Computer Science E-7
Exposing Digital Photography

Lecture 6: The Histogram
October 17, 2011

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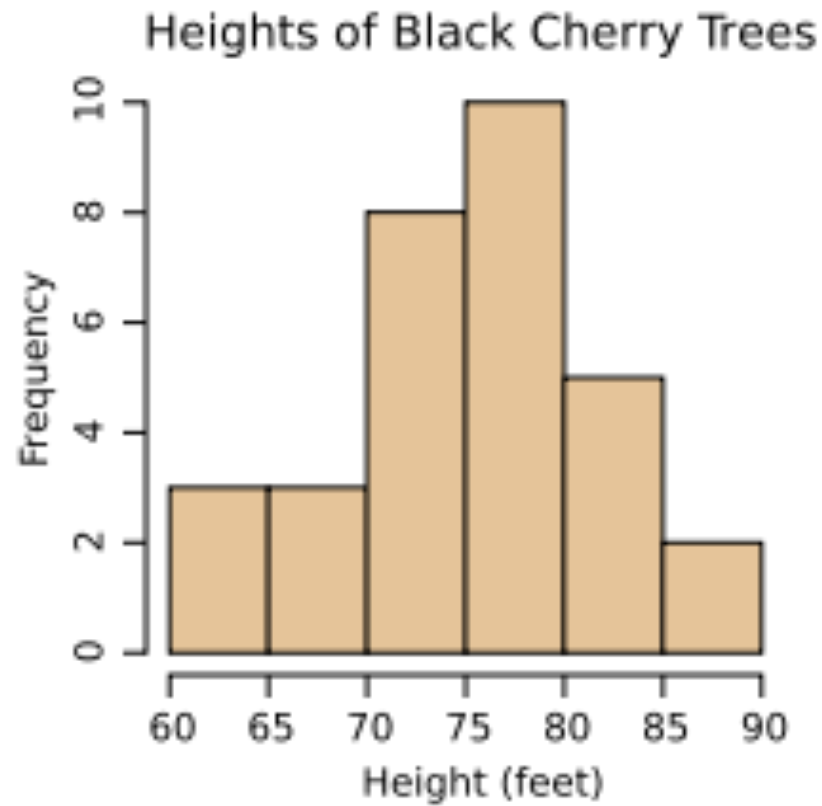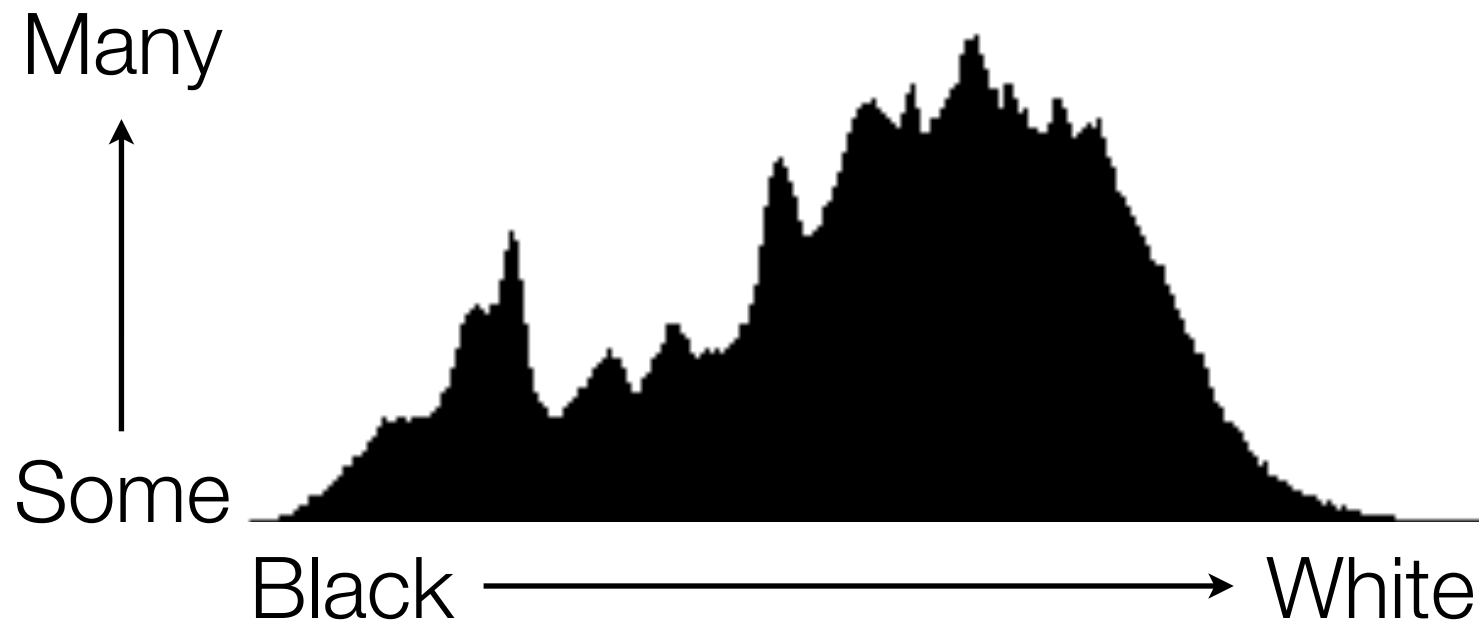
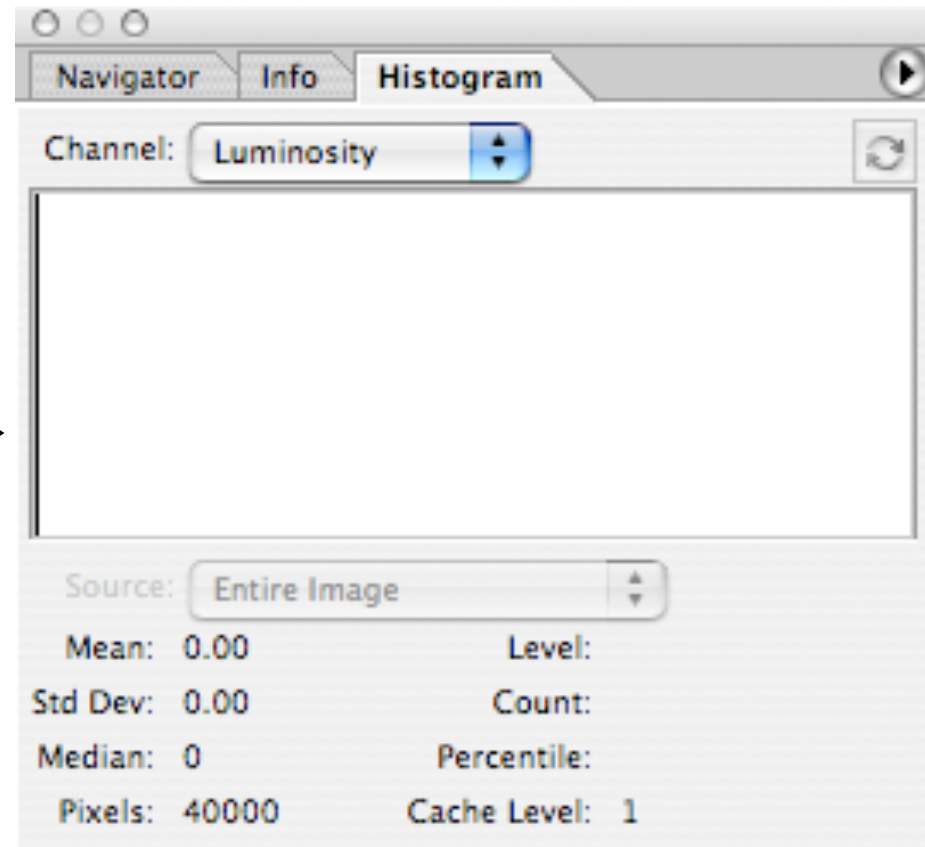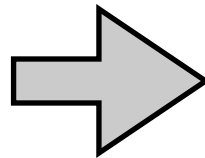Heights of Black Cherry Trees

