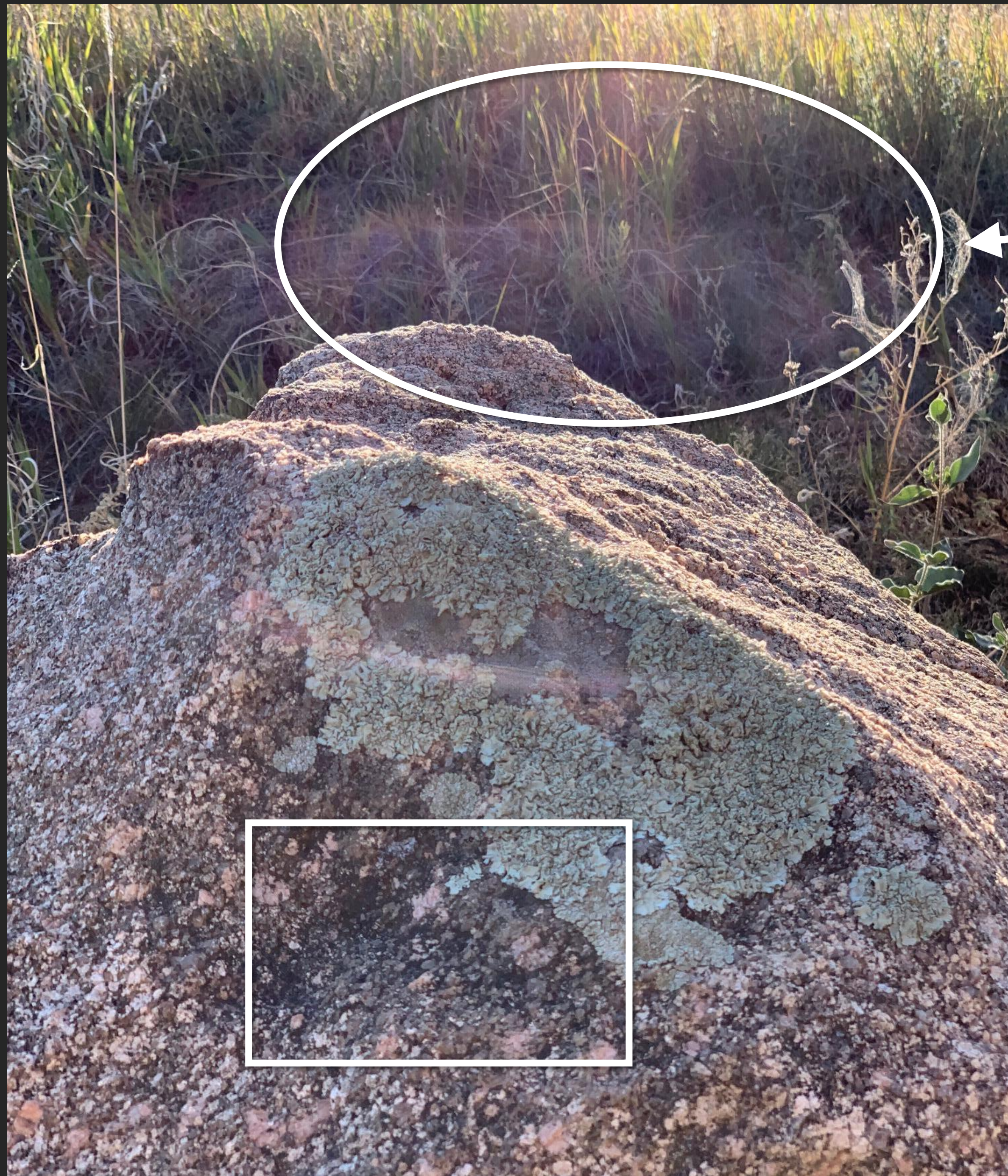
Effect of Lighting on Perceived Sharpness



Effect of Lighting on Perceived Sharpness







The flare here is obvious, but less common than the flare below, which still has a significant effect on sharpness



Close-up detail of unshielded iPhone X picture.
Sun is not in field of view of the picture.

The flare not only reduced contrast, but caused
the camera to produce a color cast.



Same picture, with hand shielding lens.

It can be tricky to shield the lens, hold the
camera, and take a picture at the same time.
Use the physical side shutter button rather than
pressing the shutter button on the screen.

Causes of and Solutions to Flare

Bright point source of light:

- Avoid having the sun or a room light directly hitting any part of the lens, even when the sun is not visible in the picture
- Avoid reflections of the sun such as off a windshield, building window, metallic roof, water, etc.
- Best solution is always use a lens hood designed for your lens.
- Other things that work – shield the lens with your hand; have a friend shield the lens with their hand or body; step into the shade or shadow of a tree, etc.

Diffuse sources of light like bright sand, snow, concrete, even if outside the picture.

- A lens hood helps a lot. Shading with a hand not practical.

Backlit scenes destroy contrast (and thus sharpness)

- A lens hood helps a little, but is less effective on zoom lenses since the lens hood is designed for the widest zoom.



Flare is worse on phone cameras due to less internal light baffling, less sophisticated lens coatings, and no lens hood.

Other tips for Reducing Flare

- Blow dust off your lens using clean air (not your breath) and clean your lens (sparingly)
- Avoid unnecessary filters on your lens. A lens hood will protect your lens better than a filter and improves image quality rather than degrading it.
- Have subjects positioned in front of a dark background rather than a white wall.
- When editing, lower the black level. Try using the clarity slider (in Lightroom).

Backlit scenes are a real problem for loss of contrast (and thus sharpness):

- Use +1 or +2 EV compensation to properly expose the subject. There will be more recoverable detail when you start editing.
- Use a lower ISO. There will be more recoverable detail when you start editing.
- When shooting birds in flight with a zoom lens at maximum zoom, consider a non-standard longer lens hood. Also consider a longer zoom lens so the bird takes up more of the field of view and there is less sky to cause flare. If the bird flies over something bright like sand or snow, the added illumination on the body will help. You can also look for times when the bird flies in front of a dark cloud or drops to flying in front of trees.

ISO, Aperture, & Shutter Speed for Sharp Pictures

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. Modern cameras have highly competent automatic algorithms.
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 use a slower shutter speed.
 - If you have things both very close and very far that you want in focus, select a smaller aperture (larger f-number)

Motion is the Enemy of Sharpness

Camera Motion

Subject Motion

Shutter Modes

DSLR only

Mechanical shutter with mirror movement

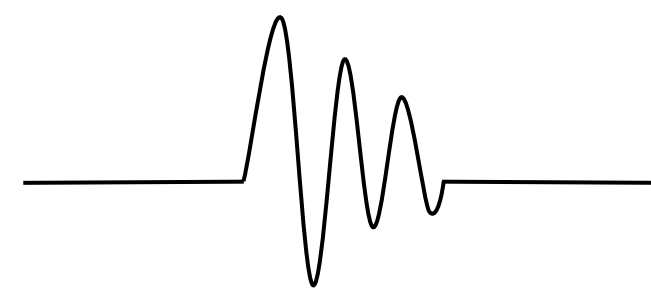
Mirror flips up



Mechanical shutter opens



Mechanical shutter closes



Most Vibration

DSLR with mirror lock up
or mirrorless camera

Mechanical Shutter

Mechanical shutter opens



Mechanical shutter closes

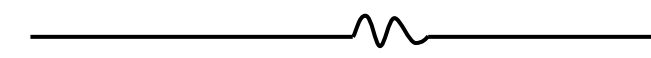


Electronic 1st curtain

Sensor is reset electronically



Mechanical shutter closes

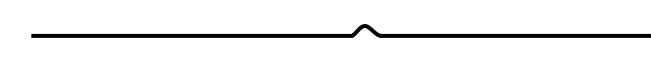


Electronic

Sensor is reset electronically



Sensor is read out electronically



Least Vibration

Basics Techniques to Improve Sharpness

1. Hold the camera with both hands, with one hand gripping the camera, one hand supporting lens.
2. Hold the camera close to your face, using the viewfinder.
3. Stand with your legs slightly apart. Ideally shoot at an angle to where your feet are pointing.
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. On DSLRs,
 - Live-view focus (aka contrast focus) can be a little sharper than normal (phase) focus. The downside is it is slower.
 - Use mirror lockup.
2. Always use the highest quality JPG setting, or better, shoot in RAW.
3. Use a remote shutter release or self-timer.
4. Take multiple pictures hoping blur from hand motion or subject motion is less in one of them. Use Continuous focus, AI-Servo (Canon) or AF-C (Nikon) and you'll get slightly different focus on each images.

Pressing the Shutter Button

The camera always moves when you press the shutter button.

The goal is minimize how much it moves.

- Press slowly and gently, rocking your finger over the button.
- If possible, press the button after you've exhaled.
- When you're in an emotional state – your child crossing the finish line, moose ten feet away - try to relax and stay calm.
- When you need to take a picture quickly, finger speed and finger force are different things - you want speed, not force. You can press the shutter quickly and repeatedly with very little force.
- Get in the habit of holding the camera still for 1-2 seconds *after* you take the picture. Reason: I've seen many photographers start moving before the exposure has finished.

Selecting and Using Tripods

- Tripods without a center column are more stable than tripods with a center column, even when the column is down.
- When setting a tripod to a certain height, use the legs to get height before using the center column. Extend the top (larger) legs all the way and work your way down.
- A center column is a convenient feature - especially for taking portraits.
- Carbon fiber has gotten cheap enough it is the preferred material for tripods.
- 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.
- Experiment with image stabilization to see if it helps or not, especially for DSLRs.
- For mirrorless cameras set on full electronic shutter, with remote shutter release, turn image stabilization off.

Tripod Feet for Dirt and Grass



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

- Great for dirt. OK for short grass.
- The rubber tips can be hard to pull off.



Really Right Stuff makes long spike feet that can be used on most tripod brands.

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

Remote Shutter Release

Even on a tripod, the camera will shake when you press the shutter. (Exception: full electronic shutter)

I've been happy with the Vello FreeWave. \$40-\$60 depending on camera model.

- Can also 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 auto first to see if you need manual.
I usually use manual for complete control.

Minimize Ambient Light: To freeze motion, most of the light needs to come from the flash. 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.



