Capturing Sharp Detail with Telephoto Lenses

A Tech Topic

Presented to the Focus Camera Club by Owen Newnan October 12, 2022.

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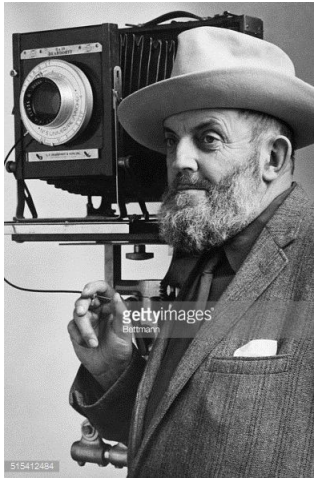
Introduction



- I pursue Ansel Adams's ideal of photography as a performing art that that harnesses technology, in a disciplined way, for artistic purposes. I aspire to produce photos from time to time that might be considered fine art.
- Telephoto shots tend to push the limits of photographic equipment and technique, especially with wildlife or sports at high magnification. In years past my telephoto shots too often fell short of the crisp, clean ideal I strive for. In particular, from my Tanzania safari where lots of compositions I liked seemed a bit blurry.
- I had bought a new camera body at that time but had an old telephoto lens. I later tried newer super-telephoto lenses but they didn't seem to help that much with sharpness. In this talk I'll explain some steps I've taken to improve and control the sharpness of my telephoto pictures.

The Sharpness of the Lens Depends on the Body

- The DxO lens database used to compare the sharpness of lens/body combinations measured in perceptual Megapixels (p-Mpx).
- Results suggested
  - A 24Mpx full frame body averages ***about 1/3-2/3 sharper*** than a 24Mpx crop frame when mounting the same full frame lens.
  - That advantage is more like 70% for telephoto zooms longer than 300 mm.
  - The best lenses available on 24Mpx full frame take nearly full advantage of the body's pixels. That's not true for the 24Mpx crop frame.
  - A full frame body also offers ***more than a full stop more ISO sensitivity*** (S/N ratio) over crop frame.

- Still, moving to ***full frame means 1/3 less magnification*** than crop frame. ***Would that be worth it to me?*** That's a significant loss for distance photography, such as, wildlife.

- I decided to trade up to a 24Mpx full frame camera with the sharpest rated 24-70mm and 70-200mm lenses for that body in the database (Tokina and Nikkor). I later replaced my old 80-400mm lens with a 200-500mm not in the database.

I bit the bullet with full frame. How's that going?

- ***I believe my upgraded gear is about 70%-100% sharper, as DxO suggested.*** Sharpness does not really seem to be a problem with the new lenses, used properly. They should also work even better on more advanced bodies.
- Besides having more than a full stop in noise reduction, I find the noise on my full frame camera ***much less bothersome*** versus the crop frame.
- With much sharper gear and much less noise, ***shutter speed is increasingly the limiting factor on sharpness***.
- All in all, *it worked out great!*!! But...

There were surprises, too--

- I could now shoot sharp expansive landscapes as I had not previously thought possible with telephoto lenses.
- The Tokina 24-70 didn't seem much sharper than the Tokina 12-28mm DX it replaced, although supposedly twice as sharp.
- Why am I now having so much trouble with depth of field, like shooting wildflowers?
- How come one shot taken with my mediocre 80-400mm lens came out way sharper than the many thousands taken with it over the years?

Why? ...

Telephoto Panoramas

- Nikkor 70-200 F/4
- 110mm
- F/11
- ISO 125
- 1/160s w image stabilization
- Crop~=1x.
- ***Sharp enough for fine art***

Telephoto Panoramas Continued

- With the new gear revealing crisp detail, I rediscovered telephoto landscapes. Standing on a hill, with the foreground a ways off, ***one can take shots with everything out to the horizon in focus.*** For example, at 80 mm, F/16, and focused at 60 feet, everything from 20 feet out will be in focus.

- Telephoto reach offers more compositions to choose from when standing in one place than with wide angle lenses.

