

What ruins a photo?

- Poor composition
 - Lack of subject, foreground, background
 - Clutter and distractions
- Improper exposure
 - Over-exposure
 - Under-exposure (sometimes fixable in PP)
- **Unintentionally blurred image**
 - Out of focus / improper depth of field
 - Subject moves too fast for set shutter speed
 - Camera shake

Agenda for the evening

- Welcome and introductions
- Overview of general problems in photography
- Review components of exposure
- Review problems reducing sharpness
- How to improve camera stability
- How to control subject motion
- How to improve focus / sharpness
- Wrap-up by 8 PM

Learning Objectives

- At the end of this session, you will be able to:
 - Identify the possible causes of a blurred image
 - Determine the most like cause for blurring of a specific image
 - List means to minimize camera shake
 - List means to optimize camera focus
 - Understand techniques to control subject motion
 - Identify post-processing tools to sharpen image
 - Obtain sharper images

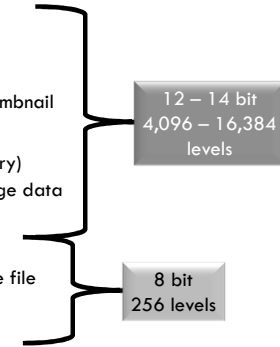
Camera Characteristics

- Type (phone, Point-and-shoot, super-zoom, mirrorless (MILC), Single lens reflex (dSLR))
- Brand
- Shooting modes – Auto, Program, A, S, Manual, Bulb
- Image capture - RAW or JPEG
- Sensor – size, pixels, resolution, sensitivity, digital noise
- ISO range
- Shutter speed range
- Burst rate
- Other bells and whistles



File Type and Sharpness

- **RAW files (.CR2, .NEF)**
 - Large file size
 - Non-viewable image data
 - EXIF and other metadata and JPEG thumbnail
- **DNG (Adobe, .DNG)**
 - Smaller file size (Adobe, non-proprietary)
 - Non-viewable, slightly compressed image data
 - No .XMP side-car file needed
- **JPEG images**
 - Highly compressed, much smaller image file
 - Edited by camera/software
 - Each save loses data



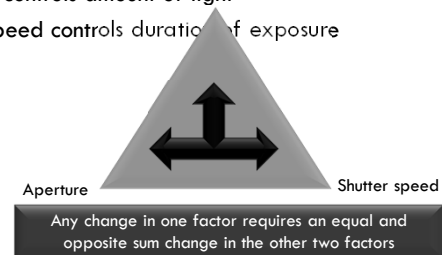
Luminance levels (brightness) per RGB channel

About pixel count

- Generally, more pixels give higher resolution
- More pixels per sensor area means smaller pixels
- Smaller pixels need more light and create more noise
- If two sensors have the same digital noise at 100%, the sensor with the most pixels will produce a cleaner image
- 8-12 megapixels give far more resolution than needed for web posts and viewing (72 ppi)
- 22 megapixels will yield 14x22 print at 240dpi

Exposure Control Triangle

- Three elements control exposure
- ISO sets sensor sensitivity
- Aperture controls amount of light
- Shutter speed controls duration of exposure



One "stop" or EV (exposure value) implies a doubling or halving of exposure.

Lens Characteristics

- Prime or zoom
- Focal length (mm)
 - Angle of view
 - "Reach"
 - Magnification
- Maximum aperture (f-stop)
 - "Speed"
- Focusing speed
- Image stabilization
- Minimal focus distance



All can affect sharpness

Stabilization Gear

- Your tripod is your most important accessory
- Tripod
 - Aluminum versus carbon fiber
 - Height – maximum and minimum; weight
 - Stability
 - Leg sections, locks, elevator, and other features
- Head
 - Pan (3 axis) head, ball head, or gimbal
- Quick connect – ARCA Swiss versus proprietary
- Monopod and other stabilization devices
- Spend the money now or spend more later!

