



# Digital Photography

From Light to Pixels to Images

# Why I Teach This Class

- Skills are being lost because cell phones are first and often main camera
  - F-stop (aperture), depth of field, shutter speed, motion blur, lens choice, optical zoom, bokeh, etc.
- I want to help you understand your camera and create better images

# Cell Phone Zooming

- Pinch out is really cropping, try to avoid, but it is of course often the only way to get closer and get the shot
- High end cells phone will switch between multiple lenses, sometimes one of these even has a small amount of optical zoom, maybe 2x or 3x

# Digital Zoom (Cropping)

- Sometimes you have to do it to improve the image
- Photoshop and Lightroom have sharpening tools that will help
- The best tool I have found is AI Sharpen from Topaz labs, it is magical!



DSLR crop



Cell phone crop



# DSLR Green Rectangle

- I want you to get away from using the green rectangle (full automatic) setting on your camera all the time
  - You can control settings on the camera for creativity and better image quality

# DSLR's Are Complex

- Break it down into these areas to learn
  1. File formats, jpg and raw
  2. Lenses, focal length, zoom, aperture
  3. Exposure, aperture, shutter speed, ISO
  4. Metering modes, spot, average, matrix
  5. Shutter release modes, single and multi
  6. Focus modes, manual, auto, tracking
  7. White balance, auto and presets



# Understanding Your Camera

- Bring your camera
  - Try camera settings and experiment
- Read the manual and online guides
  - At least look up topics you are interested in
- Shoot pictures, lots of them
  - Experiment with settings and observe effects



# Comments

- Some concepts may be new, and you may not completely understand right away, please ask questions in class and practice and experiment with your camera
- Understanding your camera will help you solve challenging photo situations to get better images

# Goals – Understand the Camera Components

- Camera
  - Sensors and controls
- Lens
  - How to choose the right lens
- Exposure
  - Controlling shutter speed, F-Stop and ISO
- Focus
  - How to focus static and moving objects
- Composition
  - How to consciously compose your images for maximum impact



# Class Overview 1

- How your camera takes digital images.
- What white balance, ISO, F-stop, shutter speed, focus modes and camera modes are and how to use them.
- How computers store pictures.
- Getting your images into your computer.
- Finding your images by using keywords.
- Editing your images to improve them.



# Class Overview 2

- Composing better pictures
- What the different lenses do and how to select the right one
- How and when to use flash (optional if interest)
- When to out-think the automatic settings on the camera and use F-stop and shutter speeds creatively.
- Printing digital images
- Archiving your pictures so they don't get lost when your computer dies or is replaced

# More Goals and Tools

## ■ Managing Your Images

### □ Metadata

- Keeping information about your images with the image file
- Useful for finding images later, better than folder names

### □ Editing Images

- How and why editing is important and how to do it

### □ Archiving

- How to keep your collection of images safe

### □ Publishing (time permitting and enough interest)

- Printing, eMail, Web, Books

### □ Lightroom (or similar like ACDSee, Luminar, ON1, etc.)

- Why it is useful



# To Improve Your Skills

- Use Av, Tv, or manual instead of full auto
- Use correct focus mode
- Use proper exposure, over/under, and ISO
- Use Raw format instead of JPG
- Don't use auto white balance
- Hold the camera correctly



# Preparation

- Proper Preparation Prevents Poor Performance!
- Learn how to use your camera before the moment you need it

