

Advanced Digital Camera

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Topics for Advanced Session

- All about the mysterious **White Balance**
- **Megapixels** and image size
- **Discussion of Aperture and Depth of Field:** Aperture mode is the most common mode used by professionals. The control over Depth of Field is a major reason for this preference.
- **ISO & Noise Factor:** Noise is an issue with digital cameras partly generated by the camera's ability to change the **ISO** setting.
- **Auto Bracketing:** How to improve on the guess factor when using non-automatic modes of the camera.
- **Exposure Value (EV):** adjust that allows for a more accurate exposure.
- **Exposure Metering:** spot, center-weighted, matrix or evaluative, and average metering.
- **Auto Focusing (AF):** single mode, servo mode
- **Histogram:** Reading histograms and making camera adjustments for an improved photo. Explanation of the "live" histogram.

Advanced Features & Functions

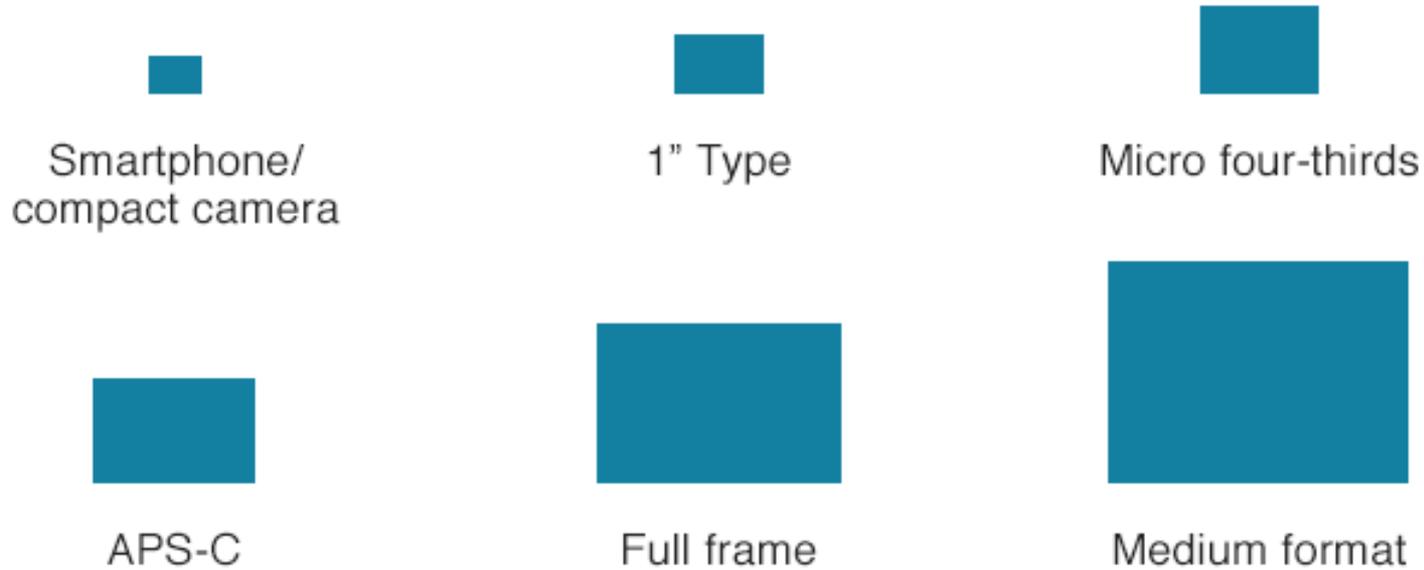
- **Program AE (P):** camera automatically sets the aperture and shutter speeds while allowing adjustment of WB, ISO and other various settings.
- **Aperture Priority (A):** the camera selects the best shutter speed for the scene and allows changing of the aperture. This mode provides more control over the depth of field environment.
- **Shutter Priority (T or S):** the camera selects the best aperture for the scene and allows the changing of the shutter speed. This mode is more commonly used in motion environment such as sporting events. This mode is rarely on the cheaper point-and-shoot digital camera.

Technology Advancements

- **Improved Focusing Mechanisms:** cameras automatically select the best focal point or let the photographer do the selection. Some modern cameras have hundreds of focal points.
- **Improved Noise Reduction:** many modern cameras can be set to reduce any noise introduced into the image while the image is being saved. This technique is far superior to letting software reduce the noise after the fact.
- **Full vs APS-C Cameras:** Use Full Frame (FF) cameras when high resolution and depth of detail is needed. Generally used by professionals. The smaller size APS-C sensors, used in most digital cameras today, is more the adequate for high quality consumer and prosumer photos.