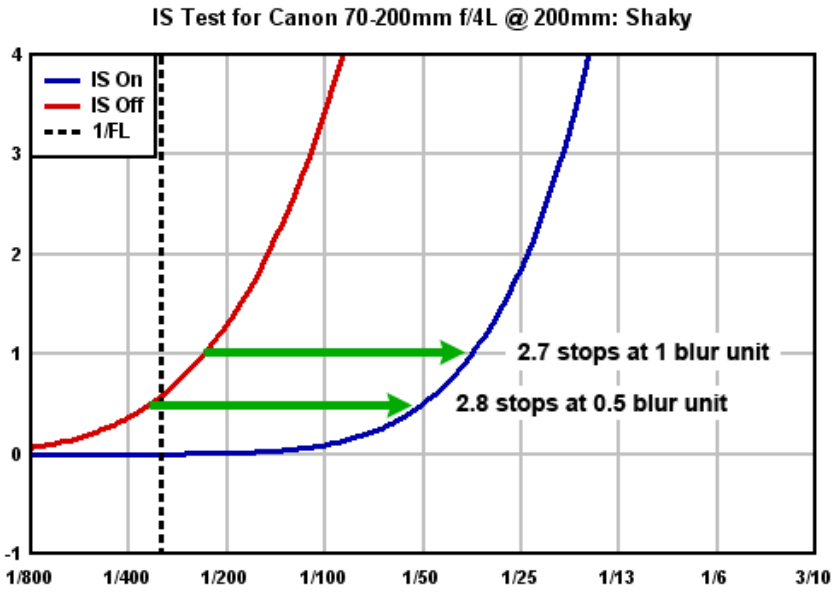
Rule of Thumb for Camera Shake

- The basic guideline is that, to compensate for camera shake in handheld photography, use

  shutter speed = one divided by the focal length

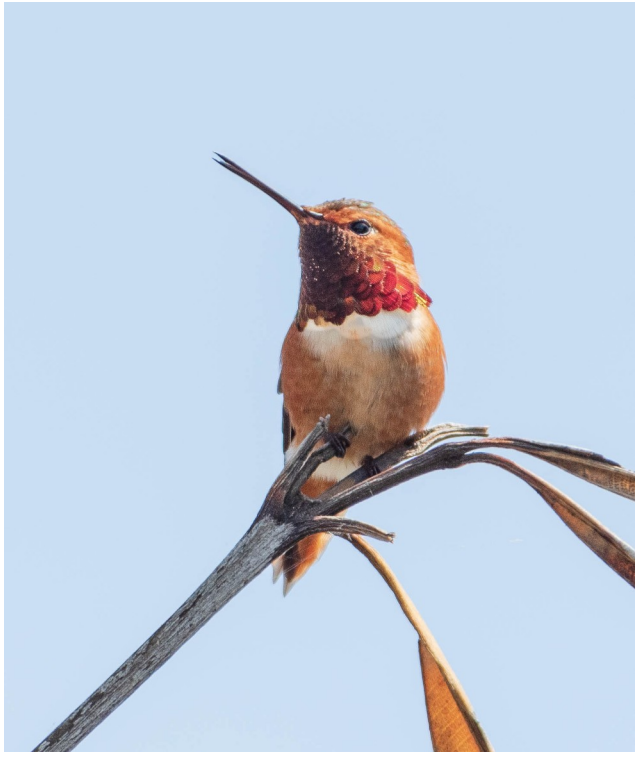
- So, for a focal length of 50mm, shoot at 1/50s
  - For 100mm shoot at 1/100s
  - For 500, shoot at 1/500s
  - Etc.
- Adjustments to this rule are needed for forms of magnification other than focal length, including cropping and print enlargement.
- The rule is just a point of departure for shutter speed. It does not tell you what shutter speed to use for subject blur, which may be the limiting factor in shutter speed. Also, you must adjust the ROT when using physical and optical image stabilization.

