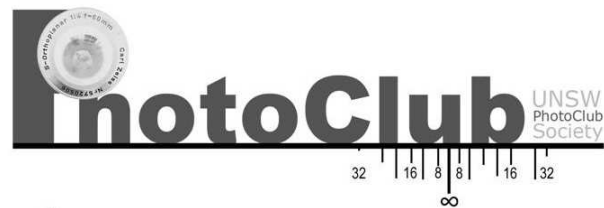# Camera Principles
Part II: Metering/White Balance

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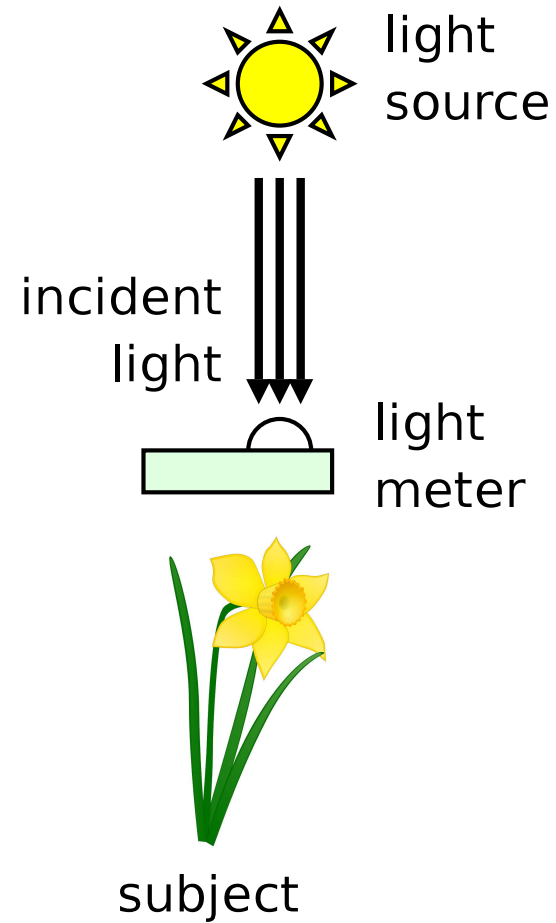
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METERING

Recall that we need to balance...

➜ ISO speed (sensitivity)

➜ Shutter speed

➜ Aperture

... to produce the correct exposure (amount of light that reaches film or digital sensor).

Goal of metering is to help determine the correct exposure.

Incident Light Metering

light source

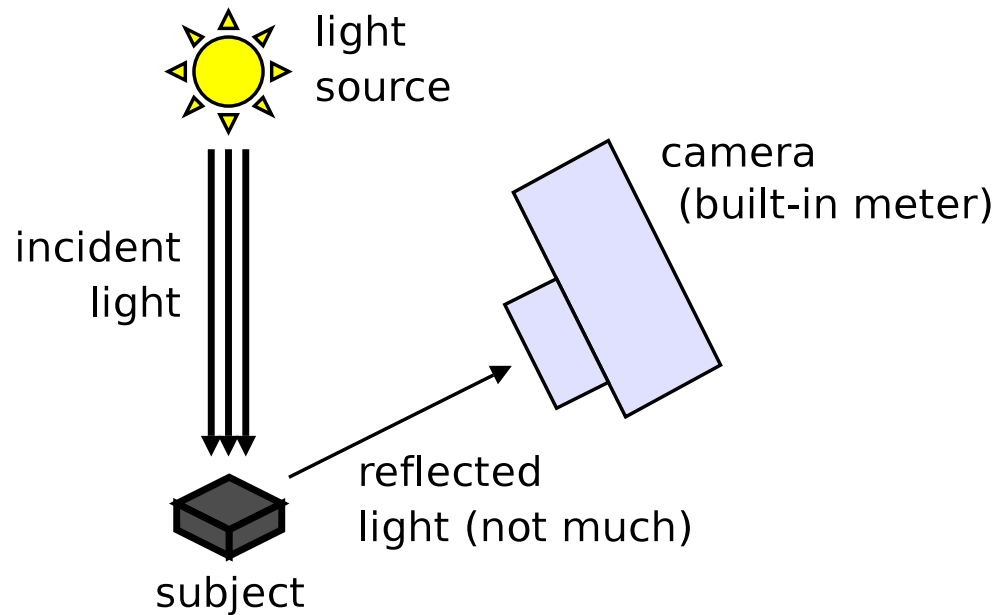incident light

light meter

subject

Measures light falling on subject (incident light).

