Back to Basics:

EVERYTHING EXPOSURE

Orleans Photo Club

February 10, 2024

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WHAT WILL WE TALK ABOUT?

Will:

- Why meter light
- Incident vs Reflected
- Metering Types
- Exposure Triangle
- Exposure Compensation

Will Not:

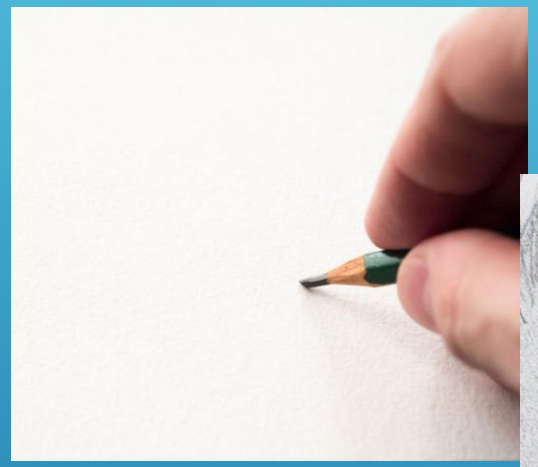
- Not Too Camera Specific
- Won't really talk about everything exposure
  - too broad!

What is "Photography"?

"Drawing with Light"

From the Greek
Photo – light
Graph – to draw

To “draw” a good photo, we have to use just enough “pressure” (light) to get our image



Not too *light*

Just the right amount

Not too HARD

Daguerreotype Camera

- ISO Equivalent 0.0004
- Earliest version required exposure time of several minutes or longer
- First used in 1840's
- Exposure was "judged"

As Cameras developed…

Cameras had one shutter speed, one aperture and the ISO was set by the film that was loaded

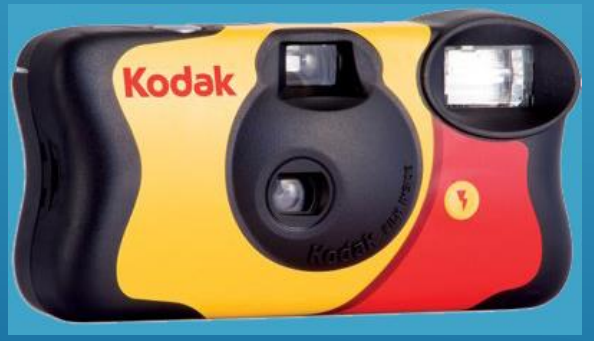
The Sunny-16 Rule

- Aperture set to f/16
- Shutter speed set to 1/ISO speed

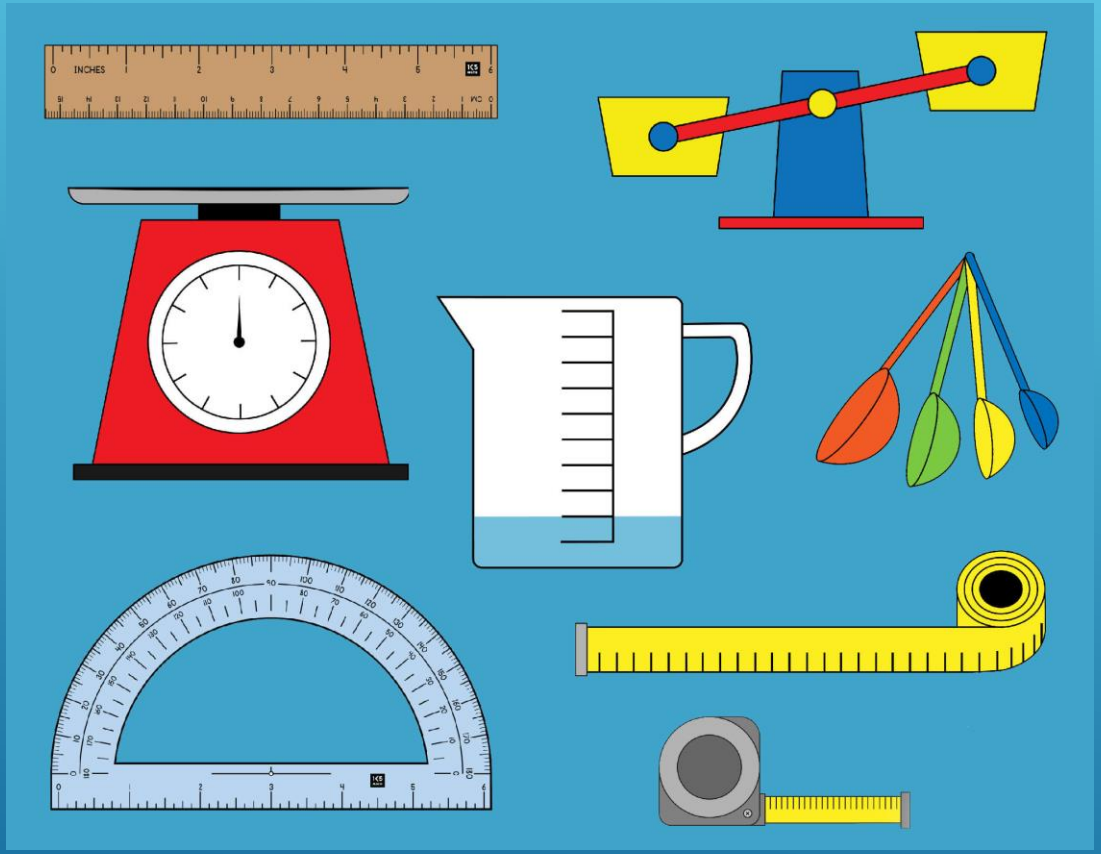
Best in bright sun

- sun in front of subject (not backlit)

Still used in some simple point and shoot cameras today



But today, cameras are more sophisticated
To get the right amount of light, we need to measure it



… or Meter the light

Metering Light

Two methods to measure light:

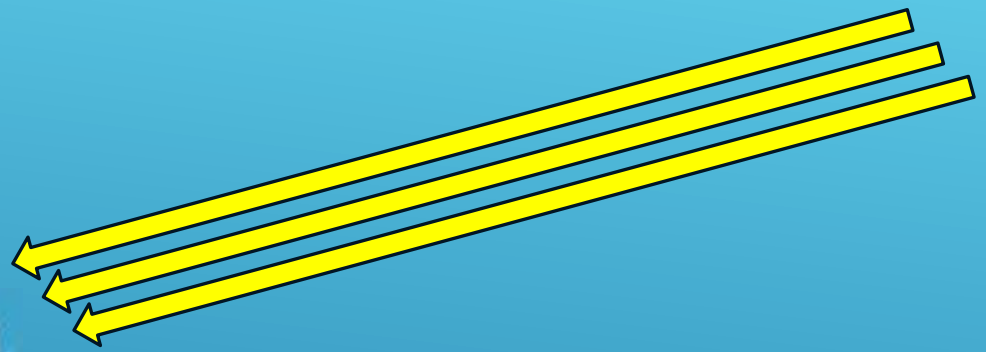
- Falling on subject **(incident** light)

- Reflected from subject (**reflected** light)

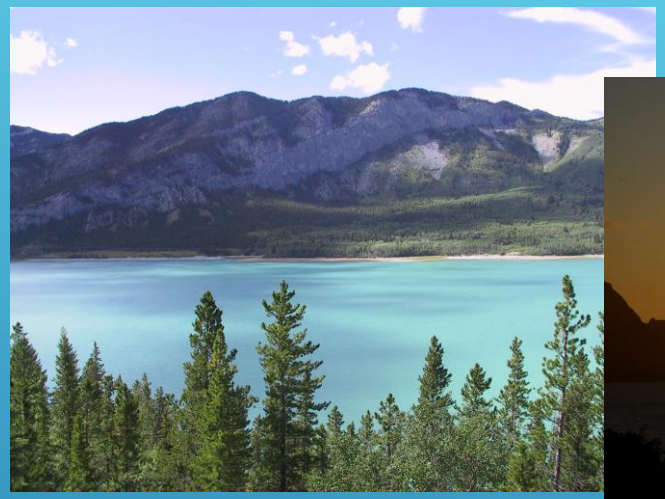
Measuring Incident Light

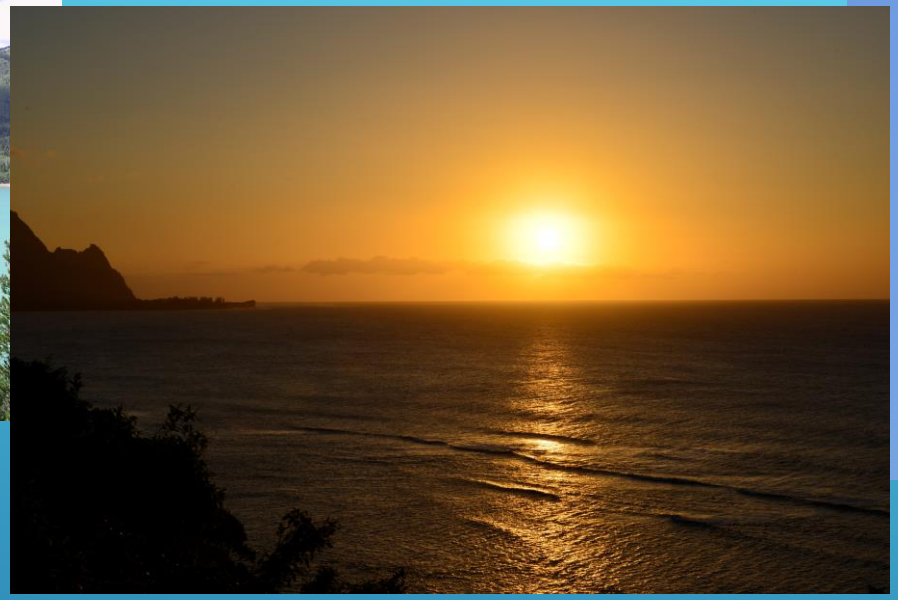
Advantages:
- most accurate
- no color bias
- consistent results

Disadvantages:
- may not be practical



Excellent for studio work
or where scene is controlled and subject is accessible





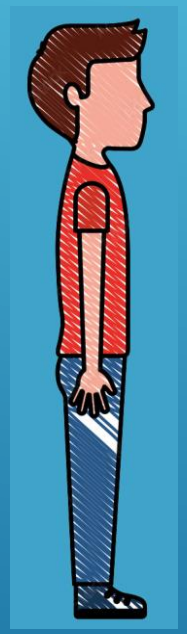
Cannot measure incident light in many situations:

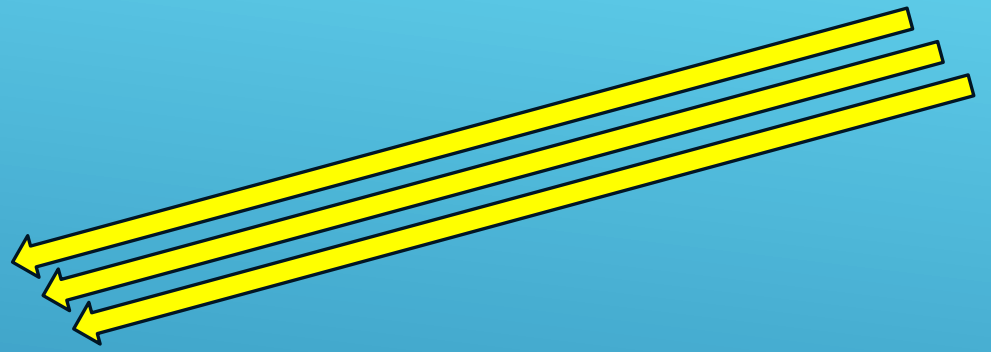
- distance photograph
- action/changing photograph
- when shooting towards the light