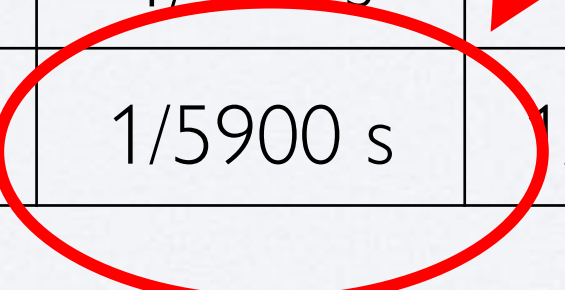
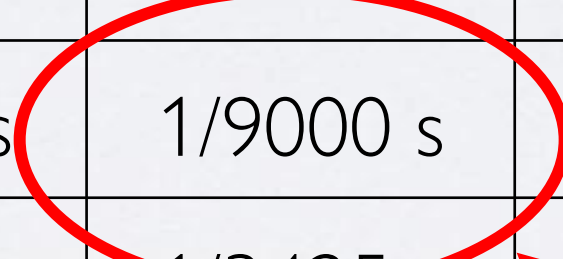
Normal Mode vs High Speed Sync:

1. **Normal Mode (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. The flash duration is much faster than this, with the duration proportional to flash power; lower flash power produces a much shorter pulse of light. 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 bright light (e.g. fill flash) when a slow shutter speed is not possible. High speed sync consumes the flash batteries faster.

Light Pulse Time for Common Flashes

	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	1/350 s	1/1630 s	1/3000 s	1/4300 s	1/5250 s	1/5600 s	1/6500 s	
Canon 580EX	1/250 s	1/919 s	1/2066 s	1/3759 s	1/6024 s	1/9470 s	1/13966 s	1/19,841 s
Canon 580EX II	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	1/1000 s	1/2000 s	1/4000 s	1/9000 s	1/15,000 s	1/21,000 s	1/30,000 s	1/35,000 s
Nikon SB-24	1/231 s	1/794 s	1/1366 s	1/3425 s	1/5208 s			
Nikon SB-26	1/245 s	1/1389 s	1/2717 s	1/4902 s	1/7813 s	1/10,870 s	1/13,889 s	
Nikon SB-28	1/265 s	1/954 s	1/2016 s	1/3623 s	1/6313 s	1/9221 s	1/13,889 s	
Nikon SB-80DX	1/258 s	1/1157 s	1/2451 s	1/4492 s	1/7396 s	1/11,062 s	1/15,823 s	1/21,930 s
Nikon SB-600	1/265 s	1/875 s	1/2150 s	1/3500 s	1/5250 s	1/7000 s	<1/8000 s	
Nikon SB-700	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	1/1050 s	1/1100 s	1/2700 s	1/5900 s	1/10,900 s	1/17,800 s	1/32,300 s	1/41,600 s

Wow



Building Shake

All buildings shake, whether you feel it or not.

The causes include wind, HVAC, people walking, and traffic on the street.



Time exposure from the roof of a hotel.

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

The streamers all have the same wavy pattern, indicating building vibration.

Atmospheric Heat Blur

- This type of blur is caused when there are different temperatures of air between the camera and subject. This is the same as heat waves you see driving down the highway. It is also what makes stars twinkle at night.
- It's not moving air that causes the blurring, but that the moving air is a mix of different temperatures, and thus different densities.
- 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 – aka 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 Blur



Most Effective:

- Shoot early in the morning, right after a rain, or on cloudy days.
- Move closer to the subject.
- Avoid 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 car, 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 minutes before taking pictures.
- Compose a wider angle picture

Less Effective, but worth trying:

- Use a faster shutter speed.
- Use a smaller aperture. This technique is also used by amateur astronomers on warm windy nights.
- Take multiple pictures and pick the sharpest.

Other Atmospheric Effects

- Landscape pictures will always have some haze in the distance. Shooting in the early morning or after a rain are times when the air can be more transparent and distant objects clearer.
- If things in the distance are hazy and soft, don't waste your depth of field on them; 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 bad – mist, fog, and sunrise haze can bring feeling to a picture.

Keeping Your Lens & Sensor Clean

- Minimize how often you change lenses, and don't change lenses in windy or dusty weather.
- Change lenses indoors in a clean area. Try to keep the camera pointed down and minimize the time the lens is off the camera.
- 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 the lens, first use a lens brush or lens blower to remove loose dust. Avoid using your breath on a lens.
- 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. Constantly change the place on the cloth you are using.
- I use Zeiss Lens Wipes or Zeiss single-use Pre-moistened cleaning cloths. These come in single-use packages with different chemicals on the cloth. You can find boxes of these at the pharmacy near the contact solution, or order larger boxes on-line.

Lenses and Sharpness

- Fixed focal-length lenses used to be a lot sharper than zoom lenses. The difference has shrunk significantly over the last 10 years.
- Zooms with a smaller range (e.g. 24-70mm, or 3X) tend to be 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 IMPORTANT RULE: Composition comes first. Select your zoom and aperture for the composition you want and ignore the rest of this slide.

Understanding Aperture



f/2.8



f/13

- Large Aperture lets in more light.
- Depth of field is less.
- Sharpness is limited by the lens design.
- Small aperture lets in less light.
- Depth of field is larger (more things in focus).
- Sharpness is limited by diffraction. By f/22, everything will be a little soft.

Selecting Depth of Field

f / 4



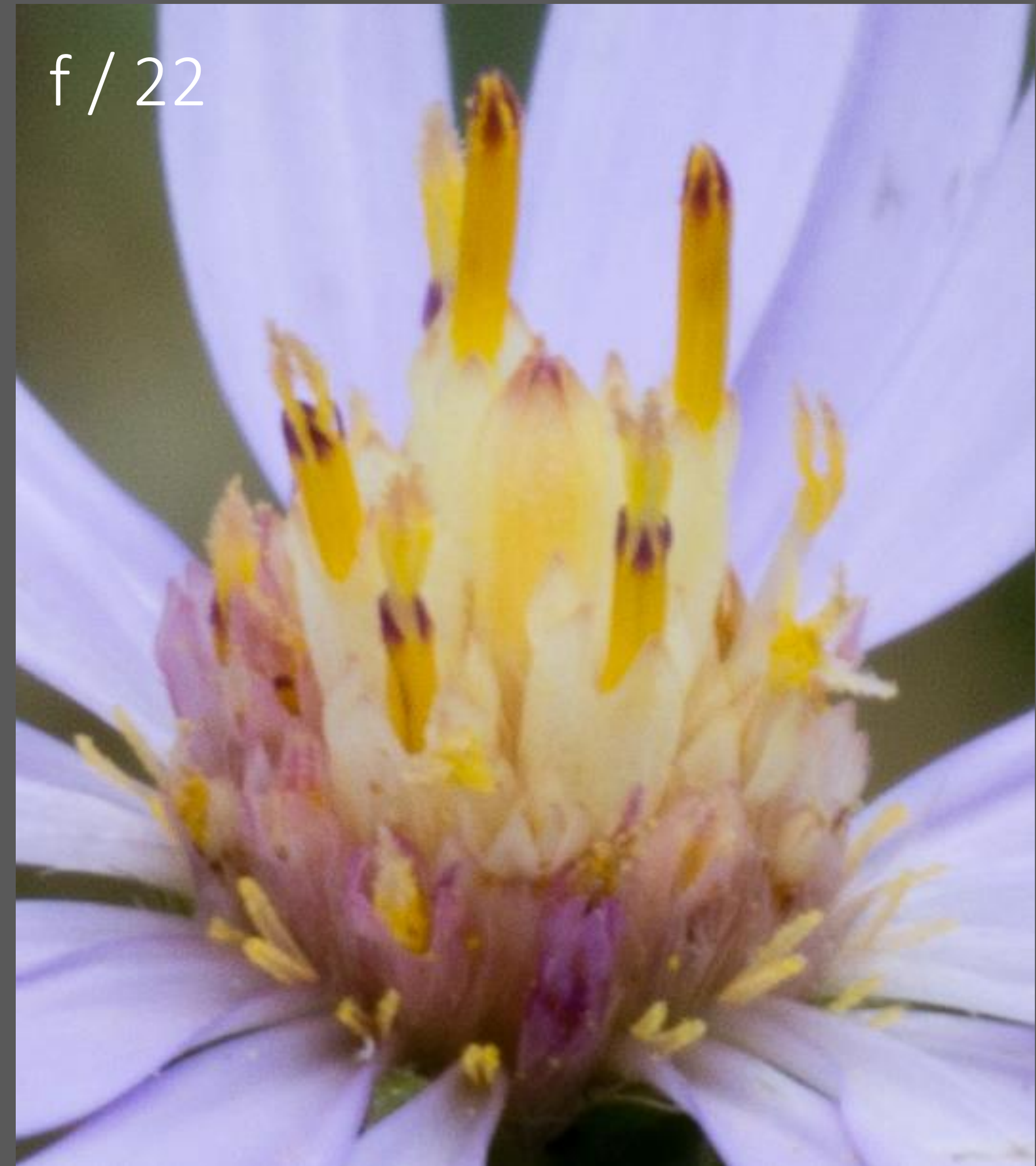
- Near and far petals look soft, which matters if the whole flower is the subject
- Background is soft and pleasing

f / 22



- Flower looks nice and sharp
- Background is distracting

If we zoom in we can see diffraction is limiting sharpness at f/22



f / 8

A nice
compromise



DSLRs: Two types of focus

Normal, or
Phase Detect focus



Live-view, or
Contrast Focus

DSLRs: 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 a lens with minimum aperture (f/5.6 or f/8).	Works by measuring image sharpness on the actual sensor, then moving lens, then measuring sharpness again and comparing the two.
Very fast. In milliseconds the camera knows which way to move the lens and approximately how far.	Slow. Camera finds best focus by trial and error.
Specific number of focus zones in fixed locations	Adjustable focus zones.
Occasionally needs lens calibration to perform as accurately as Contrast Autofocus	If subject and camera aren't moving, delivers the most accurate focus.

DSLRs: Remember 2 Things:

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



Mirrorless Camera Focus

- Mirrorless cameras have a different version of phase focus than DSLRs. It is slower and less robust than DSLR phase focus, but ...
- It is simpler and you always get phase focus in all viewfinder modes, followed by contrast focus for the final lens movement. Best of both worlds.
- Like DSLRs, mirrorless cameras can focus quicker and more accurately with a large aperture lens, like f/2.8. The benefit of larger aperture lenses is more significant in Mirrorless cameras than DSLRs.

