Booklet #14: The Northern Virginia Alliance of Camera Clubs

HOW TO IMPROVE PICTURE SHARPNESS

by

Andy Klein

PREFACE

The Northern Virginia Alliance of Camera Clubs (NVACC) is an informal organization started in 1997 by Joseph Miller with the assistance of Dave Carter and Ed Funk. Our purpose is to promote communication and cooperation among camera clubs. We accomplish this by (a) publishing a monthly calendar of the member clubs' activities; (b) conducting training seminars for photographic judges; (c) maintaining a registry of trained judges who serve the clubs' monthly competitions and critiques; and (d) maintaining a directory of speakers who have been recommended by the various clubs. You can learn more about NVACC by going to our web site at www.NVACC.org.

This booklet is one of a series that was developed by NVACC during the period 1998-2008 to capture the considerable expertise of the many accomplished photographers in Northern Virginia and share it with others. Over recent years, we have seen significant change in the photographic art form and very rapid technical advance in both the media of photography (film and digital) and the tools (cameras, lenses, computers, and software). For that reason, the detail of some of these booklets may seem "dated", although the ideas and techniques presented transcend "progress" and the digital-film divide. Watch the NVACC web for new booklets as well as revisions that incorporate new technology and ideas into the existing ones.

Originally, our booklets were made available through member clubs for a small fee that covered the cost of reproduction. Now, however, the booklets are available on www.NVACC.com where individuals may download one machine-readable copy and one print copy per page for personal, noncommercial use only. Written permission from NVACC is required for any other use.

If you would like to know more about NVACC or have questions or suggestions concerning our booklets or services, please feel free to contact us at JoeMiller@NVACC.org.

How to Improve Picture Sharpness

Image sharpness is essential for high quality images. Just listen to the judges when they differentiate the "ins" from the "outs". This does not mean that intentionally blurred images, soft focus, and other creative techniques do not produce wonderful images. They do. Creative techniques follow from the ability to create tack-sharp images. If you can create crisp sharpness when you want to, you can then overlay unsharpness when that is your creative wish.

Material in this booklet is organized around seven areas that affect sharpness: cameras, lenses, film, shooting, projection, the wet darkroom, and the electronic darkroom. Remember that an image can only be as sharp as the least sharp element in the chain. Sharp lenses cannot overcome an unsteady camera, and a sharp negative cannot overcome an unsharp enlarging lens or an unsteady enlarger. As you consider what to do to enhance your image sharpness, you must do it all!

Cameras

The camera body is a critical part of the image making process. It holds the film, sets the shutter speed, allows you to focus the image, and in most cases measures the light reflected off the scene that passes through the lens.

Variations in the camera have an impact on sharpness. No wonder camera choice is so hard!

Camera type, vibration, and negative size. Modern single-lens reflex cameras have a moving shutter and a mirror that pops up and then snaps down. Dampened shutters and mirrors greatly reduce vibration. Generally, "better" cameras do a better job at dampening their mirrors and shutters. The mirror is the big vibration culprit. This is why fully featured SLRs have mirror lockup capability. For critical sharpness, especially in macro photography, mirror lockup can make a big difference.

Range finder, twin-lens reflex, and view cameras do not have the moving mirror. The shutter may add some vibration, but not much. In-the-lens leaf shutters are virtually vibration free. Focal plane shutters, if well dampened, have very low levels of vibration. If your camera is relatively silent when the shutter is released, the mirror-shutter combination is probably well-dampened and creates minimal vibration. Trip the shutter with the lens off the camera and/or the back open. Compare the noise to other cameras. The quieter one wins.

Mechanical cameras are built like the famous Swiss watches from largely a bygone era. The elegance and beauty of such precision instruments are wonderful. The mechanical timing mechanisms set up by a series of gears, releases, springs, and wheels create vibration. Electronic cameras have no vibration from their chips and electrons. Not only

do the electronic systems produce more precise timing and exposure calculations, they will, other things being equal, produce sharper images than mechanical cameras, especially at slow shutter speeds during which the mechanical wheels and gears are active for longer periods.

Shutter releases that trip a mechanical release can jar the camera. Quality cameras with mechanical shutter releases smooth out the release a great deal. Electronic shutter releases that close a switch usually have a decreased chance of creating camera movement. Of course, squeezing the shutter release, not stabbing at it, reduces camera movement and improves image sharpness.