Measuring Reflected Light

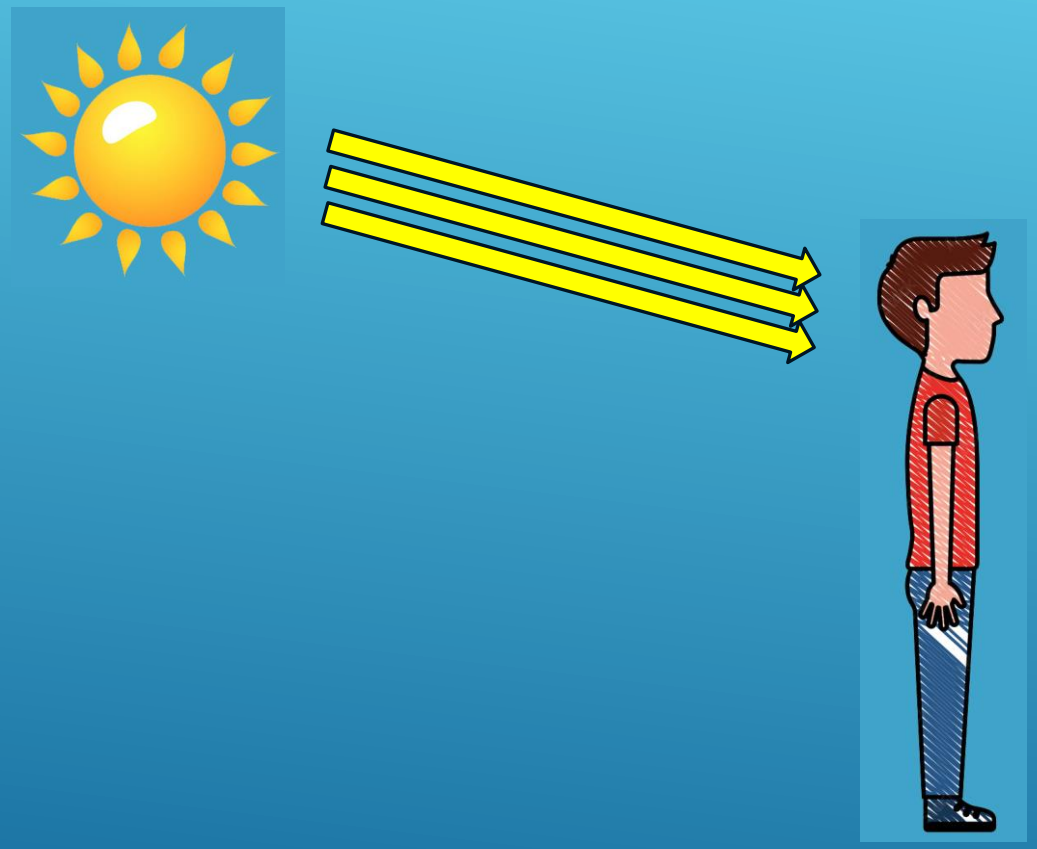
Advantages:
- easier

Disadvantages:
- more likely to be inaccurate
- may not take other scene factors into account



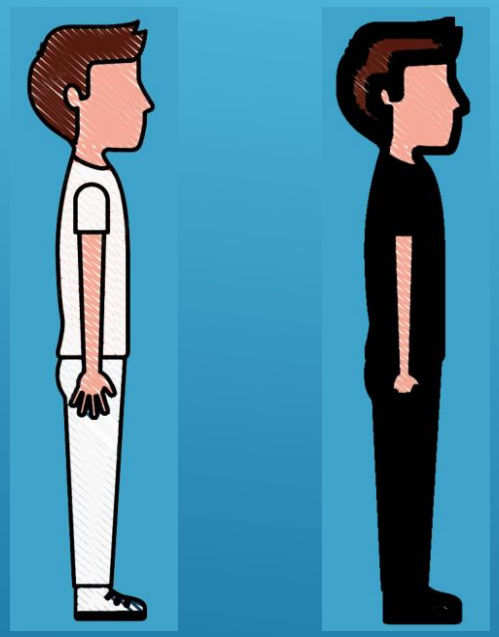


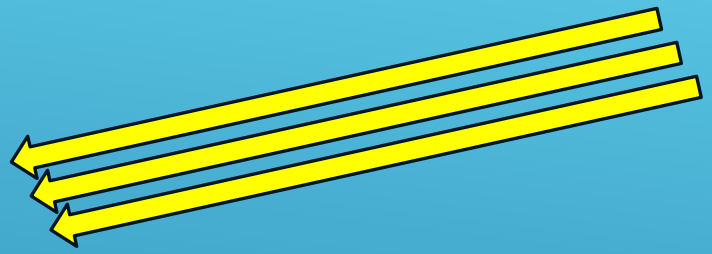
Challenges For Measuring Reflected Light



Reflected light metering can be confused by strong backlight…

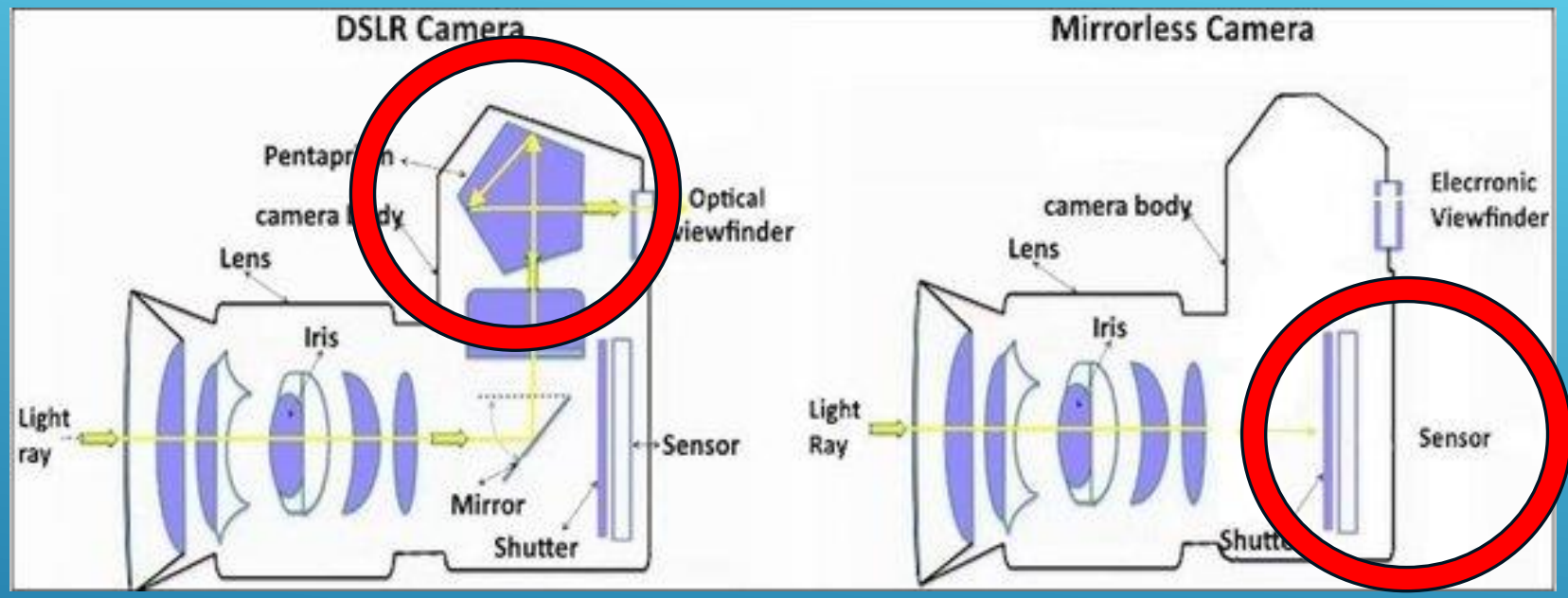
Challenges For Measuring Reflected Light





…or when the subject is predominantly light or dark (e.g. think weddings)

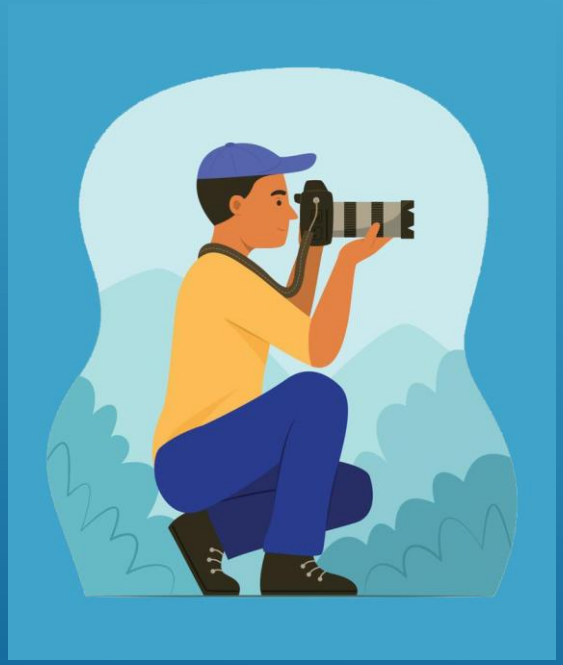
Where is the light meter in a camera?



- DSLR's use some of the incoming light and split it in the pentaprism.
- Mirrorless use the same sensor as will be used for the photo

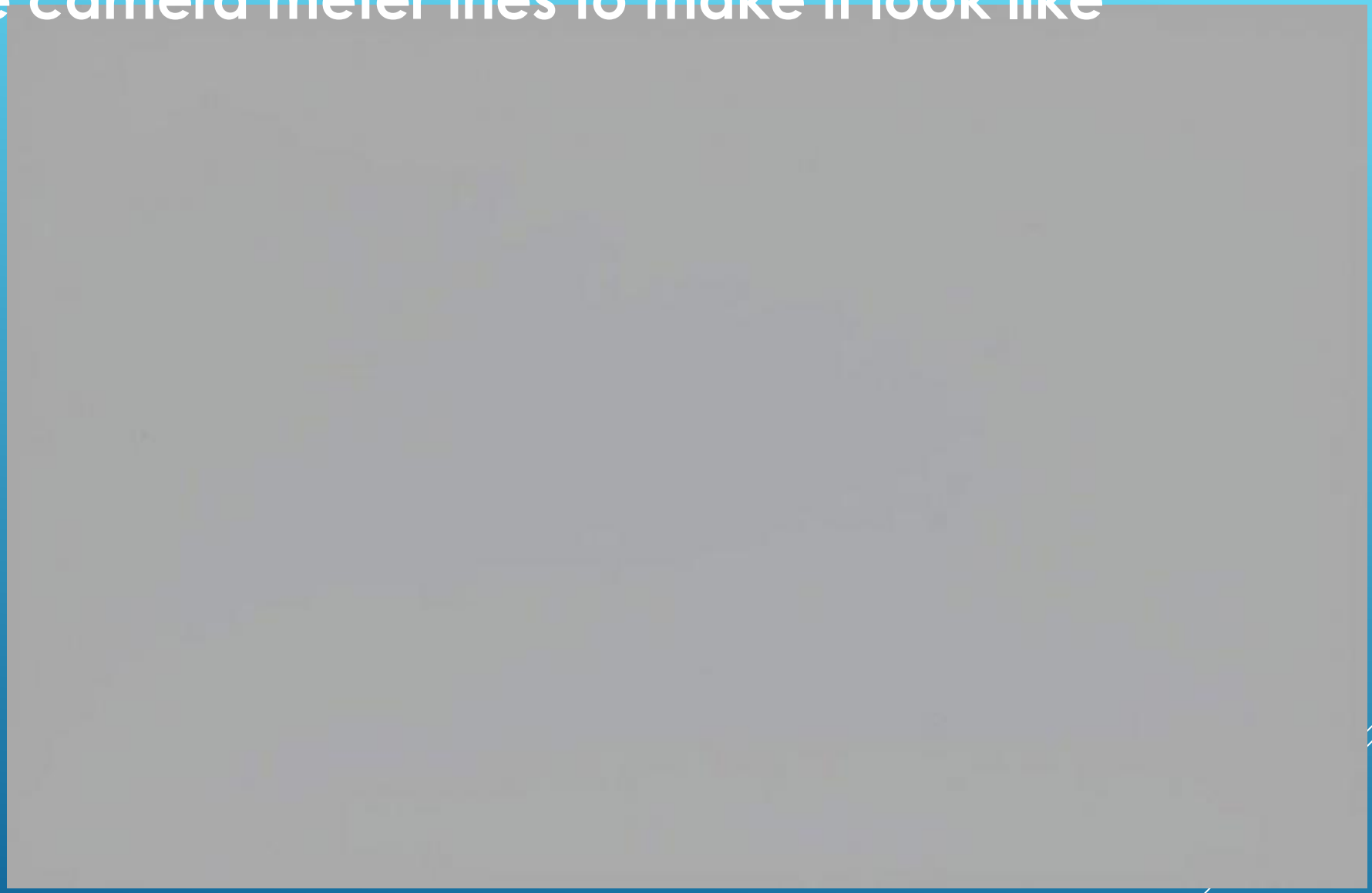
Can also use handheld meter

What does the camera's exposure meter "see" when making a photograph?