Technology Advancements

Camera sensor sizes compared

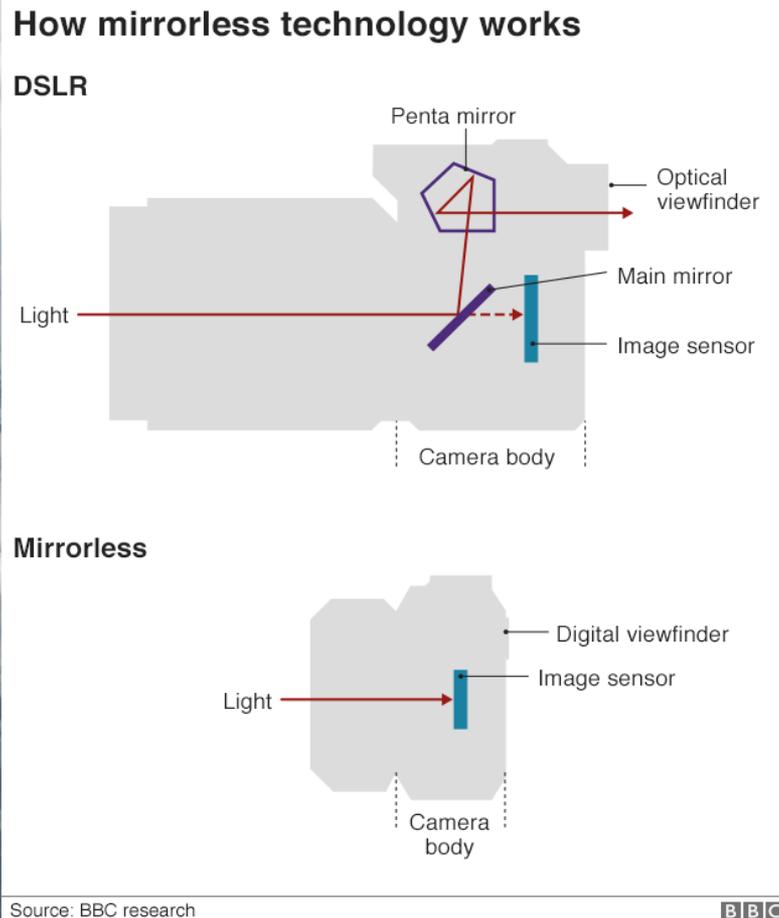


Source: BBC research



- Image provided courtesy of Reuters

Technology Advancements – Mirrorless Cameras



- Image provided courtesy of Reuters



White Balance



•White Balance is the camera's ability to correct color and tint when shooting under different lighting conditions such as outdoor (sunny, cloudy) and indoor (no light, tungsten or florescent.) Most cameras that allow WB to be changed have the following settings: Auto, Sunny, Shade, Cludy, Fluorescent(1-5), Tungsten, Night, and Custom. Some newer cameras have over 20 WB settings.

•The human eye can distinguish a color, especially white, under any light conditions. Digital cameras react differently to color and lighted conditions than the human eye. A photographer using film must either use different types of film for different lighting conditions or use lens filters. The digital camera reacts completely different from the human eye and photographic film. The digital camera has no human factors and does not have preference for color tinting like photographic film. Therefore, the **White Balance** philosophy was developed to give the capture sensor a reference point for the photo.

•White Balance must be correct for the color rendition of your image to come as close as possible to what your eyes actually see!



More on White Balance



- If you can take a photo with your camera and print it out and all looks “well” in the automatic mode then you are one of the lucky ones. This means that the camera, in automatic mode, has excellent white balance logic. If your photos do not look correct, then you must set the correct white balance for your photographic situation.
- Sometimes it is necessary to manually set the white balance for a shot to be correct. Digital cameras have a white balance set mode. The secret is to find something close-up in the shot with a gray tone and let the camera set its white balance to that area. If you cannot find a gray area, then, in an emergency, set the white balance to your hand.
- Many professionals carry white balance cards with them. These cards represent shades of gray from light to semi-dark that are used to custom set the WB of a camera for the image about to be taken.

Correct White Balance



- Camera was set in SCN mode of FIREWORKS



- Camera was placed in the SCN mode of SNOW

Megapixels

- In general, the more megapixels in a camera, the better potential for an acceptable printed photo. It is also the least important factor in determining the quality of a camera. Too many camera makers put too many megapixels into a camera which overloads the sensor/processor unit and produces a less quality image.

“Going Beyond Point & Click”

- JPG & RAW formats, Aperture, ISO, Exposure
- Auto Focus, Focus & Exposure Lock



JPG, TIF & RAW Formats

- **JPG** format compresses the image to save storage space. On the first-time save there is rarely any “noticeable” difference between the compressed and uncompressed photo. Saving the image time-and-time again compresses it into a washed out state
- **TIF** and **RAW** formats tend to be rather large. If a TIF is 30-40 mbytes then the RAW image might be 100 mbytes. The same JPG image will be somewhere between 2-5 megabytes depending upon the compression level and the nature of the image.

RAW Photo Images

- RAW images files represent millions of bits of information for shades from black-to-white for each color channel (red, blue & green.) RAW images contain the best and most complete information about the image.
- The largest benefits of RAW images are greater detail in the shadow and highlight areas of a photo.
- The White Balance, ISO factor, Exposure Value (EV) can be changed after the fact. A simple rule is “if you plan to perform considerable editing to your photographs, use RAW.”



IS or VR

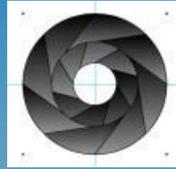
- **The IS on/off switch is generally on the lens itself**
- **When NOT to use IS or VR:** turn IS or VR off when you use a tripod or have your camera in a locked-down status. It works best on wide angle and short telephoto lenses where a minimal loss of detail is acceptable.
- **VR and IS functions:** help reduce camera movement from your hands, your breathing and anything else that causes the camera to move. It does not have anything to do with the subject of your picture moving.
- Remember that you can **reduce the effects of the movement** of your subject by using higher ISO, more light, and a faster lens.
- With **IS or VR turned on**, you can typically take pictures at 2 or 3 shutter speeds slower thus getting greater Depth of Field control and allowing more light to enter the sensor.
- When not using a tripod, turn IS or VR on (AS for anti-shake or OS for Optical Stabilization) especially when you are in low light conditions and no flash, or you are using a telephoto and zoomed most, if not all, the way out.
- IS should be used when the shutter speed is less than the reciprocal of your focal length. For a 200mm lens, IS may be needed if the shutter speed is less than 1/200 second.