Mechanical self-timers with their whirring gears set up insidious vibrations. Of course, the higher end mechanical cameras are likely to be dampened to minimize mechanical vibrations. Electronic timers have no such problems.

Lens mounts align the lens with the film plane. The goal is to have the plane of focus identical to the plane of the film. Solid lens mounts made of chromed brass or stainless steel held in place with multiple screws on rigid camera bodies are best. Professional camera bodies tend to have rigid bodies and therefore often heavy bodies to ensure that the lens stays aligned with the film plane, even when bumped. Once alignment is disturbed, the image will not be in focus from edge to edge. With deep depth of field the out-of-focus part of the image may not be noticeable. With high-speed lenses wide open the shallow depth of field can leave one edge in focus and another edge of the image out of focus.

Be sure the pressure plate that presses the film against the film rails in the back of the camera is actually pressing evenly across the film rails when the camera back is closed. If it is uneven, the film can buckle and the image will be unsharp.

Camera size matters. Ultra-small cameras are prone to shake when hand held. Lift a solid pro-level camera and note its heft. It actually is easier to hand hold a heavier camera steady than a light one. What is heavy and what is too heavy is an individual matter. Find a camera that has a "good feel" for you, allowing you to gently squeeze the shutter release without bobbing the camera up and down. Of course, putting any camera on a tripod solves the shake problem. Be sure the tripod is big and heavy enough to properly brace your camera and largest lens combination.

Focusing Screens. Sharp images are made when the image is sharply focused on the film. Focusing screens help you focus sharply. Bright contrasty focusing screens help even more. Most SLRs come with fresnel focusing screens. The image goes from soft to in-focus. Bright screens snap in and out of focus better than dim screens. Better cameras have brighter focusing screens. There are several after-market manufacturers of bright focusing screens and if your camera allows, brighter screens can be exchanged for less-bright screens.

The maximum aperture of a lens is also very important. An f/1.4 lens creates a brighter

image to focus than a f/3.5 lens. If you are struggling to focus your *f3.5-f5.6* zoom lens, try a high-speed single focal length lens and watch your focusing screen snap in and out of focus. It is a delight to watch.

As the camera industry responded to consumer interest in zooms, most of which have as the widest aperture f3.5 or slower, it became necessary to help people focus. Focusing screens were so dim that focus assist and autofocus became necessary.

With rangefinder or view camera on-the-film-plane focusing, the light is bent and reflected less than in an SLR. In an SLR the light reflects off a mirror, bends several times through the pentaprism and then exits the viewfinder. This light brightness loss in most SLRs is about 2 stops. There is almost no loss of image and focusing brightness with rangefinder cameras. Slow lenses compound the light loss and focusing problem.

You can buy critical focusing devices that attach to the viewfinder. These are magnifiers that allow the photographer to better see the focusing screen. When creating pictures with very shallow depth of field these devices can be very helpful. They are especially useful in macro photography.

Split image SLR screens show a line as broken when the image is out of focus and the line as connected when in focus. Rangefinder camera focusing is based on this split image approach. The human eye can more readily see the split image merger than it can see a fresnel screen's soft-to-sharp focusing. For SLRs with interchangeable screens you can substitute a split image screen. Longer focal length zooms with small apertures can cause half the split image to black out, disabling the split image focusing. If your eye is exactly in line with the split image part of your camera screen, the blackout goes away. All this can be a nuisance. The best SLR solution for obtaining precise focus is a highspeed zoom or single focal length lens with a fresnel screen.

Meters *and Metering.* If the scene if properly metered for the film in the camera, the film will exhibit it's maximum potential. Cameras with no meters require very good knowledge of film and light. With films that have exposure latitude or forgiveness, experienced photographers can do fairly well without a meter. For more demanding or precise exposures a supplemental hand-held meter is needed.