A Plethora of Focus Settings

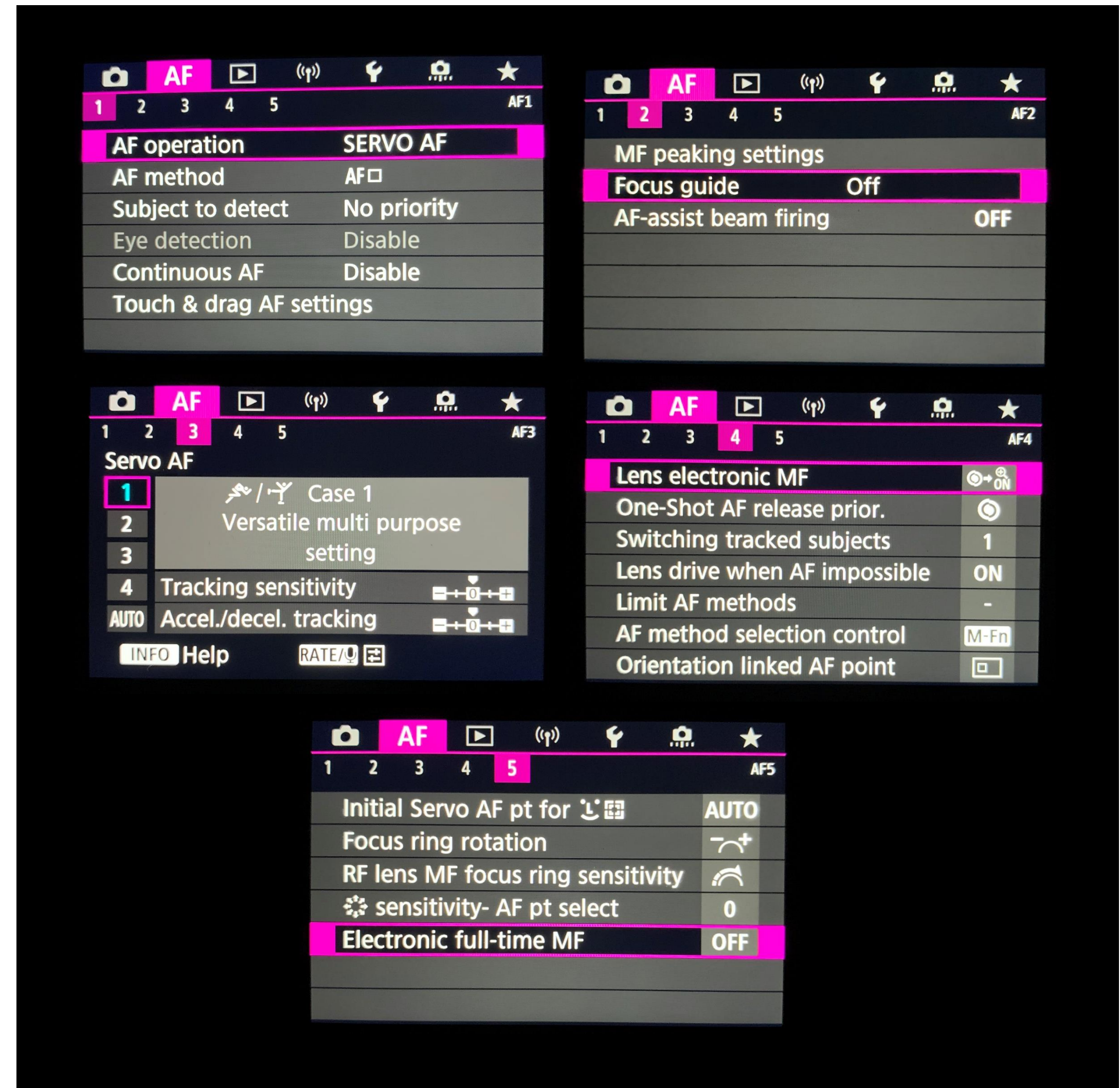
The settings fall into 4 categories:

1. Which buttons do what.
2. Focusing on the right thing
3. Focussing speed
4. Focussing accuracy

There are always tradeoffs – especially speed vs accuracy.

My approach:

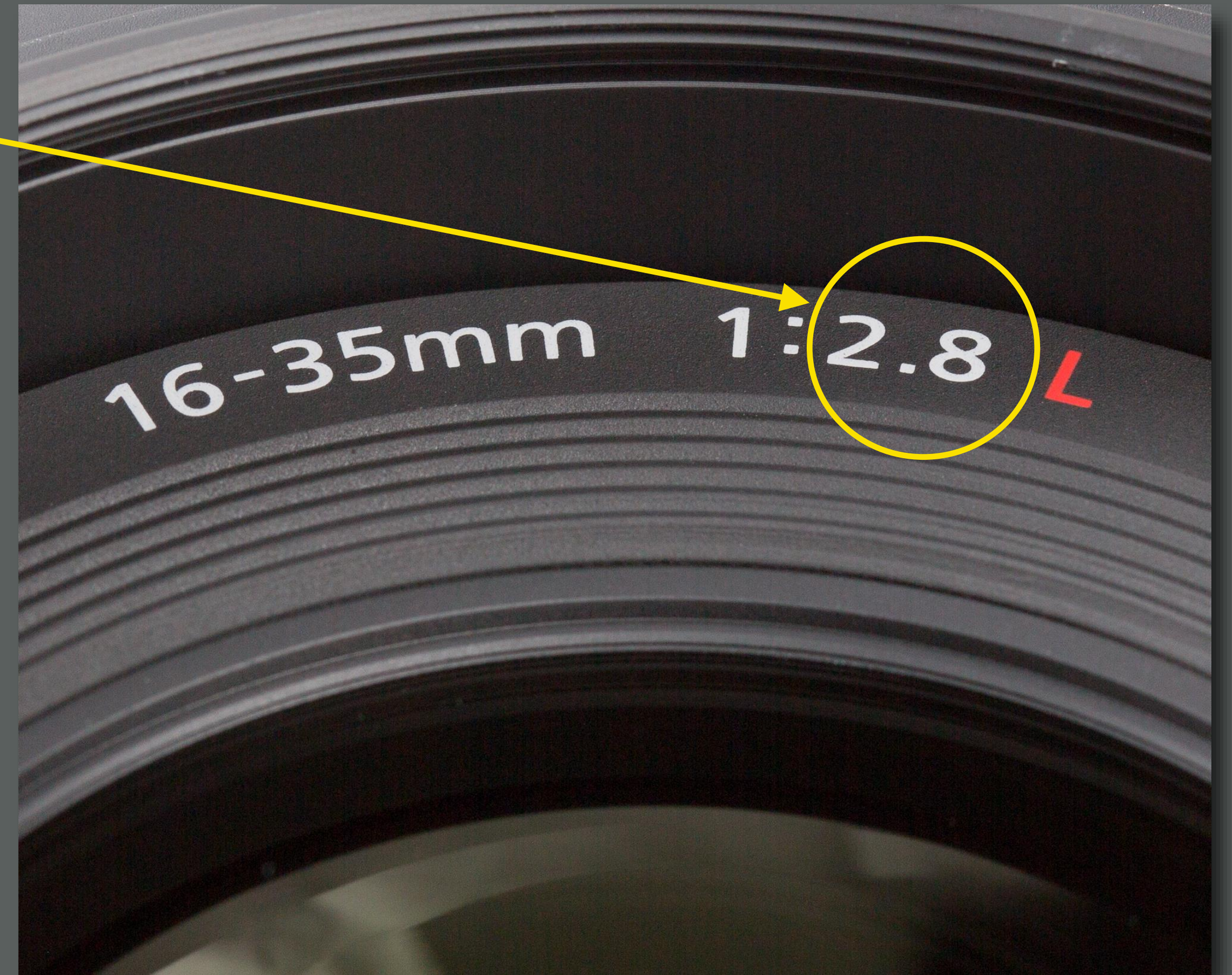
1. Start with the defaults
2. Read the manual to know what's available
3. Experiment with the settings only *if and when I have focus issues.*



Canon R5 Focus Settings

The Camera Uses the Largest Aperture of the Lens to Focus

- No matter what the aperture setting for capture, the camera uses the largest aperture to focus. The camera then stops the aperture down to your aperture setting when taking the picture.
- Lenses with larger apertures focus faster, more accurately, and focus 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 and Spot Focus

- The 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 smaller object out of a busy background, but requires more light and good detail.

Center Focus



Spot Focus
(Canon notation)

- For simplicity, many cameras only show a subset of the available focus modes. You may have to go in to a menu to enable all of the modes.

Focus-then-Recompose for Off-Center Subjects

- Center focus can be more accurate, faster, and work better in low light than the off-center focus zones.
- For the photographer it can be quicker and more convenient to focus and recompose than manually select an off-center focus zone.
- There is a small focus offset when you do this.
- The offset is more a problem for macro shots, shots with a narrow depth of field (e.g. f/2.8) or when the amount of camera pan between focus and capture is large (>1/3 of the image.)
- Since this offset is usually small, the choice of using an outer focus zone or center-focus-zone-with-focus-and-recompose is usually based on which one is more convenient.

Get close to take advantage of all the pixels on the sensor

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 (aka 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. If you put a 1.4X TC on a 400mm f/5.6 lens, the new aperture is f/8.



