

LEBANON CAMERA CLUB

Digital Image Sharpening

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See last slide for Fair
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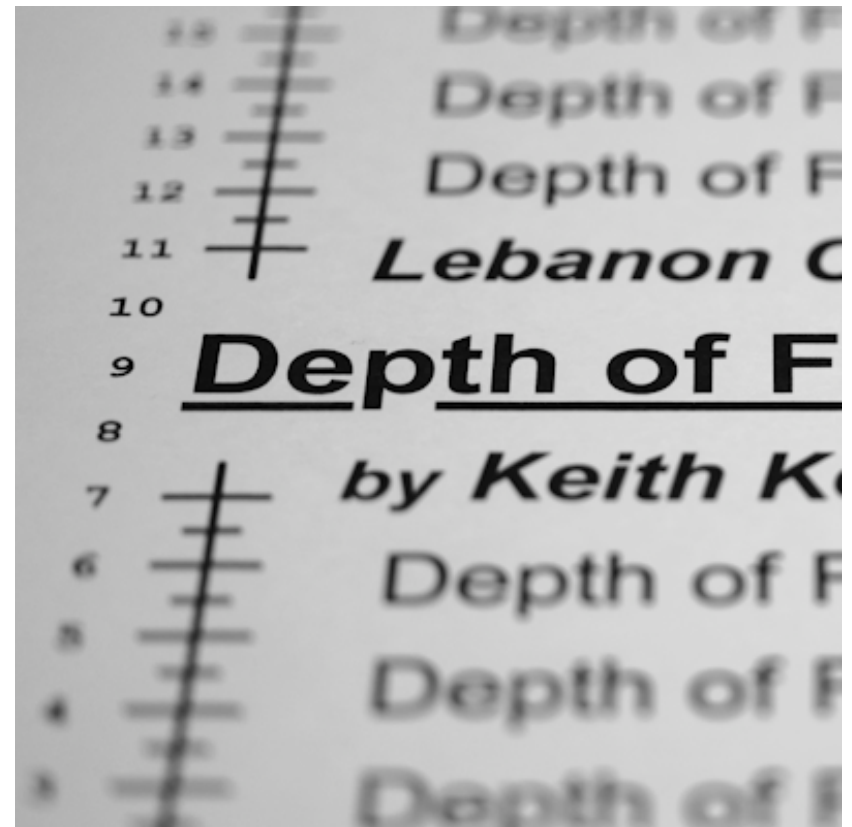
Digital Image Sharpening

Sharpness

- Overall clarity in terms of both focus and contrast
 - ◆ Clear and lifelike
 - ◆ Contrast and texture rendered in high detail
 - Edges well defined



shallow depth of field
(paper at a 45° angle,
bottom closest to camera)



Digital Image Sharpening

Sharpness

- Overall clarity in terms of both focus and contrast
 - ◆ Clear and lifelike
 - ◆ Contrast and texture rendered in high detail
 - ▶ Edges well defined



before



some sharpening

Digital Image Sharpening

Sharpness

- Overall clarity in terms of both focus and contrast
 - ◆ Clear and lifelike
 - ◆ Contrast and texture rendered in high detail
 - Edges well defined



before



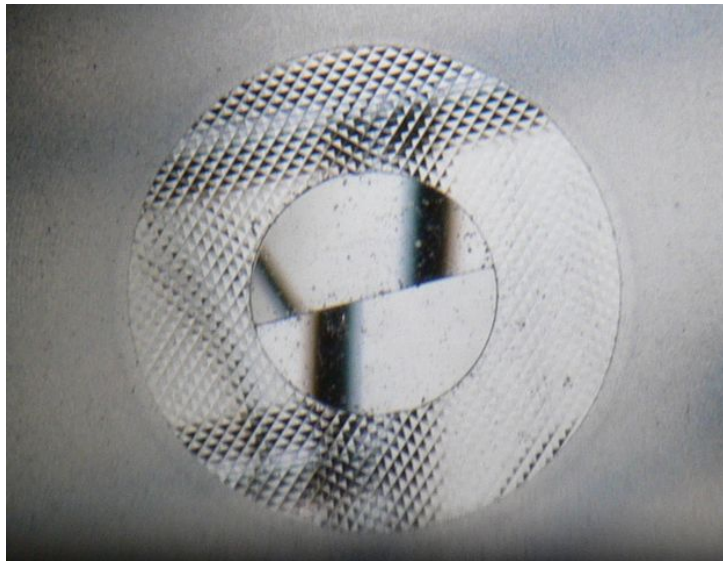
more sharpening

Digital Image Sharpening

Why are images unsharp?

- Missed focus
 - ◆ Autofocus doesn't always get it right
 - ◆ Manual focus with digital cameras can be difficult
 - Many of the focusing aids on film cameras & lenses are gone
 - Mirrorless cameras have some new ones, like focus peaking

Note: AI-based sharpening claims to be able to correct missed focus → works best if the program can identify image elements (face, flower, etc.).



film camera split prism and micro prism ring focusing aids



focus peaking highlights high contrast edges to show the area in focus

Digital Image Sharpening

Why are images unsharp?

- Insufficient depth of field
 - ◆ Some areas may be in focus, others may not
 - A problem if you want some image element to be fully in focus



$f/2$ → shallow depth of field
(paper at a 45° angle,
bottom closest to camera)



$f/16$ → deep depth of field
(paper at a 45° angle,
bottom closest to camera)

Digital Image Sharpening

Why are images unsharp?

Note: When diffraction is noticeable:
Full frame: f/11 (slight), f/16 (obvious)
APS-C: f/8 (slight), f/11 (obvious)
4/3 sensor: f/5.6 (slight), f/8 (obvious)

- **Diffraction**

- ◆ **Blur caused by light passing through a small aperture**
 - More blur everywhere, even at the best focus point
 - Another photography tradeoff → DOF vs. diffraction

ISO 100 F/8, 18mm, 1/15 sec



ISO 50 F/22, 18mm, 1 sec



Digital Image Sharpening

Note: Transverse CA can be corrected in an image editor, axial CA is very difficult to correct.