Most cameras come with built in meters, often more than one type, e.g., matrix, center, and spot. Matrix meters are good for "average" scenes, but you may struggle to get precisely the exposure you want, or to achieve the dramatic effect a selective exposure might produce. Matrix meters measure several areas of the picture space and average the pattern of light and dark. Matrix meters have proven themselves generally accurate for most scenes. But creative exposure or exposure for a particular effect requires overriding the system. If you can see or know the biased area you can meter the important segment of the scene and make adjustments to expose the scene as you wish. Center weighted meters are like averaging meters but with more of the exposure emphasis based on the center of the camera's field of view. Spot meters measure a

small area of the scene. Spot meters allow precise determination of exposure and the ability to set the exposure to produce just the effect the photographer wishes. If exposure control is your goal, a spot meter is your tool. If sharpness is your goal, precise metering is what you want. Pick the meter that fits the situation, learn about 18% gray and how a meter "sees," and you can get good exposures and maximize the sharpness the camera, lenses, and film have to offer.

Lenses

The image is created by light passing through a lens. There are many things about lenses that impact sharpness. Here are a few.

Single focal length vs. zooms. Why haul half a dozen single focal length lenses around when you can do it all with a zoom? If you are willing to sacrifice (usually) lens speed, you must assess the other factor — the loss of sharpness. Pound for pound, single focal length lenses are sharper than zooms. The optical formulas are less complex, the number of image deteriorating lens-to-glass surfaces are fewer, and zooms are, by definition, a collection of moving pieces of glass and mechanics. It takes a lot of expensive materials, precision engineering, and meticulous assembly to make a zoom that approaches single focal length lens optical quality. You get what you pay for, which means that high quality lenses — both zoom and single focal length from the best manufacturers — will usually outperform others.

Zooms also are heavy and generally larger than their fixed focal length counterparts. They take more bracing and a faster shutter speed than a comparable single focal length lens to get a comparably sharp image. If image quality is your passion, try a quality single focal length lens. You will be delighted.

F-stops. Lenses offer maximum sharpness at select *f*-stops. Usually this is one or two fstops down from the lens' maximum aperture. So a /2.8 lens is likely to be best at /4 or /5.6 and a /5.6 lens may be best at /8 or fl 1. Read lens tests in selected magazines for general guidance and remember each lens is unique, although lenses from better manufacturers tend to be more consistent from one lens to the next. If sharpness is critical, stop down a stop or so from maximum aperture, light permitting, and shoot.

Shutter Speeds. Shutter speed alone does not affect sharpness, except as noted above in some mechanically driven cameras. But shutter speed does affect sharpness if the shutter moves slowly enough that camera movement or subject movement is recorded on the film. A rock-steady camera will produce sharp pictures at any shutter speed. Only image movement (e.g. flowers blowing in the wind) will be recorded as unsharp and then you could argue you have correctly captured the movement of the flowers. As camera movement increases due to vibration, wind, or because the camera is hand-held, higher shutter speeds are needed.

Technology. Some lenses by Canon contain electronics which sense lens movement and counteract that movement by adjusting the lens. Tests have shown that these image-stabilization lenses are quite good at reducing lens movement. For hand-held shooting, these lenses can improve sharpness.

Camera stabilizers or gyros are expensive devices used mostly in aerial photography to keep the camera steady even where there are lots of movement and vibration.

Multi-coating. Multi-coating refers to multiple thin deposits of chemicals placed on the surface of a lens element. Manufacturers have found that different coatings, often multiple layers of coatings on element surfaces, improve the passage of light. Clear, crisp, undiffused light transmission produces sharp images. Buy lenses that have high quality, multi-coated surfaces.

Exotic glass. Lenses can come with aspherical glass and extra low dispersion glass. These add cost, but add to sharpness. Aspherical lens elements are non-symmetrical in shape. Their shape is designed to place the image precisely on the film plane. Without aspherical elements the image may not be uniformly placed on the film plane. Low dispersion glass reduces the diffusion of the light enhancing light transmission. Undiffused light is sharper light. Lenses with aspherical lens elements and low diffusion glass produce the best images modern technology has to offer.

Reflection and Flair. Reflection and flare deteriorate image quality. Lens hoods and clean lens elements reduce reflection and flare. Filters add two air-to-glass surfaces to your lenses. Every such surface diffuses the light and, therefore, the image. Use filters sparingly. Use high quality filters made of photographic quality glass, mounted firmly in brass or steel mounts, and multi-coated like the best lenses. Don't compromise on your filters. You are compromising on image quality. Remember that image quality is only as good as the weakest link in the photographic chain.