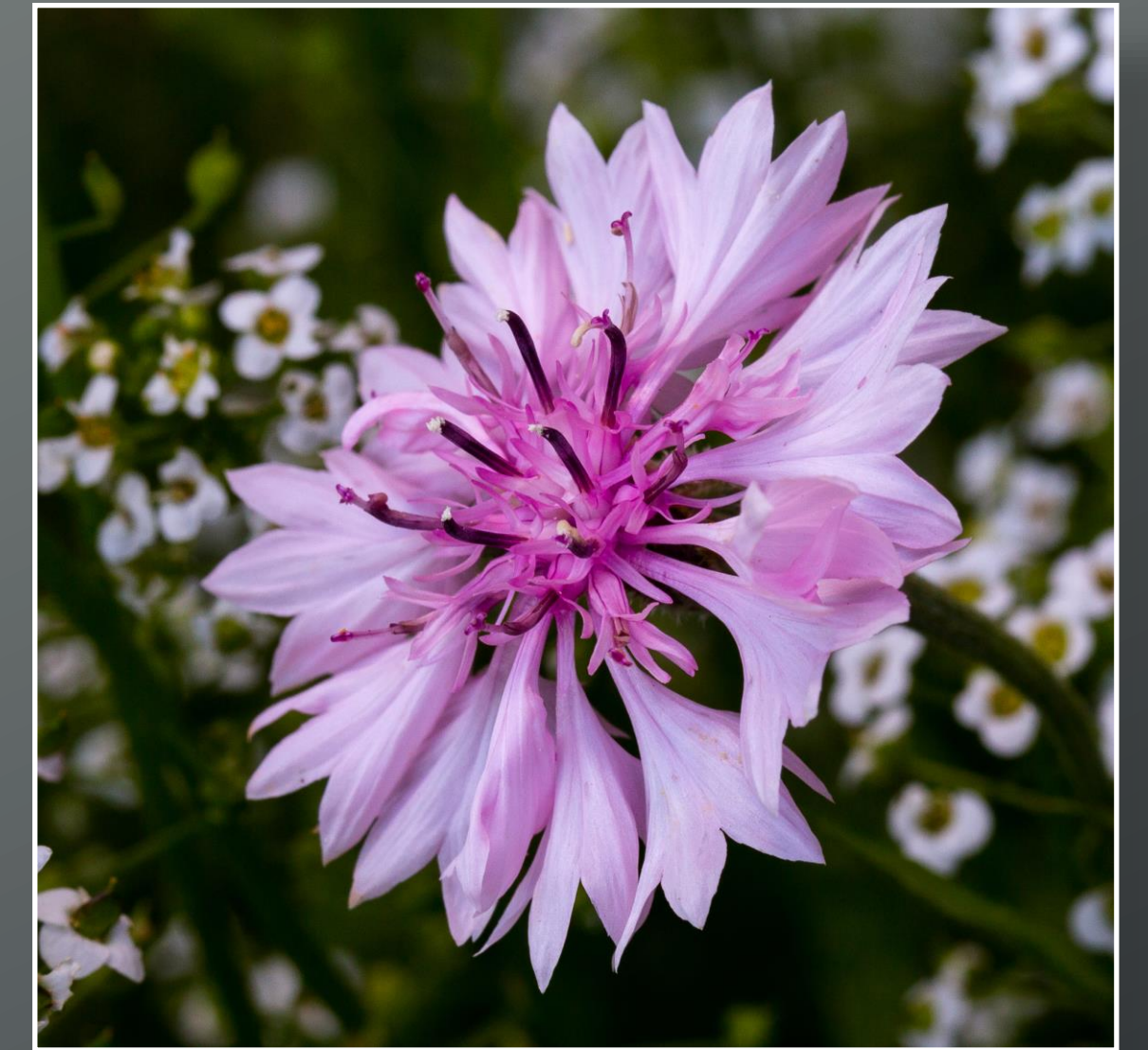
Extension Tubes

- 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.
- 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.



Focus Offset Calibration

Advanced topic that only applies to DSLRs. Focus offset is the difference between what the focus sensor sees and what the image sensor sees.



Do You Need to Calibrate Lens Focus Offset?

Probably not. Only if your camera consistently focusses in front of, or behind the subject. This isn't common but does occasionally happen, especially on older DSLR cameras and lenses.

Calibrate each lens/camera combination separately.

Some Cameras offer a single calibration to apply to all lenses. This works, but individual lens/camera calibrations is more accurate.

There are many good ways to calibrate your lens, even in the field. 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.

There's a tutorial here: <https://shotkit.com/lens-calibration/>

Bokeh

- Bokeh is a Japanese term that refers to the look of the out-of-focus regions of a picture, which ideally look soft and natural.
- Bokeh is more noticeable in high contrast out-of-focus elements of a picture.
- The Bokeh in a picture is determined by several things:
 1. The optical design of the lens
 2. The aperture setting used to take the picture: larger apertures are more prone to unusual bokeh.
 3. The focus distance and the distance to objects in the scene: objects moderately out of focus are more prone to unusual bokeh.
 4. The zoom used
 5. The number of blades in the aperture and their shape (more is better, circular shape is better)

<https://photographylife.com/what-is-bokeh>



Unnatural Bokeh in the Background

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

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 unnatural bokeh.
- If you aren't familiar with any unusual bokeh artifacts of your lens, you can mistake 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.

Bokeh can be complicated

- Every lens has different bokeh, and the bokeh varies with every lens setting - 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 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 water, sunlight peeking through leaves 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 (larger f/#).
 2. There are usually only a few combinations of zooms, distances and apertures that have funky bokeh. If you can avoid those, you can improve your pictures. It's hard to do this in the field unless you have a laptop and dark place to view it.
 3. You, as the photographer, are likely the only person that will notice the bokeh unless it is unusually bad, unusually good, or you are entering the picture a photo contest.

Editing for Sharpness

Edit Settings that Effect Sharpness

- Sharpness (obviously)
- Noise filter
- 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: Med Contrast
- Vibrance +13
- White +45
- Black -35
- Exposure +0.55



Darkened Grass

Noise filtered Grass

Sharpening on Owl:

- Sharpness: 50
- Noise Reduction: 40

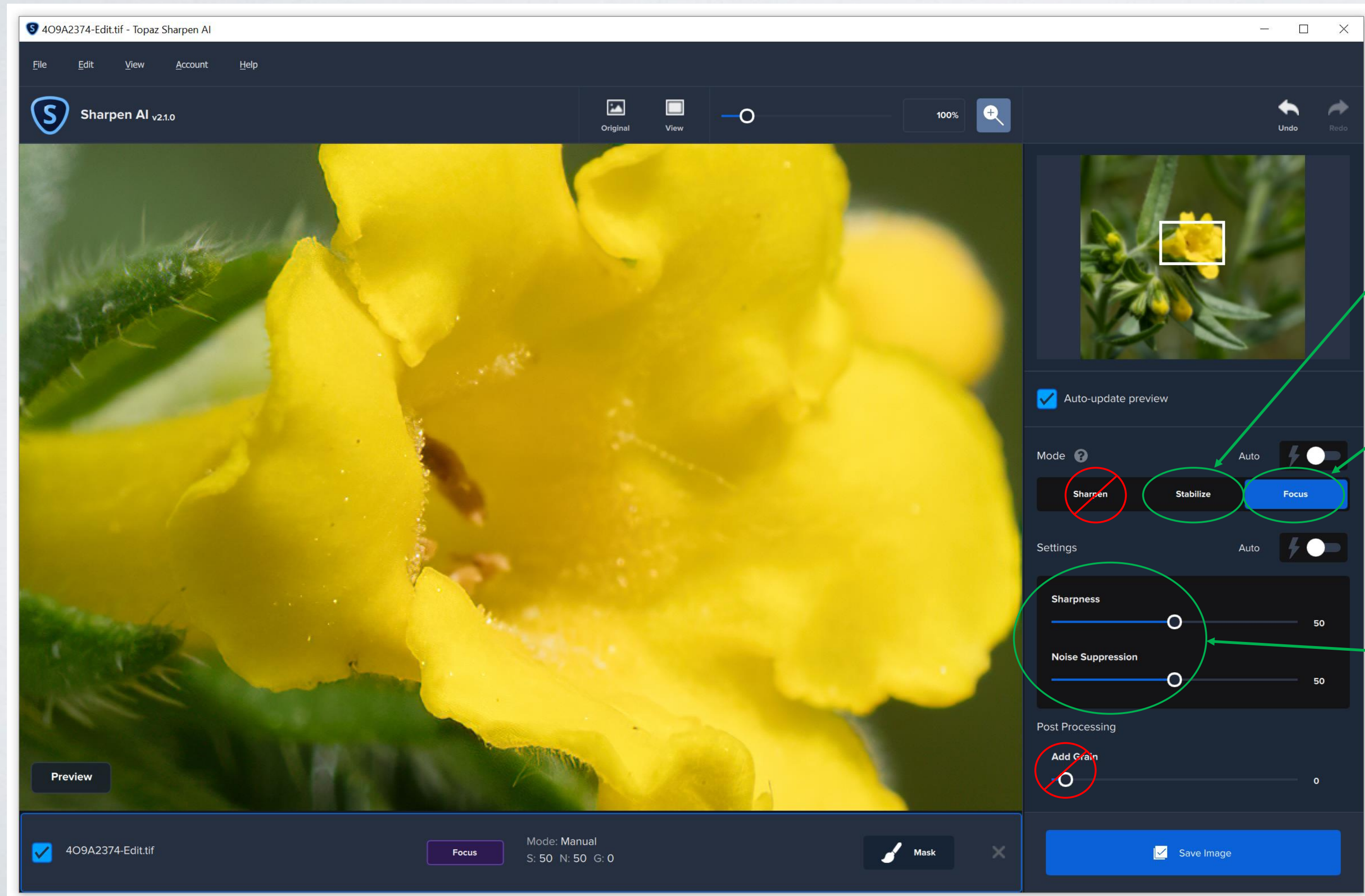
Color on Owl:

- Saturation: +10
- Clarity +12



Topaz Sharpen AI

- \$79 (good choice), topazlabs.com or Utility Bundle with other Topaz products for \$249 (what I have).
- When it works well, which is about half the time, results are magical.
- Two common failures were strange texture and strange edge artifacts.
- I usually adjust the white balance, then apply Sharpen AI, then do the rest of my editing.



Stabilize Mode often did amazing things on flowers with a little motion blur or soft focus.

Focus Mode often improved soft focus.

I got the best results leaving Sharpness and Noise at the default settings.

Focus Stacking

The basic idea:

1. Take a series of pictures (typically 4-20) while moving focus from the front to the back of your subject.
2. Use a larger aperture (lower f/#) than you would normally use. This makes for sharp individual frames (no diffraction) while leaving a softer background. For example, if you would normally shoot a flower at f/11 to get most of a bloom in focus, use f/4 to f/5.6 for the focus stack frames.
3. Merge the pictures together in photo editing software like Zerene (my favorite), Helicon, or Photoshop (my least favorite). This only takes a few minutes when things go well.

There's a tutorial here: <https://digital-photography-school.com/a-beginners-guide-to-focus-stacking/>

Focus Stack of Red Clover

Canon 5DS R on tripod

Manual aperture, shutter

Capture Process for each picture:

1. Move focus ring a tiny amount with right hand
2. Gently lift fingers off lens
3. Push remote shutter

Stacked in Zerene, Pmax, default settings.





Ways to capture the images for a focus stack

Handheld:

- Slowly lean forward as you take the pictures, or slowly rotate the focus ring while using burst mode. Least accurate, but sometimes used for insects. Requires sorting through the stack to pick the images you want to use.