# Useful Phone Apps

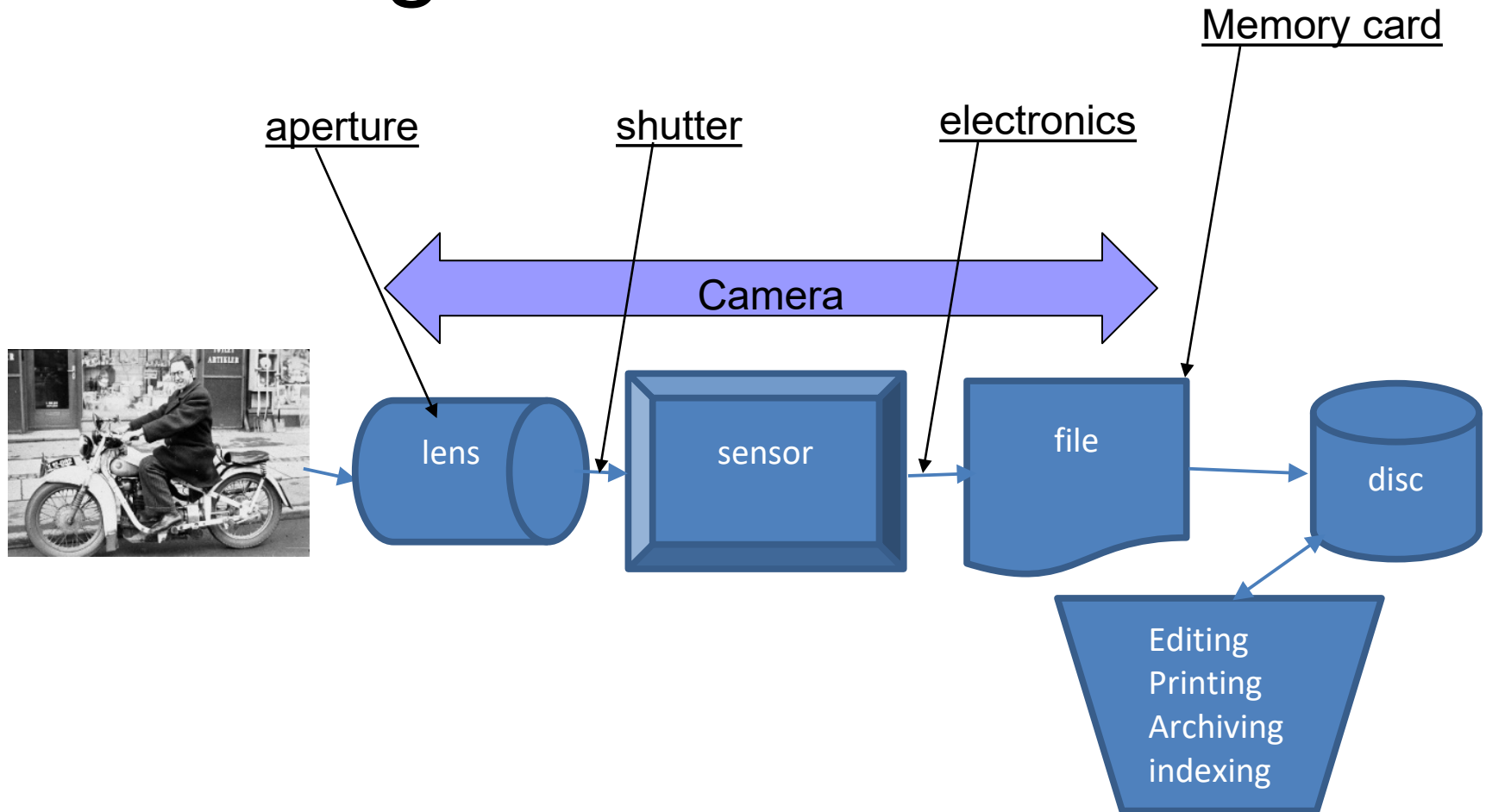
- DOF Calculator
- Lightmeter
- LunaSolCal
  - Figures out where the sun and moon are
- Photopills (\$10)
  - Shows sun, moon, and milky way, lots more
  - AR (augmented reality)



# Camera is a tool, not an artist

- Learn how to use your camera
  - Read the manual or other books
  - You want to know your camera so well that you don't think about how to reach the image you see in your mind, you just do it
- The camera isn't the artist, you are, but you must understand your tools

# From Light to File



# Digital Advantages

- Free film! Easy to take and delete images
  - Instant gratification and evaluation!
- Metadata, this is incredible!
- Easy sharing
- Archiving with multiple copies
- Amazing editing tools
  - Cropping and corrections
  - Combining multiple images for special effects