REFLECTED LIGHT METERING

light
source

camera
(built-in meter)

incident
light

reflected
light
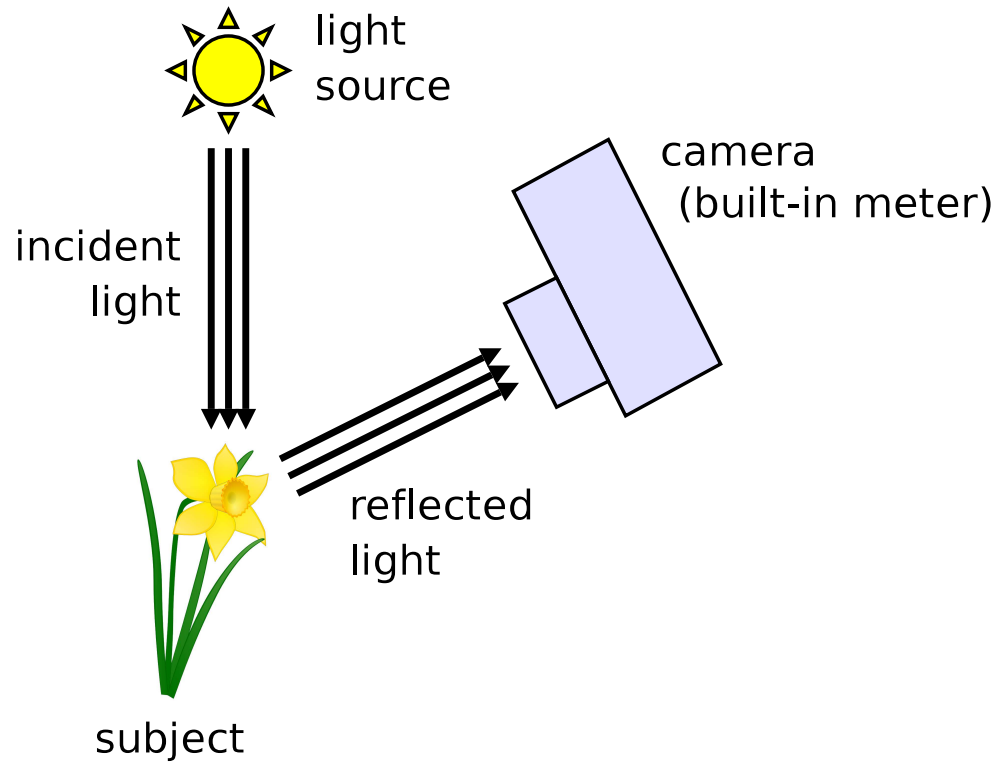
subject

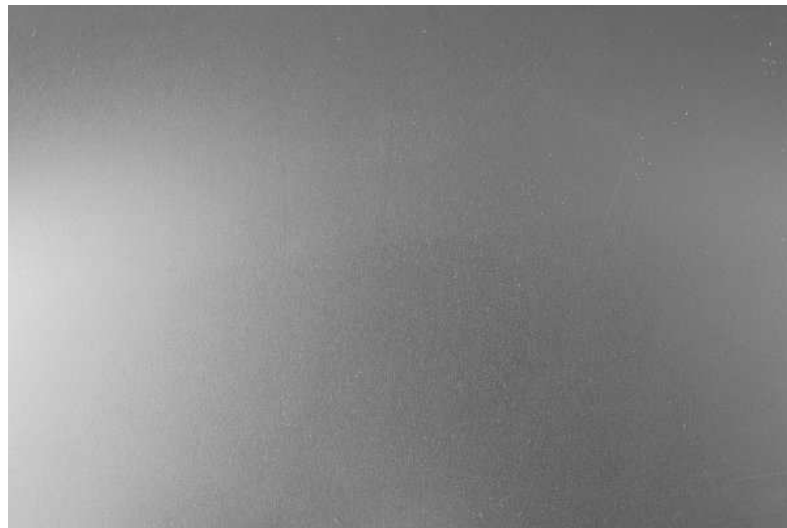Measures light received at camera (reflected light).