On Tripod:

- Use a Camranger or other automated controller to step your camera lens's focus. Slow, expensive and complicated. Good for the studio. Doesn't work with manual focus lenses like the Canon MPE-65.
- Use a StackShot controller and electronic focusing rail. Reliable, slow, and very expensive and complicated. Works with any camera and any lens. Good for the studio.
- Use a manual focus rail, adjust focus by hand for each picture and manually press the shutter for each picture. Tedious, and only works for subjects that don't move during the lengthy capture process.
- Use automatic focus stack capture feature of newer mirrorless cameras. Simple, fast, accurate. You pick the starting focus position and the camera does everything else – calculates the best focus increment, locks settings for you, and takes all the pictures.

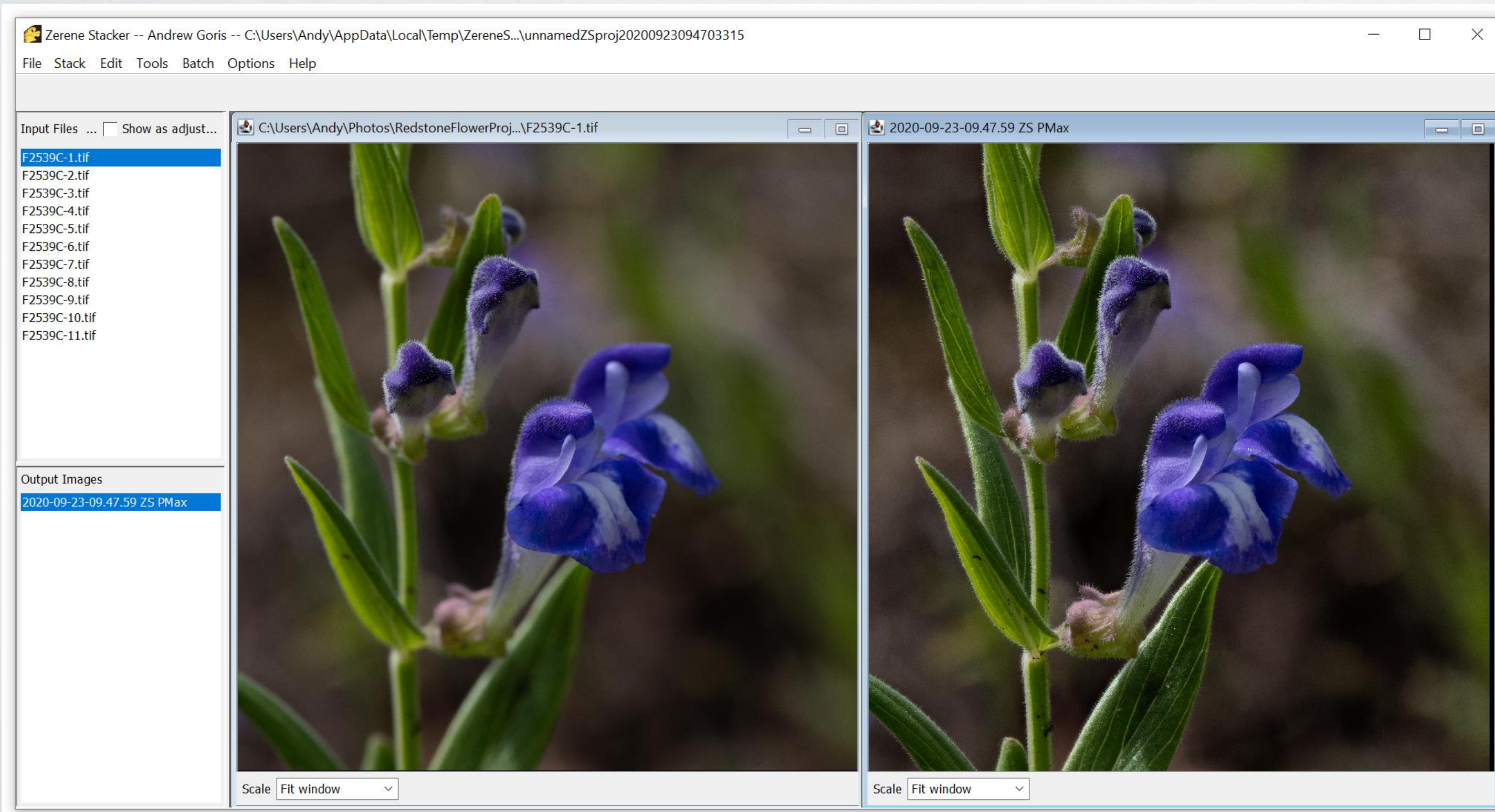


Zerene Stacker

- \$89 personal version (I have), \$189 prosumer version (I recommend).
- When focus stacking flower pictures, I had best luck with Pmax setting.
- When Zerene worked well, I kept the result. If not, I didn't try to fix it.
- The most common artifact was halos.
- Works best if the pictures are ordered from closest to furthest.

Process

1. In Field: Manual focusing (tedius), or CamRanger 2 (slow, accurate), manual focusing rail, or Canon R5 automatic focus stack capture (best).
2. LR: Import RAW photos from camera into Lightroom.
3. LR: Approximate crop first photo and apply crop to all.
4. LR: Export as 16-bit TIFF, with sequential file names.
5. Zerene: Add files to Zerene.
6. Zerene: Stack using Pmax.
7. Zerene: Export result as 16-bit TIFF.
8. LR: Import result back in to Lightroom.
9. LR: Select final crop and make other adjustments.



Combining Techniques

From Rich Ernst (on vacation this week)

The Left picture is straight out of the camera.

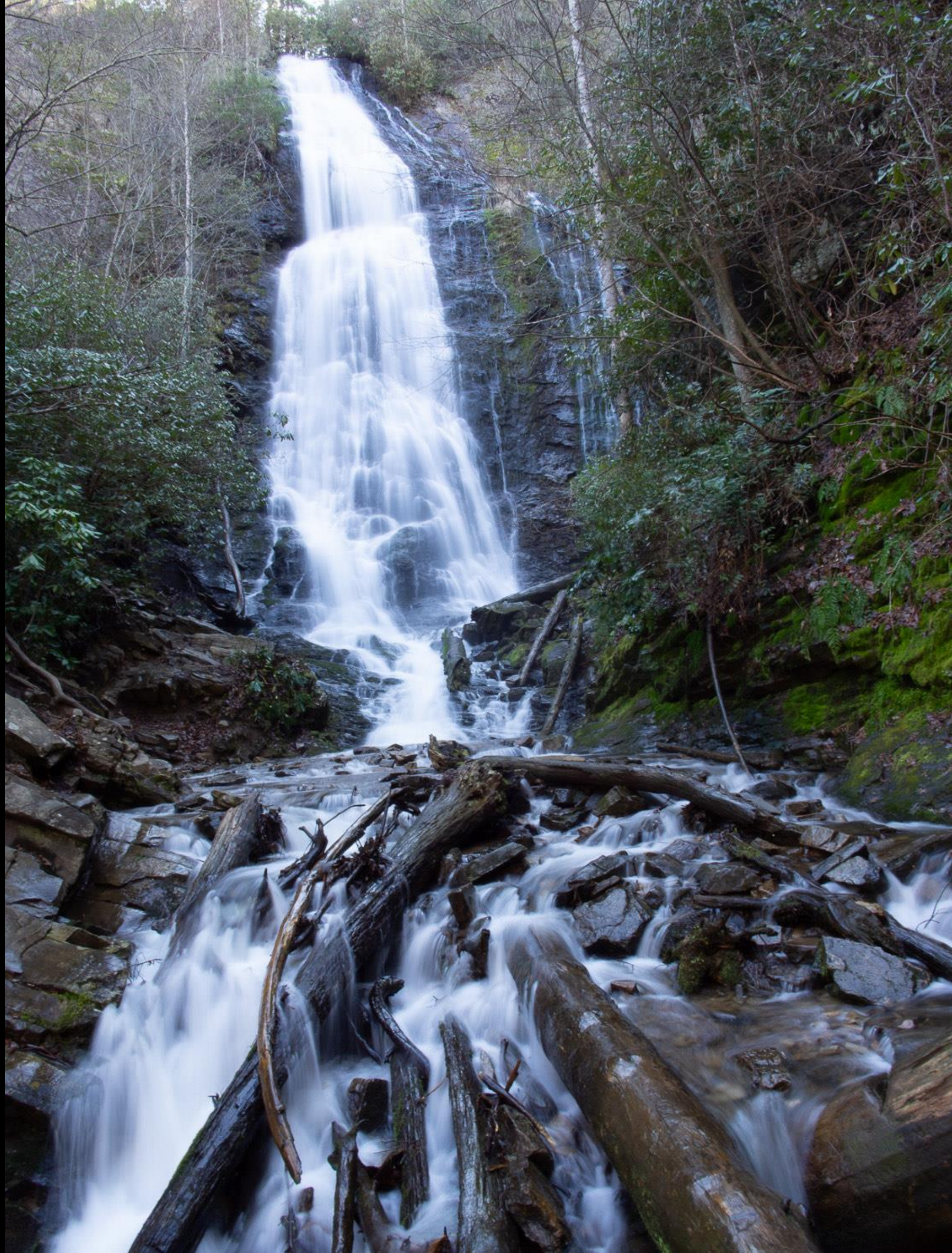
Steps for the 2nd picture involved initial processing in Lightroom, then finishing in Photoshop.

In Photoshop Rich created a new layer and send it to either Topaz AI denoise or AI sharpen.

Next, he then used Tony Kuyper's luminosity panel - the darks triple play, then lights triple play.

Rich said Tony has developed some new and easier techniques.

<https://tonykuyper.wordpress.com/2022/09/09/the-tk8-triple-play-in-2022-status-update/>



A Few Tips for Sharp Prints

Use glossy paper, which has higher contrast and a wider gamut than matte paper. Contrast and gamut both effect perception of sharpness.

In printer settings, use 600dpi or more. If you're sending a picture out to be printed, use the highest quality JPG settings or better yet, use TIFF.

Printers with more colors of ink, including multiple shades of grey will produce sharper prints because the printer does milder half-toning.

Use paper and inks of the same brand as your printer. 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 and a UV-blocking layer. It has almost no glare. It is tricky to clean. Any frame shop will have Museum Glass as an option.