Histograms | General Histogram

Many

Some

Black ⟶ White
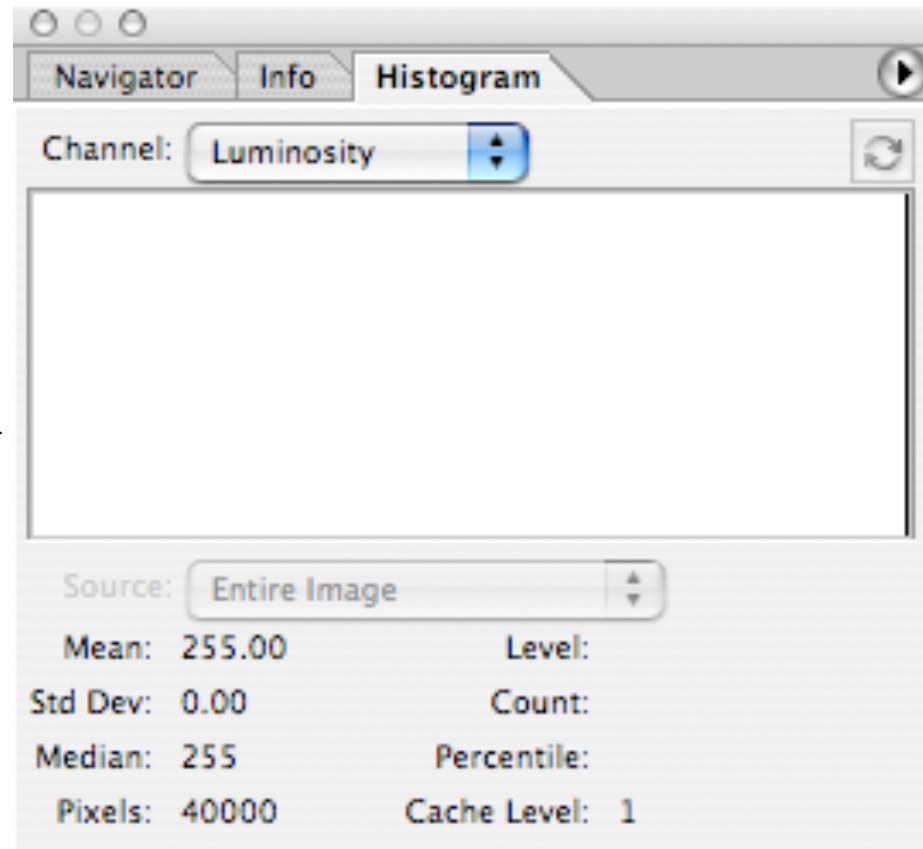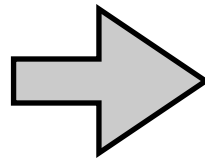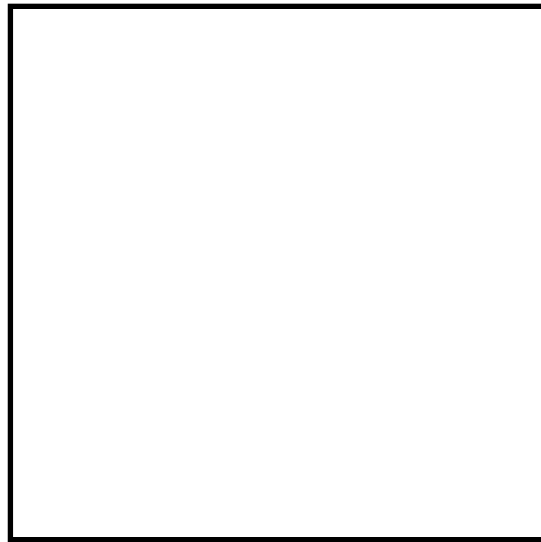
Histograms | Digital Photography