REFLECTED LIGHT METERING

Problem: Amount of light received at camera depends on shade of subject.

Black vs White

Camera doesn't know what shade the subject is actually, so it assumes everything is middle gray on average.

Black folder

White paper

ZONE SYSTEM

We have to tell the camera what shade we want the subject to be! Do this via exposure compensation:

```
-3: Black (loss of detail)
-2: Almost black
-1: Dark gray
 0: Middle gray
+1: Light gray
+2: Almost white
+3: White (loss of detail)
```


-3   -2   -1   0   +1   +2   +3

Note: This diagram is for illustration only, it may not be accurate.

Each stop or Exposure Value (EV) doubles the exposure.
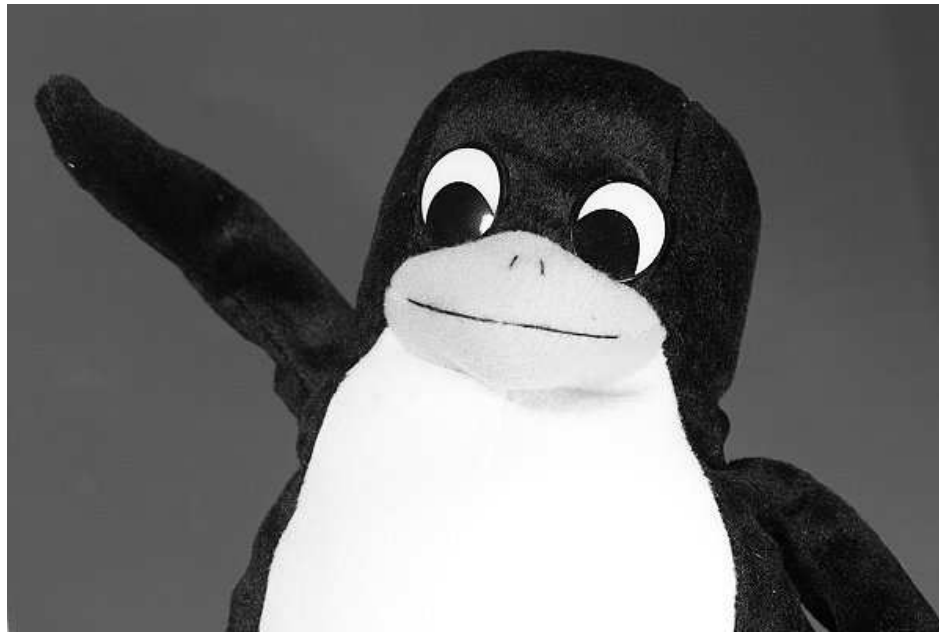
BLACK VS WHITE

Black folder, EC -2.5
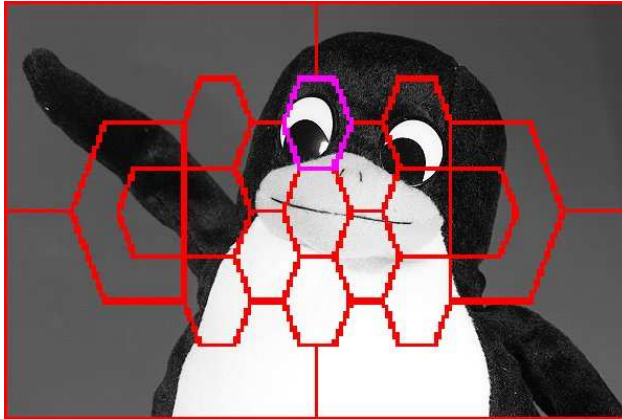
White paper, EC +2.5

Metering Example

A more complicated scene:

More than one shade in the scene, how to meter?