Aperture and Depth of Field



- The **lens aperture** helps determine how much light passes onto the sensor. It also determines the depth of field. Aperture is represented by numbers such as $f/8$, $f/11$ and $f/16$. The range of these so-called f-stops is $f/1.2$ to $f/32$ for most lenses.
 - the **depth of field** is the distance in front of and behind the focused part of the image that will be out of focus. In simple terms, the more open the aperture (a low $f/$ number or a lens at “wide open”) the better chance the image will contain a very shallow image depth.
- Depth of Field is greater with wide angle lenses than with telephotos. Generally, a lens set at $f/22$ will produce the greatest depth of field and sharpness. Using $f/32$ will actually produce less sharpness in the depth of field because the light required by the sensor is just not enough in most cases to produce a sharp image from the back to the front of the scene.

Aperture and Depth of Field



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 - the **depth of field** is the distance in front of and behind the focused part of the image. In simple terms, the more open the aperture (a low $f/$ number or a lens at “wide open”) the better chance the image will contain a more shallow sharp image area.
- $f/1.2$ represents a wide-open lens while $f/32$ represents a lens that is “stopped down all the way” and provides a very small amount of light onto the film or sensor.
- Depth of Field is greater with wide angle lenses than with telephotos. Generally, a stopped-down lens at $f/22$ will produce the greatest depth of field and sharpness. Using $f/32$ will actually produce less sharpness in the depth of field because the light required by the sensor is just not enough in most cases to produce a sharp image from the back to the front of the scene.

Aperture and Depth of Field (con't.)

As the aperture gets smaller, the background comes into focus. Look at the scissors on the right of the bottle. The bottle is slightly less focused at f/16 but has a maximum sharpness at f/5.6.



50mm @ f/5.6



50mm @ f/16

Wide Open Aperature Photo Shot at F/2.8



ISO and Noise

- **ISO** is the camera's measure of its sensitivity to light. With reduced light level in your photo opportunity, a higher ISO setting will help the photo appear more natural.
CAUTION:
 - the higher ISO, the more digital noise is introduced into the image.
- To allow more light open the aperture more but remember: with a wide open aperture there is limited depth-of-field.
- ISO 100 or less is used for bright outdoors on a sunny day.
- ISO 200 is the standard used for inside, cloudy or overcast days.
- ISO 400-800 is used for dim light situation from dawn to dusk and for general outdoors.
- ISO 1600 on up is used for night-time photography and no-flash indoors photography.

What Does Noise Look Like?



Exposure Value (EV or EC)

- EV is an in-camera adjustment that allows you to make an image lighter or darker without changing other settings.
- If the image is too dark increase the EV setting.
- If the image is too light, decrease the EV setting.

If you have “liveview” on your camera, use it during EV adjustments.

Exposure Metering

- Metering is the technique used by modern film and digital cameras to determine the correct exposure (aperture, shutter, white balance, ISO, etc.) of a scene.
- There are several types of metering systems especially in the upper end consumer digital and DSLR cameras:
 - **Average:** most common method used on low end cameras. It should not be used when one portion of the scene is vastly lighter or darker than another portion such as a bright sky and dark ground in a landscape shot.
 - **Center Weighted Average:** much like average metering but priority is given to the brightness in the center of the scene.
 - **Spot:** the camera user determines what portion or spot in the scene is best suited for metering then locks the camera on that setting. The spot usually represents 3%-5% of a scene. This method is for those who understand contrast range of the scene versus the camera's ability to capture the "darkest-to-the-lightest" range of a scene. Use this mode for bird and wildlife photography.
 - **Matrix** (also known as evaluative and multi-zone): the scene is divided into multiple zones by the camera and each zone is individually evaluated. The camera then produces an overall scheme for taking a photo that has elements such as a bright sky with dark shadows on trees on the sides of the photo.
 - **Partial:** this mode meters 8%-10% of a scene when the camera is focused on a specific subject of the scene. Use this mode of metering when the scene's background is much brighter than the subject of the scene. Partial mode is used more in the consumer digital cameras while matrix mode is used more in the professional and pro-consumer DSLR units.

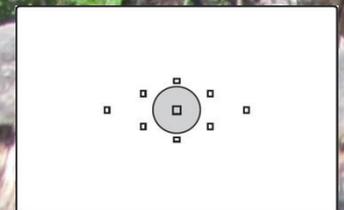
Exposure Metering

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- There are several types of metering systems especially in the upper end consumer digital and DSLR cameras. Metering images are from Canon manuals:
 - **Center-weighted:** (sometimes called “average” metering in older digital cameras) where priority is given to the brightness in the center of the scene. Center-weighted ignores the light levels in the corners and those approaching the middle of the image. It concentrates on the middle of the lens view and its surrounding area to determine light levels. *Used in high contrast shooting.*



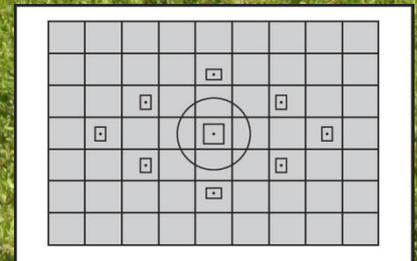
Exposure Metering (con't.)

