

LEBANON CAMERA CLUB

Summer Workshop 2019

**Introduction to Digital
Photography**

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8/6/2019

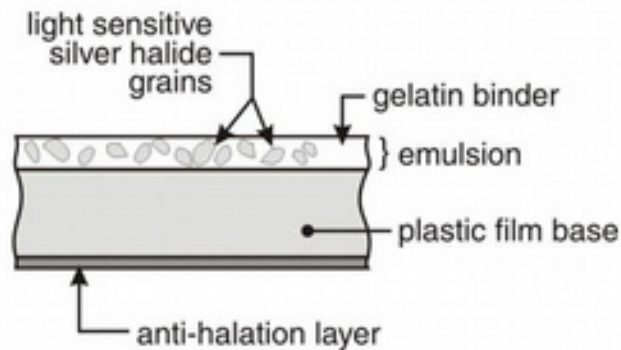
See last slide for Fair
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Introduction to Digital Photography

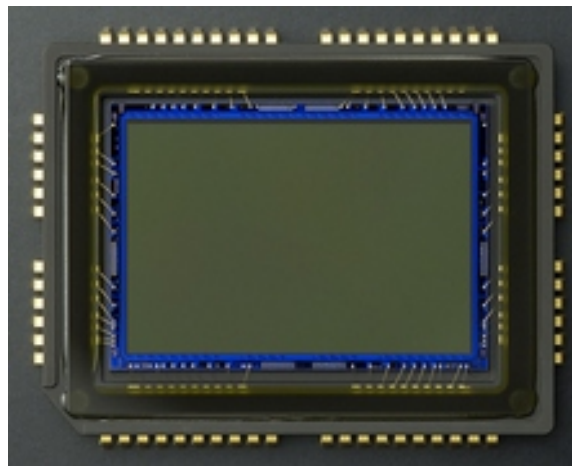
Note: The word “photography”
literally means “light drawing”

Exposure

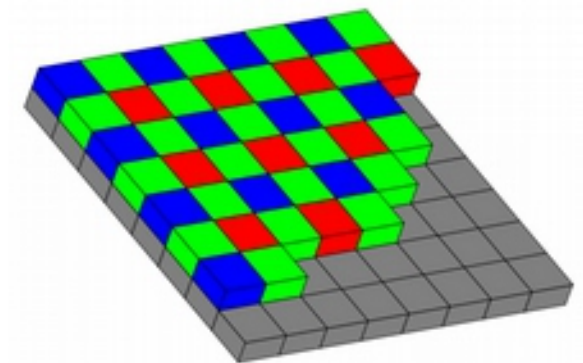
- **Photography: the art of capturing light**
 - ◆ **Exposure: (1) the act of taking a photograph**
 - ◆ **Exposure: (2) amount of light allowed to fall on a light sensitive medium (film) or device (digital sensor)**



black & white film
cross section



digital sensor



digital sensor diagram
showing color-sensitive
photosites

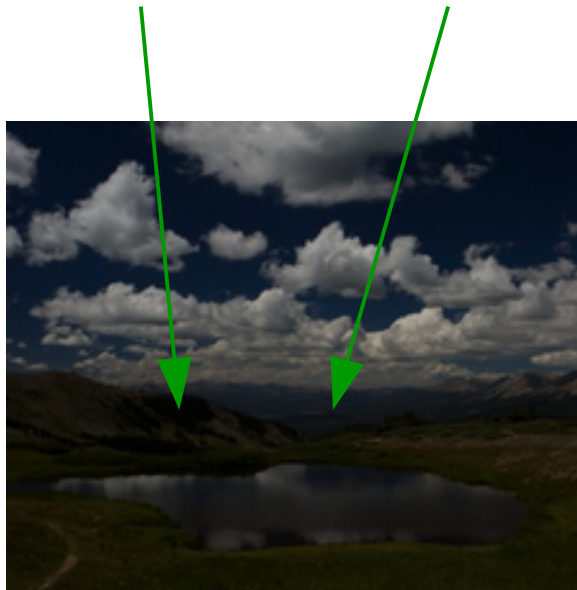
Introduction to Digital Photography

Exposure

- Proper exposure

Note: “clipping” means that the true value of light information in the scene is beyond what the sensor can capture → scene information that has been “clipped” cannot be recovered when editing

clipping (black shadows)