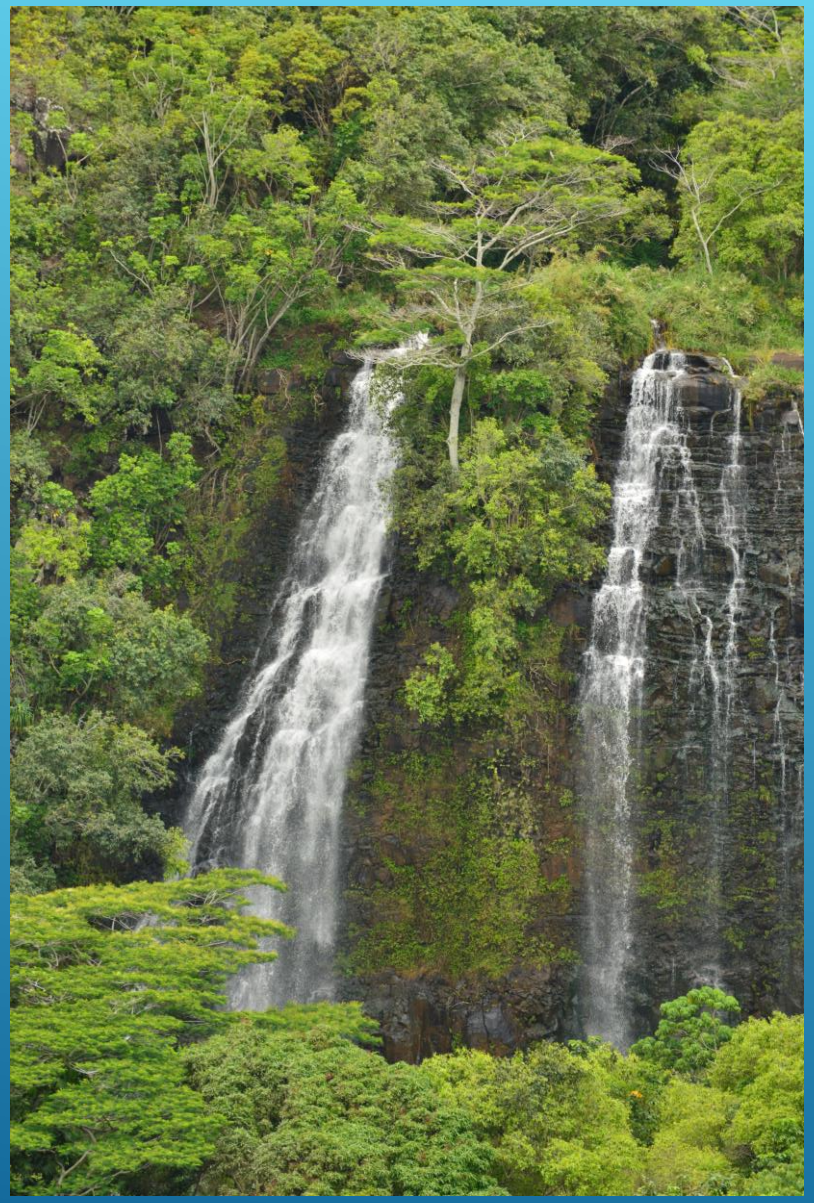


What you see…

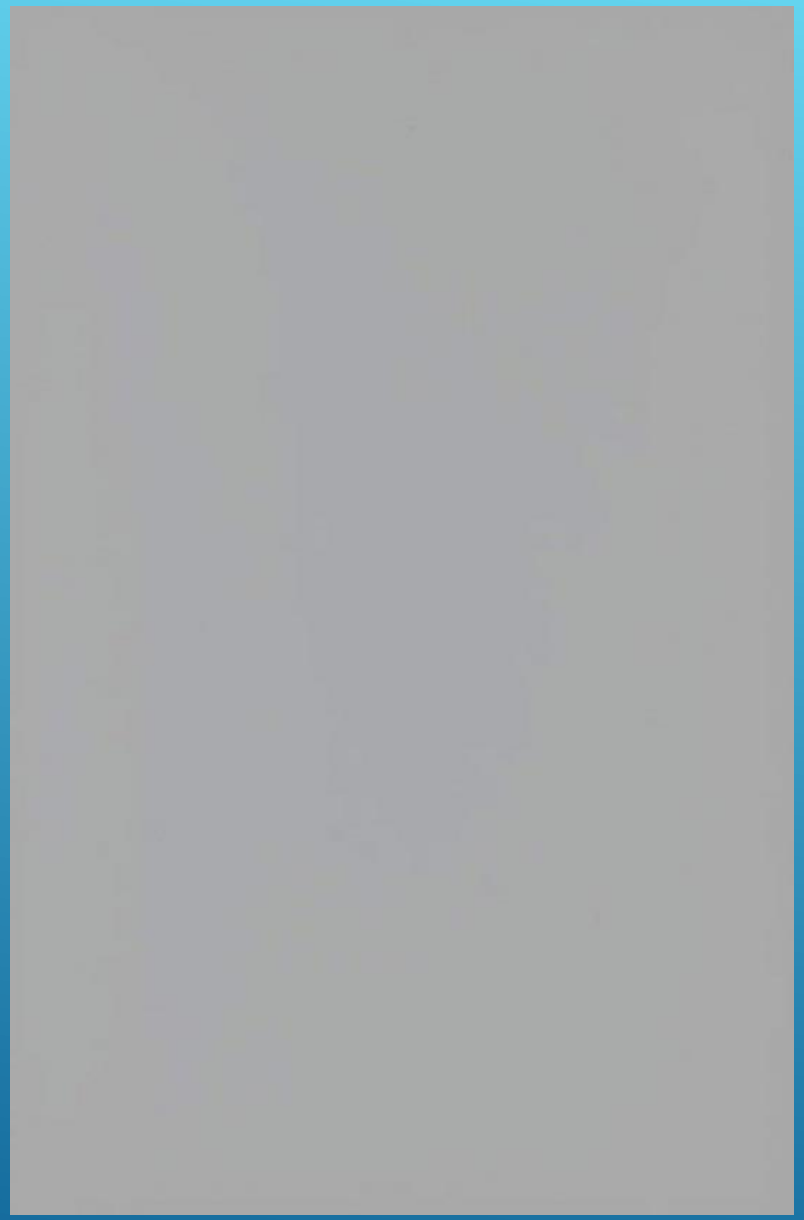
What the camera meter tries to make it look like



What you see…

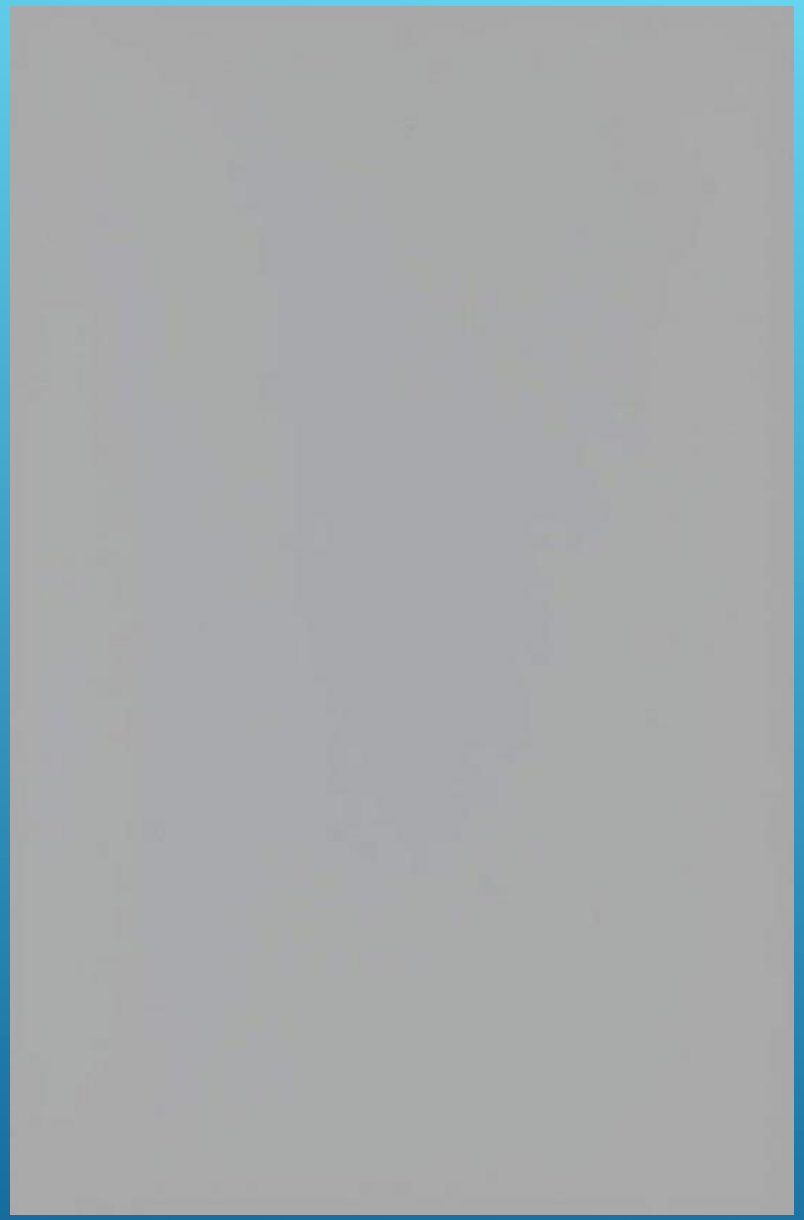


What the camera meter tries to make it look like



What you see…

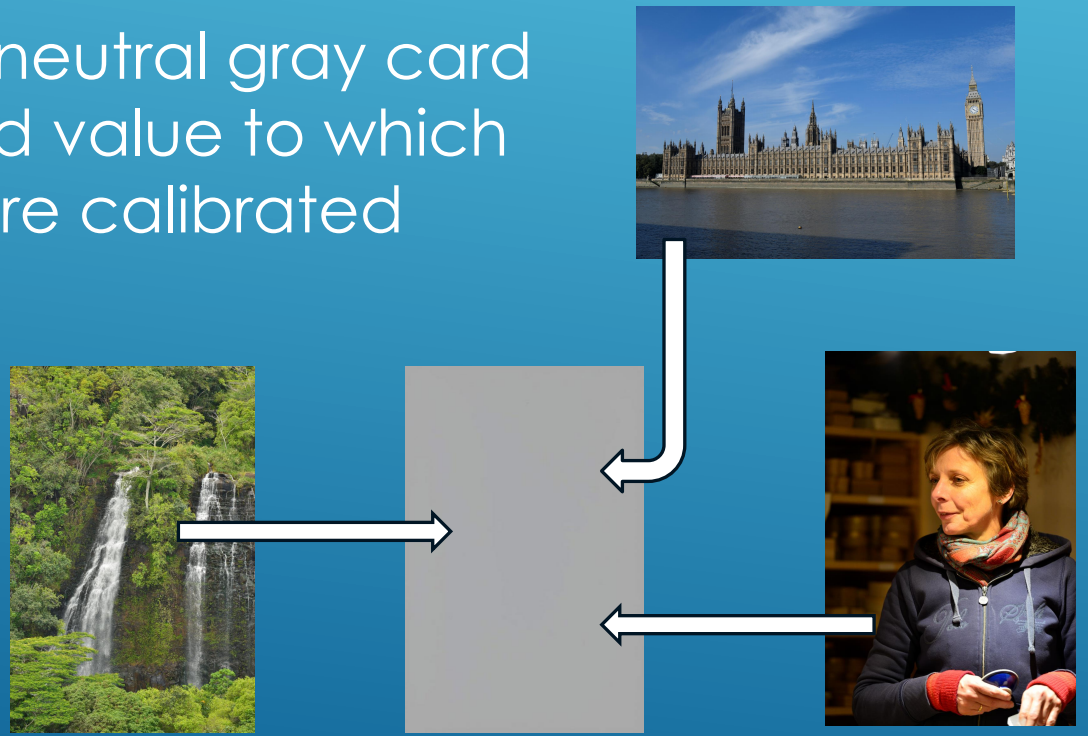
What the camera meter tries to make it look like



Averaging all tones and colours in a scene reveals that 18% of the light is reflected

Neutral gray was chosen to represent the middle colour

The result is the 18% neutral gray card which is the standard value to which all camera meters are calibrated



This explains why pictures of white objects and black objects will both look gray when photographed without exposure compensation

Snow

BBQ Cover

How does the camera meter a scene to calculate the exposure for a photograph?