Histograms | Total Underexposure

Histograms | Total Overexposure

309s, ISO 100

Histograms | Well-exposed samples

Photo by Dan Armendariz, 2007

Histograms | Well-exposed samples

Photo by Dan Armendariz, 2007
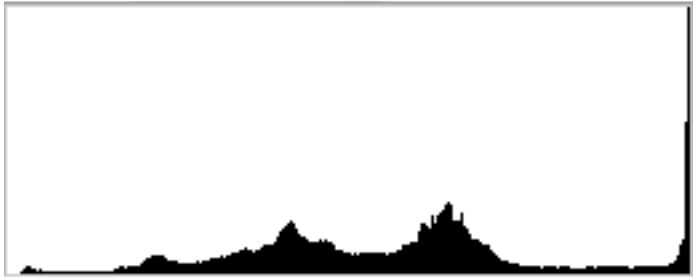
Histograms | Well-exposed samples

Histograms

Under-exposure

Photo by Dan Armendariz, 2005
8.0s, ISO 100, f/8

Histograms

Over-exposure

Photo by Dan Armendariz, 2005

15.0s, ISO 100, f/16

Left: 1/80s, ISO 400, f/2.8, 0ev. Right: 1/80s, ISO 800, f/2.5, +1.3ev

Photos by Dan Armendariz, 2005

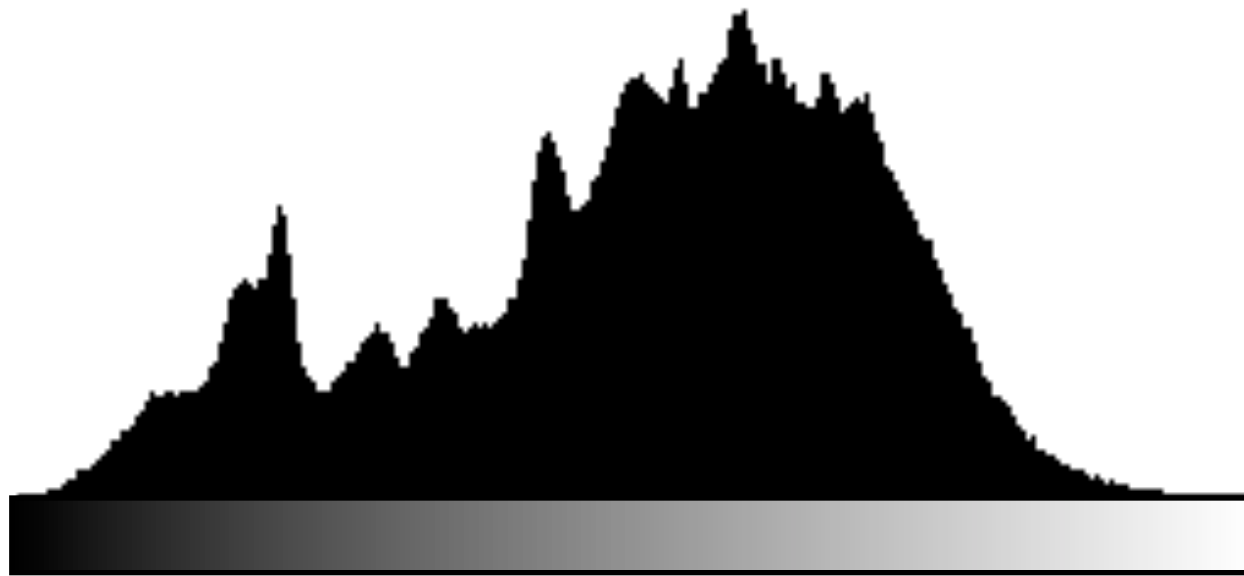# Histograms | Exposure Compensation

1/80s, ISO 400, f/10

Histograms | Over- & Under-exposure

Bit	0 or 1
Byte	8 bits

Bits and Bytes | Refresher

Black →→→→→→→→→ White

0 →→→→→→→→→ 255

Bits and Bytes | As related to histograms

JPEG

Red	Green	Blue
8-bit	8-bit	8-bit
0 255	0 255	0 255

Bits and Bytes | Bit Depth

Red	Green	Blue

?
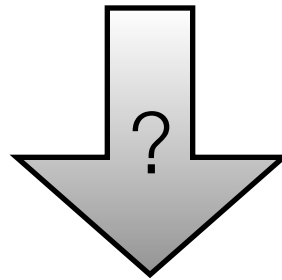
Histograms | What about color?
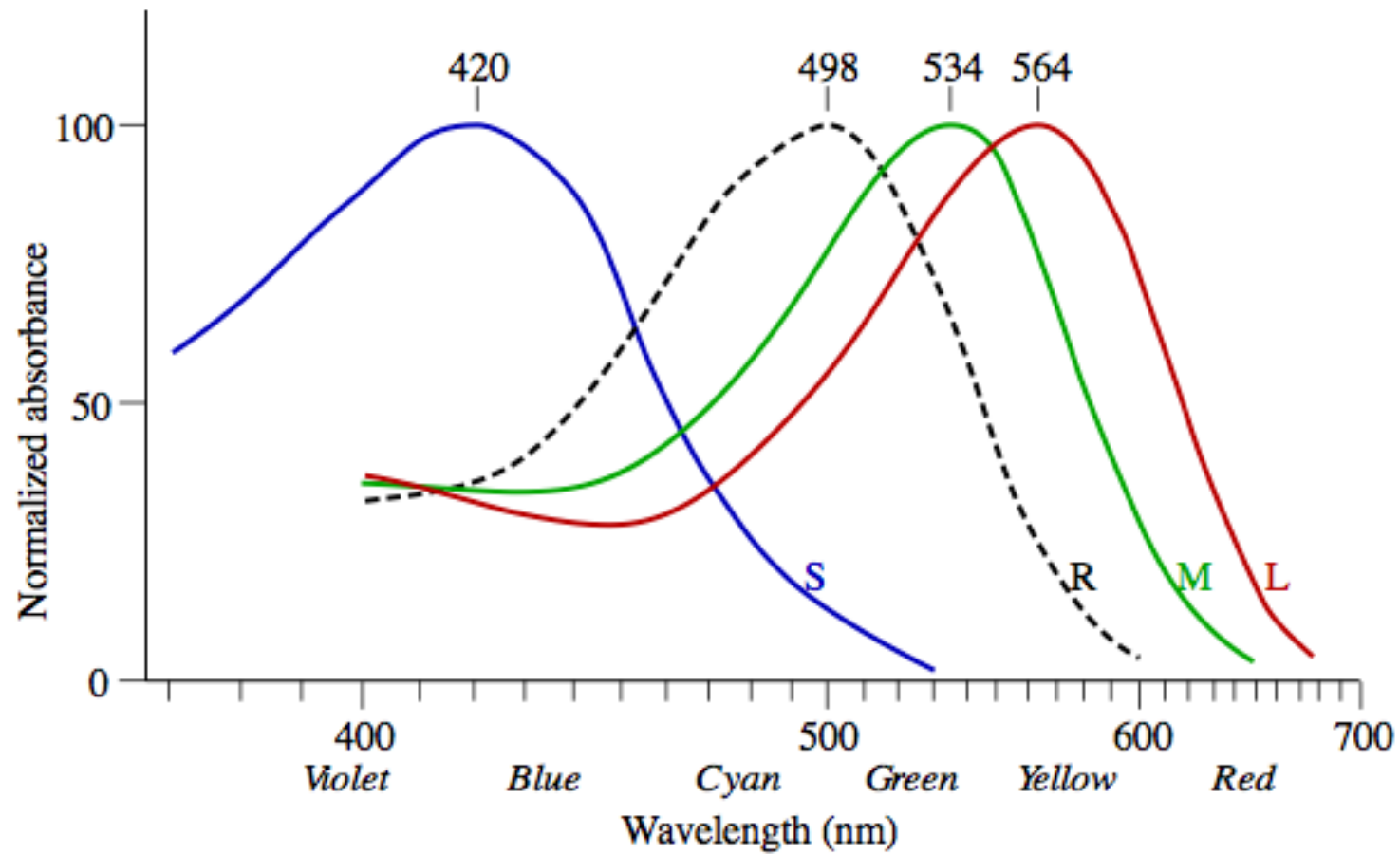
The Eye | Luminance Detection