Extra Credit: If you have the option, put a track light or spot light on your print so that it is a little brighter than the rest of the room. Hang on a neutral, slightly grey wall rather than a white wall.

Techniques for Sharper Pictures

Camera Settings

1. Faster shutter speed
2. Higher ISO for faster shutter
3. Lower ISO for less noise
4. Wider aperture (smaller aperture value, e.g. f/2.8 to 4) for less diffraction blurring
5. Wider aperture for blurrier background
6. Narrower aperture (larger aperture value, e.g. f/11) for more depth of field
7. Mirror lockup (DSLR only)
8. Electronic first-curtain shutter
9. Full electronic shutter
10. 10-second timer
11. Turn on image stabilization in camera, lens, or both.
12. Use the best image stabilization mode for moving subjects.
13. Turn off image stabilization for long exposures on a tripod.
14. Use spot focus, eye focus, subject focus, or face detect to make sure eye, face, body (in that order) are sharpest thing in picture.
15. Calibrate camera/lens focus offset. (Advanced technique for DSLR only)

Photographic Technique

16. Take multiple shots and keep the sharpest one
17. Wait for sun to add light
18. Light from side, not front

19. Hang weight from tripod. Weight must be on the ground, not swinging.
20. Rest arm on camera on tripod
21. Extend the upper (wider) part of the tripod legs first. Use center column last.
22. Hold camera with both hands, one on camera body, one on lens.
23. Hold camera closer to face
24. Lean against something
25. Stand with legs apart
26. Get closer to subject
27. Use lens hood
28. Avoid extra filters on lens
29. Clean lens (sparingly)
30. Don't shoot toward sun or reflections of the sun
31. Shoot from the shade
32. Don't shoot through windows
33. Pan with moving subjects when pressing the shutter.
34. Frame the picture when you take it rather than cropping later.
35. On windy day, wait briefly for wind to temporarily die down.
36. Stabilize blowing flowers with stick or Plamp.
37. Shield blowing flowers from wind with pack, friend, foam core, photo umbrella.
38. Shoot between breaths – e.g. after exhaling.
39. Avoid shooting fireworks or long exposures from vibrating buildings.

40. Move off of road to shoot to avoid vibration or heat waves.
41. Shoot early in the morning. E.g., first hour of light before heat builds up.
42. Don't shoot across road or parking lot.
43. Shoot after rain
44. Add light: shoot on sunny day
45. Add light: wait for clouds to move to reveal the sun
46. Add light: flash or studio light
47. Add light: use reflectors
48. Fast light: use flash, especially on lower power settings.
49. Fast light: minimize the amount of ambient light in flash pictures.
50. Condensation: Avoid bringing a cold camera into warm, moist environments.

Equipment

51. Tripod
52. Bigger tripod
53. Tripod without center column
54. Monopod
55. Tripod spiked feet
56. Remote shutter release
57. Full frame camera
58. Mirrorless camera or camera that supports full electronic shutter
59. Buy higher quality lenses. E.g., mirrorless lenses for mirrorless cameras.
60. Buy larger aperture lenses for faster, more accurate focus.

Printing

61. Print on glossy paper
62. Print with highest dpi setting (e.g. 600 dpi)
63. Print from files in TIFF or JPG with highest quality compression setting.
64. Print on papers and ink designed for your printer
65. Use a printer with more inks, especially more shades of grey.
66. Use anti-reflective UV-blocking Museum Glass ® in picture frames
67. Use track lighting or spot lighting on prints to make them brighter than the wall they are hung on.
68. When sharing pictures online, upload the largest resolution version.

Editing

69. Think of what is soft and what is sharp. Sharpness is absolute *and* relative.
70. Blur the background
71. Selectively sharpen the subject
72. Adobe unsharp mask
73. Steeper tone curve
74. Bring down black level, raise white level
75. Use clarity slider
76. Topaz: AI Sharpen, AI Noise tools
77. Do your editing in a dim room with a large monitor with good contrast.
78. Sharpness is the sum of many small things
79. Focus stack

fin

Was that a Bazillion ?

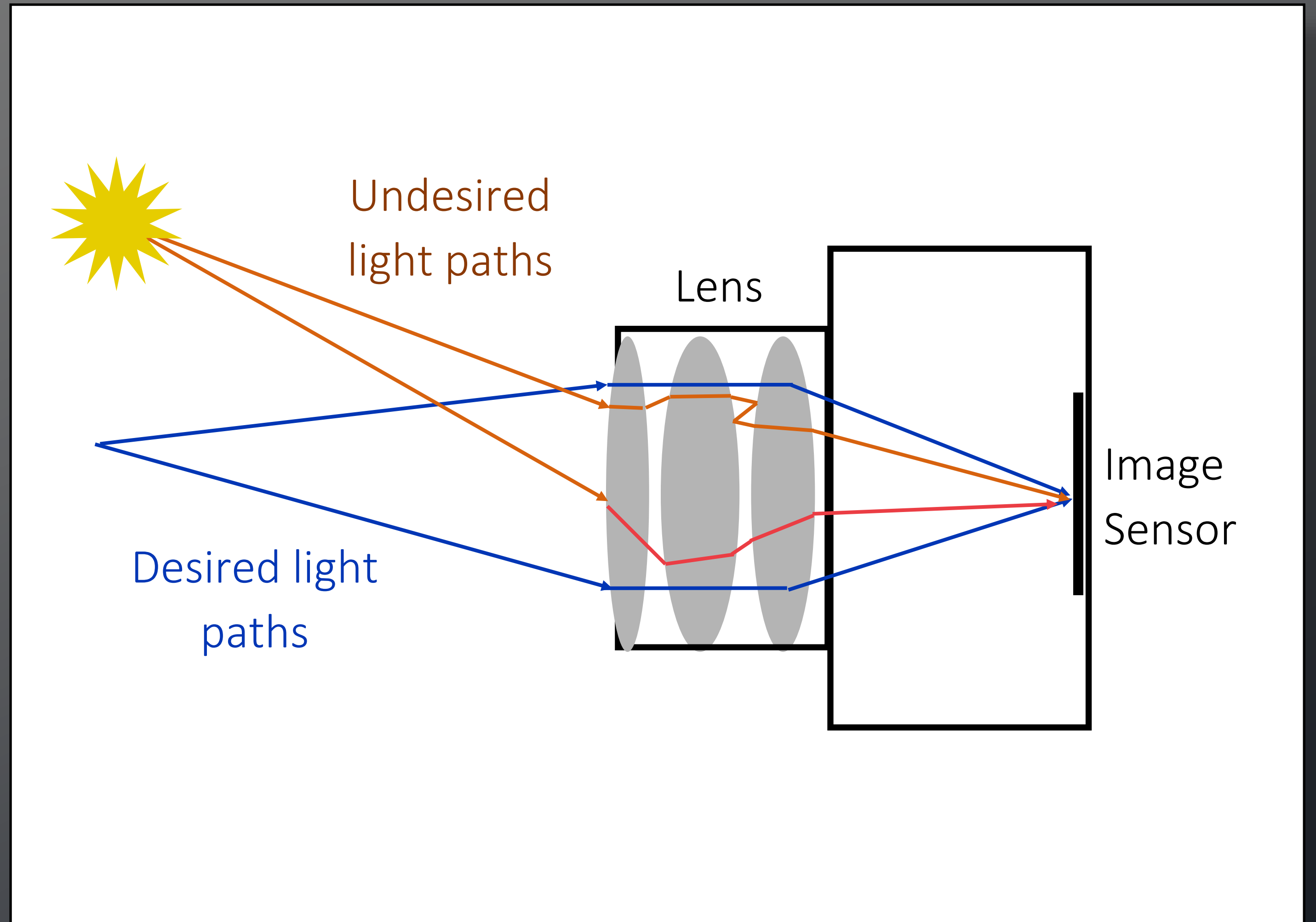
The Cause of Flare

When light hits a lens, most of it goes in the intended direction but a little is scattered.

Manufacturers put special coatings on lens elements to reduce scattering.

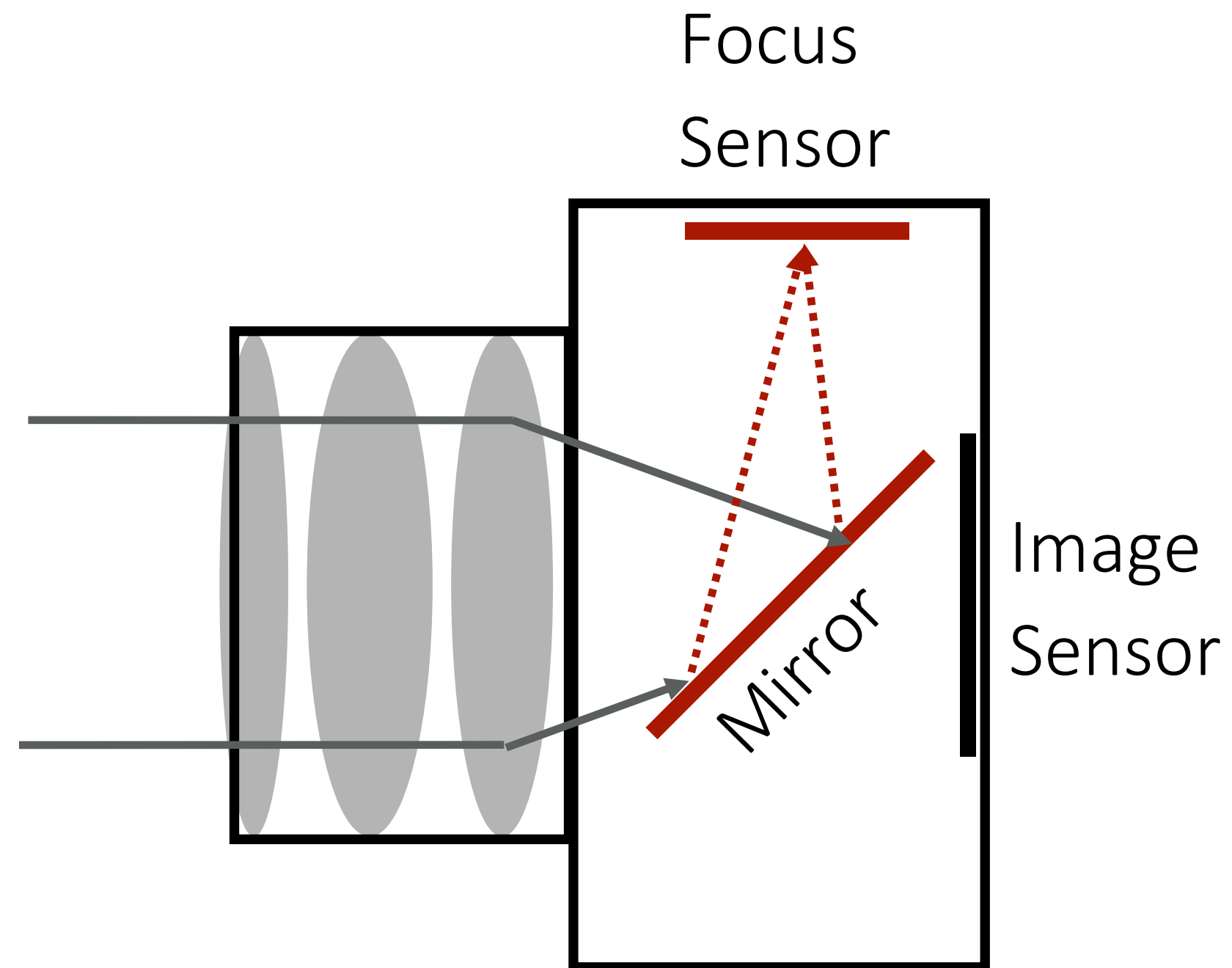
The light from *everything* that can see the lens contributes to flare, even if it is out of the picture. This includes the sun, bright clouds, room lights, and bright reflections.