- **Spot:** the camera user determines what portion or spot in the scene is best suited for metering then locks the camera on that setting. The spot usually represents 3%-5% of a scene. This method is for those who understand contrast range of the scene versus the camera's ability to capture the "darkest-to-the-lightest" range of a scene. Use this mode for bird, wildlife and macro photography where a dark background is desired. This mode is good when used in high contrast situations.



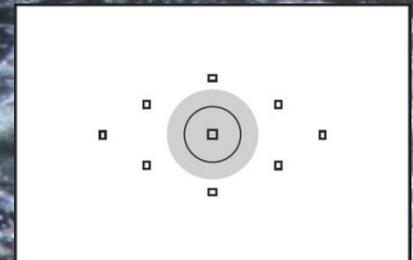
Exposure Metering (con't.)

- **Matrix or Evaluative:** the scene is divided into multiple zones by the camera and each zone is individually evaluated. Many cameras will give a little more priority to the focus point or points that have been set. Use this mode when the object of the photo is off-center (a rule of thirds situation.) This mode is also great for taking landscape images.
- Many cameras have AE-Lock or automatic exposure lock. You use this to lock the exposure metering of a scene and subsequent images are taken at the same metering level. This feature is most useful in panoramic photography.



Exposure Metering (con't.)

•**Partial:** this mode meters 8%-10% of a scene when the camera is focused on a specific subject of the scene. This mode can be used when the subject of the photo has adequate lighting in the background but not enough on the subject itself. Using Partial mode will avoid the subject being under-exposed while the background appears normal. Partial mode is used more in the consumer digital cameras while matrix mode is used more in the professional and pro-consumer DSLR units.



Auto focusing (AF)

- Autofocus is rather sophisticated in modern cameras. Many digital and SLR cameras have at least two automatic focusing modes:
 - **Continuous or AI Servo focus:** the camera is always attempting to adjust the focus until the picture is taken. The Canon AI SERVO mode and the Nikon CONTINUOUS SERVO mode are used for photography based on moving subjects. The camera actually predicts where the subject will be in the “very near” future based on the subject velocity from a previous focus point. The camera then focuses at the future point of the subject, calculates for the lag time of the shutter, then takes the shot.
 - **One Shot or Single:** used mostly for still images: you don’t expect the subject to move.
 - **Spot focus:** used when auto focus won’t focus on the primary subject of the image; when there is low contrast on the subject of the scene or zooming the lens in for a close-up image.

Auto Exposure & Auto Focus Lock Button (AE-L & AF-L)

- Many modern DSLR cameras has an external button on the camera back that is labeled AE-L or AE-L/AF-L. This button allows the user to lock the selected exposure when the shutter button is pushed halfway down.
 - **AE-L:** once the shutter button is depressed halfway down, the user presses and holds the AE-L button for as many photos taken. All the photos will be taken at the identical exposure.
 - **Primary Use:** this function is invaluable when taking panoramic images. It is very desirable to have the same exposure across all the images used to create a panoramic image.
 - Be sure and check your camera manual on how to operate the AE-L button.

The button known as **AF-L**, or Auto Focus Lock, forces focus on the primary subject of an image. For example, you have an individual standing in front of a mountain range. The camera will tend to focus on the brighter background and not the subject nearest the camera. Point the camera at the subject, press the shutter button halfway and while holding it in that position, depress the AF-L button and hold it. Move the camera toward the mountains while keeping the subject in the image (rule of thirds) and finish depressing the shutter button. When you take the picture the subject will be sharp and the background will look in focus.

NOTE: do any zooming first, before the AF-L feature is used.

Auto-focusing (AF)

- Many digital and SLR cameras have at least two automatic focusing modes:
 - **Continual autofocus:** the camera is always attempting to adjust the focus until the picture is taken.
 - **Spot focus:** used when auto focus won't focus on the primary subject of the image, when there is low contrast on the subject of the scene, or zooming the lens in for a close-up image.
- Newer digital cameras use a combination of focus points in the scene to achieve optimum focus.
- In order to take a shot of a person up close and in focus and still have the distant background in focus, autofocus and spot focus will not work. The **locked-focus technique** should be used.
 - Use locked-focus when it is desired that the objects close to the front of the image and the distant background objects are both in focus.
 - Many modern digital cameras allow the user to lock the focus on an object by depressing the shutter button half-way down and holding it. With the camera focused on a person or object slightly off-center in the image, the camera can then be moved to the center of the image and the shutter button fully depressed.
 - Some cameras have an AF-Lock button which locks the focus to the location you are most interested in shooting, then allows you to reframe the shot without worrying about re-focusing.

Auto-focusing (AF)

- One Shot Focus – used when the subject is “still.” Use this mode for landscape scenes, flowers and still life photography
- AI Servo Focus – used when the subject is constantly moving and you are tracking the subject. The camera enters a predictive mode where it predetermines the focus in front of the movement. Use this mode for sports, moving vehicles, wildlife movement, birds in flight, planes in flight, etc. It also is useful when you are using a Macro lens.
- AI Focus – used mostly for still shots but, if the subject moves, the camera will automatically enter AI Servo to keep the movement in focus. This is the least used focus mode in modern digital cameras.