# Why Edit Photos

- Improve colors, contrast, exposure
- Crop to remove extraneous “stuff”
- Straighten tilted images
- Add or remove objects
- Blur and sharpen elements
- Fix lens problems
  - chromatic aberration
  - Distortions, pincushion and barrel

# 3 Important Edits

- It is good to capture the best image in the camera, but it doesn't always happen
- Three basic adjustments often needed
  - White balance
  - Exposure
  - Crop and straighten

# One More Editing Thing...

- Editing to improve your images will often teach you how to improve them in the camera so you will spend less time editing the images after shooting them 😊

# Quick and Easy Improvements



Crop, color, and sharpness



# Digital SLR

- SLR = Single Lens Reflex
- You look through the lens using the mirror and a pentaprism
- Sensor is behind the mirror and shutter
- The mirror flips up and the shutter opens to let light hit the sensor
- The shutter is two curtains or blades



# Mirrorless

- Interchangeable lenses
  - No mirror or pentaprism
- Lighter bodies
- Very quiet when using electronic shutter
- Use a tiny display in the viewfinder
- Sony, Olympus, Canon, Nikon, Fuji, others
- Slightly shorter battery life, still  $>\sim 400$
- IBIS (in body image stabilization)



# Menu Systems

Designed to Let You Adjust Camera Settings



# Menu Groups (Typical Example)

- Menus items are grouped
  - Image Viewing
  - Video Recording
  - Still Image Shooting
  - Camera Settings
- Buttons and dials are used to select
  - Manual can help figure this out



# Viewing the Image

The different ways cameras let you see what is about to be recorded



- Cell phone

- Mirrorless

- DSLR

- The screen

- Screen on back or tiny screen as view finder

- View finder through lens or screen on back

# View finder or screen

## View Finder

- See what lens sees, on DSLR
- Easy in bright light
- Must hold camera at eye level
- Can be hard with tripod

## Screen on back

- See what sensor sees
- Hard in bright light
- Can hold camera at different heights
- Good with tripod, tilt screen useful



# Pixels

Let's explore the magical world of little picture elements



Notice each block has one color and brightness.





All you have to do is make them small enough so you can't see them.



# Pixels (Picture Element)

- An image is made of little pixels
- Each one has color and brightness, actually 3 different color brightness's
- If they are small enough you can't see each individual element
- How many you need depends on how far your eye is away from them

# How Many Mpixels Needed?

- Many monitors about 2MP (1600x1200)
  - Example: 2560x1600 is 4MP
- Images look fine (lens quality important)
- 8 MP is enough unless extreme crop
  - Billboards are 15 ppi and about 2MP

# Megapixels

- More megapixels can make smoother images, but also tend to have more noise
- Ideal ranges are in the 18-45 Megapixels
  - Lower megapixels are typically better for night photography, 18-25
  - Sweeping landscapes can use 45+