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

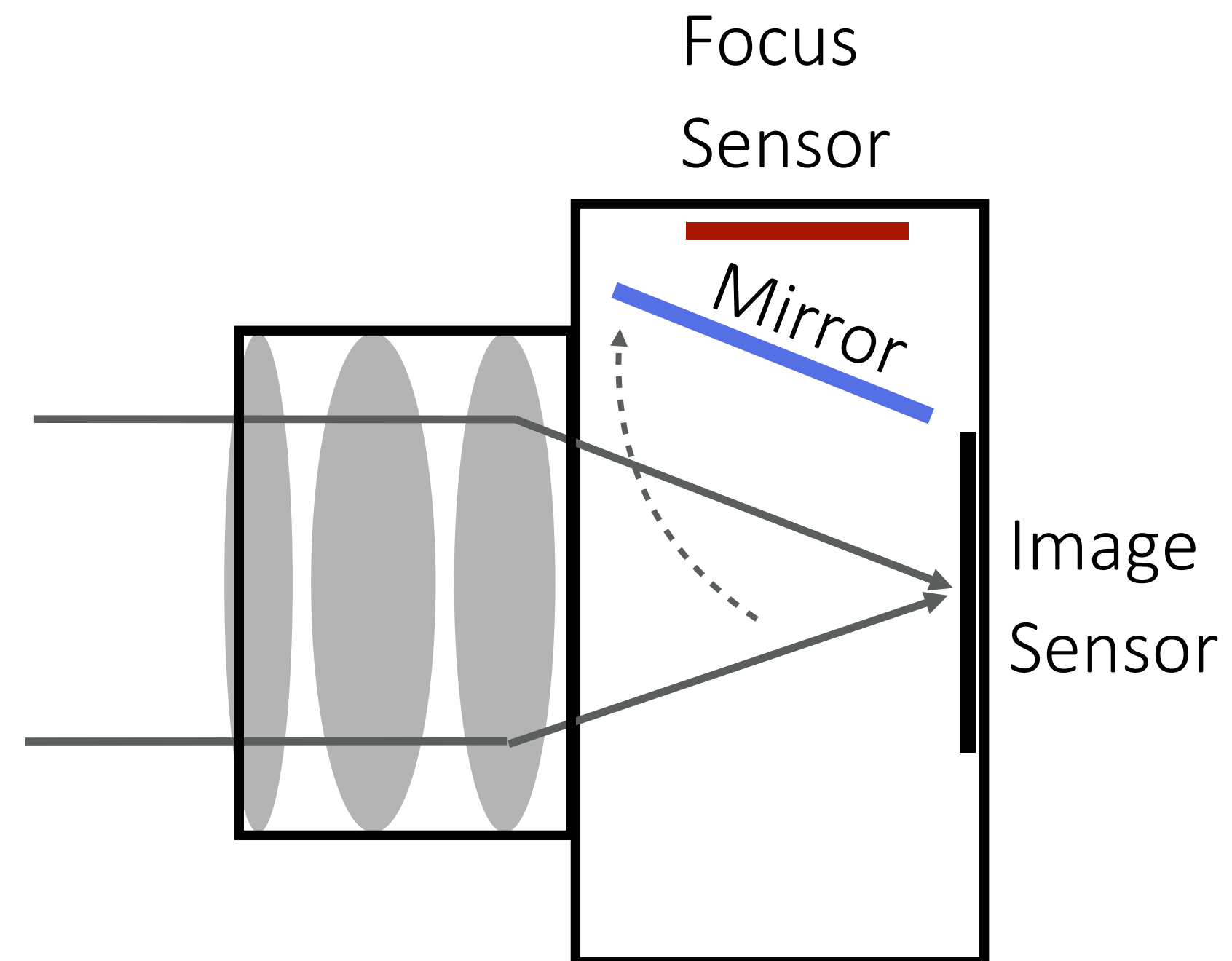


DSLRs: What Happens in the Camera During Phase Detect (Normal) Autofocus

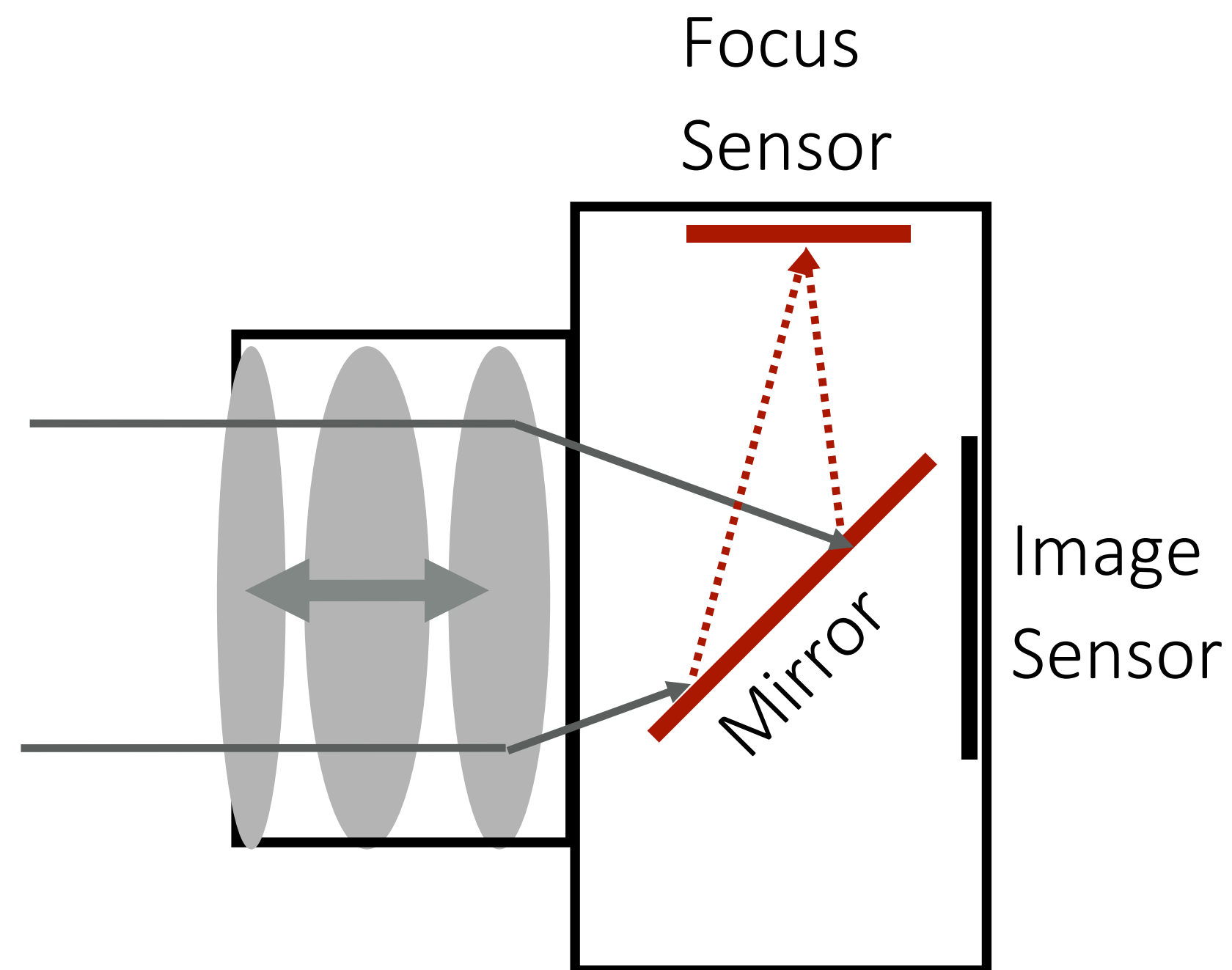
During Focus



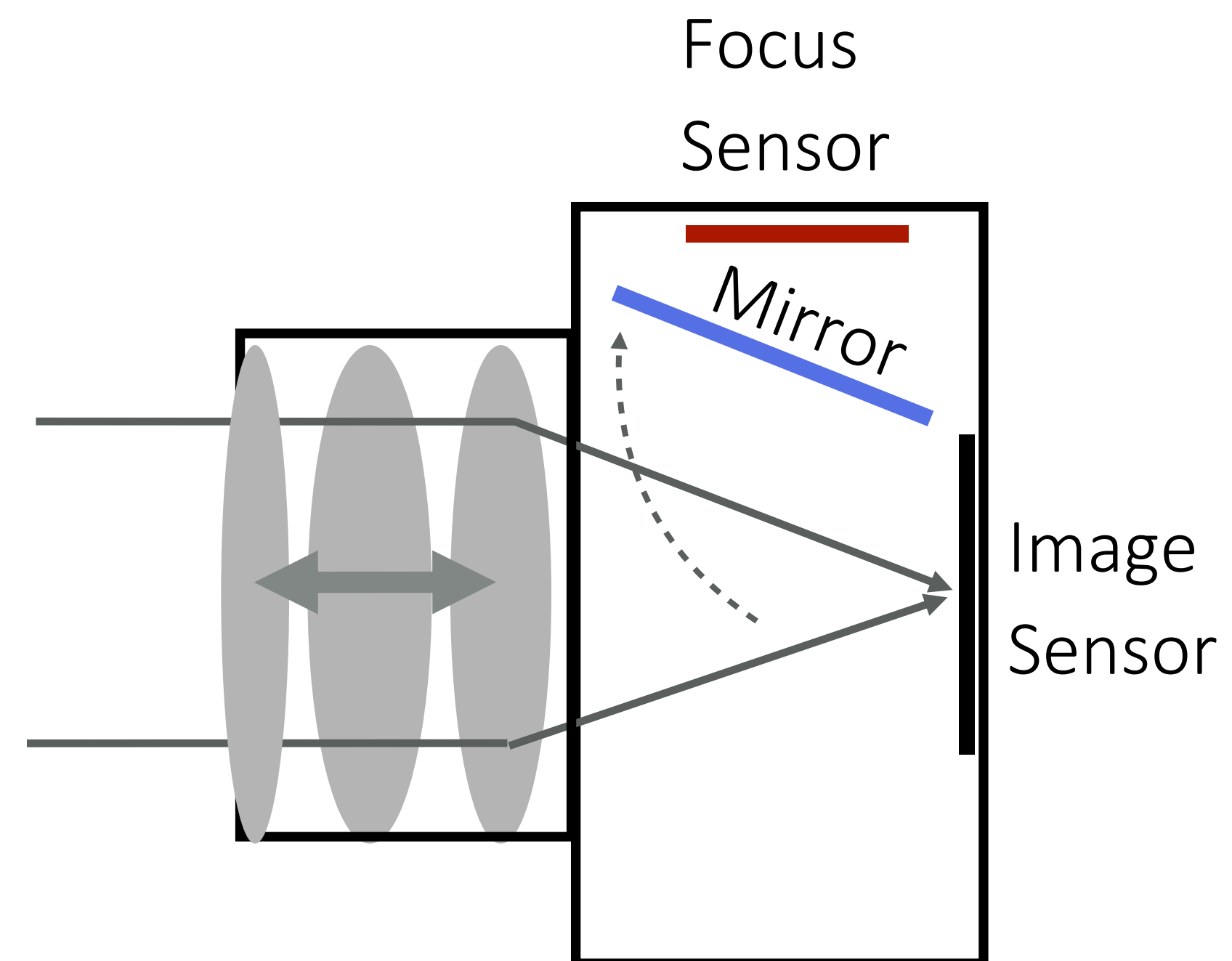
During Exposure



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

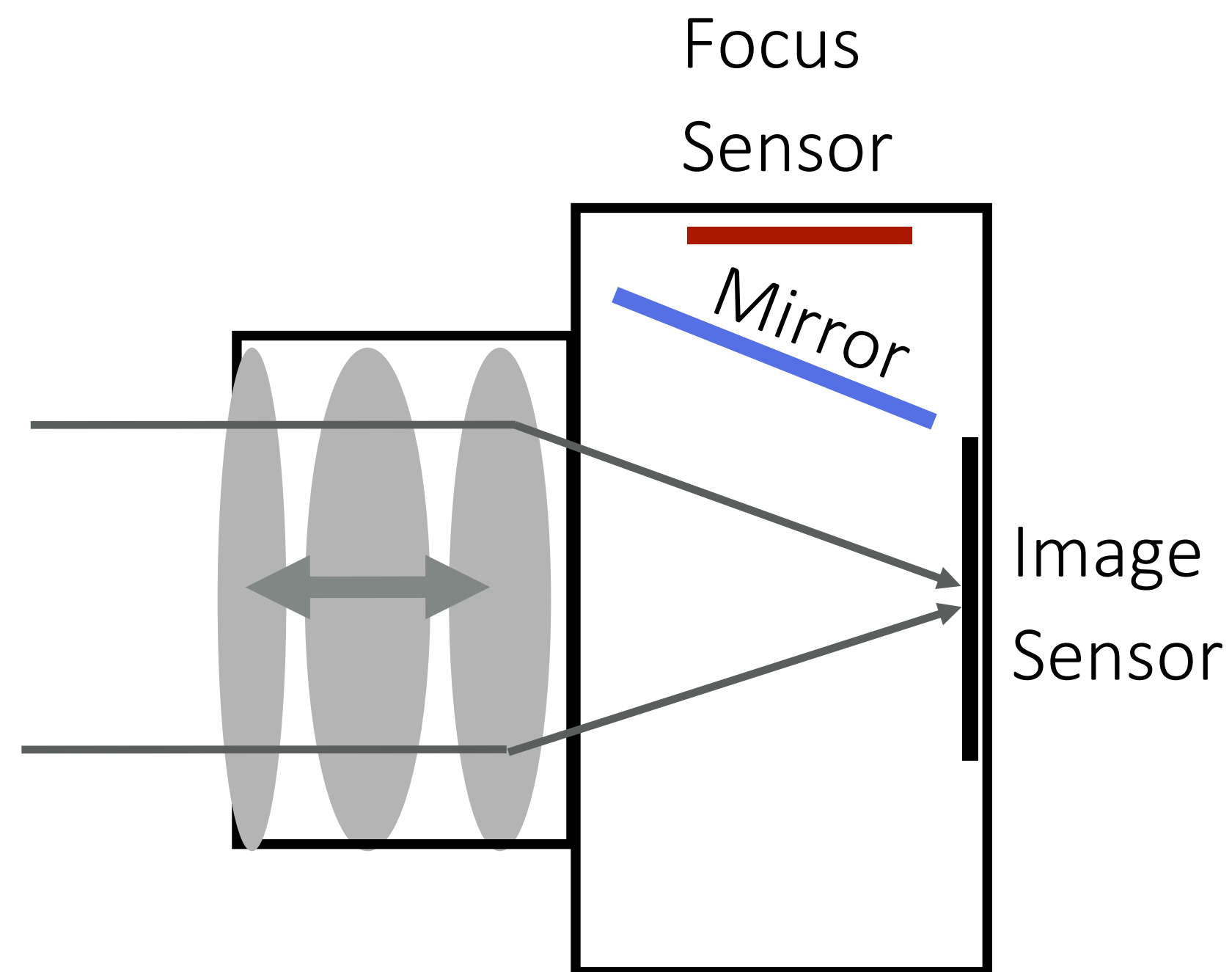


1. Light through the lens is directed to a *focus* sensor, which compares the view through two