Meter here?

Meter here?

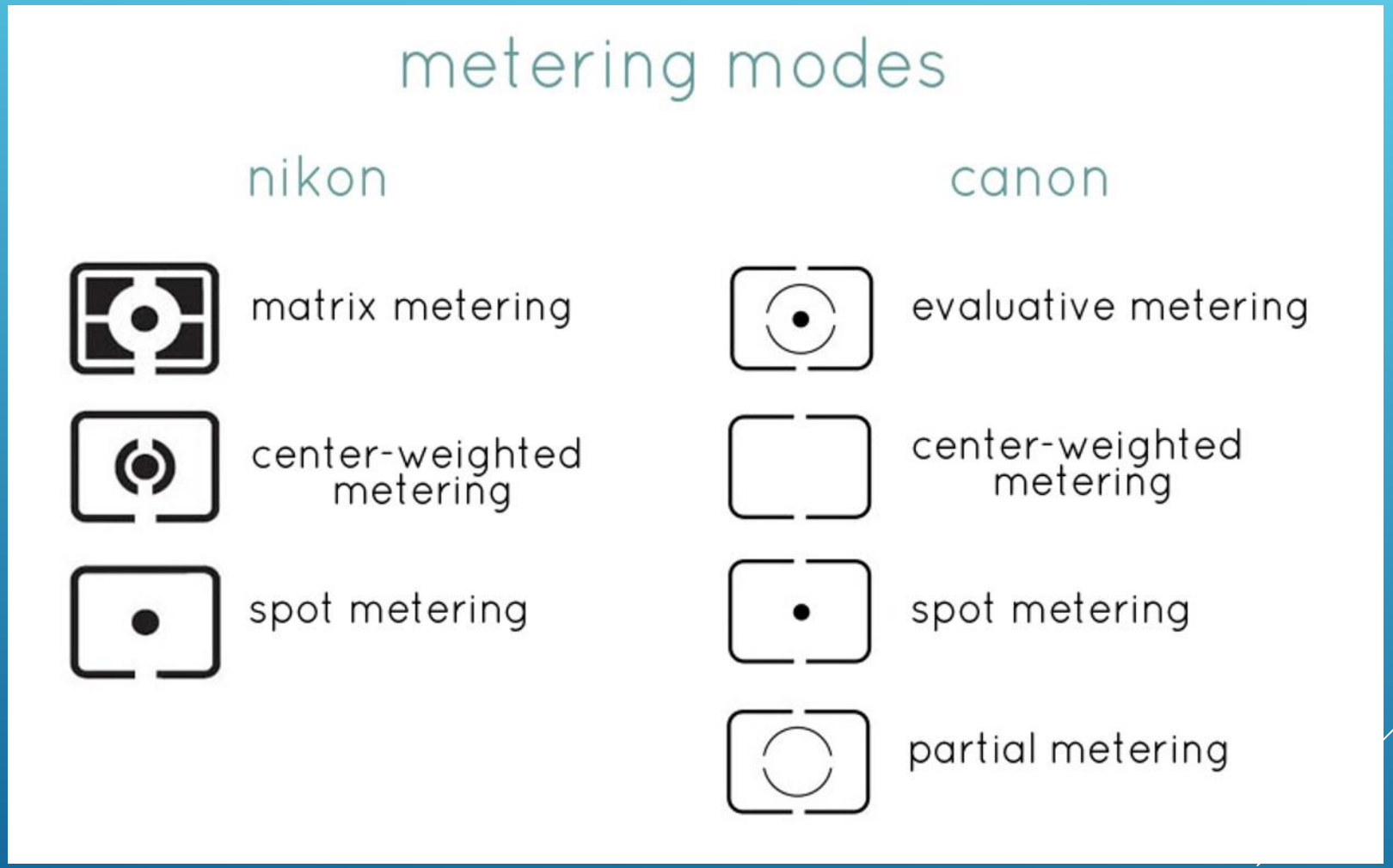
Meter here?

Meter here?

Meter here?

The camera uses various metering methods to measure areas of the frame and arrive at a reasonable exposure

Typical Camera Metering Modes



Matrix or Evaluative Metering Mode

- Usually the default option on most cameras
- Measures entire scene
- Divides scene into multiple “zones”
- Creates “intelligent” average
- May use internal “reference photos” to adjust exposure
- May use focus point to adjust exposure

Best used

- all-round metering setting for most subjects, particularly landscapes

Center-weighted Metering Mode

- Considers all areas of the frame but is heavily weighted to the center
- Size of the center-weighted portion may be changeable in camera settings – 8 to 12%
- Generally does not consider position of focus point, only the center is emphasized

Best used

- taking photos of subjects against a lighter background
- important to prioritize what is in the center of the frame – portraits

Spot Metering Mode

- Only evaluates light around the focus point
- Ignores all other areas of the frame
- Emphasis on a very small part of the frame ~1.5 to 3%

Best used

- Subjects positioned against a bright background
- Subjects that are small relative to the frame

Metering Modes Compared

Matrix/Eval

CW

Spot

Metering Modes Compared

Matrix/Eval

CW

Spot

Metering Modes Compared

Matrix/Eval

CW

Spot

But shooting RAW can be used to forgive a lot of sins

Original Exposure

Adjusted RAW Image

Other Metering Modes

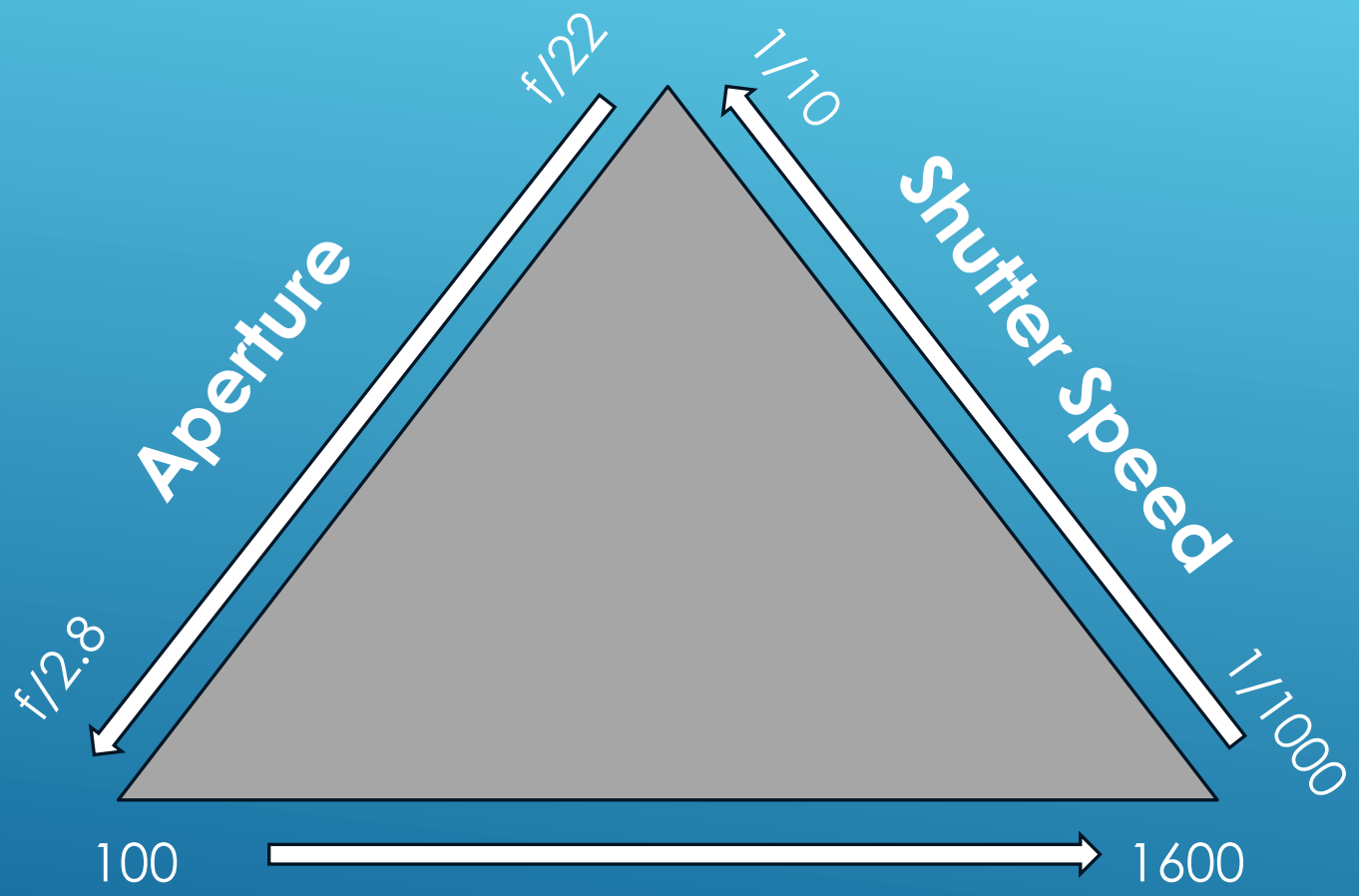
- Highlight Priority Metering – protects highlights and is useful if there is a bright subject against a dark background
- Partial Metering – only small section of the center of the frame is measured (Canon only)
- Entire Screen Average Metering – evaluates entire frame but does not assign priority to focus point (Sony only)

Metering seeks to combine the optimum values for variables to achieve a proper exposure

- **Aperture** – the amount of available light that is passed through the lens
- **Shutter speed** – the amount of time that light may impinge on the sensor
- **ISO** – the sensitivity of the sensor to light

These three variables are connected to form **The Exposure Triangle**

The Exposure Triangle



Elements of the Exposure Triangle

Aperture

- Amount of light passing through the lens
- Influences depth of field
- Diffraction limiting at small apertures
- Distortion at wide apertures

Elements of the Exposure Triangle

Shutter Speed

- Length of time the sensor is exposed to light
- Controls perception of movement in the image
- Possible camera shake at slow shutter speeds
- Upper shutter speed limit based on camera