Auto Focus Lock

- Use Autofocus Lock (AF-Lock) when it is desired to have the focus on one part of a scene but to take the picture of the entire scene. Today, many digital cameras have an AE/AF lock button that can be used or simply push the shutter ½ way down. If you desire to take multiple shots, press the shutter button down half way then press and hold the AF-Lock button while taking multiple photos. Using this method allows the camera to concentrate on the actual image and not worry about refocusing every time the camera is moved.

D-Lighting, Auto Lighting

- A technique built into cameras to balance high contrast and shadow conditions in an image to provide a proper balance between contrast and brightness. This feature helps bring out the detail in shadows that are typically lost when there is proper exposure for the highlights.
- Nikon had D-lighting, Canon had Auto Lighting Optimizer, Sony has Dynamic Range Optimizer and Olympus has Shadow Adjustment.
- In all these cameras, the idea is to hold the highlights of the image constant and boost the shadow (dark) areas.
- Use in high contrast situations such as powerful sunlight or night scenes with distinct lights and dark areas.

High Dynamic Range (HDR)

- When discussing HDR in photography “contrast” is the key word. Dynamic range is the ratio between highest and lowest light intensity values in an image.
- Today’s technique is the result of taking multiple images (at least 3) that are brighter and darker than each other then merging them together into a very balanced, tonally correct, proper contrast image (most of the time.)
- Generally, HDR photography should be accomplished using a tripod shooting a still image so the resulting image is as sharp as any one of the individual images.
- Newer digital cameras have HDR capability built-in while software such as Photoshop, Paint Shop Pro and Photogenics provide software capability.

High Dynamic Range (HDR)

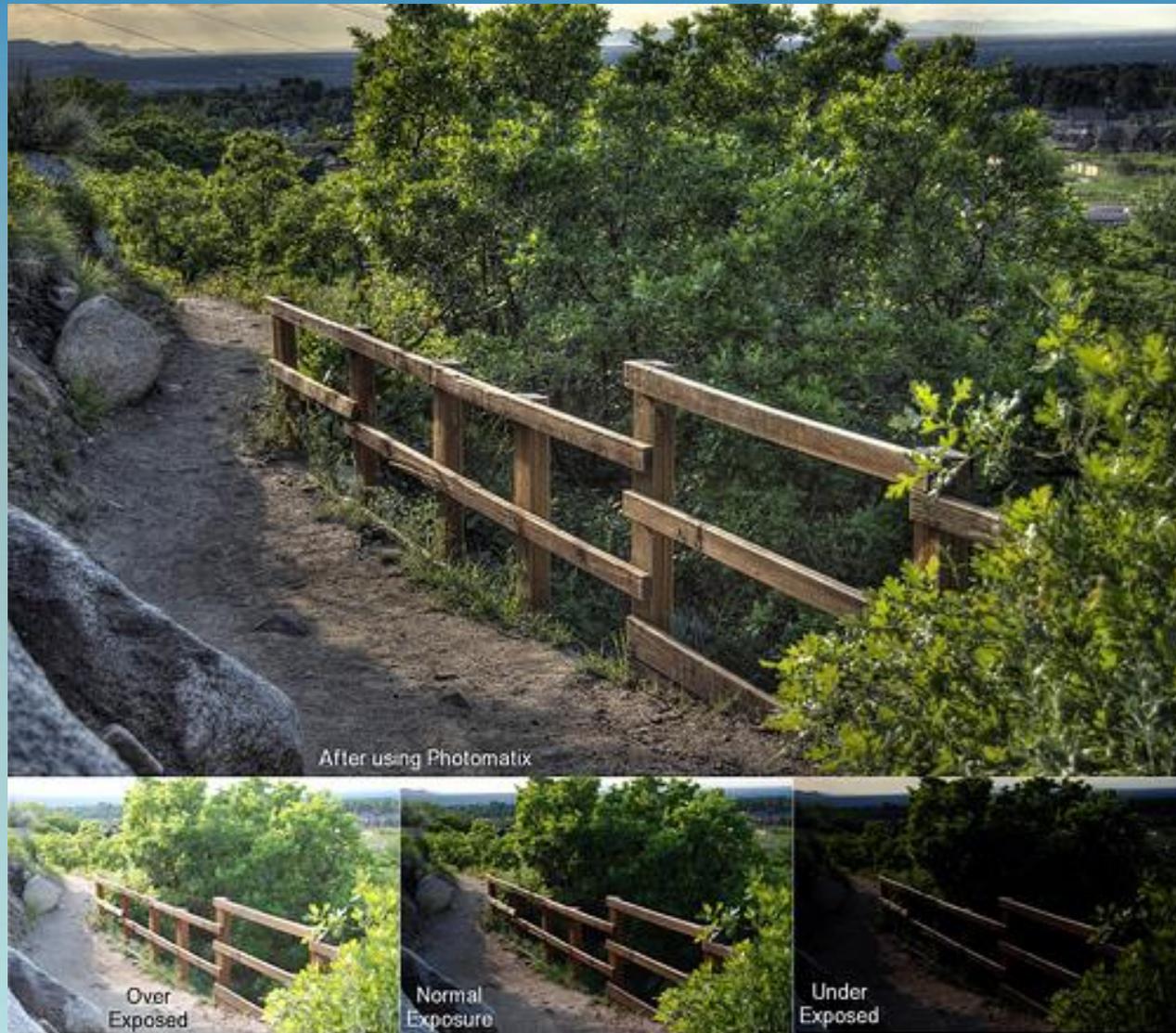
- The most common method for HDR photography is to bracket the image with the camera's bracketing mode. Most photographers bracket the Exposure Value (EV or sometimes known as EC) at -2, 0 and +2 at a minimum.
- Generally set the ISO to 100 to help manage potential noise introduced into the HDR process.
- For manual HDR, simply change the EV setting for each image or change shutter speed. While there are so-called experts on the internet that tell you to set your camera to "A" for aperture mode. **DO NOT DO THIS!** It is better to change the shutter speed thus ensuring the depth of field stays constant. If you change the aperture during each shot, the resulting HDR may become blurred.