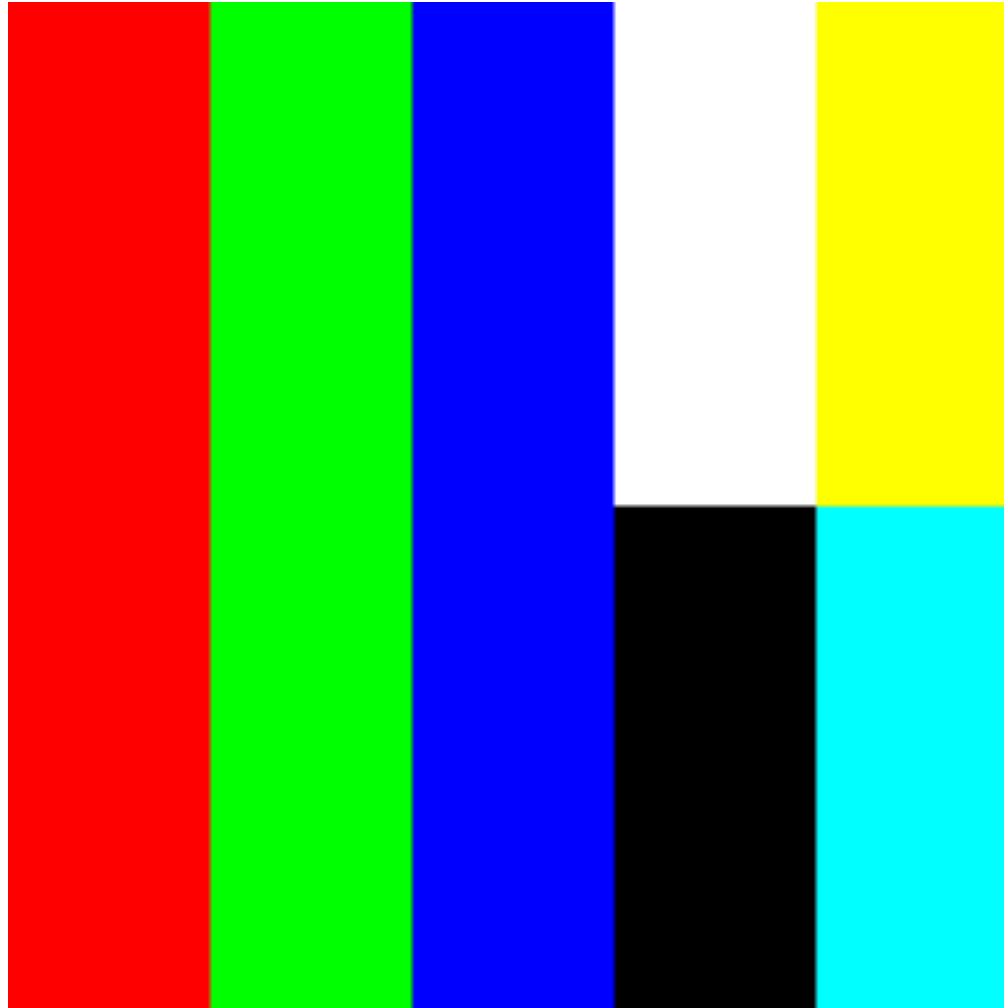| Red	Green	Blue

The Eye | Luminance Detection
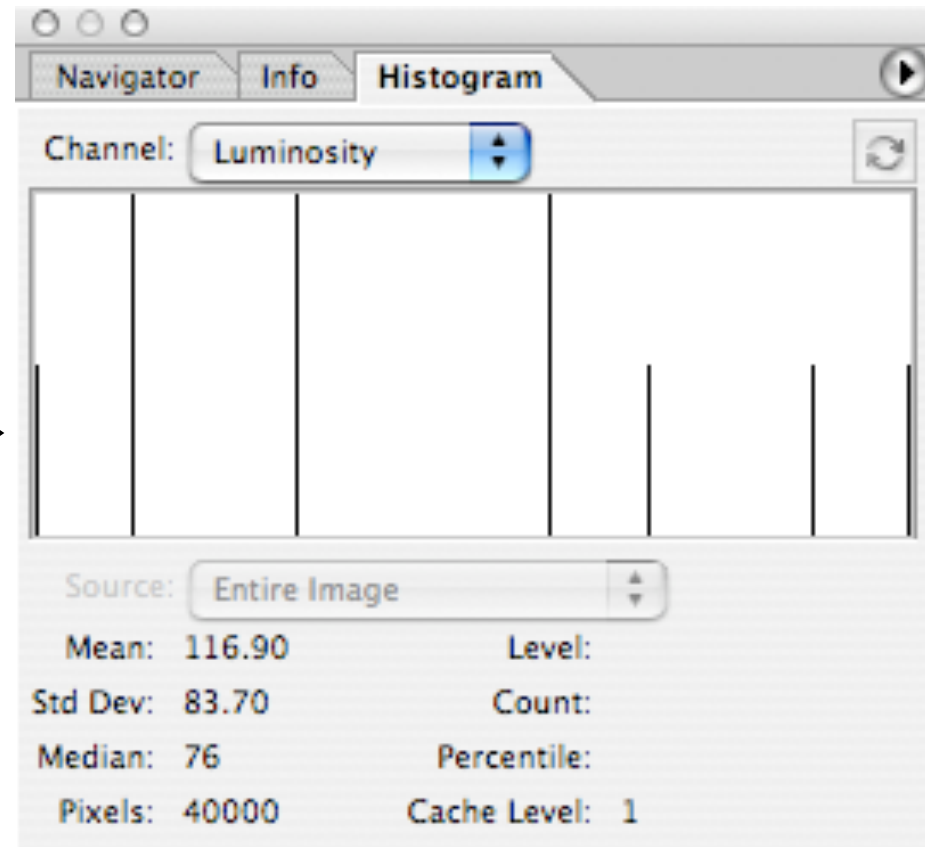
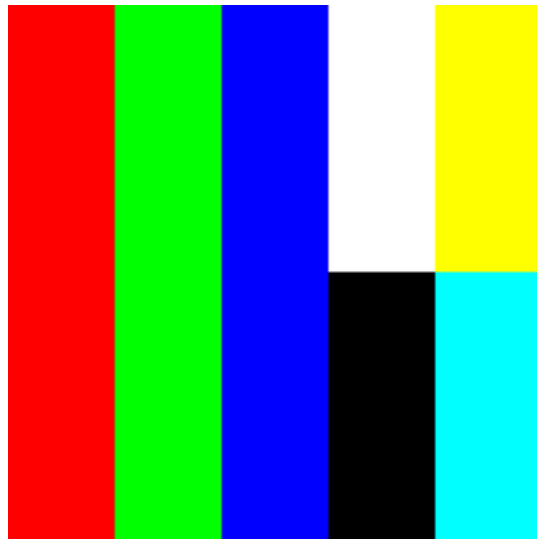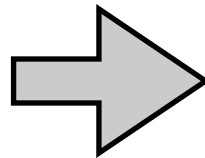Luminance ≈ 0.3 R + 0.59 G + 0.11 B