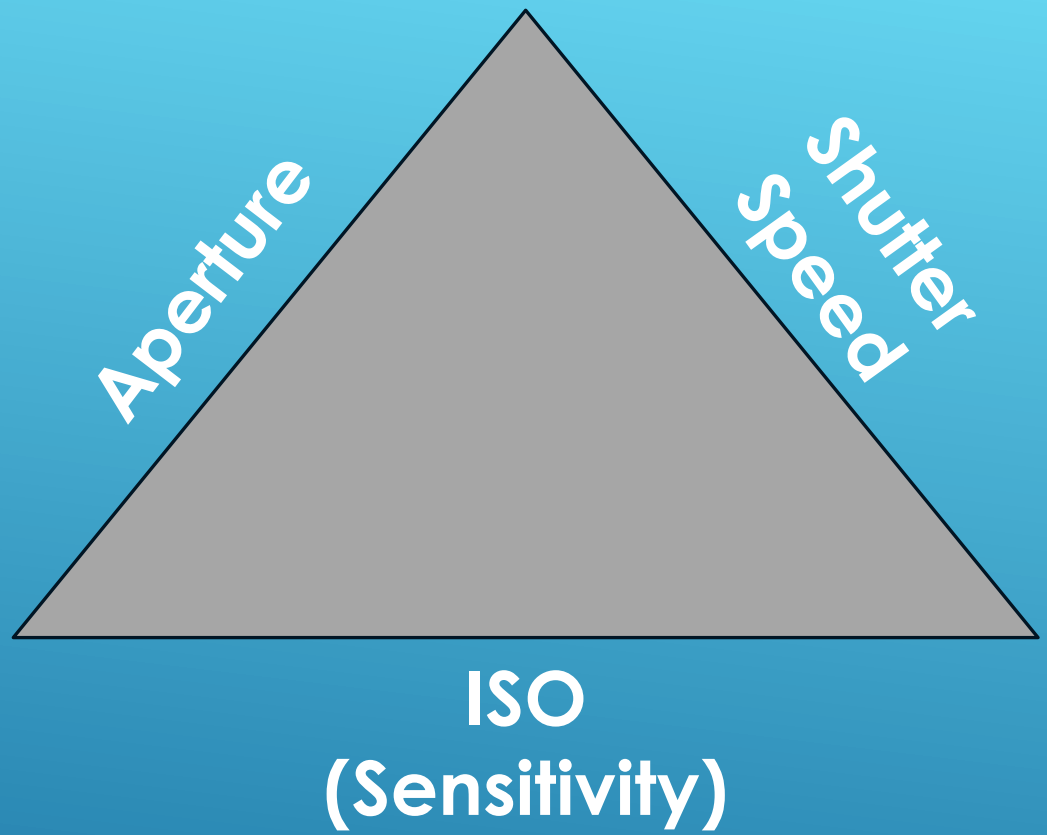
Elements of the Exposure Triangle

ISO

- Sensitivity of the sensor (or film)
- Limited by dynamic range of camera or set by the film selected
- Very low ISO may have low contrast
- Very high ISO may have grain or noise

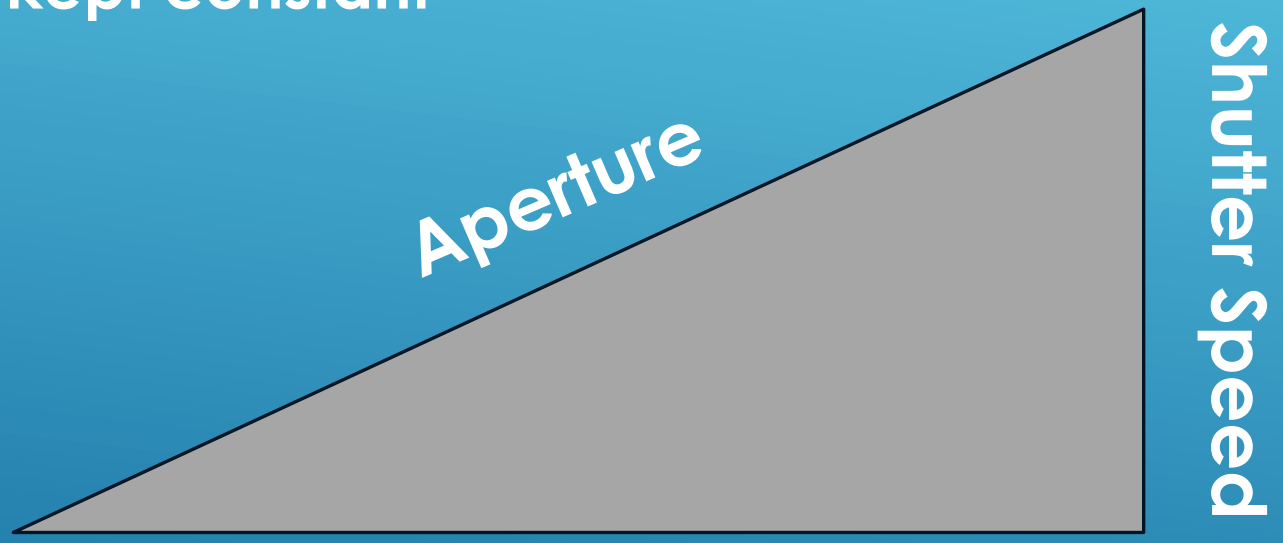
Together, these three parameters form a triangle where the area of the triangle is the exposure

Any exposure is a combination of these three parameters

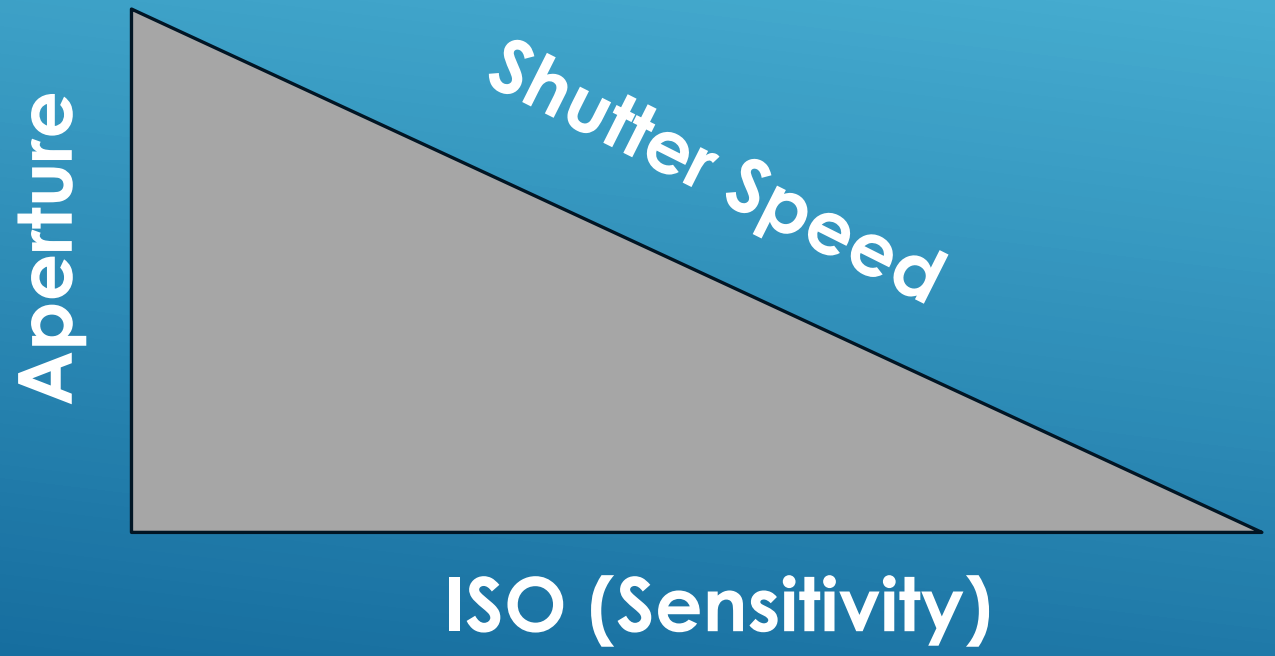


To keep the same exposure value, the area of the triangle (the exposure) must remain constant if one or more parameters are changed

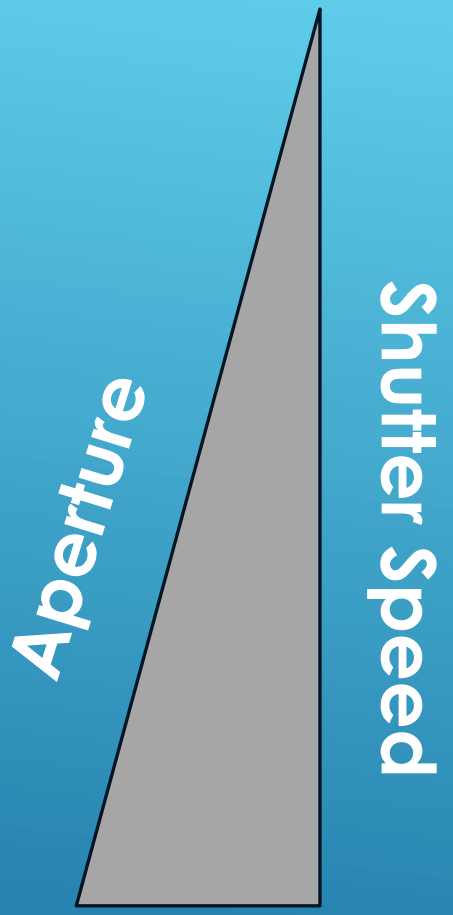
Shortening the shutter speed (faster) means opening the aperture if the ISO is kept constant



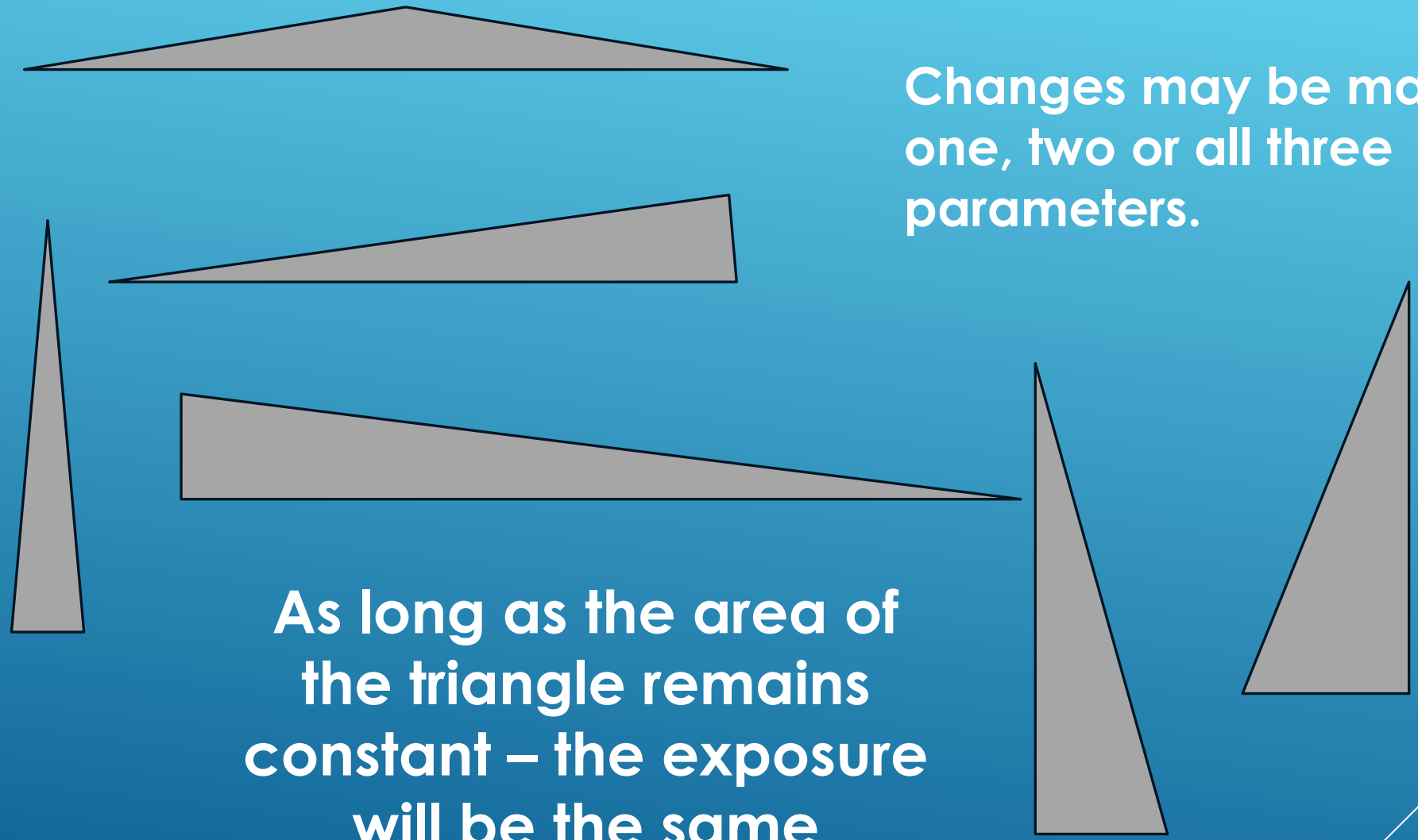
Meanwhile, choosing a smaller aperture with the ISO held constant means the shutter speed has to be lengthened for a longer exposure time



In this case, keeping the shutter speed constant but decreasing the ISO requires that the aperture be adjusted larger to compensate.