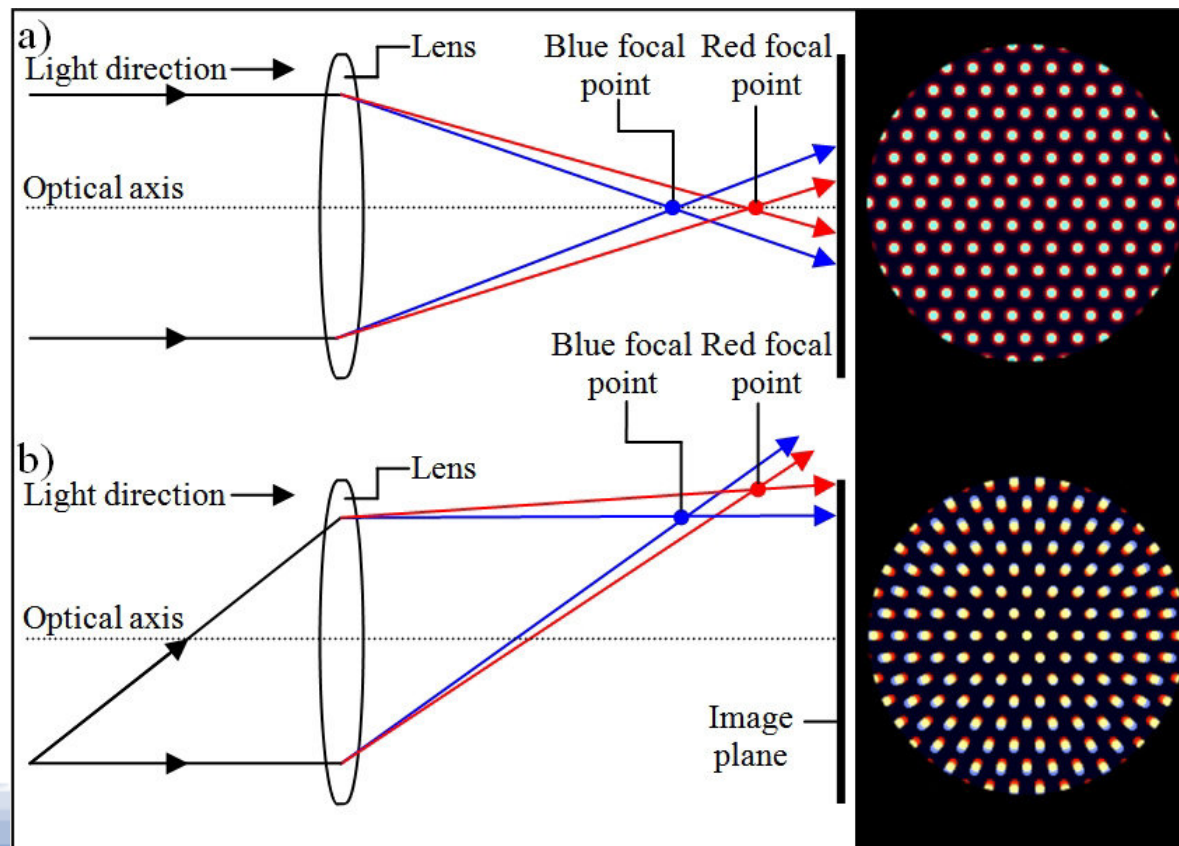
Why are images unsharp?

- Lens aberrations

- ♦ Chromatic aberration → colors not focusing at the same point

a) Axial (longitudinal) → misaligned in the optical axis (near/far)

b) Transverse (lateral) → misaligned in the sensor plane (up/down/left/right)



Digital Image Sharpening

Note: Transverse CA can be corrected in an image editor, axial CA is very difficult to correct.

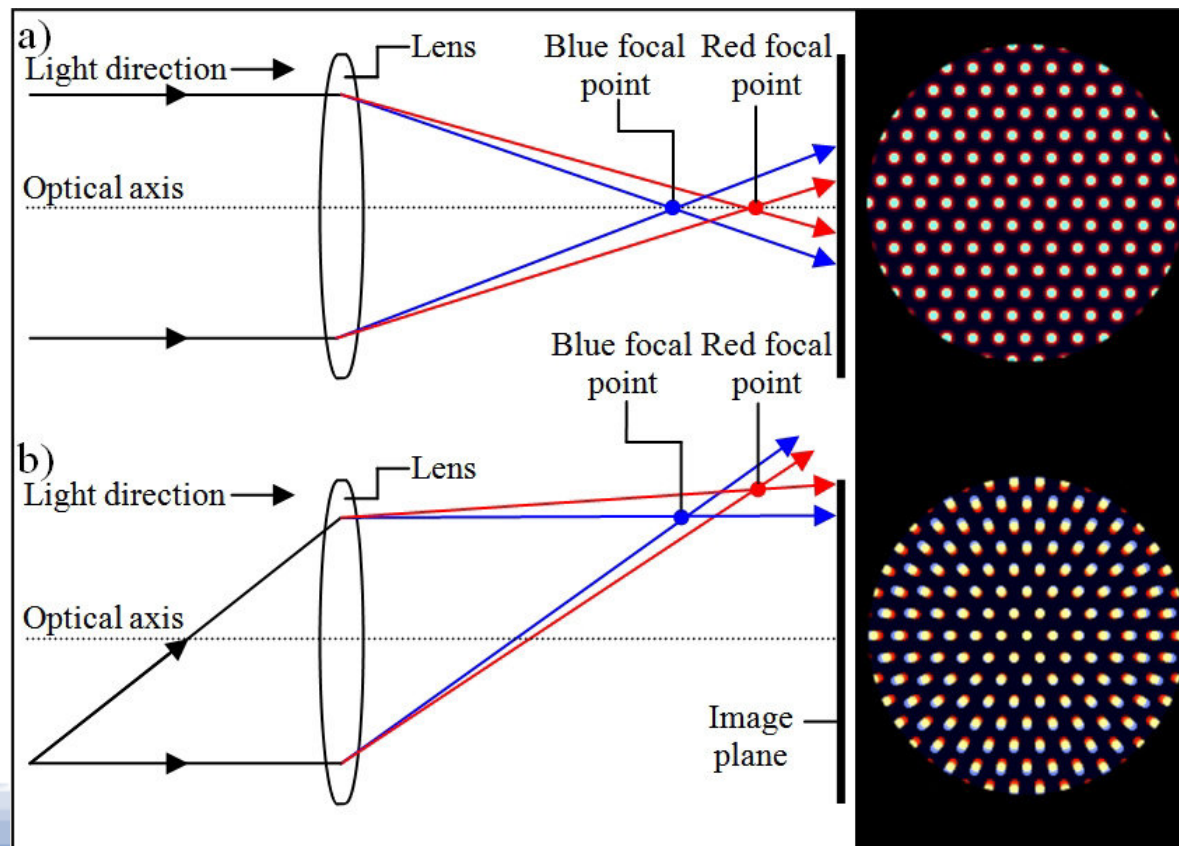
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Digital Image Sharpening