High Dynamic Range (HDR)

- Here are two example of three images combined into one HDR image. Notice the depth of contrast and the shadow detail in the HDR image



High Dynamic Range (HDR)



High Dynamic Range (HDR)



High Dynamic Range (HDR)



High Dynamic Range (HDR)

Images from Molnar Csaba from Eyes Beyond – Things and Thoughts



Rocks sharpened, sky saturated with tonal changes,
chromatic aberrations removed

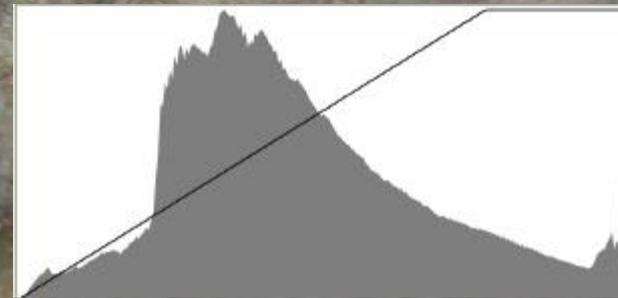
High Dynamic Range (HDR)

Over and Under-Exposed Flower corrected with HDR



Histograms

- A histogram (HG) reveals the intensity or luminosity distribution of the scene – how the dark and light areas of the shadows, mid-tones and highlights relate to the overall image . A correctly exposed image will generally have a full tonal range from black to white such as this grayscale histogram:



•Shadows
(black)

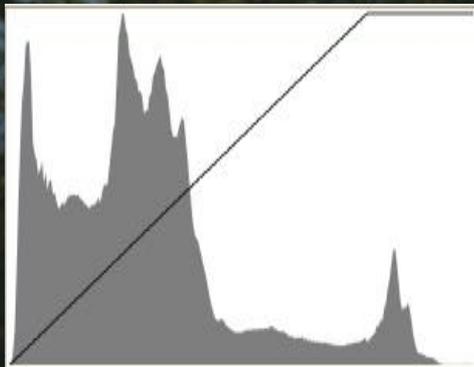
midtones

highlights
(white)

Incorrect Exposure

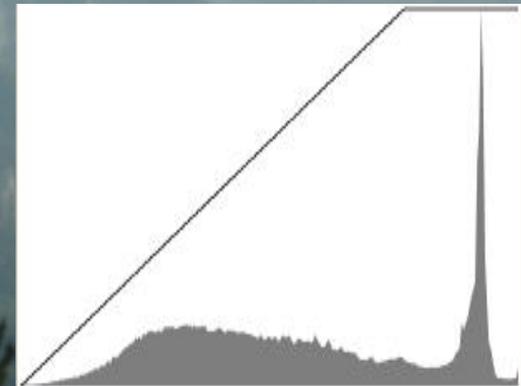
- The following histograms reveal an under-exposed and an over-exposed photo. You can use ISO, EV (also known as EC) and/or aperture and shutter combinations.

Under-exposed



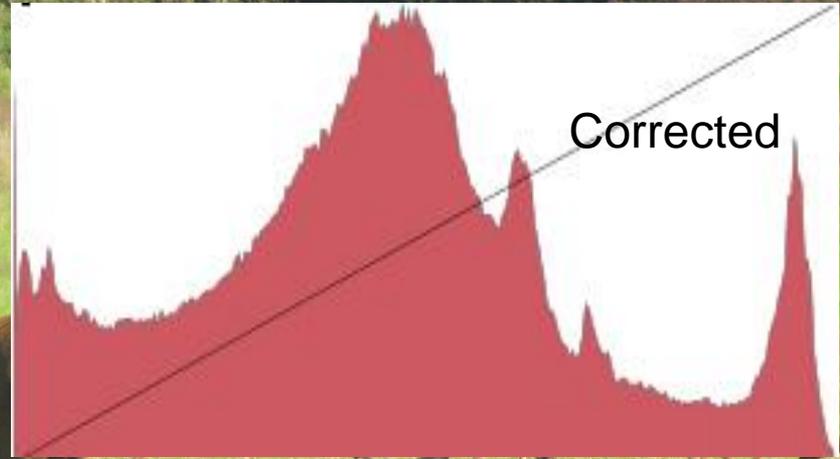
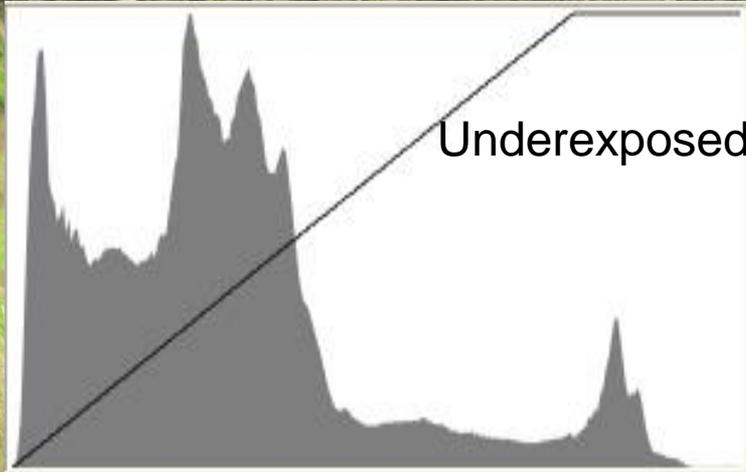
Good tonal range but overall darkness

Over-exposed



Limited tonal range and no transition from dark to light. This is typical of "washed out" photos

Correct Histogram for Underexposed Photo



Over Exposed Photo



Color Management

RGB-CYMK Discussion

- The issue of color management deals with the world of additive and subtractive color philosophies.