Evaluative/Matrix/"Auto" metering

➜ Light measured in many different zones of the image

➜ These readings are magically combined (usually favouring the zone with the active focus point)

➜ Pattern and method depends on camera manufacturer

➜ Exposure compensation may be needed if "average" shade is darker or lighter than middle gray

➜ Usually works okay, but difficult to predict outcome and any needed exposure compensation

Spot/Partial metering

➜ Light measured in a small area, usually around center point

➜ Best control over exposure

➜ Often used together with *exposure lock*:
  ➜ Point camera at an appropriate metering point
  ➜ Set exposure compensation based on shade at that point
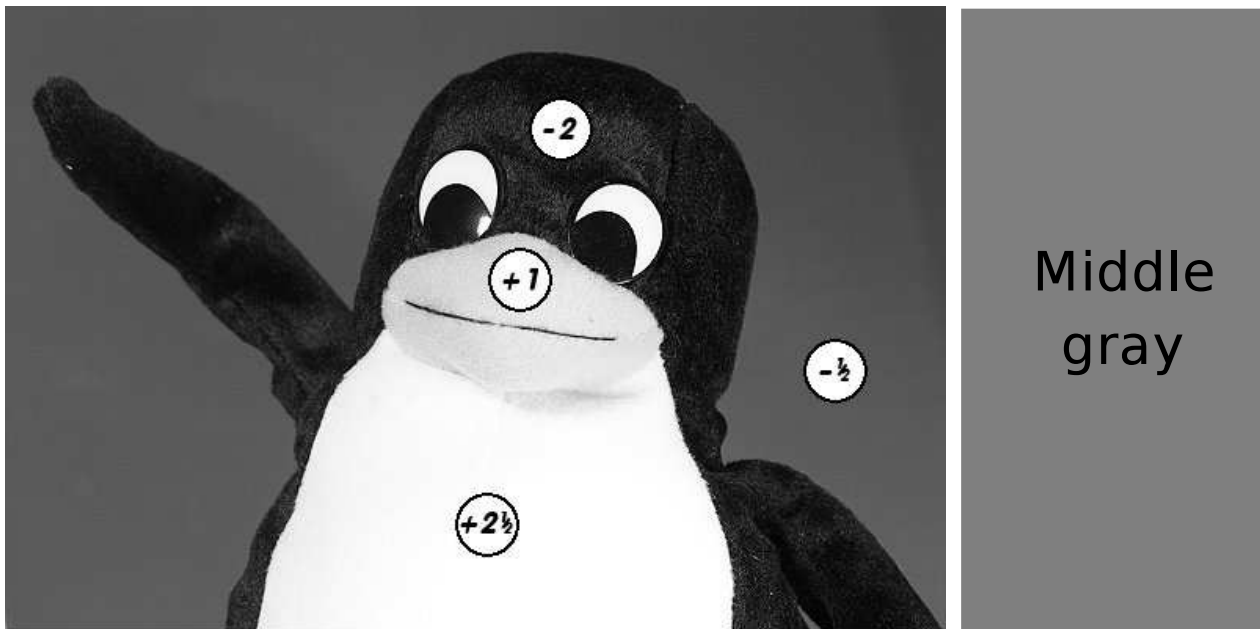 ➜ Press *exposure lock* button (*/AEL)
  ➜ Recompose and shoot

METERING EXAMPLE

Returning to our example, gray patch shown for comparison:

Middle gray
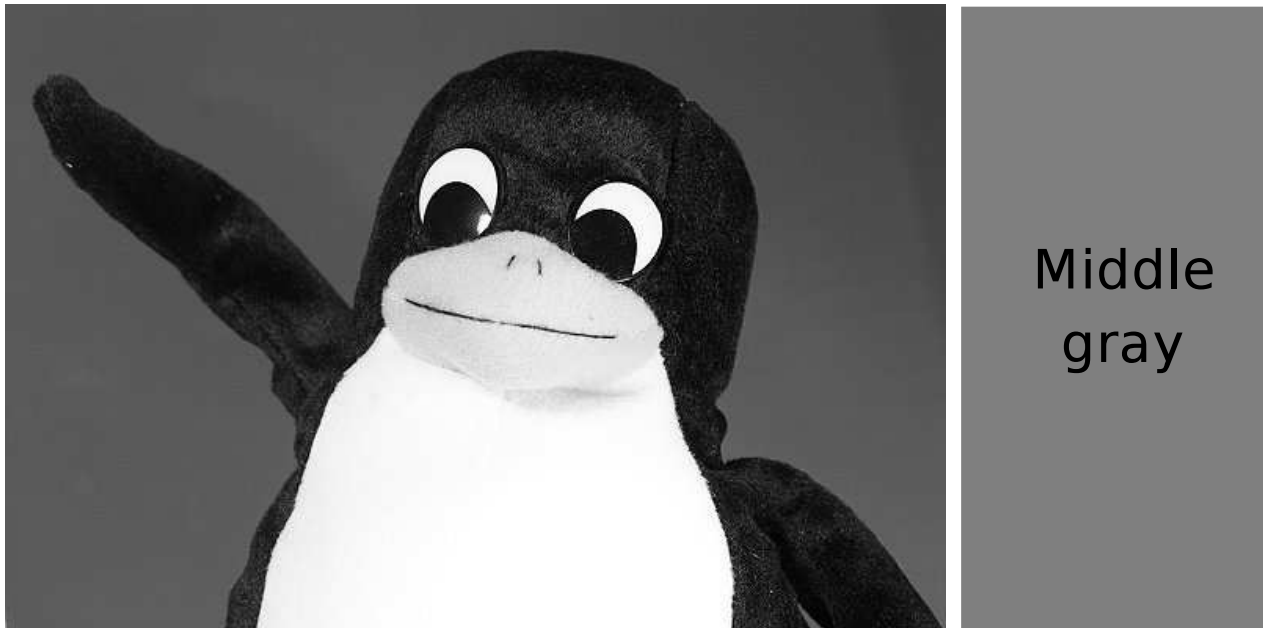
METERING EXAMPLE

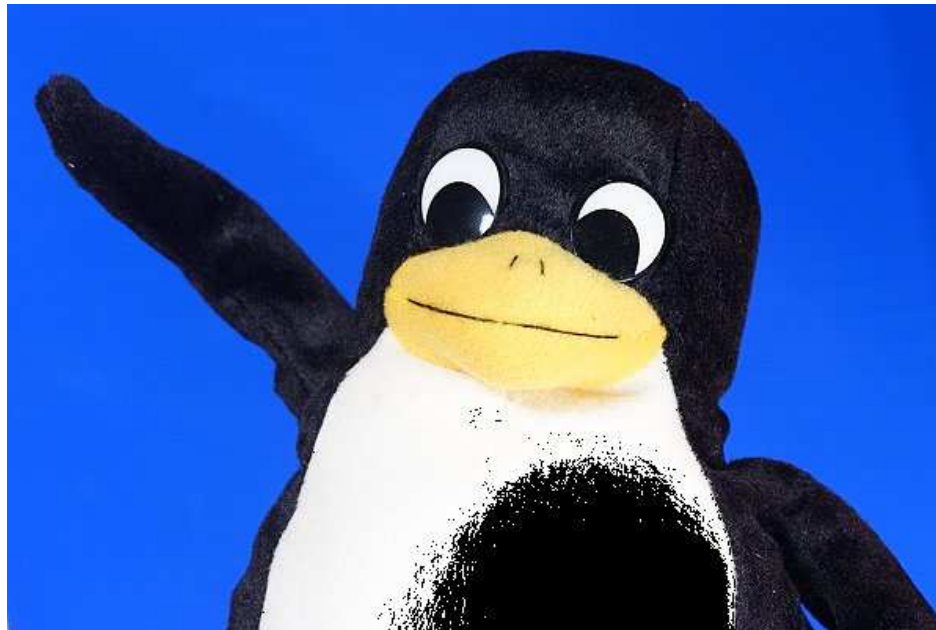Various possible metering points and EC values are shown.