# Colors

Wonderful World of Color

# How We See Colors

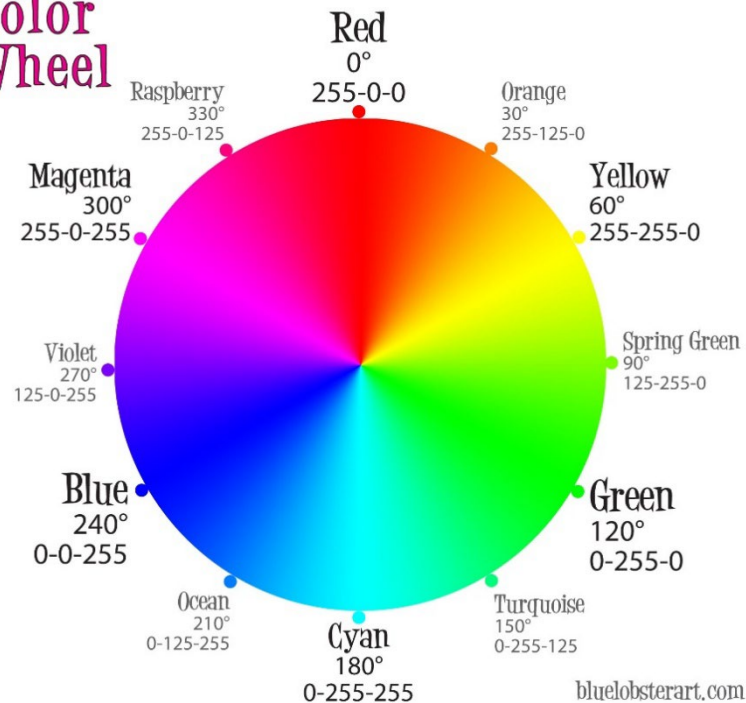
- Our eyes see wavelengths from 380 (blue) to 720 (red) nanometers
  - Between IR and UV, way above radio waves
- Cones see color (RGB) depending on the wavelength (or combinations)
- Rods see luminance, especially useful in dim light
  - Can't see color in dim light very well

# Color Mixing of Primaries

- Any color can be made up by mixing varying amounts of primaries
- Two sets of primary colors are used in digital photography
  - RGB (red, green, blue)
    - Additive, things that glow, like monitors
  - CMY{K} (cyan, magenta, yellow, {black})
    - Subtractive, things that absorb, like paper
- Not the same as you learned in school with crayons!

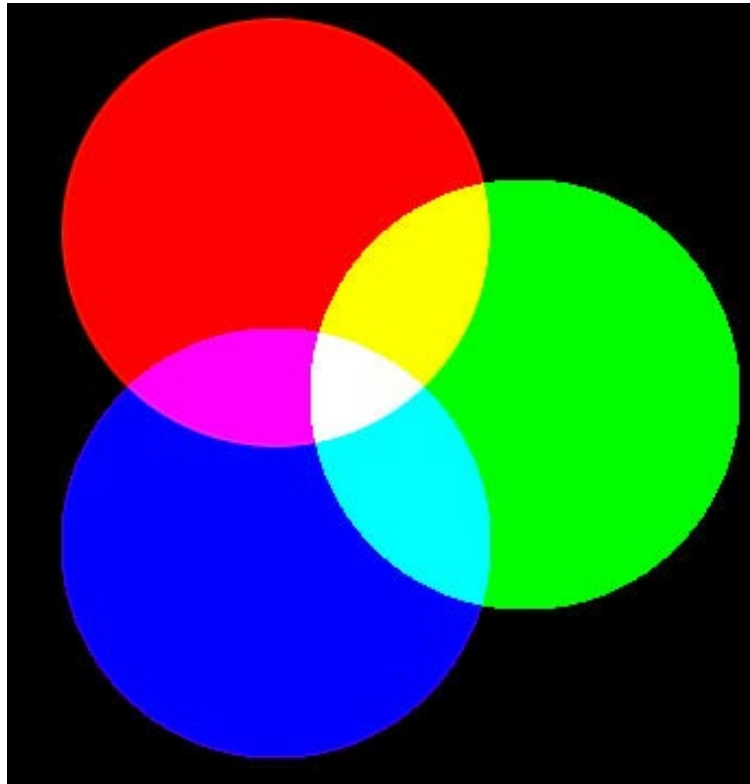
# RGB Color Wheel

## RGB Color Wheel





# Combining Colors



Think of these as  
three colored  
spotlights hitting a  
white background.

# RGB Color Values

- Often shown as byte values (0, 255, 255)
- Sometimes shown as (100%, 0%, 100%)
- 255 is 100% of a single byte value
- What is (255, 255, 255)?
- What is (50, 50, 50)? Or (0, 0, 0)?
- How about (255, 0, 0)?