Adjust ROT for Image Stabilization



- Opinions vary; I always shoot with image stabilization on except when using a tripod.
- Tests show ***ROT only gives "acceptable" results 60-80% of the time and doesn't do justice to super sharp lenses.***
- ***Adjust ROT for image stabilization based upon your lens.*** Experiment to find the number of stops of stability you can count on. Example: at 120mm with 2 stops of trustworthy IS, adjust the tradition ROT of 1/120s to 1/30s.
- ***If considering extensive cropping or enlargement, use a faster shutter speed than otherwise.***

Subject Blur can be Insidious



- At 400mm (400 / 50 = 8x magnification) and cropped with 3.4x enlargement, this image is magnified 27 times. I shot it at F/8, 1/1250s with IS, and ISO 240. The tip of the beak is somewhat blurry. I did not expect subject blur with a ***seemingly stationary*** subject at 1/1250s--way faster than ROT.
- Managing camera shake does no good if there's too much subject blur, which can sneak up on us at high levels of magnification. ***Image stabilization and tripods are no help for subject blur!***
- ***Caution: 3.4X crop not only magnifies subject blur but abandons over 90% of the pixels.***

Focusing Tips

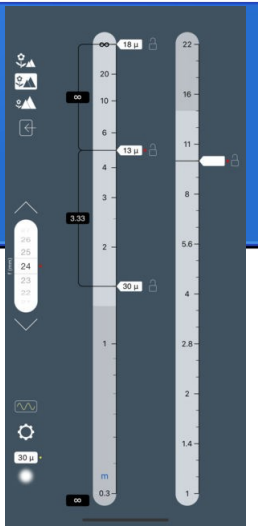
- Use Back Button Autofocus
  - Focus and shoot independently
  - Pre-focus to settle image stabilization
  - Focus to focus again better
  - I like repeated static focus w/ shutter release priority
- Focus on sharp edge of subject, e.g., nearest eye.
- For general landscape scene, focus on edge 1/3 into desired depth of field
- Configure camera to display where pictures really *were* focused—and sanity check your results.

Autofocus Fine Tune

JJC ACA-02

- AFT is a setting to adjust viewfinder/lens focus distance to match the sensor.
- Improves sharpness for many SLR/lens combinations.
- Many cameras support AFT. Some lens manufacturers even support firmware adjustment at multiple focal lengths.

Diffraction & Depth of Field



- Diffraction is a property of all lenses that adds increasing blurriness at narrower apertures. The effect is imperceptible wide open but of increasing importance starting around F/8.
- Some DoF calculators ignore diffraction, which leads to over-optimistic DoF results. Don't trust them!
- Allowing for diffraction, ***real world DoF tends to peak around F/16***. Worse, sharpness of the focal plane declines as much as DoF due to diffraction.

- Industry standard DoF calculations are for achieving "acceptably sharp" 8x12" prints.
- If you need a "tack sharp" or larger print adjust the blur factor on your calculator.

More Depth of Field Gotchas

- Given equal magnification levels (the same perspective) full frame lenses offer ***less*** DoF than crop.
- So, zooming in with a full frame camera, DoF can become cramped if not ridiculous, e.g., 3/10 inches for a flower 4 feet away at 200mm and F/9.
- Worse, DoF is in effectively cut in half when focusing on the nearest point of a subject since the foreground DoF will not be visible and thus wasted.