Metering for Digital

Avoid overexposing digital! (same goes for slides)

Detail is permanently lost in overexposed areas. Err towards underexposure (where there is more latitude).

Some digital cameras have a warning feature:

Colour Correction

Light sources are not all the same!
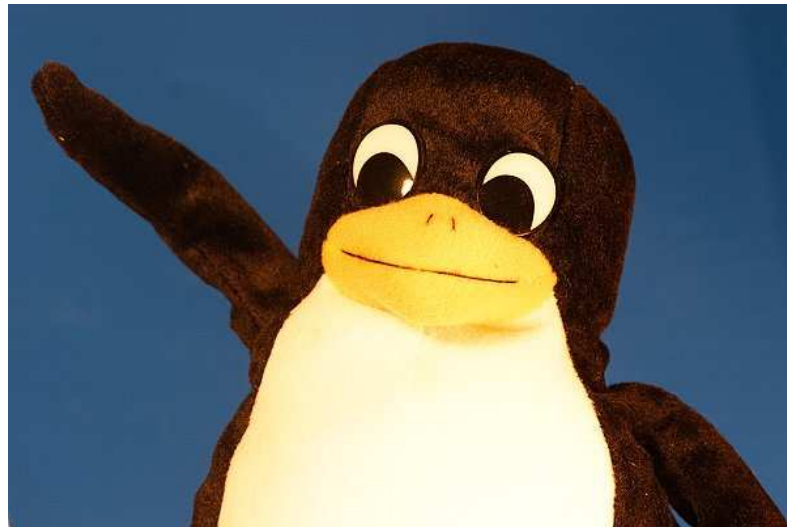
Uncorrected photo
(tungsten light, yellow cast)

Desired image
(white whites, clean colours)

➜ Light sources have spectrums biased towards certain colours
➜ But typically we want to create a "neutral" image where white objects appear white

Colour Correction

Digital: Camera setting called white balance.

➜ Auto white balance typically works well, but not always

➜ If one colour is prevalent, AWB may overcorrect

➜ If shooting RAW, white balance can be chosen post-exposure with no effect on quality

Film: Use different films or filters.

COLOUR TEMPERATURE

Temperature of light source (assuming it is an ideal "blackbody" radiator, or else the temperature of a blackbody which produces light of a similar hue).

Consider heating a metal, such as the tungsten in a light globe: glows red, then white, then blue.

Note (counter-intuitive):
Lower colour temperature = "Warm" colours (red/yellow)
Higher colour temperature = "Cool" colours (blue)

COMMON LIGHT SOURCES

Daylight

→ Most films and digital sensors are optimised for daylight spectrum (colour temperature around 5000-6500K)

→ But not all daylight is created equal

Daylight in deep shade or cloud

→ Higher colour temperature (6500K-7500K): blue shift

→ Film: Use "warming" filter such as 81A

Daylight at sunrise/sunset

→ Lower colour temperature (as low as 3200K): red/yellow shift

→ Can use 80A filter, but colour shift is usually pleasing

COMMON LIGHT SOURCES

Tungsten lighting

➜ Low colour temperature (2700K-3200K): red/yellow shift if uncorrected

➜ Film: Use tungsten-balanced film, or 80A filter (2 stop light loss)

Flash

➜ Usually 5500K: approximately equivalent to daylight

➜ Beware mixing flash with tungsten lighting (unfortunately, this is often unavoidable)

Fluorescent lighting

➜ Poor colour rendition (not full spectrum)

➜ Green cast if uncorrected

➜ Film: Use FL-D filter (or FL-W with tungsten-balanced film)

QUESTIONS