# Color Relationships

- Understanding the color wheels will help you fix image color problems or to use colors creatively

- Learn these relationships

- $R+B=M$

- $R+G=Y$

- $B+G=C$

## Opposites

- $R \sim C$

- $G \sim M$

- $B \sim Y$



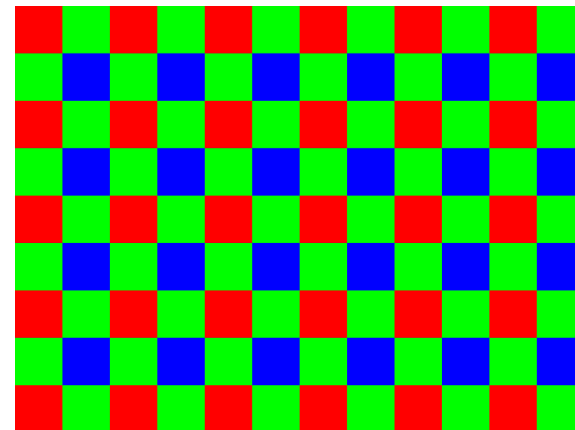
# The Sensor

Collect photons to create pixels

# Most Common Sensor

- Red, green, and blue sensitive areas, done with color filters
- Notice there are twice as many G's. Why green screen is better than blue screen for digital
- De-mosaicking maps this to RGB pixels

Bayer pattern sensor



# Dynamic Range

- The range of dark to light that can be recorded without losing or both of:
  - Highlights (blown out)
  - Shadows (blocked)
- Eye sees at least 16 stops (doublings)
- Some Digital sensors are 14+ stops now

# HDR (High Dynamic Range)

- Take multiple images at different exposure setting to capture more image data and combine later on the computer
  - Some DSLR's have a feature to do this
- Some cell phones take several exposures quickly for high contrast scenes, e.g. night
  - This is also possible on mirror-less DSLR



Bright outside, dark inside,  
very high dynamic range.  
Single automatic exposure.  
You could get brights or  
darks better by sacrificing  
the other.

Shot with camera HDR setting. Notice  
highlights and shadows are much  
better. The camera actually takes 3  
images in sequence so any motion in  
the scene can be a problem.





# Dynamic Range Film vs Digital

- Film has a very large range between the deepest shadow and the brightest light
  - High lights don't saturate easily due to logarithmic nature of film
- Digital sensors have a limit where they saturate and start to spill over into their neighbors, “blooming”, like water buckets overflowing
- Electrical noise (dark current) limits the low light sensitivity



Expose for the rocks and the lights get blown out.



Expose for the lights and the rocks are blocked out.

Combine them and you get this (actually from 3 exposures)



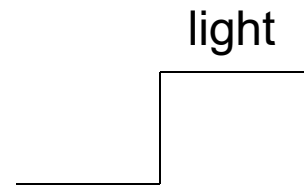


# The Sun is Dangerous Even During Eclipse

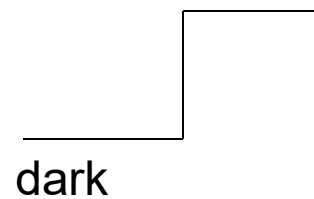
- Must use high density solar filter
- DSLR can damage your eyes
- Mirrorless or cellphone will damage sensor

# Bit Depth - Resolution

- 8 bits gives 256 levels for each channel
- 16 gives 65536 (Adobe uses 15, 32768)
- Cameras have at least 10, often 12 or 14, this gives 4096 or 16384 levels
- Jpeg limits to 8 bits



The number of steps is determined by the bit depth



# Banding Effect Due to Resolution



10 levels of gray



256 levels of gray

## Sensor size comparisons for digital cameras.

PhotoSeek.com

For new **digital cameras**, a bigger **sensor area** captures better quality, but requires larger diameter, bulkier lenses. To **optimize** the size of a serious **travel camera**, consider **1-inch Type sensor** or up to **APS-C sensor size**.