sides of the lens, much like you use your left and right eyes to guess distance.
2. When you press the shutter or focus button, the camera reads the focus sensor and moves then lens.



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.

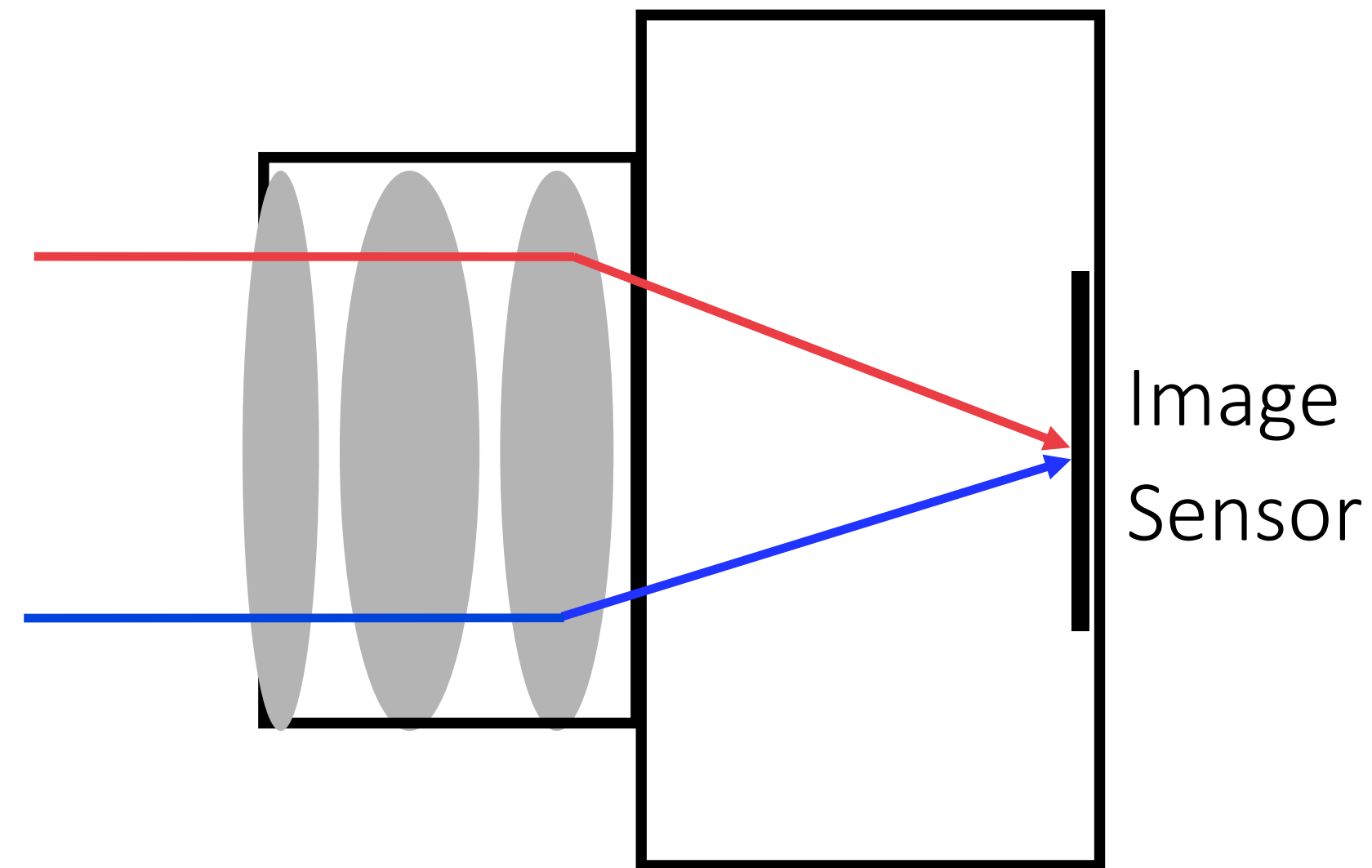
What Happens in the Camera During Contrast Focus



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.

All mirrorless cameras and some DSLRs, 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.