When F/16 isn’t enough

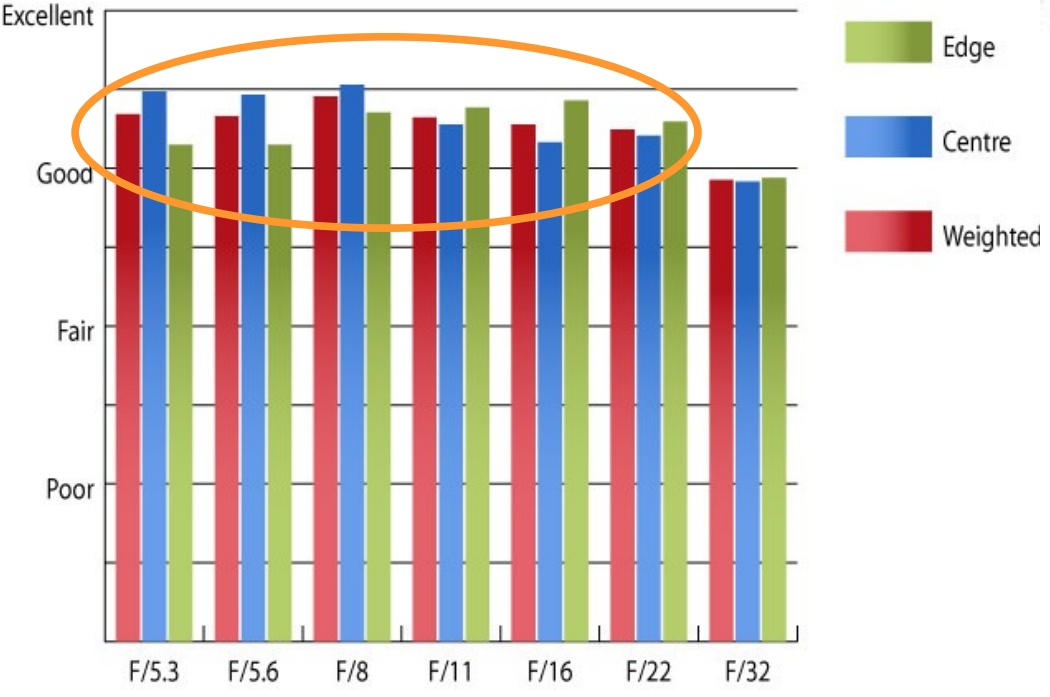
- ***Step or zoom back***; then recompose and crop to compensate.
- Focus at the middle of the range of where you really need DoF.
- Focus on critical detail only, like the nearest eye of nearest subject. Plan to de-emphasize other non-critical details in post-processing.
- Consider focus stacking as an option for static scenes.

What's Right With This Picture?

- Taken at 330mm, F11, 1/400s with IS, ISO 220, crop 1.46x.
- This shot, taken with my "unsharp" obsolete 80-400D lens is tack sharp. Why?

Know Your Lens's Sweet Spots

200 mm



400 mm

Blur & Sports

- My goal was to take high quality “portraits” of Roger Federer playing before he retired.
- The trade-offs of tennis remained tight even with a full frame body. Shot with Sigma Sports 150-600mm @ 400mm, F/9, 1/1250s with IS, ISO 1250, 1.46X crop.
- The subject blur imparts a sense of motion. On the other hand, even 1/1250s pushes it for portrait quality detail in face and hands.

Honey, Grab Your Camera

- Be prepared for quick setup!
- User Setting (U2): F/8, auto ISO with minimum shutter speed 1/2000 & max sensitivity 3200.
- Actual: F/8, 1/1600s, ISO 3200, 500mm, crop 1.9x, magnification 20x.

Autofocus in Live Mode

- Method of choice when working with DSLR, tripod and static subjects, e.g., landscapes.
- No mirror flap. No discrepancy between sensor and focus points.
- Zoom in electronically to select exact focus point.
- Focus anywhere on sensor, trigger using remote.
- Slow but very accurate.
- Old lens again, 400mm, 1 sec, F7.1, ISO 1250, ***7x crop leaves about 2% of pixels***

Conclusions

- Sharpness of the subject's key features is crucial to a photo's success; ***blurriness can be the kiss of death.***
- Magnification accentuates all defects of your art including blurriness. When selecting shutter speed, ***allow for all forms of magnification:***
  - use of a telephoto lens;
  - use of a crop-frame camera
  - cropping factor; and/or
  - upscaling the edited product for print or display.
- ***Subject blur may be the limiting factor*** for shutter speed.

Questions?

References

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- "Proof that Image Stabilization should be Stabilized", Nasim Mansurov, 2017.
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- The Ultimate Guide to Back Button Focus", Dan Carr, 2018.
- JJC Autofocus Chart. I use this for autofocus fine tune and am pleased with it.
- Nikon 80-400mm f/4.5-5.6D ED VR AF Nikkor Interchangeable Lens Review.