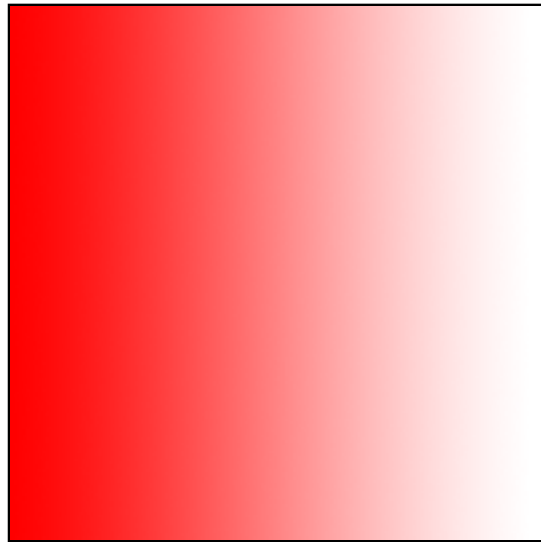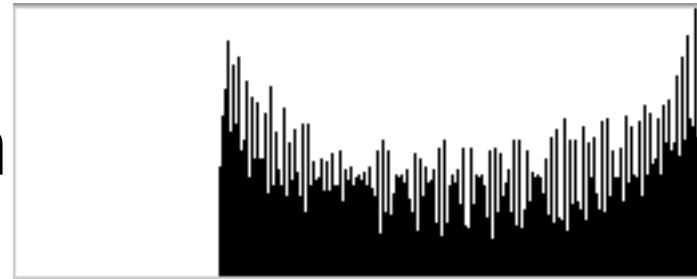
Luminance | Calculation
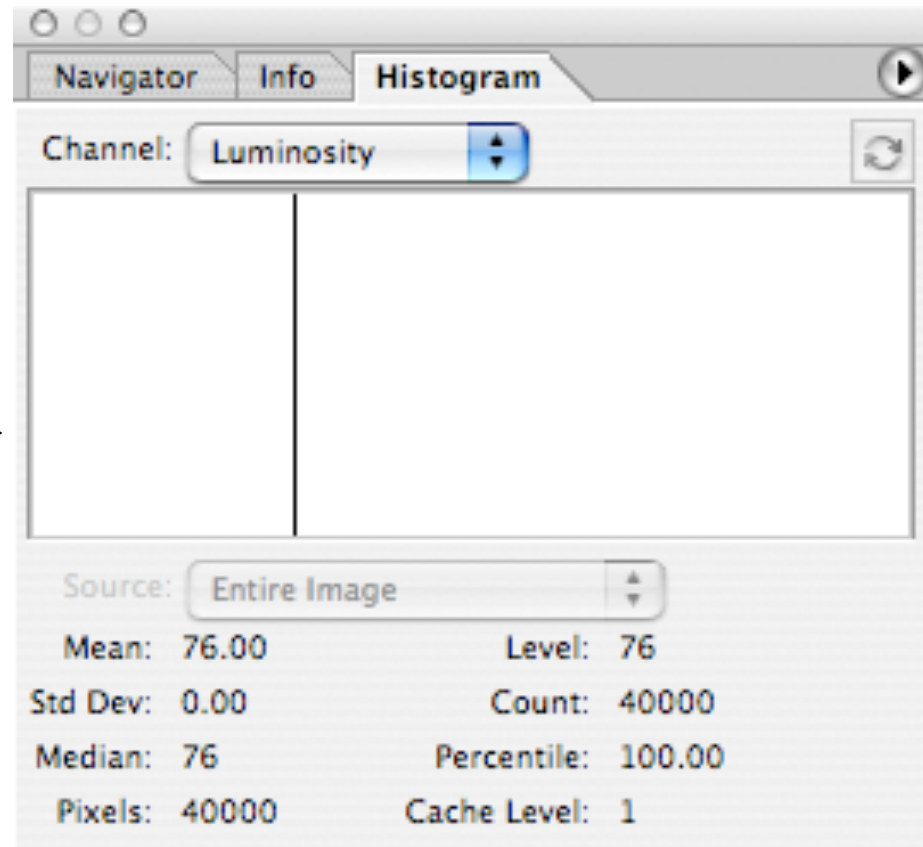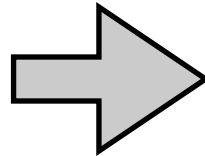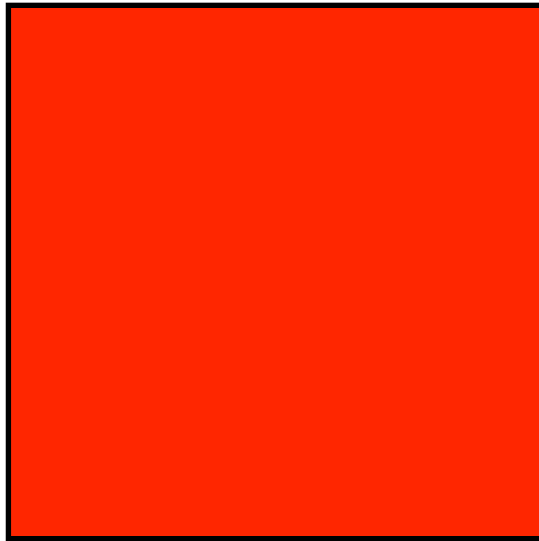
Luminosity Histograms | DIY!