Television, computer monitors, scanners and most digital cameras deal with the additive primary colors: red, green and blue (RGB).

Almost every printing process converts RGB into the subtractive primary colors of Cyan, Yellow, Magenta and Black (CYMK). These colors subtract, in varying intensities, the RGB wavelengths from a white background to produce colors of the visible spectrum.

Black (the K in CYMK) is known as K because, in the printing world, it is the key to color combinations needed to produce true color.

- Going from the RGB that we all view using electronic devices to the CYMK world that we all use to print our photos is a problem for everyone and is the reason for Color Management and the need to define the “color space.”

Selecting A Color Space

- Many modern digital cameras allow for the selection of Color Space. The two most common spaces are sRGB and Adobe 1998.
 - sRGB is the most common color space (profile) and is used by computer monitors, televisions, scanners, ink jet and laser printers, and professional image print shops. It is the default established by Microsoft, HP and others for the internet, computers, and monitors. Unless you are going to shoot photos in RAW image mode use the sRGB setting in the camera, computer and printer.
 - Adobe 1998 is preferred by the Adobe software users and half of the professional photographers. It does provide greater range of color for photo editing at the cost of some loss of shadow detail and, in most cases, must be converted to sRGB before sending the image to your printer or a commercial printer. It is the preferred color space of many professional photographers who shoot in RAW mode but is being phased out by the true professionals for newer, more expansive and expensive color spaces.

Selecting Color Space (con't.)

- Adobe 1998 images will appear washed out when sent to commercial printers or used for being displayed by web browsers.
- Adobe 1998 is mostly used in the commercial world to print brochures and other offset-press materials.
- Adobe 1998 strength is in its presentation of cyan and green colors but, to produce these richer tones, it sacrifices fine increments of color detail that are important to shadow detail. Using RAW format compensates for this lack of detail.
- Both sRGB and Adobe 1998 were designed for 8-bit color. For true 16-bit photo manipulation you need to use software like ProPhoto RGB and Ekta Space PS5 for 16-bit color and color gamut beyond sRGB and Adobe.
- If your printer can handle Adobe 1998, and you don't mind large image files, and you and everyone that sees your prints has full retinal color range, then you can use Adobe 1998 for your digital camera color space. Understand that sRGB is the most used color space in the world today and you can find many fine sRGB prints hanging in galleries around the world.
- **Conclusion:** either sRGB or Adobe 1998 will work wonders for your digital photography experience. While most Adobe users stay with Adobe 1998, and most sRGB users don't know why they are using sRGB, Sean McHugh (author) states it best:

Selecting Color Space (con't.)

- *"My advice is to know which colors your image uses, and whether these can benefit from the additional colors afforded by Adobe RGB 1998. Ask yourself: do you really need the richer cyan-green midtones, orange-magenta highlights, or green shadows? Will these colors also be visible in the final print? Will these differences even be noticeable? If you've answered "no" to any of these questions, then you would be better served using sRGB. sRGB will make the most of your bit depth because it allocates more bits to encoding the colors present in your image. In addition, sRGB can simplify your workflow since this color space is also used for displaying images on the internet. What if you desire a speedy workflow, and do not wish to decide on your working space using a case-by-case method? My advice is to use Adobe RGB 1998 if you normally work with 16-bit images, and sRGB if you normally work with 8-bit images. Even if you may not always use the extra colors, you never want to eliminate them as a possibility for those images which require them."*
- Bottom line from Mike Francis: "If you shoot in RAW image mode and/or perform strictly 16-bit editing in your software, use Adobe 1998 color space. Otherwise stay with sRGB. But, if you do use Adobe 1998 space, be sure to convert your photo back to sRGB before you print since most printers do not support Adobe 1998 color space. If you try to print a photo made with Adobe 1998 color space to a printer that only prints in sRGB the photo will appear washed out."

Time of Day Photography

- If you want an object that appears white to your eyes to appear white in a photo then you need to set White Balance in the digital camera. Automatic white balance is based on a “guesstimate” thus modern digital cameras allow you to change the color temperature of your camera based on the time of day, the object being photographed or indoor lighting conditions.
 - Just before dawn the light is blue or cooler
 - Just after dawn the light is warmer
 - Mid-morning and mid-afternoon present a neutral light color. Shooting scenes away from the sun produces rich, saturated colors.
 - Shooting at mid-day (high sun) in the tropics and around the equator can produce a more washed-out photo unless the shade is used. Shadows tend to be short but colors are more neutral.
 - Late day light is often soft and colors are rich because the color temperature shifts toward a more warmer temperature. Late day photography will produce a less contrast image than early morning environments. This time of day is excellent for shooting sky and other reflections in any nearby water.
 - When shooting sunsets, wait until the sun is low in the sky to avoid damage to the digital sensor. Dust and water particles accumulate in the atmosphere all day. By the time the sun sets, the light is completely diffused and produces an extremely warm light.
 - The most dramatic color shots come from the afterglow of the sunset at dusk which exists more outside the tropics. A cloudy sky tends to reflect the residual rays of the sun back onto the earth to produce tremendous warm color temperatures.