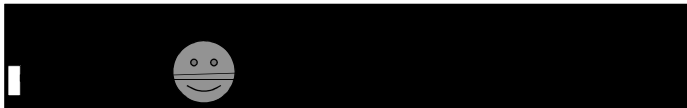
Shutter speed rule

- Minimum shutter speed = $1/\text{focal length of lens}$
- Crop sensor modification? $1/\text{focal length} \times \text{crop factor}$
- Image stabilization (IS) may add 2-3 stops (EV)
Vibration reduction (VR)

100mm lens = 1/100th sec

100mm lens = 1/150th sec

100mm lens = 1/25th - 1/50th sec



"Camera shake"

Camera Stabilization

- Quality tripod and head
 - Size and weight
 - Aluminum versus carbon fiber
- Heads
 - Pan and tilt – three planes
 - Ball head
 - Gimbal head
- Other stabilization – monopod, bean bag, window mount, rifle-stock, noodle, Gorilla-pod
- Proper hand-held technique
- Image stabilization (in lens or some cameras)
 - Not used under certain conditions
- Mirror lock-up or timer with long lenses
- Remote shutter release



***f*-stop Pro and Con**

High *f*-stop

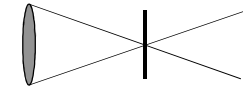
- Small aperture
- **Wide** depth of field
- Slow shutter speed
- Star-effect in bright light
- Motion effects
- Defraction softening



Low *f*-stop

- Large aperture
- **Narrow** depth of field
- Fast shutter speed
- Freeze action
- Minimize camera shake
- Corner softening

Depth of Field

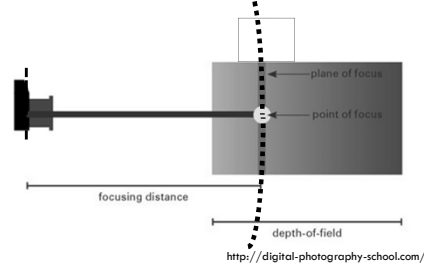


- Distance between nearest and farthest objects that are in acceptable focus
- Precise focus is at a single point in a plane
- Any plane nearer or farther the light point on the sensor will appear as a circle
- When focus of the circle is sufficiently small to appear to be a single point, we say focus is acceptable
- The actual size of the circle is called the “circle of confusion”
- The distance of the subject that yields an acceptable circle of confusion (i.e., a point) before and behind precise focus is the depth of field

Depth of Field – what is acceptable focus?

- Lens focuses on a single plane – parallel to the sensor
- A range of “acceptable” focus occurs on each side of the plane
- Rule of thumb – 1/3 in front and 2/3 behind plane of focus

Only a rule of thumb!
Actual acceptable focus varies with the lens, its focal length, and the focusing distance



Determinants of Depth of Field

- Image magnification
 - How the camera “sees” the subject
 - Sensor size – larger = more DoF
 - Effective focal length – longer = less DoF
 - Distance – closer = less DoF
- **Aperture**
 - Set *f*-stop
 - Larger opening (lower *f* number) = less DoF

Hyperfocal Distance

- The minimum distance beyond which everything is in acceptable focus
- Sensor size (Crop Factor)
- Focal length
- Aperture

Camera Type: Digital SLR with CF of 1.6X

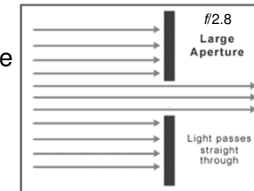
CALCULATE HYPERFOCAL DISTANCES

Note: CF = "crop factor" (commonly referred to as the focal length multiplier)

Aperture	50 mm	75 mm	100 mm	150 mm	200 mm	300 mm	400 mm
f/2.8	1.1 m	5.2 m	10.3 m	87.5 m	178.6 m	714.3 m	2857.1 m
f/4.0	0.8 m	3.6 m	7.2 m	61.3 m	125 m	500 m	2000 m
f/5.6	0.6 m	2.6 m	5.1 m	43.8 m	89.3 m	357.1 m	1428.6 m
f/8.0	0.4 m	1.8 m	3.6 m	30.3 m	62.5 m	250 m	1000 m
f/11	0.3 m	1.3 m	2.6 m	22.3 m	45.5 m	181.8 m	727.3 m
f/16	0.2 m	0.9 m	1.8 m	15.3 m	31.3 m	125 m	500 m
f/22	0.1 m	0.7 m	1.3 m	11.1 m	22.7 m	90.9 m	363.6 m
f/32	0.1 m	0.5 m	0.9 m	7.7 m	15.6 m	62.5 m	250 m