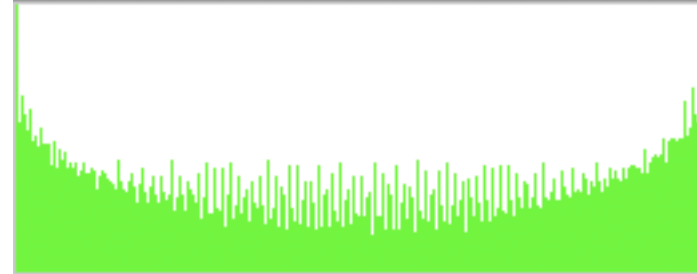# Luminosity Histograms | DIY!

Luminosity Histograms | DIY!

Lum

R

G

B
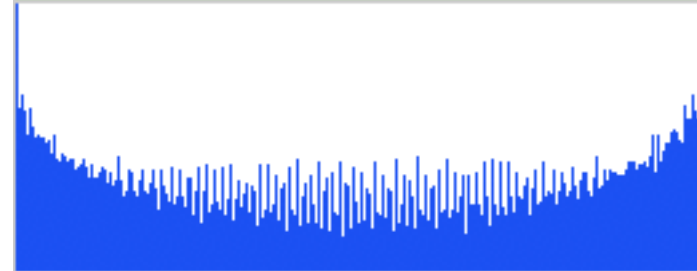
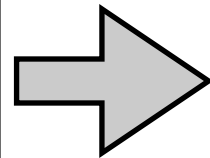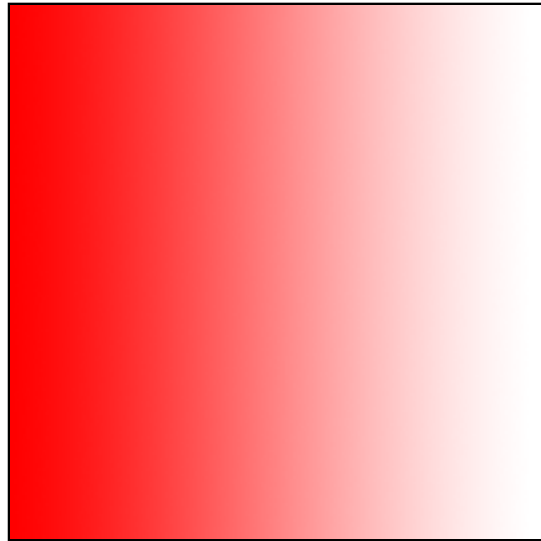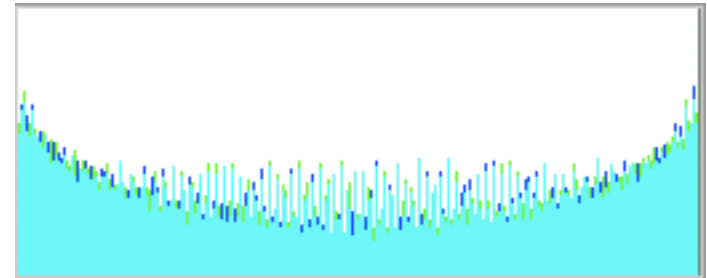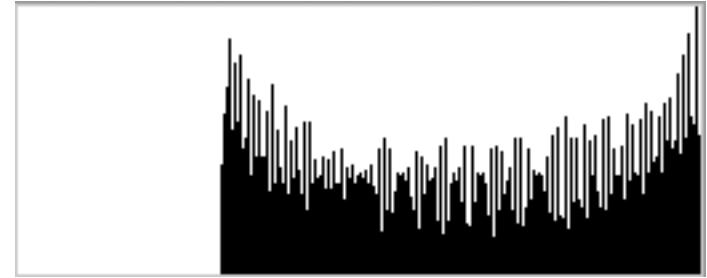# Histograms | More than just Luminosity...
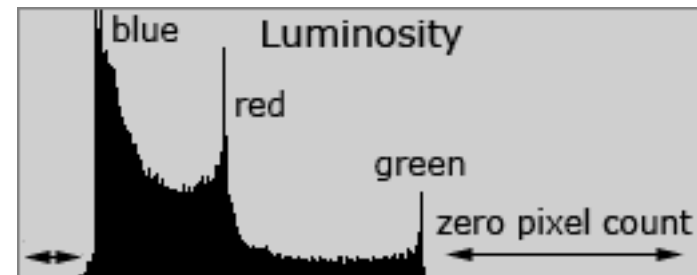
Lum