Lens hoods block stray light from hitting the outer lens element at an angle. Light hitting glass at an angle bounces around, softening the image. Use the deepest lens hood you can that does not cause vignetting. The increase in saturation of the colors can be seen in the viewfinder, and your film will record sharper, crisper images.

Cleanliness is next to godliness. Dirty, smudged lens elements produce less sharp images. Keep the front and back elements of all lenses clean. Clean with great care so as not to scratch or abrade the elements in any way. After gently blowing off any large bits of dirt, use cleaning fluid placed on cleaning tissue or micro fiber cloth and then lightly clean the lens. DO NOT put cleaning fluid directly on the lens element, and DO NOT use anything but photographic quality lens tissues or micro fiber cloths.

Shooting

Shooting is where the equipment, the scene, and the photographer all come

together.

Tripods. Some will say never handhold your camera and always use a tripod. If you hand hold your camera (most of us do at least some of the time) shoot with the shutter speed no slower than 1 over the focal length of the lens. For a zoom lens, use 1 over the focal length you are using. For example, for a 200mm lens, shoot at 17250 or higher. For a 50mm lens, shoot at 1 /60 or higher. You will get decent sharpness if you do this. Also be sure to squeeze the shutter release carefully, and brace the camera with your body, as suggested later in this booklet.

The bigger and heavier the tripod the better it will absorb vibration and keep your camera rock steady. But big, heavy tripods often get left at home or in the car, and then they do not help you get sharpness. Experience suggests that a tripod of no less than six pounds (legs and head combined) is satisfactory. A quick release device to make it easy to get your camera on and off the tripod will help you use it more often. A tripod that does not take much time to set up and collapse will be used more often. Flimsy tripods can wiggle around and pass along the tiniest vibration. Always brace light tripods by adding some push toward the ground with your hand, especially if it is windy. Be sure the tripod and tripod head are strong and heavy enough to handle your camera and largest lens.

If the surface the tripod stands on vibrates, or if the wind is blowing, add bracing to your tripod. Put your hand on it and push down or add a stable weight. Do not hang your camera bag from the tripod. A swinging camera bag will not help you keep things steady!

With lenses over 200mm, a second support may be needed. In this way both the lens and the camera body are supported. Having a long, unsupported lens extending in front of the camera body creates a big target for the slightest breeze or vibration.

Other *Supports.* Monopods have an impact when hand-holding is compromised by extra large lenses or when the photographer is moving around a lot. While a monopod can help, it is a poor substitute for a tripod.

Table-top tripods are miniatures of big tripods. They can do a lot to brace and steady a camera. Find a solid surface and hold them steady against that surface. Table-top tripods are better than monopods.

Gunstock braces look like rifle gunstocks with a camera mount on the top. These can help you handhold long lenses more steadily. They are not as good as a tripod, but when you must handhold, they do help.

Using a windowsill, door jam, car hood (engine off), rock, fence post, or other solid surface as a brace also can steady a camera. Place the camera on the surface gently, then hold it solidly against that surface. Using a beanbag or even a wadded up coat or sweater protects and cradles the camera, making for a more adjustable yet somewhat

braced camera.

If you are hand-holding your camera for a picture, tucking your elbows in, pushing the camera against your face as you look through it, taking a breath, releasing the breath half-way, holding it for a second while you release the shutter, all help reduce camera movement.

Try to be a human tripod. Lean against something, legs apart. Or get down on your knees, or in any position that allows you to have tripod-like steadiness.

Subject movement. The faster the shutter speed the more frozen is subject movement. The more frozen the movement, the sharper the image. If you want sharpness, use the highest shutter speed you can for the light available.

Depth of field. Big lens openings, denoted by small numbers (fl.2, fl .4, f2.8) produce shallow depth-of-field. This means that what is rendered sharp in front of and behind what you focus on is rather limited. Small lens openings, denoted by large numbers (fl 6, *f22,* f32) give greater depth-of-field. If you want a sharp image, front to back, use a small lens opening. If you just want what is of interest to you to be sharp, use a large lens opening.

Focal point. To increase the perception of sharpness and make images jump out as crisp and sharp, selective focus is used. By identifying the important point of critical sharpness in an image, and letting other elements of the image be soft, the selected area appears sharp. This point of critical focus, or focal point, is that part of the image you want the viewer to really see, or see first. The flower that appears razor sharp and pops out of a soft background is clearly the focal point of the picture.