Full-frame sensor (Nikon FX, Canon EF, Sony FE) = **36 mm wide**

**"Full-frame 35mm"** sensor / film size (36 x 24 mm) is a standard for comparison, with a **diagonal field-of-view crop factor** = 1.0

*In comparison, a pocket camera's 1/2.5" Type sensor crops the light gathering by 6.0x smaller diagonally (with a surface area 35 times smaller than full frame).*

**APS-C** Nikon DX, Sony E = **1.5x crop**

**APS-C** Canon EF-S = **1.6x crop**

**Four Thirds 4/3"** = **2x crop**

**1" Type** = **2.7x crop**

Sony RX10, RX100

**1/1.7"**: **4.6x**

**1/2.5"**:

**6.0x crop**

24 mm

"Medium format" size 48 x 36 mm

*Compact & pocket zoom cameras have small, noisy sensors, tiny enough to extend superzoom lens reach.*

*APS-C sensor gathers 15 times more light (area) than a 1/2.5" Type sensor, and 2.4 times less than Full Frame.*

# Cell Phone Sensors

- Tiny, but excellent computational photography makes very good images
- 1x combines image from .5x to improve quality and reduce noise
- Different aspect ratios may crop images so the full sensor size isn't used
  - See the following examples, Samsung S10



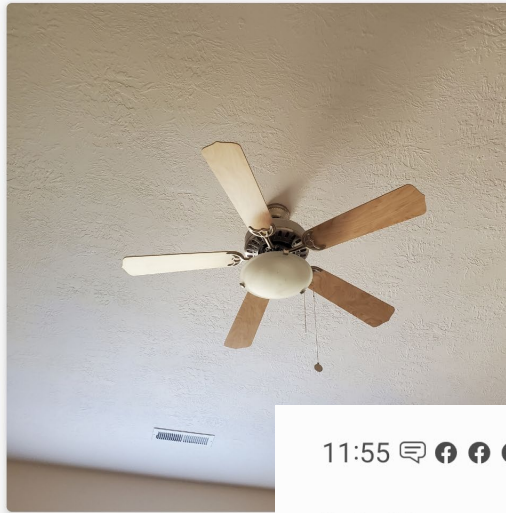
Feb 18 11:25 AM



20230218\_112507.jpg  
5.19 MB 4032x2268  
/SD card/DCIM/Camera



Feb 18 11:23 AM



20230218\_112312.jpg  
5.09 MB 3024x3024  
/SD card/DCIM/Camera

Notice the pixel counts for the different aspect ratio settings. 3:4 is the only one that saves all the pixels.

Feb 18 11:44 AM



20230218\_114405.jpg  
4.37 MB 4032x1908  
/SD card/DCIM/Camera



20230218\_114108.jpg  
7.03 MB 4032x3024  
/SD card/DCIM/Camera





# Memory Cards

Where are my images stored?

# Common Memory Card Types

- CF – Compact Flash (type I/II)
- SD – secure digital
- Micro SD
  - SDHC ≤ 32GB
  - SDXC >32GB
  - Class is the speed (at least 10)
- XQD (CFexpress) – much faster



# Get the Correct Card

- One class member was about to return a recently purchased used camera because it wouldn't format the 64GB SDXC card
- It was an older model that only supported SD, so the maximum size was 32GB
- Those cards appear to be identical, but they aren't!

# My Predictions ☺

- CF Express will be the gold standard for high end cameras
- SD/Micro SD will stay the consumer standard for the time being



# Computer Image Files

How images are stored

# File Formats, Container Files

- BMP
- **JPG/JPEG/JPG2000/JFIF**
- GIF (pronounced like JIF)
- **TIFF**
- PNG
- **PSD**
- DNG
- **Raw** (many variations)
- Others

**BOLD** ones are  
the most important

# New Formats

Smaller and less lossy than JPG!

## ■ HEIF (High Efficiency Image Format)

- Rotation, cropping, titles, and overlays are stored without altering the underlying image. This means you can undo those edits later.
- Transparency is supported
- 16 bit data!