Colors

RGB
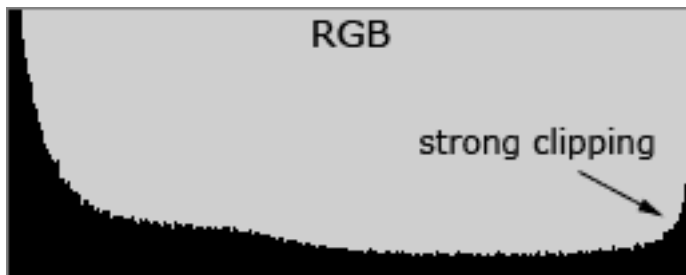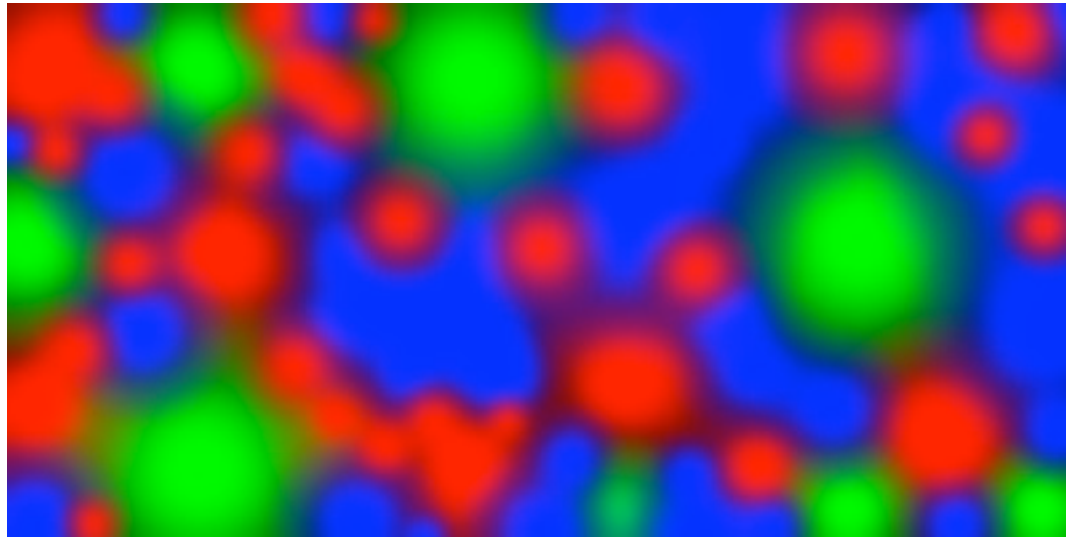
Histograms | Luminosity, Colors, & RGB

Images from http://www.cambridgeincolour.com/tutorials/histograms2.htm

Histograms | Luminosity, Colors, & RGB

RGB — Little or No Apparent Clipping

Luminosity

Red Channel Histogram — Visible Clipping

Images from http://www.cambridgeincolour.com/tutorials/histograms2.htm
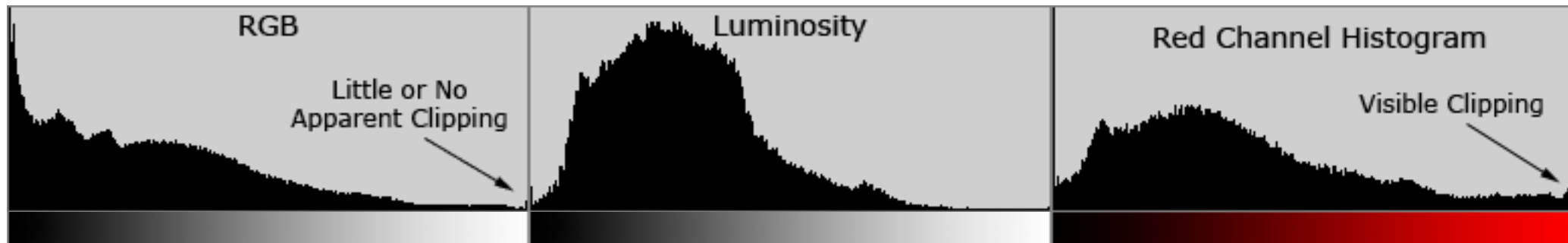
Histograms | Luminosity, Colors, & RGB

1/80s, ISO 400, f/10

Histograms | What is Black and White?