Photographic Color Temperatures

- The visible light spectrum is divided into Kelvin temperatures developed by William Thomson Lord Kelvin in Great Britain in the mid-1800s.
 - Color Temperature (in degrees Kelvin) is the temperature of a color emitted from a substance when heated.
 - The human eye does not have a nominal color temperature. The eye sees white outdoors as one temperature, indoors as another temperature. The digital camera cannot perform this feat without the use of White Balance.
 - “Daylight” is defined as a clear blue cloudless sky at 6000K.
 - Most modern televisions have a color temperature of 6500K but allow you to adjust to a “cooler” or “warmer” look. The industry has called this setting White Balance long before digital cameras appeared on the market.
- Some digital cameras can be set to a default color temperature. For all practical purposes, set the camera’s color temperature for your most common type of shooting: 5200K-5500K for general purpose shooting and 6300K-6500K for outdoor shooting. If your camera’s default color temperature cannot be set then the camera simply does the best it can with automatic WB.
- Film has a native color temperature (daylight and tungsten) and is designed for a specified light source. Digital cameras use WB to set the color temperature for the scene being photographed and the overall color balance of the photo.

Common Color Temperatures

These temperatures are affected by time of day, elevation and haziness.

1500k	candlelight, oil lamps
2000K	early morning sunrise
2680K	40W incandescent light
3000K	200W incandescent light, warm fluorescent lamp
3200K	sunrise and sunset
3400K	tungsten light; dawn/twilight
3500K	sunlight right after dawn, retail fluorescent lamp
4300K	sunlight in early morning or late afternoon hours
4500-5000K	xenon light, sunlight fluorescent lamp
5500K	sunny day at noon time
5600K	electronic camera flash
5500-6500K	daylight made of sun and sky
6000K	bright sunlight with clear sky
6500-7500K	overcast sky
7000-8000K	outdoor in the shade
8000-10000K	partly cloudy sky
10000K	heavily overcast sky
9000-12000K	deep blue sky, open shade on a clear day
11000K	deep blue sky viewed away from the sun
20000K	open mountain shade on a cloudless, very clear day

Lens Types



50mm
Standard:



Macro (105mm):



Wide Angle
(15-30mm):



Telephoto w/Zoom
(50-500mm): shot
@ 200mm



Other lenses of interest: Fisheye, Shift Control and specialized Distortion Lenses like the Lensbaby

Some Modern Lens Nomenclature

- **APO:** apochromatic lens made from low dispersion glass in order to reduce chromatic aberration.
- **ASP:** an aspherical lens which is more compact than regular lens and more expensive.
- **DG:** lenses with added optical coatings meant to minimize reflections of light off of the image sensor. Used by Sigma.
- **EF:** used by Canon meaning Electronic Focus.
- **EF-S:** Canon short focal length Electronic Focus for newer digital cameras.
- **HSM:** Sigma Hypersonic Motor – quiet and fast
- **IS:** refers to Image Stabilization.
- **OS:** Sigma optical stabilizer similar to Canon's IS and Nikon's VR.
- **USM:** Canon Ultrasonic Motor – very quiet and fast.
- **VR:** Nikon Vibration Reduction lens (same as **VC** or compensation)
- Example: Sigma EX 50-500 F/4-6.3 APO HSM

Lens Adaptors -- Nice to have items for DSLR world



Bellows
and
Extension
Rings

The Extension Ring(s) and Bellows allow the lens to focus closer to a subject or object. Extension Rings or Bellows are placed on the camera then the lens onto the last extension ring.

The Bellows produce outstanding close-up images and are preferred over the extension rings. High mm zoom macro lenses for modern digital cameras have replaced the need for Bellows or Rings in many cases.



Teleconverter

The Teleconverter expands the range of a lens. They are made in 1.4x and 2x magnification factors with 1.4x being the safer to use with modern digital cameras. Note that some digital and regular auto focus SLRs have trouble with focusing and metering when a teleconverter is installed.

Lens Filters --

Three Mandatory Filters for Digital



Circular
Polarizer

The circular polarizer filter, CP, reduces object glare and haze wash out caused by UV rays. Because of the sensors in digital cameras, always use a circular polarizer which is designed to protect the sensor and not interfere with the auto focus and metering. The multi-coated filters are the most popular



UV

The UV filter should stay on a lens at all times. It protects the lens from dust and scratches. It also block UV rays that tend to wash out the photo and add bluish-purple tent. It can be used with a CP filter.



Neutral
Density

This filter, ND, is designed for daytime outdoor photography in order to reduce the brightness of the top or bottom portion of the image. It helps keep contrast and brightness in balance. The GRADUATED NEUTRAL DENSITY filter is the most popular..

Macro Lenses

- Macro produces lifelike images on a 1:1 basis
- 50-60mm is good for detail in most close-up objects such as dishes, glasses, etc
- 90-105mm is ideally suited for floral images, bugs, coins
- 150-200mm is used for very close detail such as the eye of a bug
- Zoom macros allow you to back away from an image and focus inward thus reducing “noise” elements that might scare off an insect.