## ■ HEIC

- Apple container variant holding an HEIF



# File Data Compression

- File size is reduced by eliminating less visible information
- Lossy
  - Some information is removed
  - JPEG, JPEG2000
- Non-Lossy
  - Nothing is lost
  - PSD, TIFF (usually)

# RAW vs JPEG

- If your camera supports RAW, use it!
- It saves all of the sensor data
- JPEG reduces resolution to 8 bits and permanently eliminates some detail
- Editing in 16 bits allows for large changes with less image degradation

# JPEG compared to Raw

- JPEG
- 8 bits/pixel
- Color resolution loss
- White balance fixed at shot time
- Should NEVER be re-saved, image rot (generation loss)
- RAW
- 12-15 bits/pixel/RGB
- No loss
- White balance adjustable later
- Save in PSD/TIFF or other non-lossy format

- re-compression causes problem, happens on cropping or quality settings etc.
- IF you don't change size or jpg settings the quality loss can be minimal
- Top is original, bottom is 6 pixel cropped and saved 4 times



# RAW Attributes

- Large files
- No standard, each vendor is different
  - Vendors even have more than one format
    - Nikon is NEF, but there are variations
    - Canon has CR2, CRW, and others
  - Adobe released common DNG standard, a few cameras have adopted it
    - Hasselblad, Pentax, Leica, others?

# RAW Issues

- When you first look at a RAW image it looks worse than jpg, often much worse
- The jpg has been processed! Not the RAW
  - Contrast, sharpness, saturation, noise, black/white points, etc. have all been processed in the jpg
  - However, the RAW image has inherently more data, it just needs to be processed first

# Metadata

- Data that is attached to the image file
  - Automatically contains date, camera, lens, flash, F-Stop, shutter speed, ISO, and others
- No more little notebooks to record exposure and other details
- Can add keywords, copyright, etc.
- Either stored in image file or as “sidecar”
  - Jpeg and psd/tiff store in file
  - Raw in file and more in sidecar file (xmp)



# Special Effects

Change the image in countless ways



# Camera Special Effects Settings

- Black and white
- Various colors
- Odd distortions, example “tiny scene”
- Fun, but mostly not useful since they permanently modify the image and it can't be made normal again, effects can always be added later to a copy



# Lenses

Bring the world into focus

# Lens Properties

- Important
  - **Focal Length or range for zooms**
  - **F-Stop, maximum or range for zooms**
- Other things
  - Manual/automatic focus
  - Resolution, contrast, and distortion (quality)
  - Filter diameter
  - VR/IS



# Lenses

## ■ Focal length

- **Normal** is diagonal of the squared sensor
- **Telephoto** is longer than normal
- **Wide Angle** is shorter than normal

## ■ F-Stop

- “Hole” size through lens
- Bigger allows more light
- Ratio (Focal\_length/hole) is F-Stop number
  - Allows F numbers to always indicate light amount

# More Lens Properties

## ■ Depth of Field

- The range of distance that looks “sharp”
- Larger F-Stop numbers make this longer
  - Note diffraction effect can reduce sharpness
    - > F11 depending on the lens
- Longer focal lengths make it shorter

## ■ Bokeh

- What out of focus shapes look like
  - Easiest seen in highlights, halos, donuts, etc.