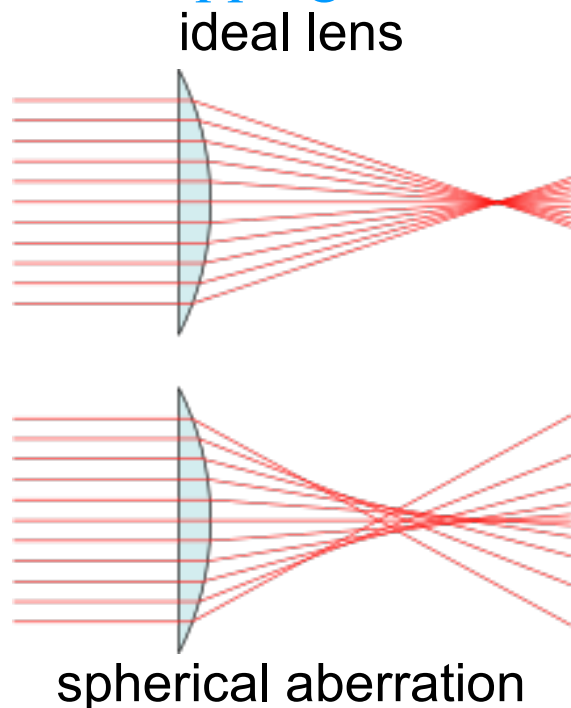
Why are images unsharp?

- Lens aberrations

- ◆ Spherical aberration

- Light rays from different areas of the lens focus in different points
- Most prominent at large apertures (small f -number)
- Stopping down reduces it → at some aperture it may not be noticeable

Note: Spherical aberration is sometimes used as an effect to produce a soft, 'dreamy' look. Fast legacy film lenses shot wide open often show SA.



SA wide open



stopped down

Digital Image Sharpening

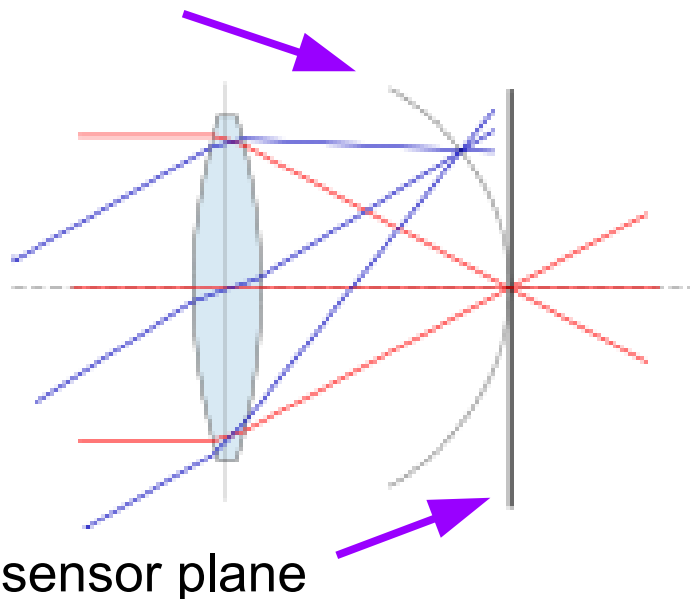
Why are images unsharp?

- Lens aberrations

- ♦ Field curvature

- Light rays focus on a curved surface, not a plane
- Since the sensor is planar, only some parts of the plane are in focus
- A larger DOF can allow more of the image to be in focus

curved area of focus



Digital Image Sharpening

Why are images unsharp?

Note: AI-based sharpening claims to be able to reduce the effects of motion blur.

- Motion blur
 - ◆ Camera moving
 - Insufficient shutter speed → may need a tripod
 - Lens and/or in-body optical stabilization can minimize it
 - ◆ Subject moving
 - Insufficient shutter speed (tripod of no use)



Digital Image Sharpening

Why are images unsharp?

- Ultraviolet light
 - ◆ Bluish cast, reduces detail → high altitude or bodies of water
 - UV filter can prevent it
- Haze
 - ◆ Fog, mist, dust in the air can soften details
 - Skylight 1A and 1B filters can reduce the effect

Note: UV filters are clear, Skylight filters have a warming tint and are more aggressive. **Any filter can introduce its own aberrations.**



UV filter



Skylight 1B

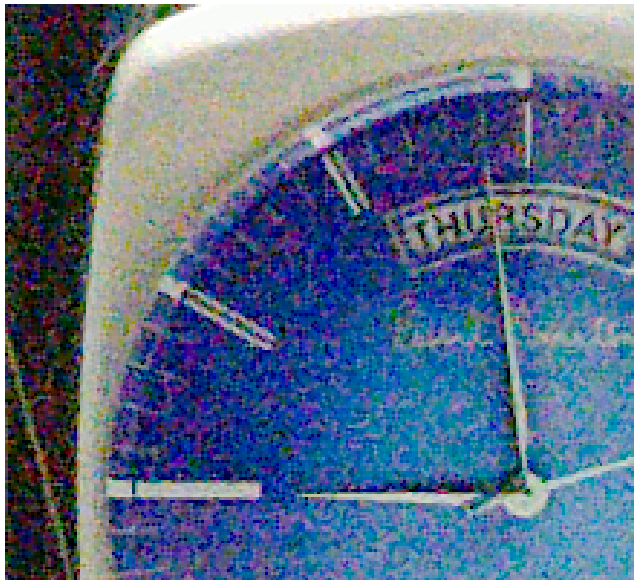
note the warming effect on the woman's face

Digital Image Sharpening

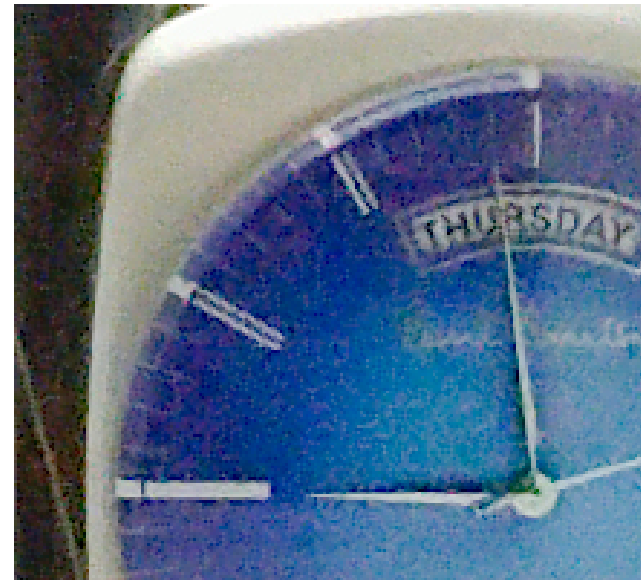
Why are images unsharp?

Note: Noise reduction tools may have a sharpening option to restore the appearance of sharpness lost by reducing noise.