Atmospherics. As a general rule, cold or really dry air renders images sharper than warm moist air. The further away the subject is you are shooting, the more moist air the light must transverse and the softer the image. While this can be a beautiful image; it is not as sharp as an image shot in cold or dry air.

Contrast. A sharp demarcation in the image between light and dark creates an impression of sharpness. Crisp image lines improve the sense of sharpness.

Quality of Light. Light quality is the combination of atmospherics, contrast, angle, and intensity of the light. Light that strikes the surface from an angle or the side increases the line of demarcation and adds surface texture. This angular light creates sharper appearing images than does softer, diffused light. Light that creates sharp shadows and a strong delineation between shadow and light produces perceived sharpness. Photographers use harsh light to create "masculine" portraits and soft, diffused light to create appealing, "feminine" portraits. Choice of and/or control of the light allows the photographer to choose the sharpness the fits the subject.

Flash. An electronic flash produces a bright light for 1/30,000 of a second or less. It is during this short time that the image is formed. With such a short exposure it is no

wonder that flash allows a photographer to capture a speeding bullet or the beat of a hummingbird's wing in frozen sharpness. If you want a sharp image, and you have the image in focus, flash will give it to you. With the advent of electronic fill flash many photographers use their flash almost all the time, dialing the power back so as not to overpower the ambient light, but to ensure sharpness.

Shutter release. Squeezing rather than stabbing at the shutter release helps keep the camera steady. Remote releases, especially electronic ones, do not move the camera. Learn to release the shutter with a soft, smooth, squeeze, bracing the camera so that it does not move as you push the release.

If you cannot release the shutter without the camera jumping, get the camera release adjusted, if it can be adjusted. There are soft-release buttons that screw into the cable release socket at the top of some release buttons. These do help.

Film

Film choice is a major factor in image sharpness. There are many factors that contribute to sharper images.

Speed Slower films have finer grain structures than fast films and, therefore, produce sharper images. Don't use a fast film unless you need to record an image in low light or if you want grain to add texture or mood to your image.

Film size. When images of equal size are made from different size pieces of film, the larger piece of film will produce a sharper image. Thus, an 8x10 print or a 30 x 20 projected image made from a 2-1/4 x 2-1/4 negative or slide will be noticeably sharper than from a 35mm negative or slide.

Contrast. Film comes in different contrasts. Usually high contrast film is used for copy work. It is used because it renders sharp delineation between light and dark. Using this film for architectural work can produce some very sharp images. Using high-contrast film can also produce images without the full range of grays. You can have fun and create some really dramatic images when using high contrast film.

Age of film. Film is made of various chemicals. Chemicals migrate, that is, move around, and in so doing over time mix with surrounding chemicals. This deterioration is the loss of the film's engineered characteristics of color, palette and sharpness. Film is at its maximum sharpness when it has aged a precise amount of time since manufacture. This peak age varies for different types and speeds of film.

When sharpness is of critical importance, shoot with fresh professional film. Professional film is released by the manufacturer at its peak. Like most films, it should be kept refrigerated to hold it at or near peak. Amateur films are released when they are manufactured. They may age to peak on the dealer's shelf. Film that is out of date will not produce its designed sharpness or color balance.

Processing. Earlier it was stated that image sharpness is only as good as the weakest link. Always have your film developed by a quality processor.

If you have a processor develop the negatives and then make a print for you, be sure to use a place that keeps fresh chemicals in the correct balance. Also be sure the processor uses quality enlarging equipment and paper.

If you want maximum image quality of prints, you will want to do your own darkroom work, using fine quality enlarging lenses, chemicals, etc. See more on the darkroom, below.

Slides vs. prints. Slides are originals. The image is what the film captured. Each time there is a generation away from the original, image quality declines. Slides are sharper than prints. When you start projecting slides, the ratio between the size of the slide to the projected image size can be very large. The more you enlarge the image, the less sharp it will appear. Also, the surface upon which you project the image will affect how sharp it appears to be. See the section on projection, below.

Projection

Once you have created a slide, serious photographers project the image. Again, sharpness is only as good as the weakest link.