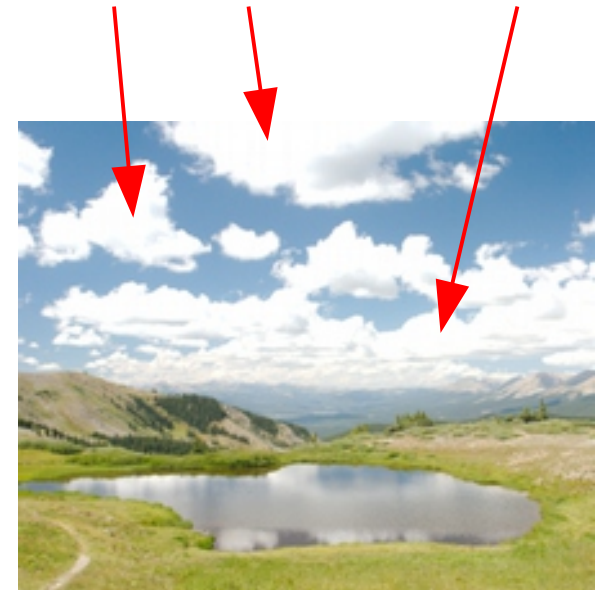


under exposure
shadows have little or no detail, bright areas are too dark



proper exposure
shadows and bright areas have good detail

clipping (blown highlights)



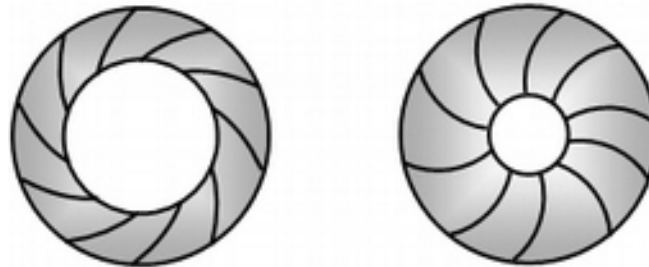
over exposure
shadows have good detail (but brighter than the scene truly was), bright areas have little or no detail

Introduction to Digital Photography

Exposure

◆ Parameters

scene
brightness

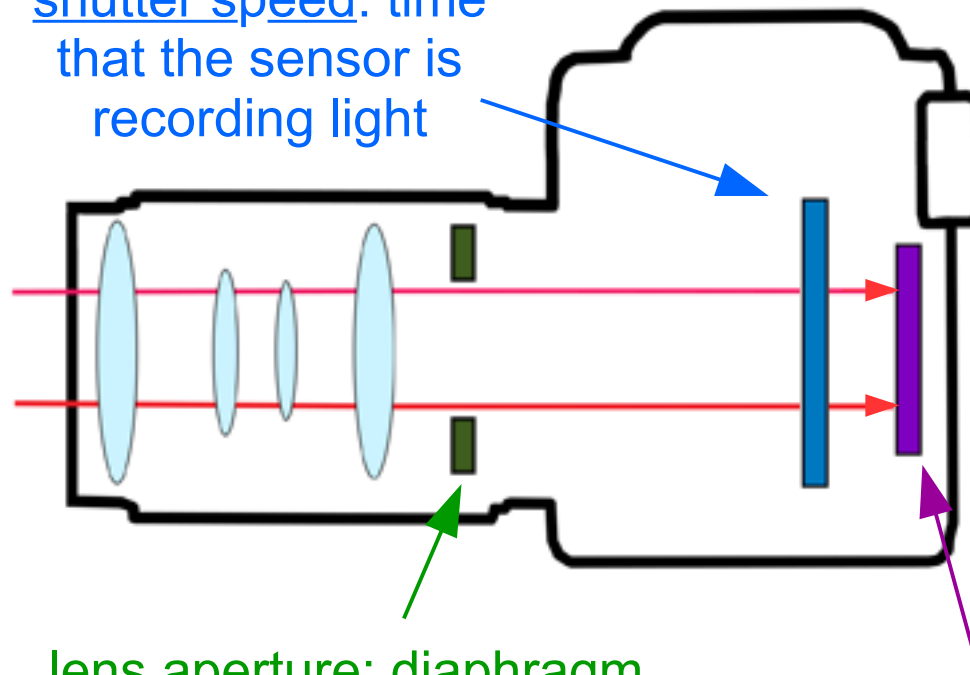


diaphragm: adjustable iris



shutter: mechanical or electronic mechanism to limit light collection to a specific time period

shutter speed: time that the sensor is recording light



lens aperture: diaphragm which controls amount of light passing through the lens

sensitivity: how responsive the digital sensor is to light



Introduction to Digital Photography

Exposure

Note: a factor of $2\times$ or $1/2\times$ the amount of light is considered a 'stop', and allows changes in different parameters to offset each other exactly→digital cameras often allow adjustments in $1/3$ stop increments