- Noise
 - ◆ High ISO noise can destroy detail
 - ◆ Noise reduction algorithms can also reduce detail



noise at ISO 3200
(older sensor)



noise reduction works,
but detail can be lost

Digital Image Sharpening

Why are images unsharp?

- Sensor anti-alias filter
 - ◆ Intentional blurring to eliminate moiré effects
 - Interference patterns → regular pixel array + textured subject

Note: Some newer digital cameras do not have an anti-alias filter to preserve sharpness → the risk is visible moiré.

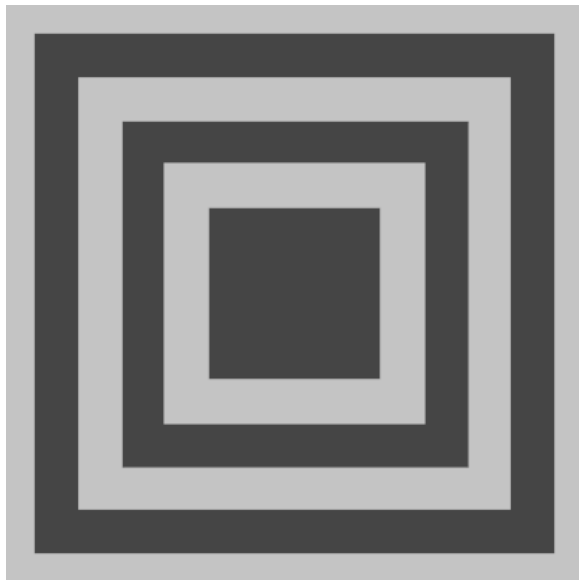


Digital Image Sharpening

Sharpening images

Note: The claimed advantage of AI sharpening is that the algorithm can 'identify' image elements and therefore sharpen 'smarter'.

- Basic idea: make edges more prominent
 - ♦ Easiest way to improve the **illusion** of sharpness
 - Cannot create detail that was not captured by the sensor
 - ♦ Increasing edge contrast makes them more prominent
 - 1) Identify edges
 - 2) Make darker side of the edge darker, lighter side of the edge lighter



original



gaussian blur 2



(over) sharpened

Digital Image Sharpening

Sharpening images

- Paintshop Pro sharpening options
 - ◆ Sharpen
 - Basic, no controls, almost invisible effect
 - ◆ Sharpen More
 - Basic, no controls, slightly visible effect



gaussian blur 2



PSP Sharpen



PSP Sharpen More

Digital Image Sharpening

Note: A radius of 6 is high but used for demo purposes. Strength of 100 is the maximum.

Sharpening images

- Paintshop Pro sharpening options
 - ◆ High Pass Sharpen
 - Radius → distance with which dissimilar pixels are sharpened
 - Strength → strength of the sharpening
 - Blend mode: Overlay (removes neutral tones), Hard Light (more contrast than Overlay), Soft Light (produces a softer-looking photo)



gaussian blur 2



PSP HPS:6_100_soft



PSP HPS:6_100_hard

Digital Image Sharpening

Sharpening images

- Paintshop Pro sharpening options

- ◆ Unsharp Mask

- Radius → distance with which dissimilar pixels are sharpened
- Strength (Amount) → strength of the sharpening
- Clipping (Threshold) → lightness values adjacent pixels must have to be sharpened (higher values sharpens more pronounced edges only)

Note: Close-up subjects and softer details → higher Radius settings; lots of fine detail → lower Radius settings. Radius of 6 is high for demo purposes.



gaussian blur 2



PSP USM:6_75_5



PSP USM:6_150_5

Digital Image Sharpening

Sharpening images

- Paintshop Pro USM

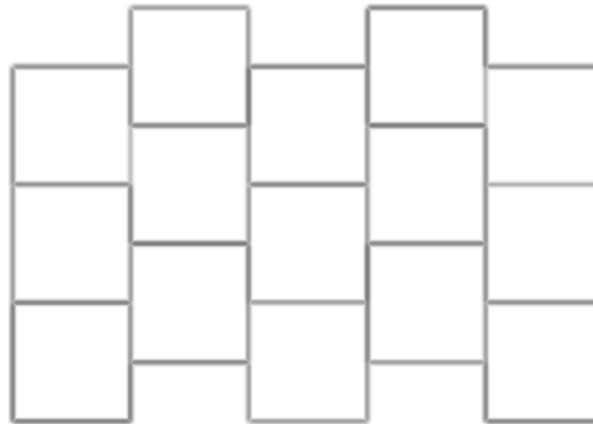
- ♦ Edges → luminance vs. hue

Note: The name “unsharp mask” comes from a sharpening technique used with film, where a blurred positive copy of the image was combined with the original negative in an enlarger.