ISO (Sensitivity)

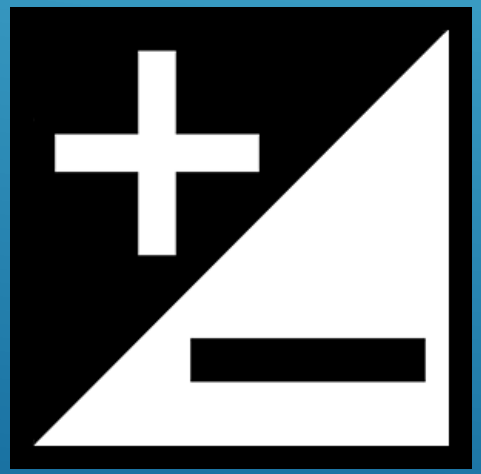


Changes may be made to one, two or all three parameters.

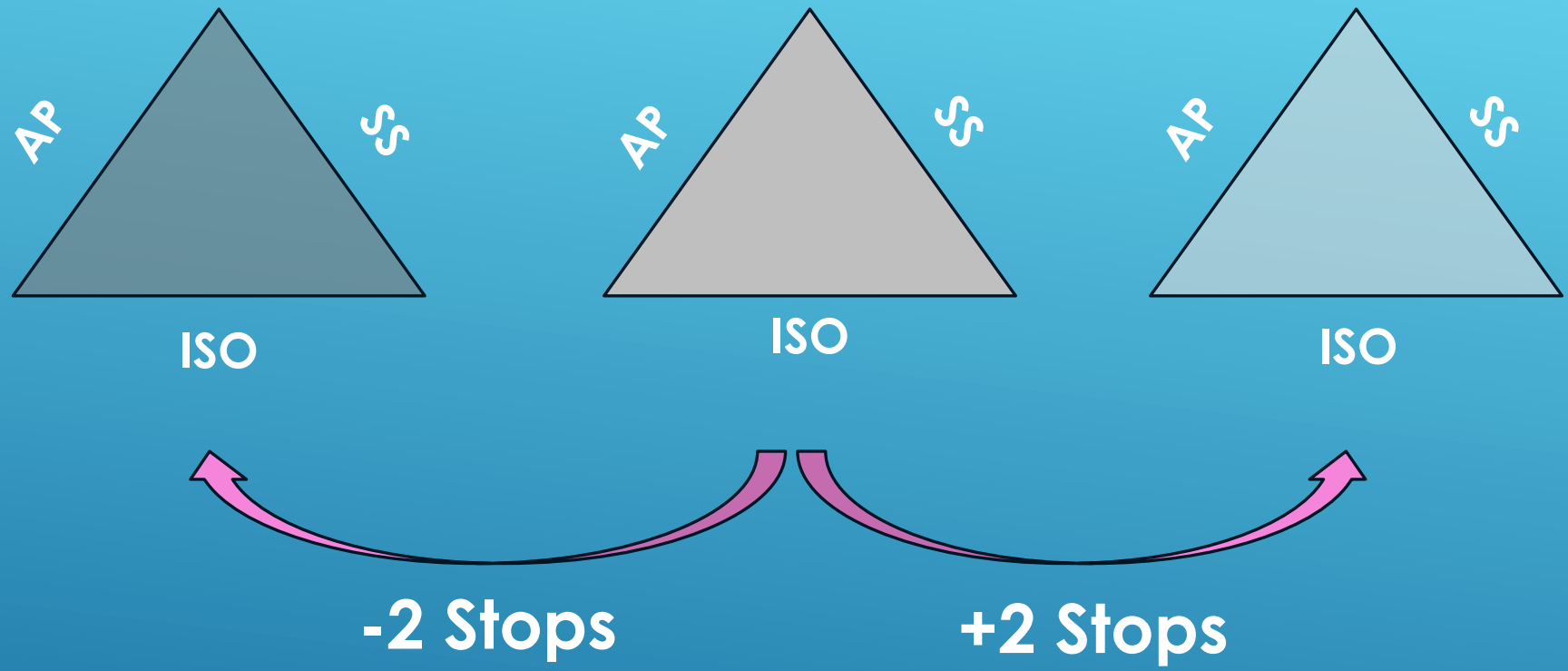
As long as the area of the triangle remains constant – the exposure will be the same

But what if the photographer wants to alter the exposure without changing the relationship between the ISO, aperture and shutter speed?

Exposure Compensation – the fourth control



Exposure Compensation

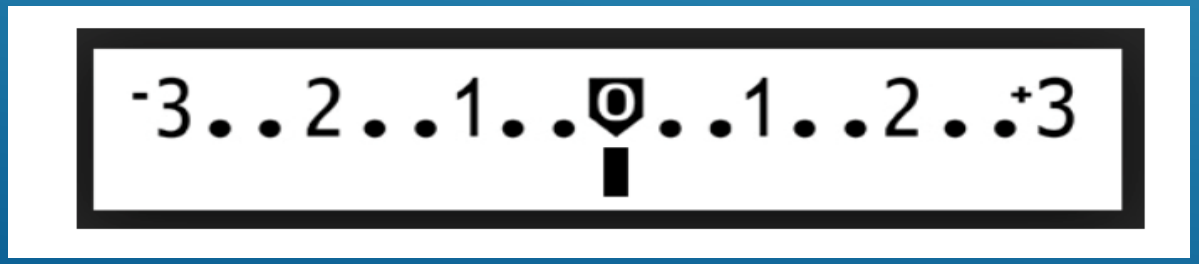


Introduces a *bias* into the metering system

Measured in stops or fractions of a stop

Exposure Compensation

- Override exposure settings selected by camera
- Allows photographer to *manually* increase or decrease brightness of the image
- The range of exposure compensation is set in the camera



The following images were exposed at ISO 64 and f/5.6

- only the shutter speed was adjusted based on the exposure compensation setting

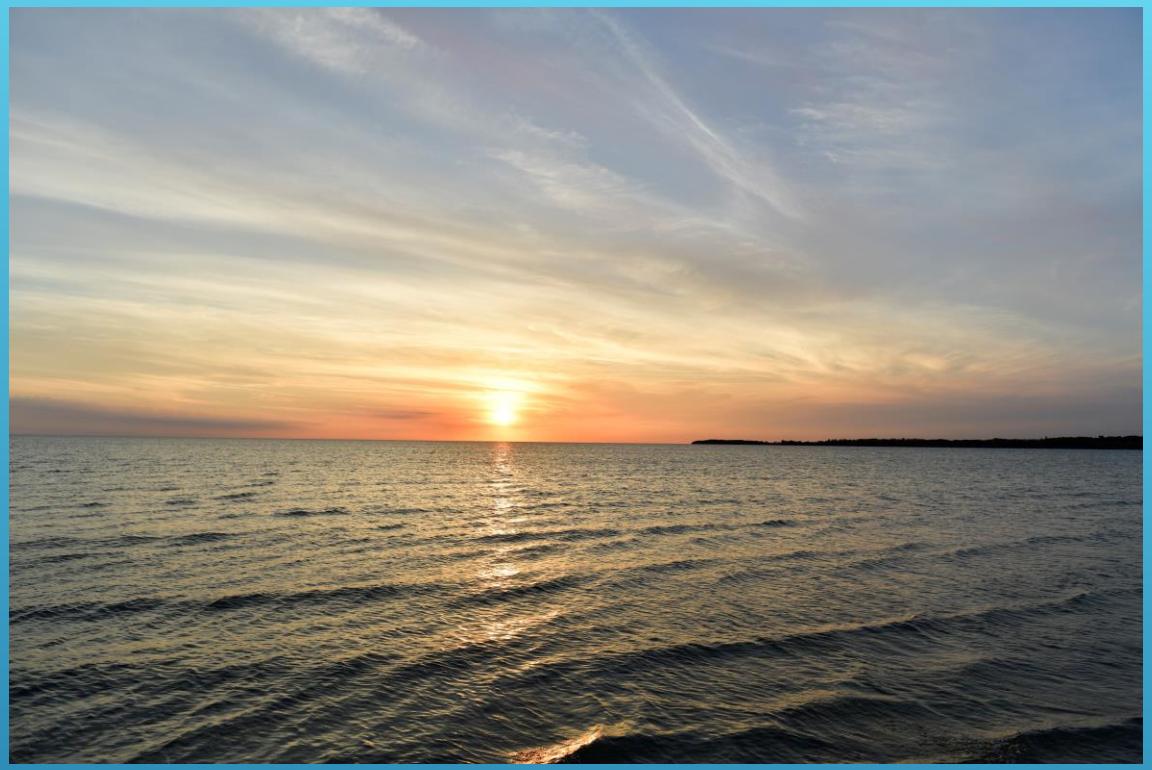
For each exposure,
the camera meter reported that
the exposure was correct
and equivalent

No Exposure Compensation

Manual Mode, Center Weighted, ISO 64, f/5.6, 1/1600s, EC0

Exposure Compensation set to -2 stops

Manual Mode, Center Weighted, ISO 64, f/5.6, 1/14000s, EC -2



Exposure Compensation set to +2 stops

Manual Mode, Center Weighted, ISO 64, f/5.6, 1/1250s, EC +2

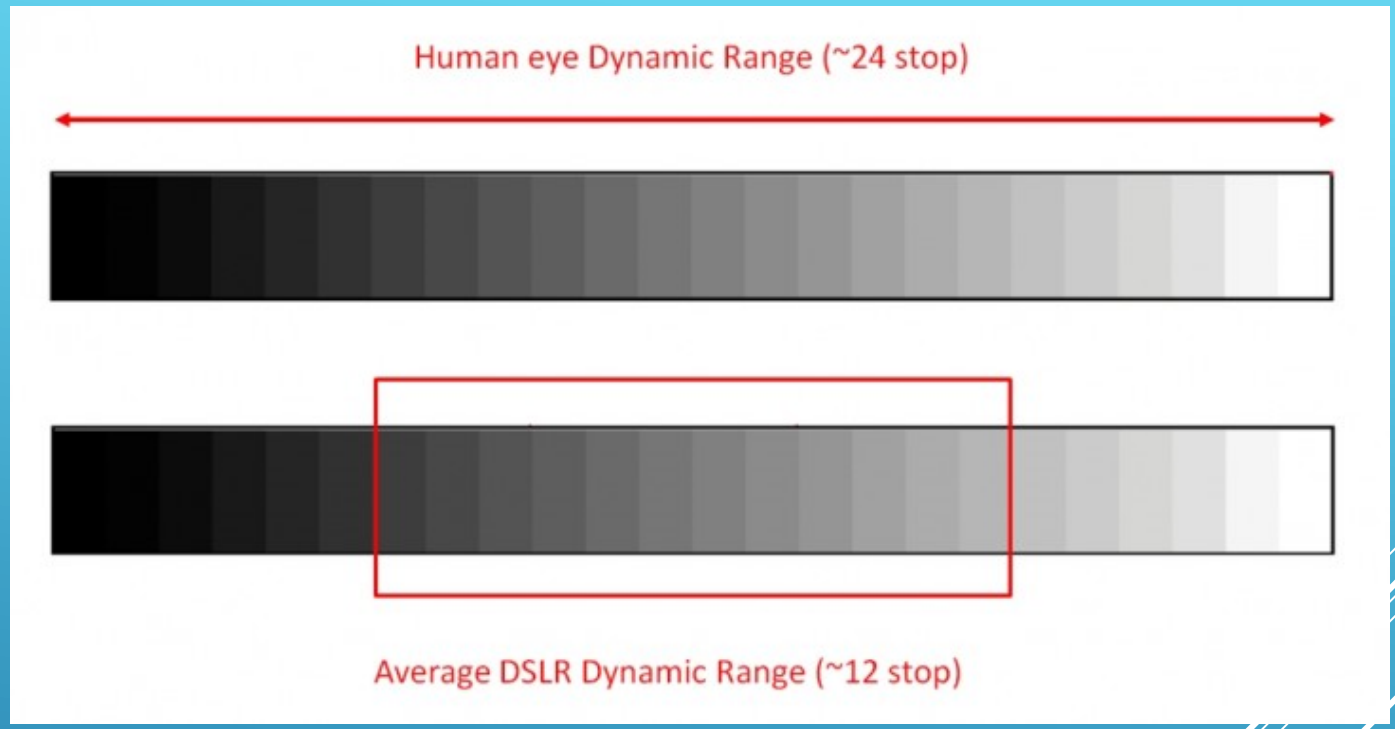
Exposure Compensation

- Works on all modes, <u>including manual</u>
  - Can be changed in manual mode by adjusting shutter speed, aperture or ISO