- Parameters

- ◆ Sensitivity → ISO
 - Examples: 25, 50, 100, 200, 400, 800, 1600, 3200, etc.
 - Higher number is more sensitive → 200 is $2\times$ as sensitive as 100
 - Digital cameras usually start at 100 or 200
- ◆ Aperture → *f*-number (or *f*-stop)
 - Examples: *f*/1.4, *f*/2, *f*/2.8, *f*/4, *f*/5.6, *f*/8, *f*/11, *f*/16
 - Lower number passes more light → *f*/1.4 passes $2\times$ the light as *f*/2
 - “Fast” lenses have lower “wide open” numbers such as *f*/1.4
- ◆ Shutter speed → time in seconds that the shutter is open
 - Examples: 1/250, 1/125, 1/60, 1/30, 1/15, 1/8, 1/4, 1/2, 1, 2, 4, 8
 - More time passes more light → 1/30 passes $2\times$ the light as 1/60
- ◆ All three parameters comprise an 'exposure luminance'
 - Proper exposure→exposure luminance \approx scene luminance

Introduction to Digital Photography

Exposure

- Equivalent exposure luminance
 - ◆ Three parameters → many combinations are equivalent

ISO	aperture	shutter speed
200	$f/4$	1/125
400 (+1 stop)	$f/2.8$ (+1 stop)	1/500 (-2 stops)
800 (+2 stops)	$f/5.6$ (-1 stop)	1/250 (-1 stop)
1600 (+3 stops)	$f/2$ (+2 stops)	1/4000 (-5 stops)
3200 (+4 stops)	$f/11$ (-3 stops)	1/250 (-1 stop)
100 (-1 stop)	$f/16$ (-4 stops)	1/4 (+5 stops)

- ◆ Why choose one combination over another?
 - Each parameter has a secondary image effect → more later

Introduction to Digital Photography

Exposure

Note: On some lenses, especially from the film era, the lens aperture is set using a ring on the lens→on digital cameras the aperture is often set by the body

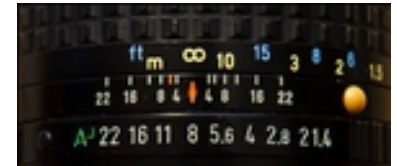
- **Parameter adjustment**

- ◆ **Camera body dials**

- Film cameras had dedicated dials/rings for parameters
 - Digital cameras may have dials for aperture and/or shutter speed
 - Single dial may be used for different parameters in different modes

- ◆ **Menu system**

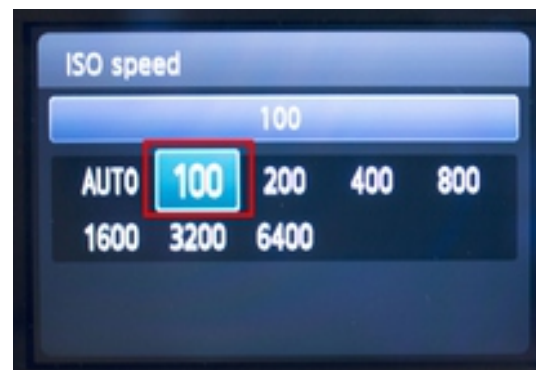
- MENU button enters menu system→scroll to select values
 - Shortcut buttons may go directly to specific parameters
 - Some cameras have programmable buttons or settings memories