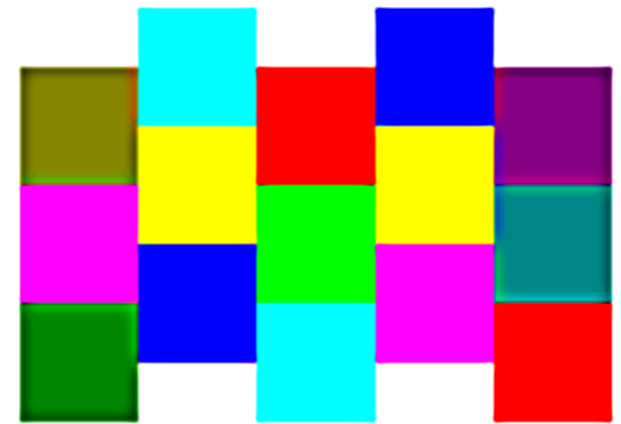
radius of 8 is high, used for demo only



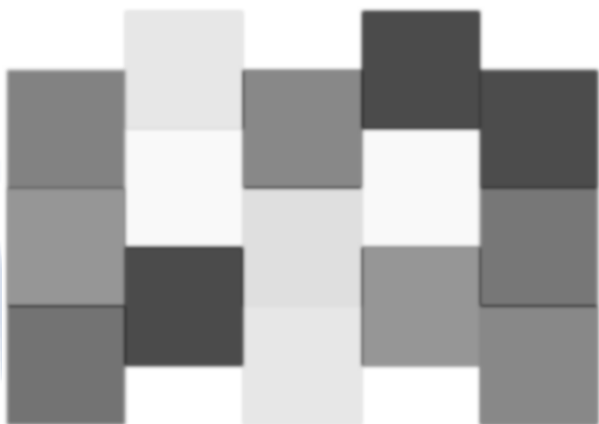
gaussian blur 2



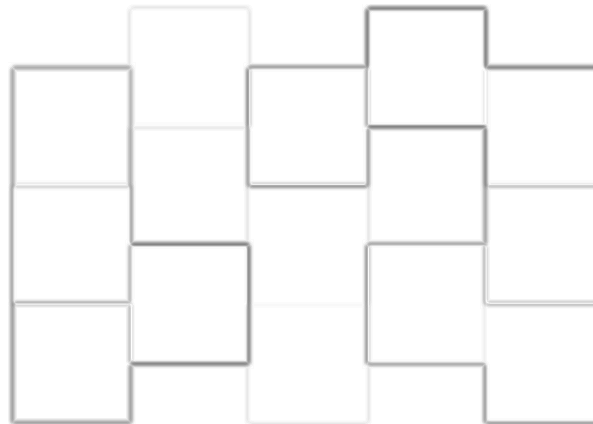
blur 2 edges



blur 2 USM:8_150_5



gaussian blur 2 greyscale



blur 2 greyscale edges



blur 2 USM:8_150_5

Digital Image Sharpening

Sharpening images

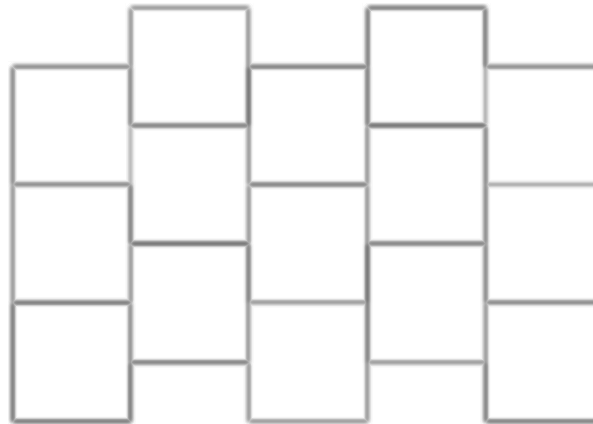
- Paintshop Pro USM
 - ♦ Edges → luminance vs. hue

Note: PSP unsharp mask has a “Luminance only” option → good for reducing color shifts if they are occurring.

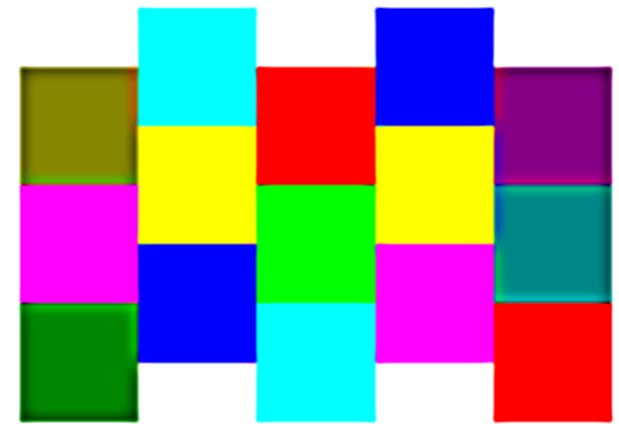
radius of 8 is high, used for demo only



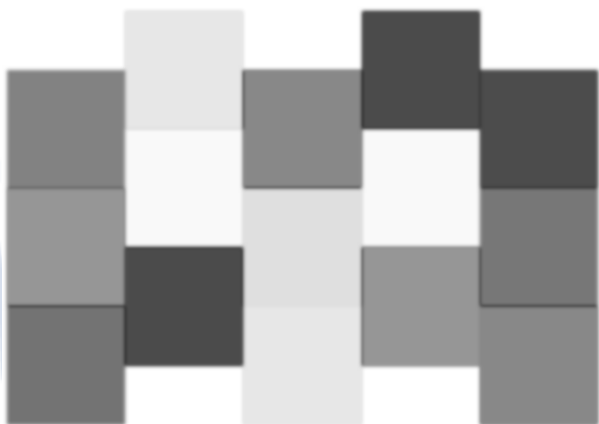
gaussian blur 2



blur 2 edges



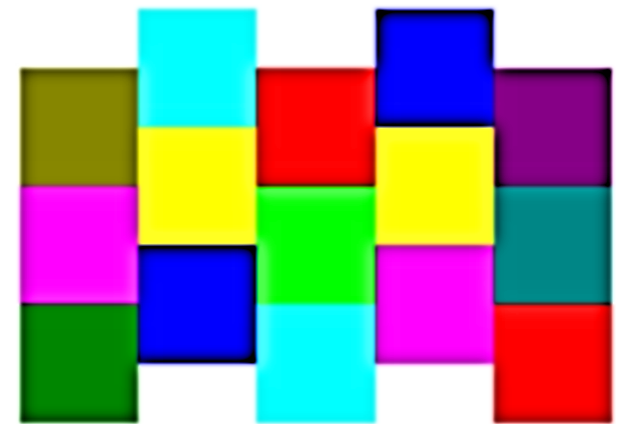
blur 2 USM 8_150_5



gaussian blur 2 greyscale



blur 2 USM 8_150_5



blur 2 USM Lum only

Digital Image Sharpening

Sharpening images

- Issues

- ♦ Halos

- Bright borders around high contrast edges
- Dark borders around edges occur, but are less noticeable

halos



Digital Image Sharpening

Sharpening images

- Issues

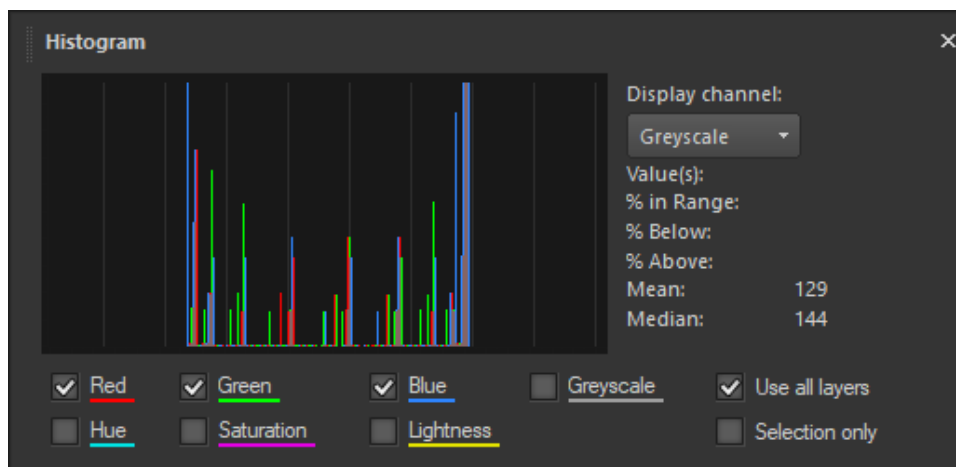
- ◆ Halos

- Bright areas around high contrast edges
- Dark areas around edges occur, but are less noticeable