Projector. A projector must hold the slide in good alignment with the projected light, the lens, and the screen. Make sure your projector is well maintained and nothing inside has come loose or come out of its rails. Make sure the projector is clean. The lenses inside the projector (yes, inside) focus the light. They need to be cleaned from time to time. This is a tricky process and only if you are very careful and really know what you are doing should you do this yourself. Fingerprinted, smudged, or oily lenses are going to degrade the image. If they are dusty, use a gentle air blower to clear the dust away. Use the right lamp for your projector. Too much wattage and you can melt the slides. Too little wattage and your slides will look dingy.

Projector Lens. A cheap projector lens, especially if it is plastic, is akin to viewing your images through the bottom of a jar. Use as good a lens on your projector as you can. Otherwise, why bother with high quality camera lenses. And keep the projector lens just as clean as your camera lenses.

Slides. Sharp slides project sharp images. What looks sharp on the light table should be sharp when projected. Make sure the slide is clean. Use a soft puff of air for dust and a slide cleaner for smudges. Always keep hands off the image area.

Projection Screens. The sharpest screen for projection is a matte screen. A very smooth wall painted flat white works well. Projection should be done in a dark room with no extraneous light.

The popular beaded screen is better at brightening up an image, even when there is stray light. But the beading makes the image soft and less sharp than the matte surface.

Ektalite screens are 15 times brighter than matte screens and second only to matte screens in sharpness. They are really great, but expensive, hard to transport, and fragile.

Wet Darkroom

We have touched on processing by outside labs. Here we talk about what affects sharpness in the darkroom.

Enlarger. The enlarger needs to be very firmly anchored to the wall or to a baseboard with a solid beam to support the enlarger head. The wall and/or table the enlarger is on needs to be vibration free. Watch out for air conditioners, refrigerators, and other devices in the house that set up vibrations.

Enlarger adjustments should work smoothly. After an adjustment, give the enlarger a minute to resettle before turning on the enlarging light. Be careful with enlargers having cooling fans in the head which can cause vibrations.

Lenses. Like the projector, an enlarger uses internal lenses (condensers) to focus the light. These must be clean and in alignment. The negative holder should be clean and aligned with the enlarger head and the lens board. Everything in the enlarger should fit snugly.

The enlarger lens should be of the same quality as your camera lenses, for reasons which are now obvious. And keep it clean.

The negative. Make sure the negative is clean. A soft puff of air will get rid of dust. For smudges use a special negative cleaner. Keep hands off the image area.

Image size. The more the image is enlarged, the grainier it will appear. Also, the larger the image the more any image softness will be magnified. Few 35mm negatives do well enlarged beyond 11x14 inches unless great care is taken in the enlarging process and the negative is extremely sharp.

Focusing, papers, and chemicals. Sharp focus can be achieved with a grain magnifier. Use an enlarging easel that will hold the paper flat so the image will be focused sharply edge to edge. If you cannot get it sharply focused edge to edge your enlarger may not be aligned with the easel or the negative carrier may not be aligned with the easel.

Higher contrast papers tend to give an impression of greater sharpness because they emphasize lines between light and dark. Sometimes you can salvage a soft image with a higher contrast paper, or a higher contrast filter with multi-contrast papers. But this may not be the look you want. Higher contrast comes with a price. Higher contrast can cause highlight and shadow detail to drop out from the image. Finding the best balance

between exposure and contrast is a difficult choice.

Clean, fresh chemicals process the image in a way that takes full advantage of the negative's potential and the paper's ability.

Electronic Darkroom

The transformation of film to an electronic image reduces sharpness. Not only is the image in the computer a generation away from the original, the process is one where the image is transformed into dots. Multiple scans and reproductions from slide/film to CD, from CD to computer, from computer to printer, from printer to paper, is a multi-generational process bound to show a difference from the sharpness on the film. When the scan/printer has many dots for the image size, the image will be closer to the original in sharpness. Fewer dots can make a sharp negative or slide look like a newspaper quality image.

In the computer there are programs that allow you to enhance sharpness. These edge-enhancing functions work very well. They are a way to make up for image sharpness problems you were unable to control when you took the picture. These programs have their limits. A sharp image on the film is always going to give you a better final image, even in the electronic darkroom.