ISO dial



shutter speed dial



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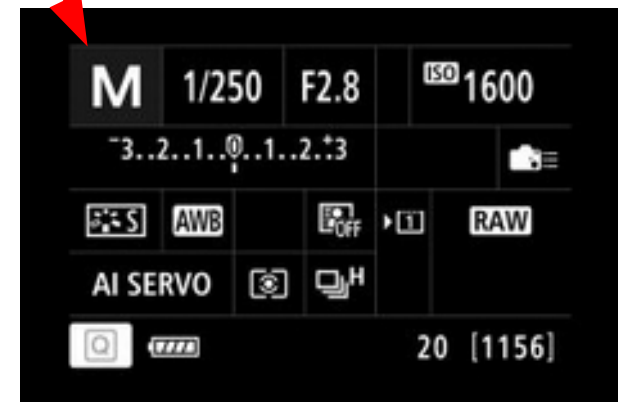
Exposure

Note: If the camera has no exposure mode dial, then exposure mode is set by the menu system

- Manual parameter adjustment
 - ◆ Photographer sets ISO, aperture, and shutter speed
 - ISO is usually set via the menu system (may be a shortcut button)
 - Exposure mode dial controls how other parameters are set
 - Dial contains the letters **M**, **S**, **A**, **P** (possibly in a different order)
 - Set the dial to **M** for manual setting of aperture and shutter speed



exposure mode



Introduction to Digital Photography

Exposure

- Manual parameter adjustment exercise
 - 1) Set ISO to 200
 - 2) Set exposure mode to **M**→with mode dial or menu
 - 3) Set aperture and shutter speed to specified values
 - a) Instructor will use light meter to obtain proper exposure values
 - 4) Take photo→should be properly exposed
 - 5) 1. adjust ISO, 2. adjust aperture, 3. adjust shutter speed
 - a) Take photos and observe exposures
 - 6) Try equivalent exposure luminance values to #3
 - a) Take photos and observe exposures



Note: Use the 'playback' button to look at the previous photo taken by the camera→usually indicated by a triangle

Introduction to Digital Photography

Exposure

Note: The more decisions the camera makes, the less the photographer is in control→the **art** of photography lies in expressing the photographer's vision of the scene

- **Basic exposure modes**

Mode	Symbol	Photographer Sets	Camera Sets
Manual	M	ISO, aperture, shutter sp.	—
Aperture Priority	A	ISO, aperture	shutter speed
Shutter Priority	S	ISO, shutter speed	aperture
Program	P	ISO	aperture, shutter sp.
Automatic	AE/Auto	—	ISO, aperture, shutter sp.

- **Scene exposure modes**

- ◆ **For specific types of photography**

- Landscape, portrait, macro, sports, night, etc.
- Camera is guessing your goals→you lose control



Introduction to Digital Photography

Metering

- How do we know the proper exposure?
 - ◆ Trial and error
 - Take a lot of different exposures and see which one comes out best
 - Not the best use of the photographer's time (but sometimes is effective)
 - ◆ Rule of thumb, example: Sunny 16 Rule
 - On a sunny day, with f/16 aperture, set shutter speed to 1/ISO
 - Example: sunny day, ISO 200, f/16→set shutter speed to 1/200
 - Or any equivalent exposure luminance→ISO 200, f/8, 1/800
 - ◆ External light meter
 - Was the only option before film cameras had a built-in meter
 - Often used in a studio setting

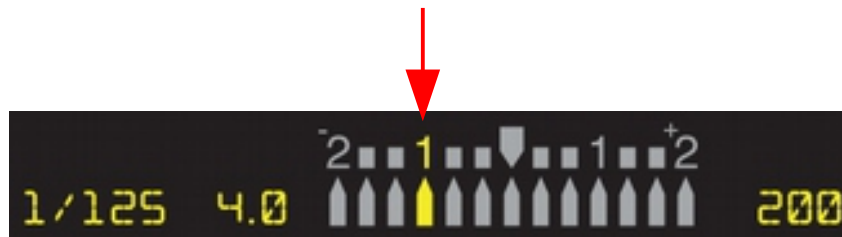


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Metering

- How do we know the proper exposure?
 - ◆ Internal light meter
 - Added to 35mm film cameras in the 1960's
 - Standard feature of all digital cameras (some may have more options)
 - Used in all modes except **M** (works in **M** but does not affect parameters)
 - ◆ Light meters are calibrated to 18% reflectance
 - If subject reflectance is not 18% metering will be incorrect
 - Gray card is designed to reflect at 18%