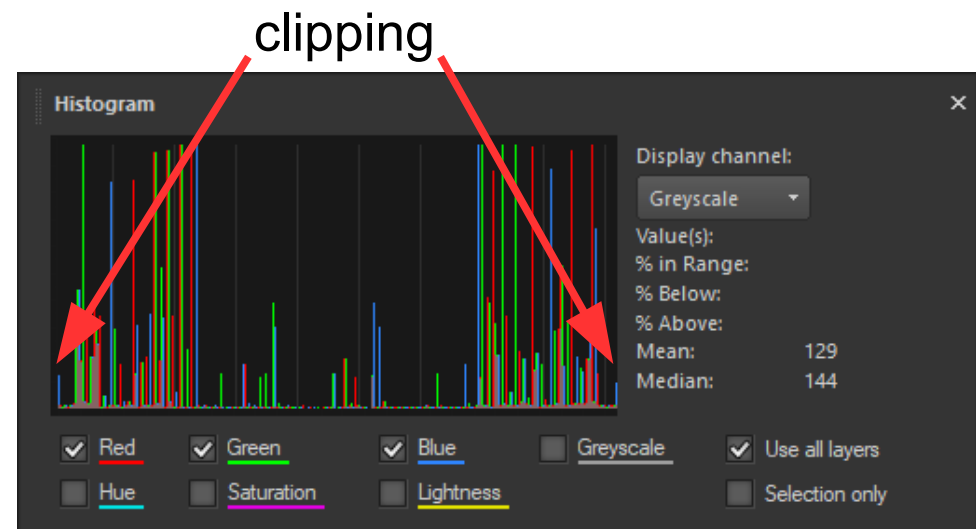
- ◆ Clipping

- High contrast edge sharpening may cause bright areas to clip
- Clipping → pixel value at the minimum or maximum value

Note: When pixel values clip information is lost. This can happen during exposure, and in post-processing. If no further processing done some clipping may be okay, but too much is obvious as blown-out areas.



gaussian blur 2



gaussian blur 2 + usm 6_200_5

Digital Image Sharpening

Note: Radius of 6 is high, done for demo purposes.

Sharpening images

- Issues

- ◆ Halos

- Bright areas around high contrast edges
- Dark areas around edges occur, but are less noticeable

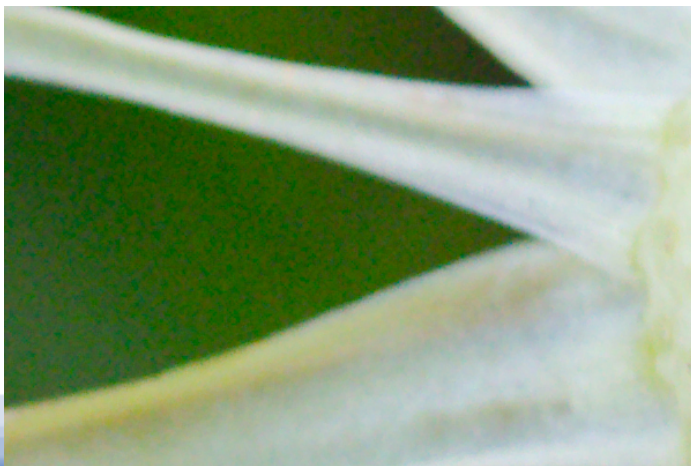
- ◆ Clipping

- High contrast edge sharpening may cause bright areas to clip
- Clipping → pixel value at the minimum or maximum value

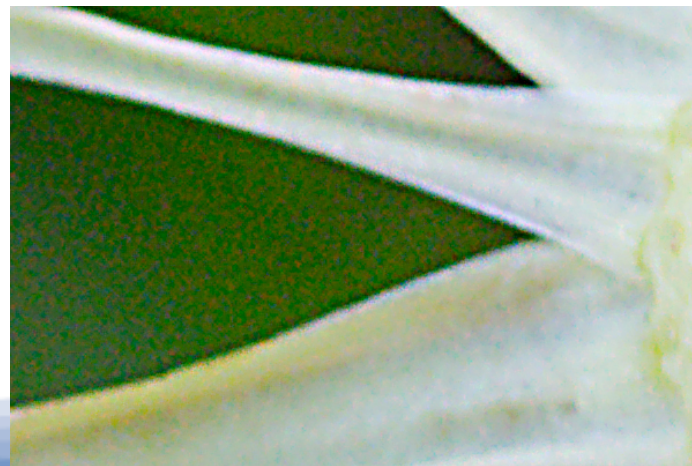
- ◆ Noise emphasis

- Any noise will be more prominent → do noise reduction first

ISO
800



ISO
800



USM
6_150_5

Digital Image Sharpening

Note: Prints are usually given more sharpening because printing introduces its own amount of softness.

Sharpening images

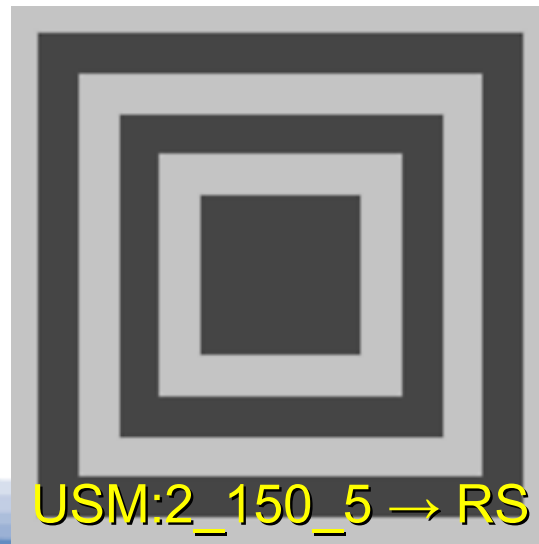
- Unsharp mask settings
 - ◆ I use this taken from a photography magazine:
 - Radius (Amount) = 1.5
 - Strength → I use 67 to 100, maybe 50 or 125, 125+ for prints
 - Clipping (Threshold) = 5
 - ◆ One suggested method
 - 1) Set Strength to maximum, Clipping to minimum
 - 2) Increase Radius until halos become too obvious
 - 3) Back off Radius until halos disappear
 - 4) Lower the Strength to a more reasonable value
 - i. 150 to 200 for prints
 - ii. 50 to 70 for email and web
 - 5) Increase Clipping value to limit sharpening to areas that need it
 - 6) Use “Luminance only” (“Luminosity” mode) if color shifts occur

Digital Image Sharpening

Sharpening images

Note: Some people divide sharpening into 'capture sharpening', creative sharpening', and 'output sharpening' done at different points in post-processing.