- Can compensate for filters, uneven lighting or to produce specific effect desired by photographer
- Assists in properly capturing the dynamic range of the image

Dynamic Range

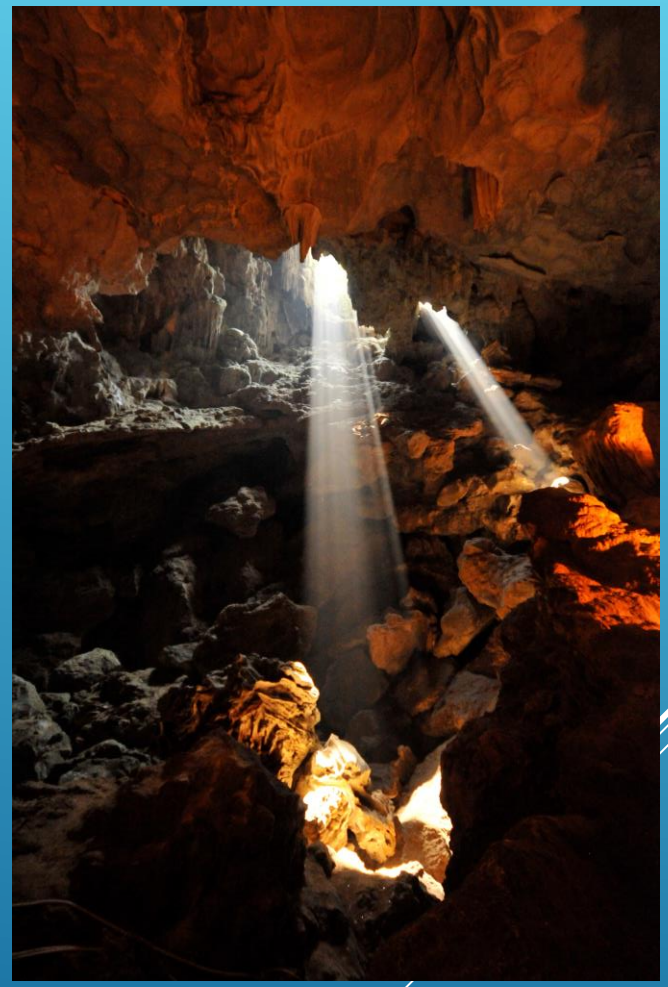
- Ratio of brightest part of image to darkest
- Bigger dynamic range is preferred
- Colour negative – 4-5 EV
- Colour slide – 5-8 EV
- Tri-X (B&W) film – 10+ EV
- Digital cameras – 12-15 EV



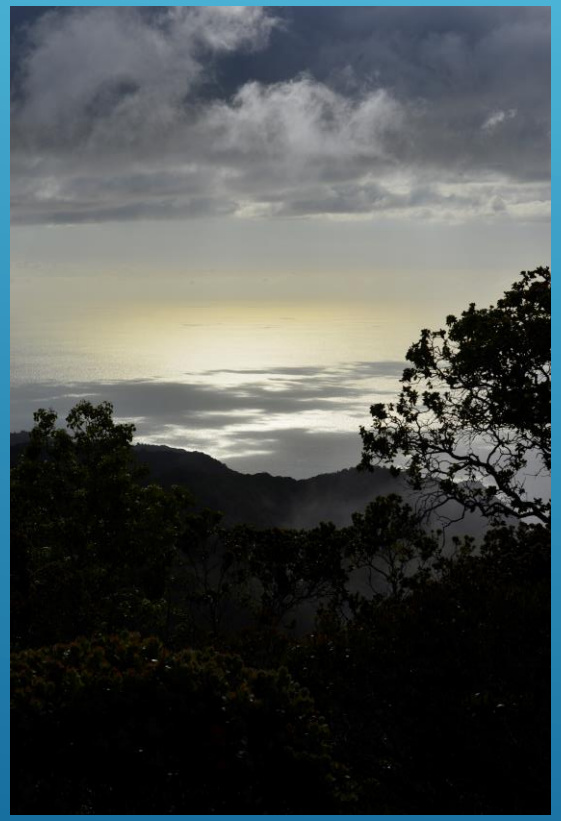
Dynamic range can be increased through techniques like High Dynamic Range Photography

High Dynamic Range Photography (HDR)

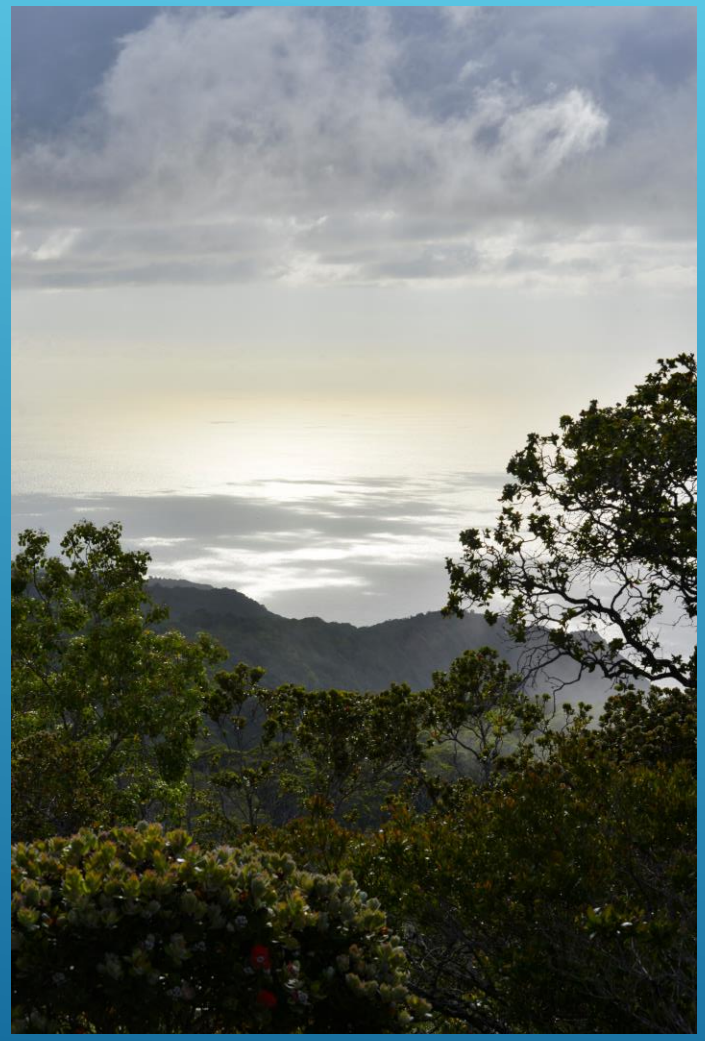
- In difficult lighting, cannot capture what the eye sees
- Use two photographs
  - one exposed for highlights
  - one exposed for shadows
- Combine in camera or in software to produce image with higher dynamic range than that of camera
- Can also use RAW images



High Dynamic Range Photography (HDR) in camera



Regular image



HDR image
In camera

High Dynamic Range Photography (HDR) RAW processing

Shooting in RAW allows the photographer to capture image elements not otherwise available in JPG image

Unprocessed JPG image

Processed RAW image

The Zone System

- Developed by Fred Archer and Ansel Adams
- Systematic control of image values to properly relate visual image with final image
- Control of dynamic range through selection of film, camera and lens
  - Manipulation during development of the final photograph
- Usually used spot-metering techniques to isolate image elements

Zone	Description
0	Pure black - no detail
I	Near black, with slight tonality but no texture
II	Textured black; the darkest part of the image in which slight detail is recorded
III	Average dark materials and low values showing adequate texture
IV	Average dark foliage, dark stone, or landscape shadows
V	Middle gray: clear north sky; dark skin, average weathered wood
VI	Average Caucasian skin; light stone; shadows on snow in sunlit landscapes
VII	Very light skin; shadows in snow with acute side lighting
VIII	Lightest tone with texture: textured snow
IX	Slight tone without texture; glaring snow
X	Pure white: light sources and specular reflections - paper white, no detail

"Expose for the highlights and process for the shadows"

Getting the Correct Exposure

Using:
- exposure triangle
- exposure compensation

allows the photographer to create a properly exposed photograph

A balance between darkest parts of the image and the lightest parts

Key Issue:
- minimize noise in the photograph

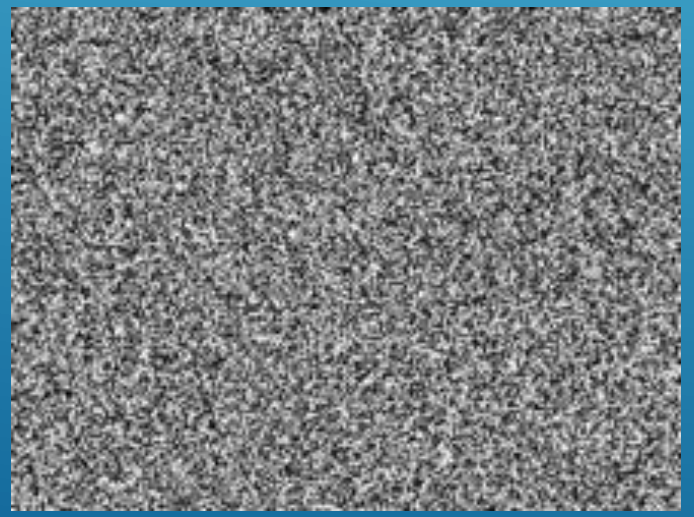
Noise in Photographs

With film, it was the grain size of the emulsion
With digital photography, noise is an issue

'Noise' is random electrical signals that become interpreted as part of the image

Sources:

- Sensor noise
- System noise



Managing Noise

Maximize the signal
Minimize the noise

How?

- Minimize sensor noise
  - Use lowest possible ISO setting
  - Keep exposure times as short as possible

- Combine short duration exposures to maximize signal

Stacking Images to Reduce Noise

Stacking increases S:N ratio

Used in astrophotography

T = 2 seconds

Short duration images lead to long exposure

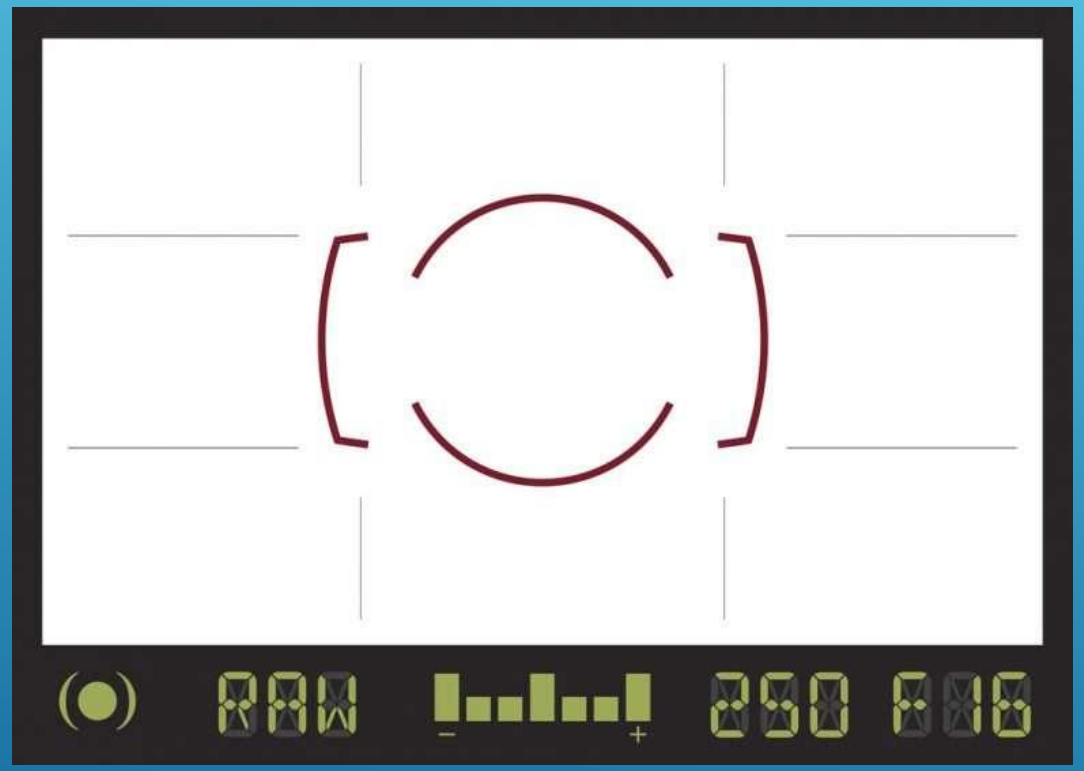
T = 35 minutes

Manipulation of the exposure triangle allows the photographer to produce a wide range of photos, which can evoke emotion with the image