-1 stop relative to what the camera
thinks should be the proper exposure



viewfinder light meter



gray
card

Introduction to Digital Photography

Metering

Note: Exposure compensation is a way to tell the metering system that it must adjust what it thinks is the proper exposure→used in **S**, **A**, **P**, **AE** modes

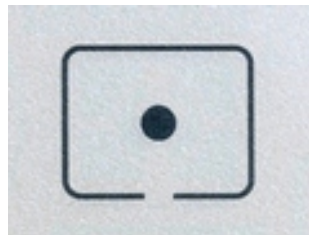
- Metering modes

- ◆ Determine how the meter is used to measure light levels
 - Center-weighted→the center area gets more importance
 - Spot→only a small area is considered (possibly moveable)
 - Matrix or multi-zone→the entire area is used, with an algorithm
- ◆ Spot metering on a gray card should give good exposure...
 - ...unless there are very bright or dark areas in the scene→clipping
 - Exposure metering may need adjustment
 - (1) use **M** mode or (2) 'exposure compensation'

example icons, real ones will vary by camera



center-weighted



spot



matrix



exposure compensation dial



exp. comp. button

Introduction to Digital Photography

Note: On some cameras you may need to press the shutter button down half-way to activate the meter

Exposure

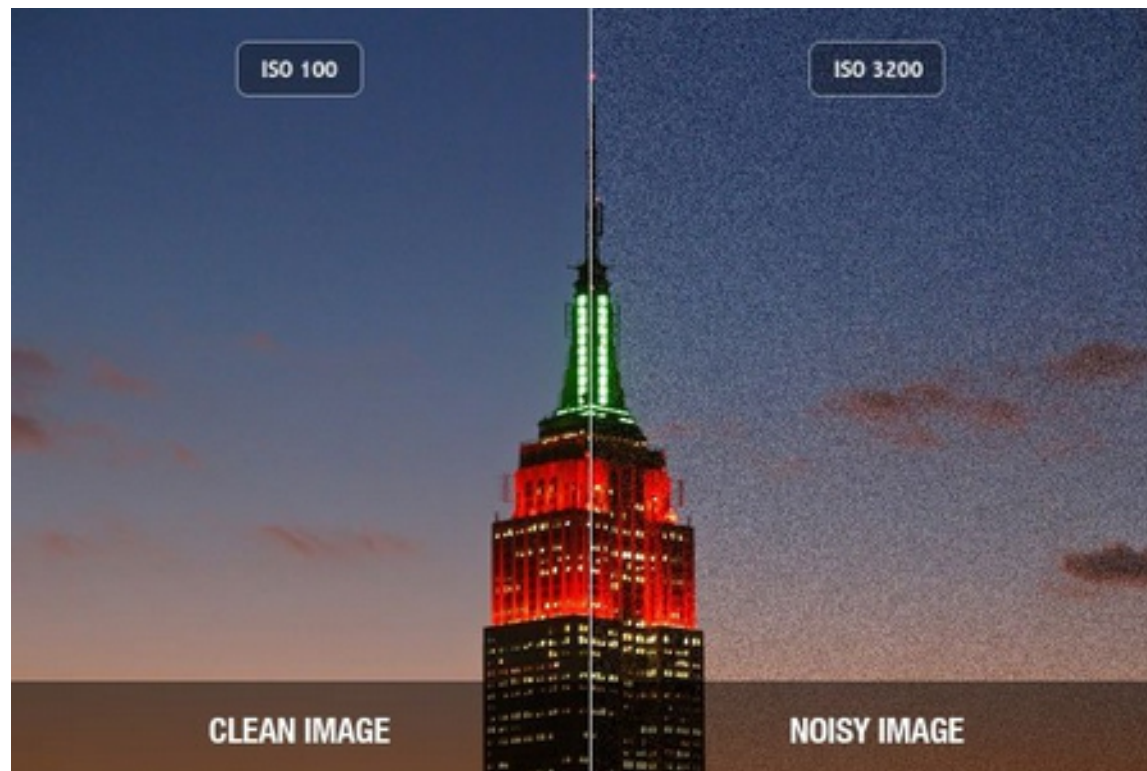
- Exposure modes and metering exercise
 - 1) Set ISO to 200 or 400
 - 2) Set metering mode to 'center-weighted'
 - 3) Set exposure mode to **M**→with mode dial or menu
 - 4) Set aperture to $f/5.6$ (or lowest value available from lens)
 - 5) Adjust shutter speed based on light meter
 - a) Take photo and observe exposure
 - 6) Change metering mode to 'spot'
 - 7) Meter off gray card (put spot on gray card), set shutter speed
 - a) Take photo and observe exposure
 - 8) Set metering mode to 'matrix'
 - 9) Set exposure mode to **A**→select different f -numbers
 - a) Take photos and observe exposures (try exp. compensation if available)