- **When to sharpen?**
 - ◆ **Other edits should be done before sharpening**
 - Sharpening (usually) costs detail, so it should be done last
 - ◆ **Sharpen then resize?**
 - Resizing reduces halos and noise emphasis
 - ◆ **Resize then sharpen?**
 - Resizing can reduce sharpness, so some sharpening can bring it back
 - This is the recommended way, but I still have reservations



Digital Image Sharpening

Sharpening images

- **Topaz Sharpen AI**
 - ◆ **Price: \$80**
 - ◆ **Models**
 - Motion → for motion blur
 - Focus → for missed focus
 - Softness → for giving images that extra 'pop' (finely detailed features)
 - ◆ **Model variants**
 - Normal
 - Very noisy
 - Very blurry
 - ◆ **Best approach is to audition the options**
 - Use split screen mode to audition the models
 - After choosing a model, audition the variants

Note: Topaz has a bundle of Sharpen AI, Gigapixel AI (upscaling tool), and DeNoise AI for \$199. They can be used as plugins or standalone.

Digital Image Sharpening

Sharpening images

- Topaz Sharpen AI motion
 - ◆ The only option for motion blur
 - ◆ Works well when it works, but don't expect miracles



before



after

Digital Image Sharpening

Sharpening images

- Topaz Sharpen AI motion
 - ◆ The only option for motion blur
 - ◆ Works well when it works, but don't expect miracles
 - ◆ My test → handheld high ISO closeup
 - Topaz has recovered more detail, but it's not totally sharp

Note: My Topaz Sharpen AI examples have a watermark because I am using a trial version. Also, I am using the preset values for the models – tweaking parameters may give better results.

handheld ISO 800



shutter 1/50 f/4



PSP USM:2_150_5



Topaz Sharpen AI - motion

Digital Image Sharpening

Sharpening images

- Topaz Sharpen AI motion
 - ◆ The only option for motion blur
 - ◆ Works well when it works, but don't expect miracles
 - ◆ My test → handheld high ISO closeup
 - Topaz has recovered more detail, but it's not totally sharp
 - Much better to use a flash → higher shutter speed, bigger *f*-number

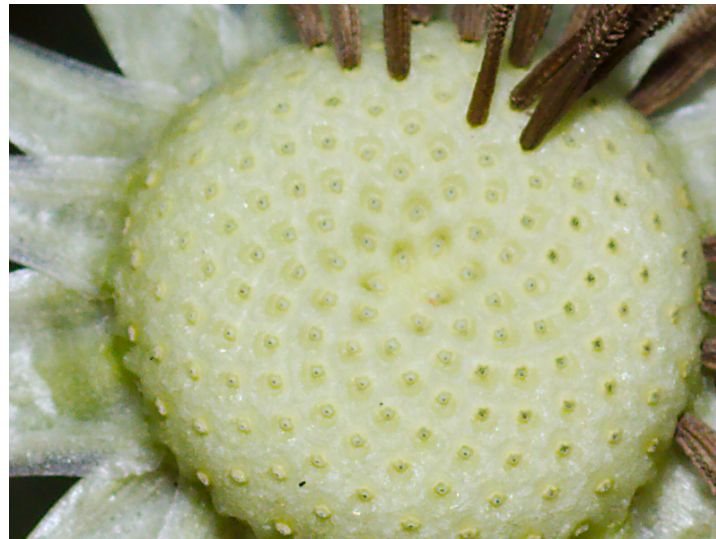
Note: Although a flash provides better shooting conditions, the lighting is different, and may be inferior in other ways → another photography tradeoff.

handheld ISO 800



shutter 1/50 f/4

handheld flash ISO 200



1/250 f/7.1 USM:2_150_5



Topaz Sharpen AI - motion

Digital Image Sharpening

Sharpening images

- Topaz Sharpen AI focus

- ◆ Topaz claims this is the most difficult recovery

- “Won’t recover 100% of your photos”
- “When it works it can completely recover a throwaway image”

Note: Some image editors now include a re-focus and/or DOF modification tool. DOF mod may simply be a selective blur tool for reducing DOF, or a tool that can increase DOF.



before

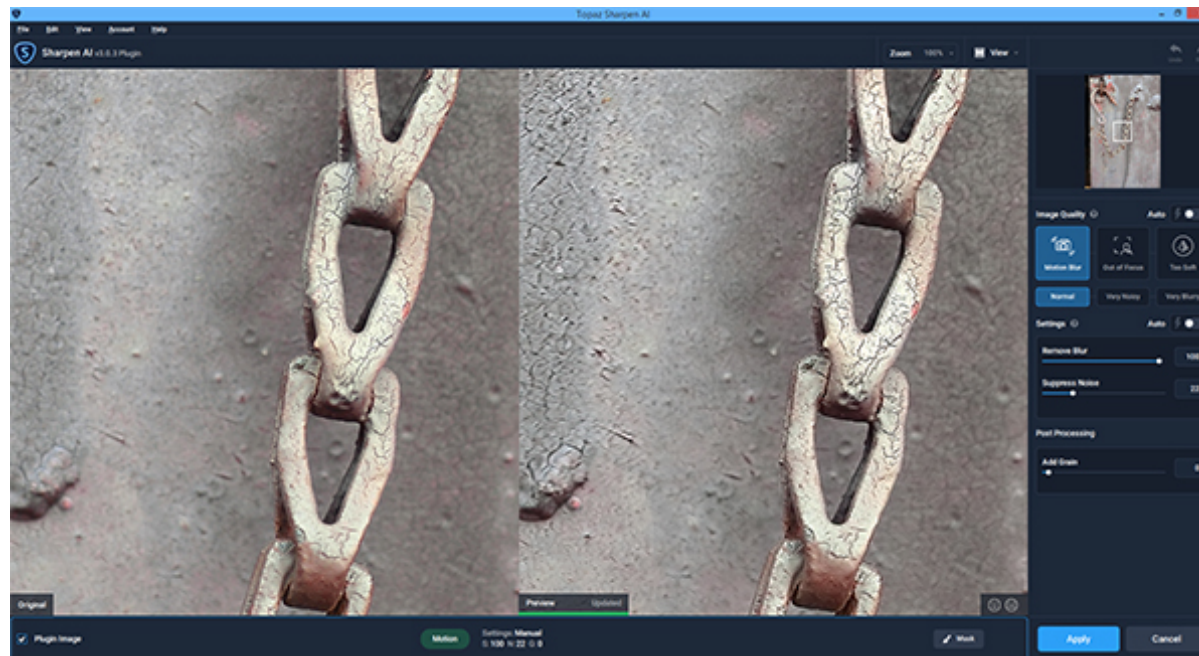


after

Digital Image Sharpening

Sharpening images

- Topaz Sharpen AI softness
 - ◆ Result is 'similar' to unsharp mask
 - Topaz claims fewer artifacts
 - USM is a global tool → all edges are treated the same
 - Topaz → supposedly more specific due to image 'understanding'