Image from http://en.wikipedia.org/wiki/Fovea

Dynamic Range | The Eye

Photons (Light)

Pixel ("Bucket")

Collected Light
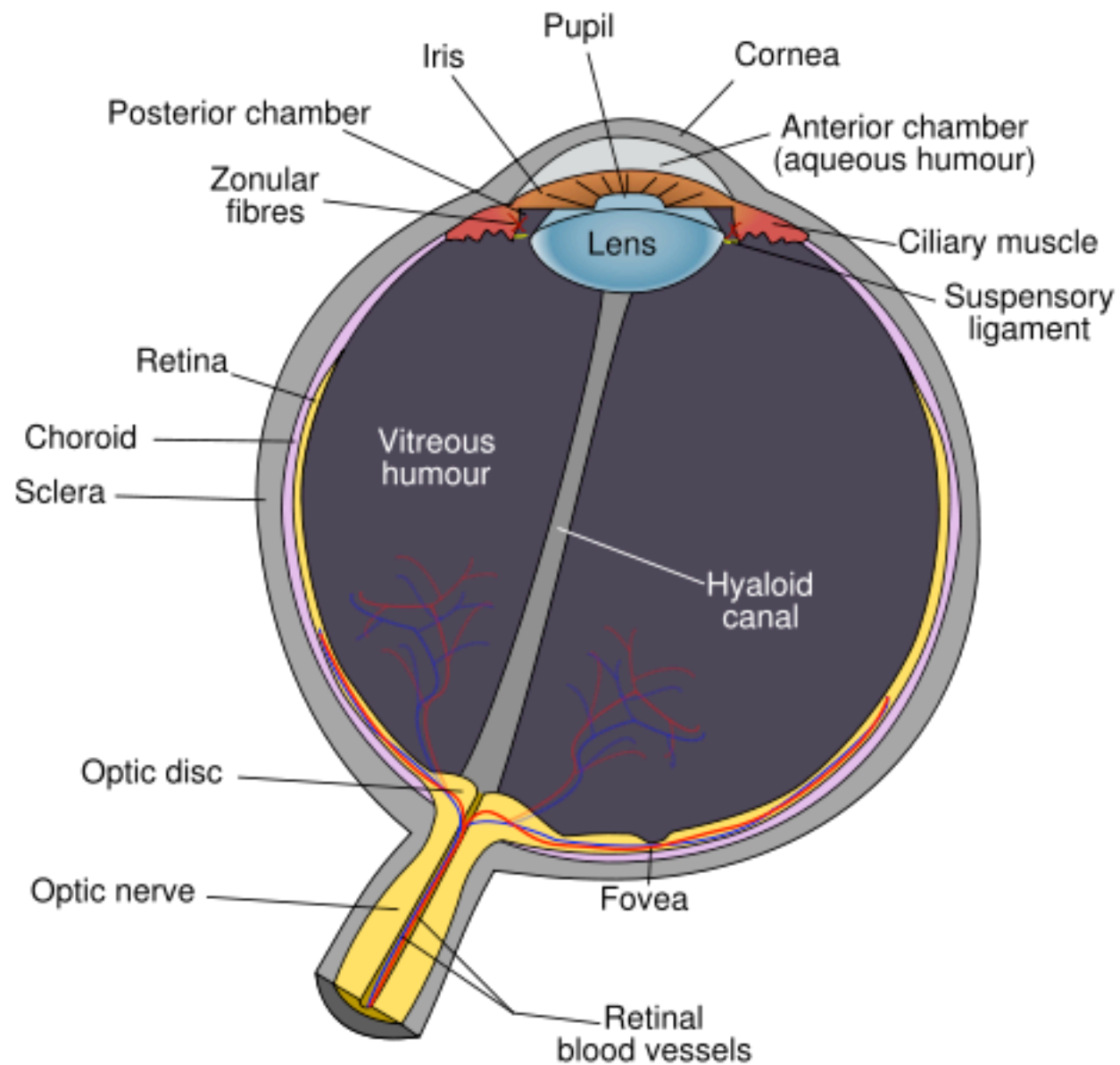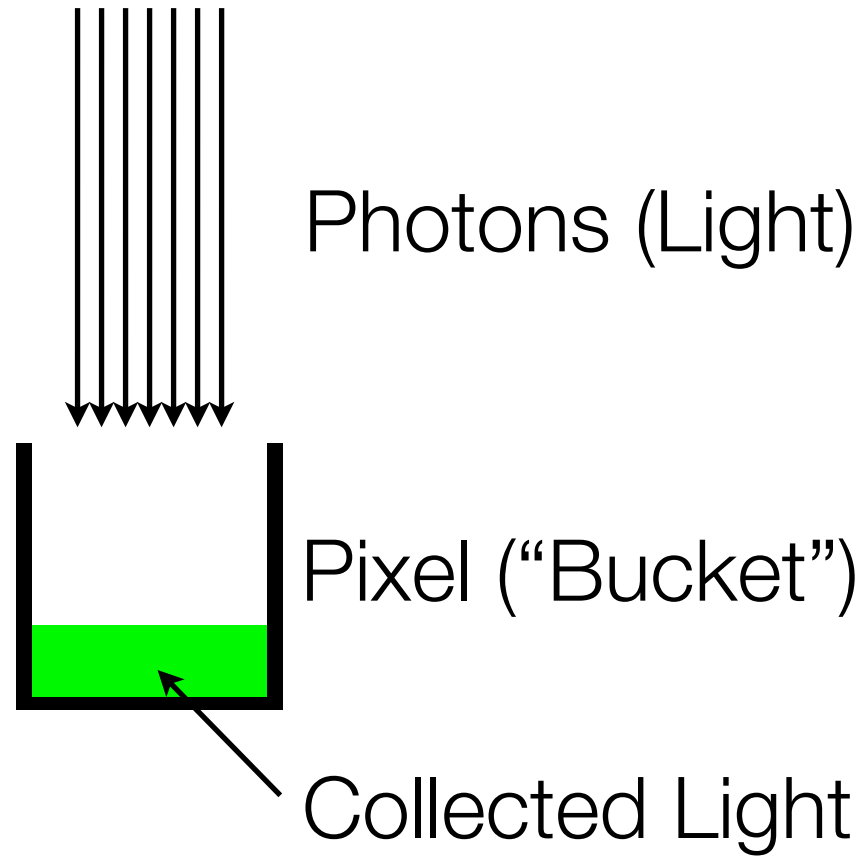
Dynamic Range | Digital Cameras

$$\text{Dynamic Range} = \frac{\text{Biggest Signal (full "bucket")}}{\text{Smallest detectable signal}}$$

Dynamic Range | Simplified Calculation

Photo by Dan Armendariz, 2006

Dynamic Range | In Scenes

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