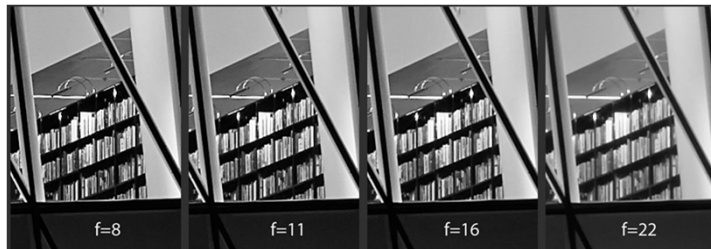
Diffraction

- Minimal with large aperture
- Potential problem with small aperture
- Depends upon sensor size
 - Full frame above f/22
 - APS-C above f/16
- Result is lower resolution
- Softer image
- Maybe compounded by slow shutter speed



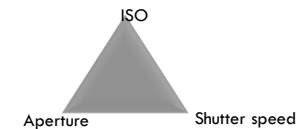
Diffraction

- Assume high quality lens
- Full-frame camera diffraction-limited at smaller than f/22
- APS-C sensor diffraction-limited at smaller than f/16



Shutter Speed Pros and Cons

- | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Pro high (fast) shutter speed</p> <ul style="list-style-type: none"> • Freeze action • Minimize camera shake • Large aperture so narrow depth of field • Need higher ISO | <p>Con low (slow) shutter speed</p> <ul style="list-style-type: none"> • Blur image for motion effect • Smaller aperture so greater depth of field • Can use lower ISO |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



Exposure Balances

For every positive, there is a negative

And on and on...

Focus Modes

Canon EOS 5D Mark III AF Area Selection Modes

	Single-point Spot AF (Manual Selection)		AF Point Expansion (Manual Selection, Surrounding Points)
	Single-Point AF (Manual Selection)		Zone AF (Manual Selection of Zone)
	AF Point Expansion (Manual Selection)		61-Point Automatic Selection AF

Focus Methodology

- Number of focusing points
- Type of focus points
 - Phase detect vs contrast detect
 - Cross-type vs horizontal or vertical
- Modes of focus control
 - Manual
 - Single point (spot, expansion)
 - Zone / multipoint
 - One shot (AF-S)
 - AI Servo (Continuous; AF-C)
 - AI Focus – blend (AF-A)
- Autofocus assist beam (“active” AF)

Back Button Focus

- Move autofocus from shutter release to thumb
- Locks focus so can recompose and shoot

Mirror Lock-up

- Designed to reduce vibration caused by “mirror slap”
- When activated, press shutter release once to lock mirror and press again to activate shutter
- Use only on tripod
- Other options:
 - Two second delay
 - Live View mode

Post-processing / Editing

- Exposure / luminosity – intensity of light
- Contrast / tonality – range of luminosities
- Saturation (intensity of color)
- White balance
- Level and crop
- Sensor dust
- Distractions
- Digital noise reduction
- Sharpen

Moving Subjects

- Intentional blur
 - Slow shutter speed
 - May need stabilization (tripod)
- Panning
 - Blurs the background and not the subject




Post-processing Sharpening

- Not really sharpening
- Local contrast adjustments of “edges”
- Noise reduction / sharpening paradox
- Lightroom or CameRaw clarity slider
- Lightroom or CameRaw sharpening
- Photoshop sharpening tools
 - High-pass filter, Smart Sharpen, unsharpen mask, other filters, other
 - Blur simulation filters (many in PSCC)
- Other software sharpening tools & plug-ins

Critical focus challenges

- Low light situations
 - Longer shutter speed – more camera shake
- Long telephoto / super-zoom lens
 - More 'magnification' of camera shake
- Extreme close-up / macro
 - Extremely shallow depth of field
 - More 'magnification' of camera shake

Keys to sharper images

- Camera stabilization
- Appropriate lens
- Appropriate shutter speed 
- Appropriate aperture for desired DoF
- Choose best focusing mode
- Always consider best motion blur for moving subjects
- Apply noise reduction and sharpening in post-production

Expanded Focus (Depth of Field)

- Focus stacking software
- Merge multiple overlay images at sharpest points
- Stable tripod necessary +/- focus rail (for macro)
- Photoshop
 - Select images (Edit in Photoshop as layers); Select all layers
 - Auto-align images
 - Auto-merge images
 - Edits, flatten layers?, save, close
- Helicon Focus
 - Controls the camera and creates series of layered images
 - Merges at sharpest points

Good to Great Photographs

- Good photographs
 - Proper exposure
 - Sharp focus
 - Nice composition
 - Good subject
- Great photographs
 - Emotional impact / visual tension
 - Creativity and style
 - Feeling and emphasis
 - Seeing and understanding
 - Unique perspective / lighting