Introduction to Digital Photography

Exposure effects

Note: Noise reduction in post-processing is effective, but it also removes fine detail

- Each exposure parameter has a side effect
 - ◆ ISO
 - Higher ISO has more image noise
 - Ideally want to shoot at the lowest practical ISO

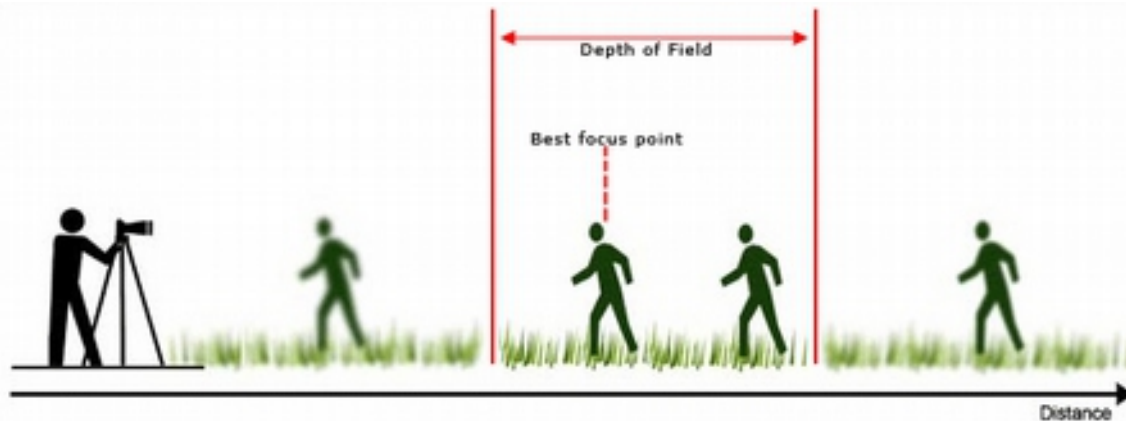


Introduction to Digital Photography

Exposure effects

Note: The start of the diffraction effect depends on sensor size→for APS-C cameras it is around $f/8$, for full frame cameras it is around $f/11$

- Each exposure parameter has a side effect
 - ◆ Aperture
 - Smaller aperture (larger f -number) has greater depth-of-field (DOF)
 - DOF is the zone that appears to be 'sharp' (in focus)
 - Very small apertures lose sharpness due to 'diffraction' (blurring effect)



Note: Landscape photography usually uses small apertures to ensure everything is in focus; portrait photography usually uses large apertures to blur the background



Introduction to Digital Photography

Exposure effects

Note: Without stabilization in the lens or camera body the shutter speed should be at least $1/(\text{lens focal length})$

- Each exposure parameter has a side effect
 - ◆ Shutter speed
 - Slower shutter speeds cause motion effects
 - Camera shake→rarely good, but can be reduced by stabilization



shutter speed too slow for camera shake



moving camera→abstract images

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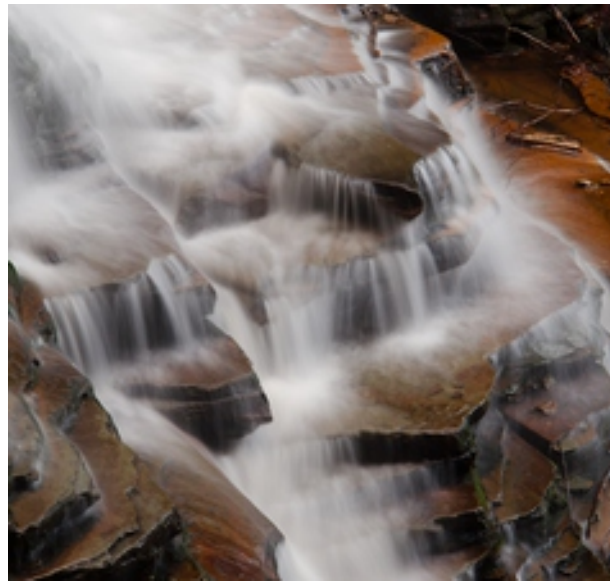
Exposure effects