before

after

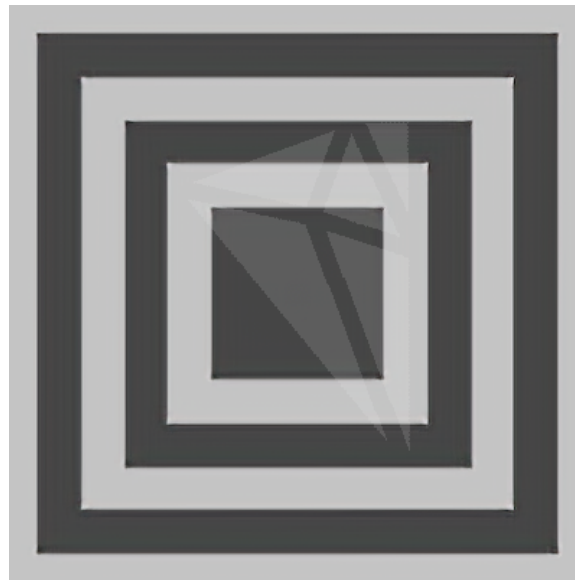
Digital Image Sharpening

Sharpening images

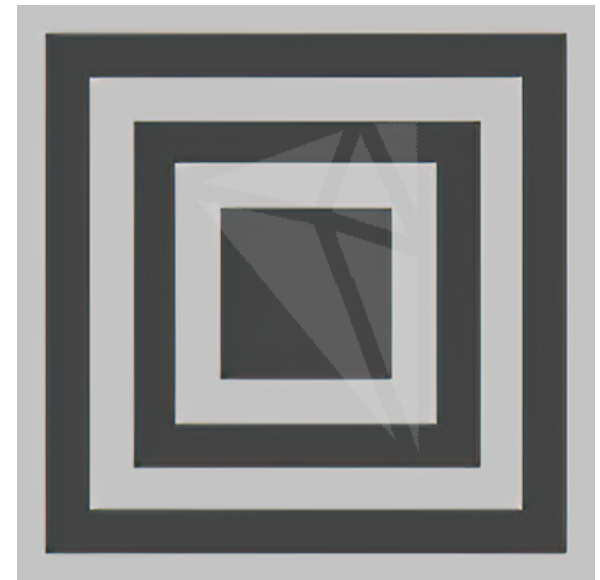
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 - Topaz → supposedly more specific due to image 'understanding'
 - ◆ My test → good results, motion better than softness



gaussian blur 2



AI softness - very blurry

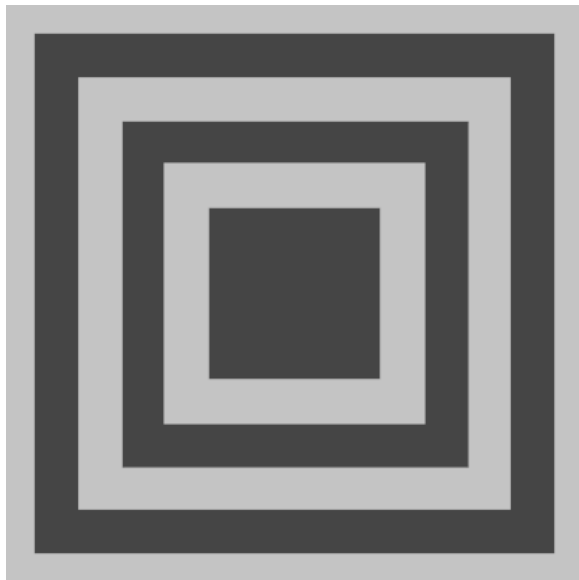


AI motion - very blurry

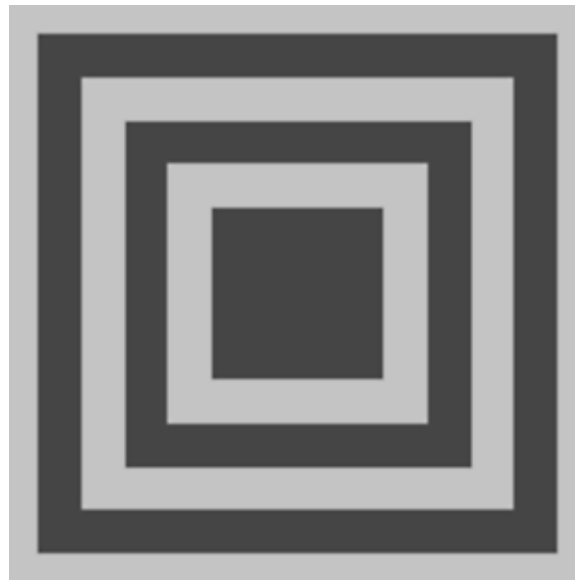
Digital Image Sharpening

Sharpening images

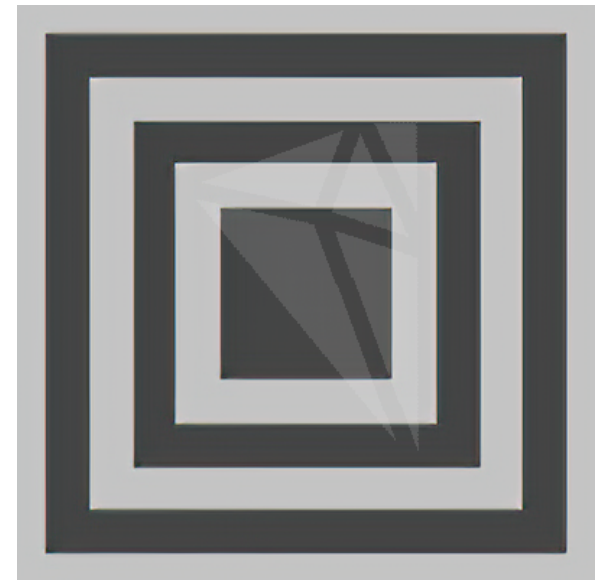
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original



USM:2_150_5 → RS



AI motion - very blurry

Digital Image Sharpening

Sharpening images

- Topaz Sharpen AI

- ◆ Is it worth it?

- Many reviewers say “Yes!”, and based on initial tests I agree
- It can definitely do things other tools cannot
- It may not always produce the dramatic effects shown in examples
- If it can 'rescue' several images a year it would seem to be worth it
- Careful with DOF & avoid motion blur → USM may be good enough

Note: Images taken while traveling are precious, as you may never get the chance to take them again → 'rescuing' these images may be worth the cost of Topaz Sharpen AI.

Digital Image Sharpening

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