Low Key

High Key

The metering system helps achieve the *desired* exposure by accurately and reproducibly measuring the light it sees



Summary

By manipulating:

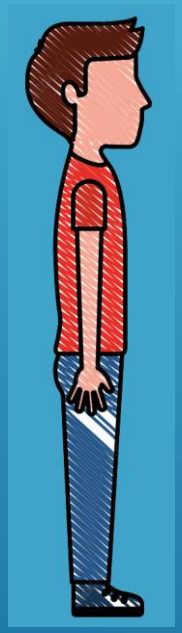
- Aperture
- Shutter speed
- ISO

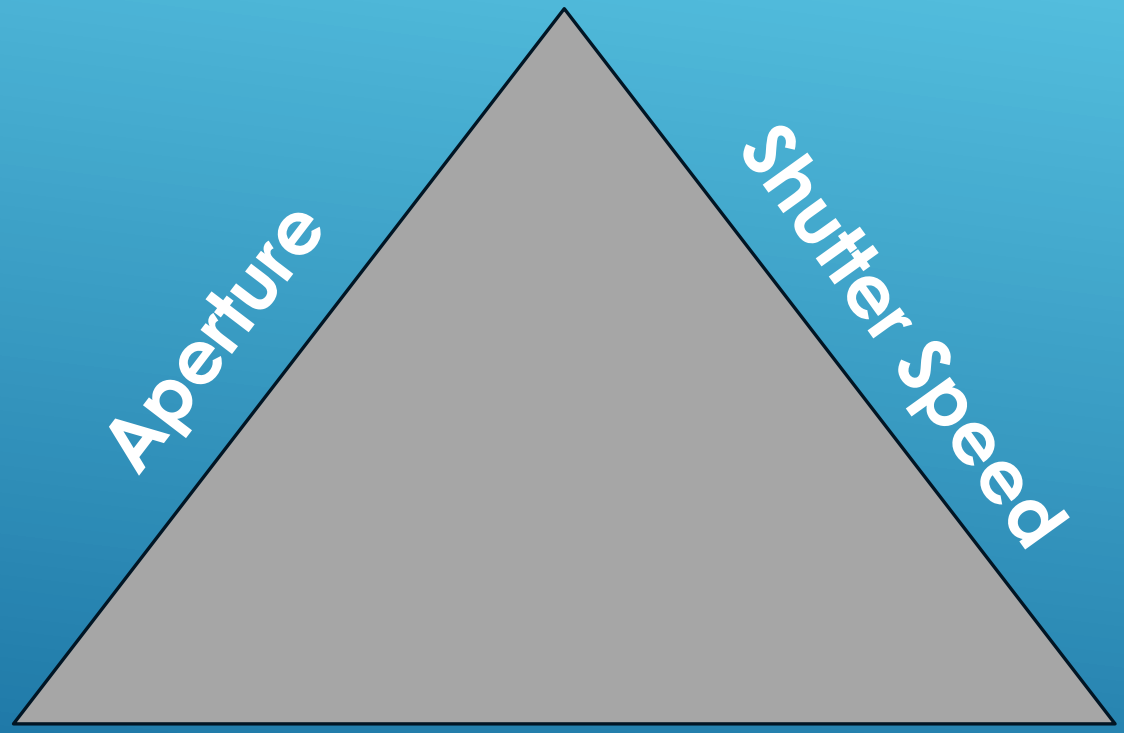
…and using appropriate exposure compensation

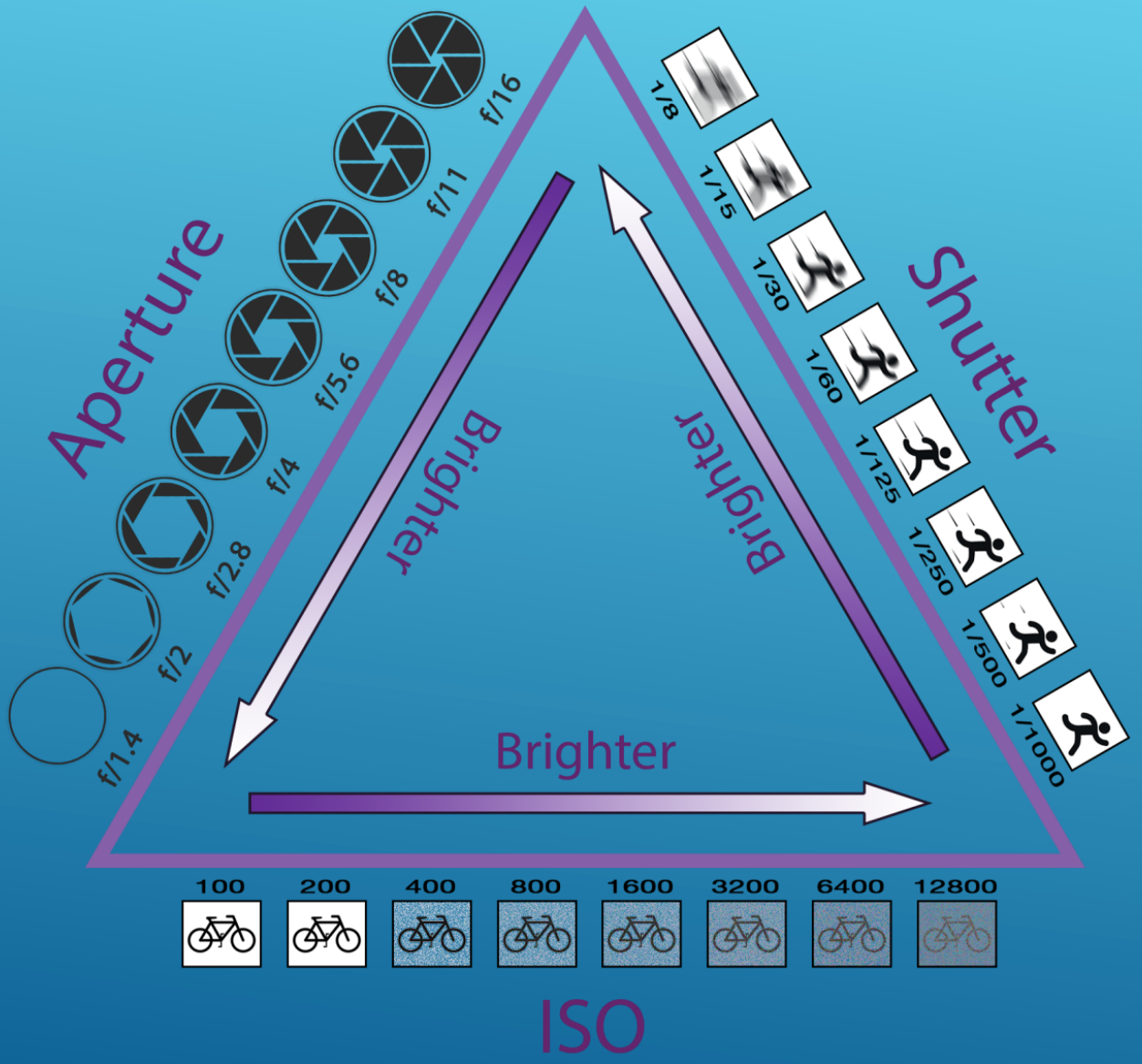
The photographer has the flexibility to craft an image which represents their vision of the scene

Thank you!

QUESTIONS?




Aperture
Shutter Speed
ISO (Sensitivity)


Aperture
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f/4
f/5.6
f/8
f/11
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3200
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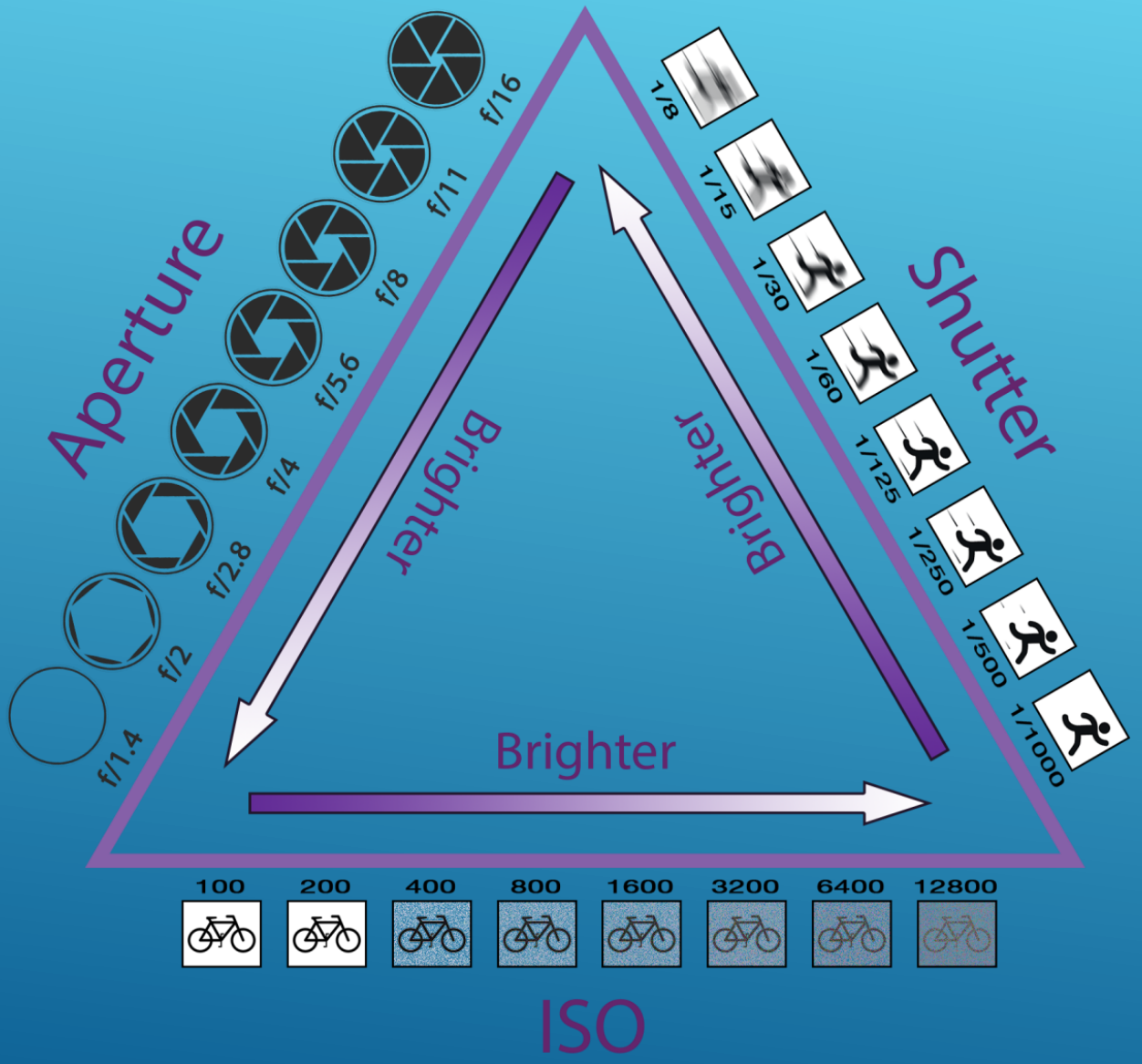
12800
ISO


Aperture
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Brighter
Brighter
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800
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3200
6400
12800
ISO