Note: Achieving slow shutter speeds may require the use of a neutral density filter, which reduces light by several stops

- Each exposure parameter has a side effect
 - ◆ Shutter speed
 - Slower shutter speeds cause motion effects
 - Camera shake→rarely good, but can be reduced by stabilization
 - Subject motion→sometimes desirable as an effect



shutter speed = 1/60 sec



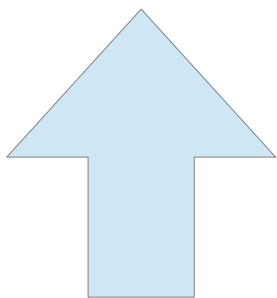
shutter speed = 2.5 sec



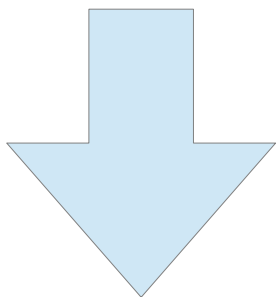
emphasizing motion can make a photograph more interesting

Exposure Effects Summary

Brighter

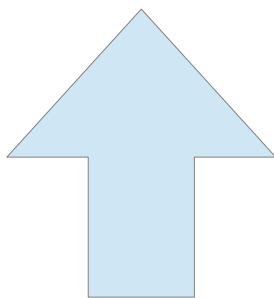


Exposure
Luminance

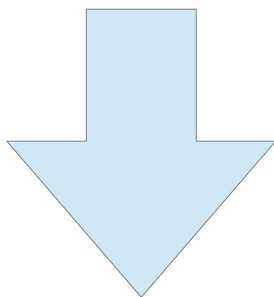


Dimmer

More
Noise
Higher



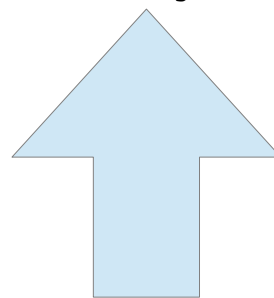
ISO



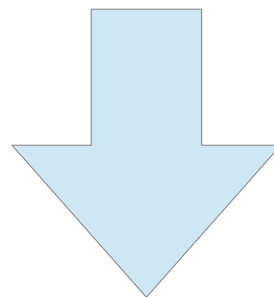
Lower

Less
Noise

Less
DOF
Wider
lower *f/#*



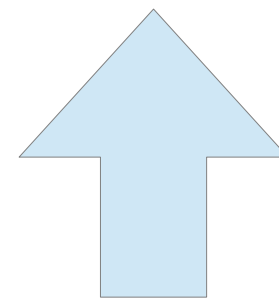
Aperture



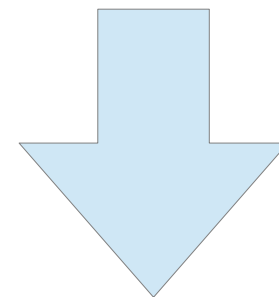
Narrower
higher *f/#*

More
DOF

More
Blur
Slower



Shutter
Speed



Faster

Less
Blur

Introduction to Digital Photography

Note: Image playback magnification usually involves pressing a button with a magnifying glass icon

Exposure

- Exposure effects exercise
 - 1) Set metering mode to 'center-weighted'
 - 2) Set exposure mode to **M**→with mode dial or menu
 - 3) Set ISO, aperture, and shutter speed for proper exposure
 - 4) Vary ISO to see how noise changes
 - a) Compensate for ISO changes with other parameters
 - b) Note that noise can be difficult to see on a small display
 - c) Magnify in image review to see noise more easily
 - 5) Vary aperture to see how depth-of-field changes
 - a) Compensate for aperture changes with other parameters
 - b) May need to magnify in image review to see effects
 - 6) Vary shutter speed to see how blur changes
 - a) Compensate for shutter speed changes with other parameters
 - b) May need to magnify in image review to see effects

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