## ■ Sharpness and Contrast

# Depth of Field



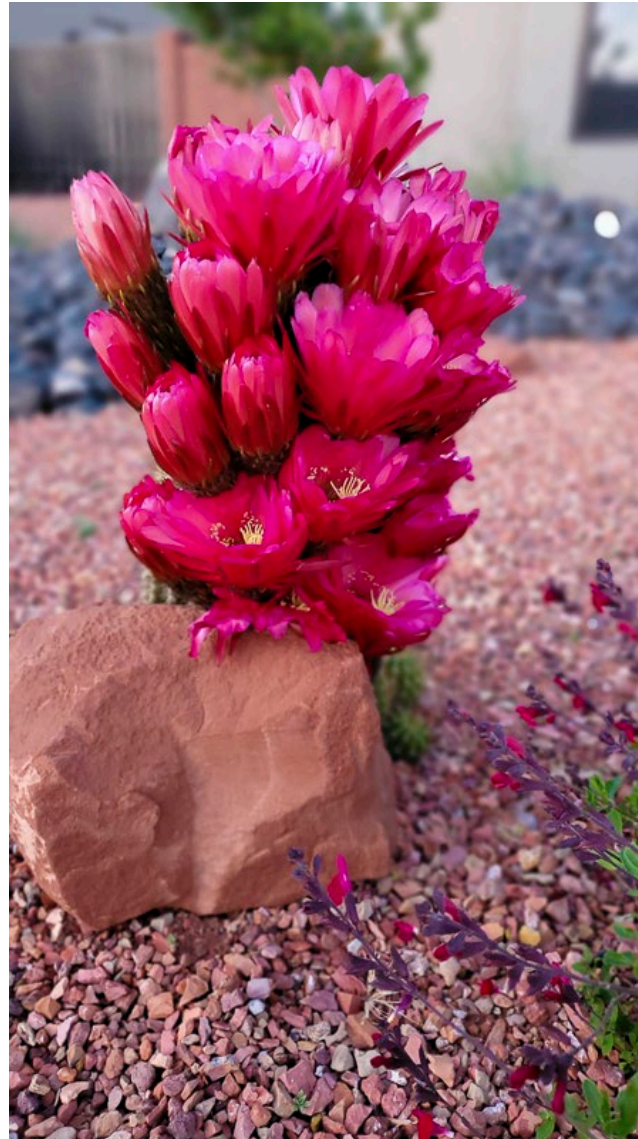
F4



F8



F22



Notice how the little rocks become more blurry the further away they are? That is a true optical blue.

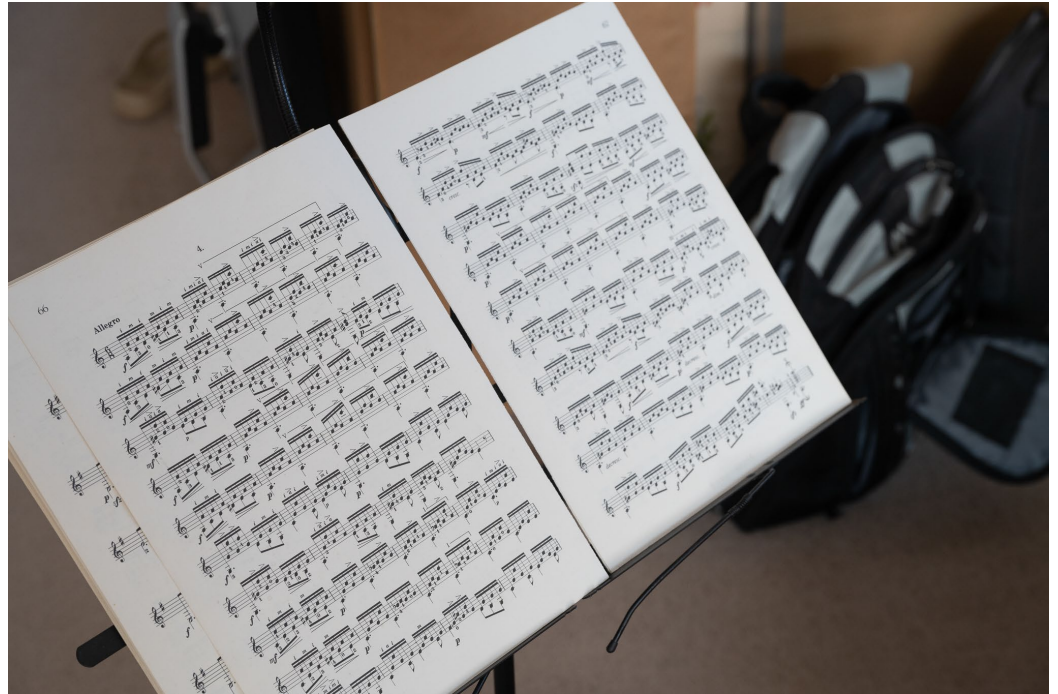
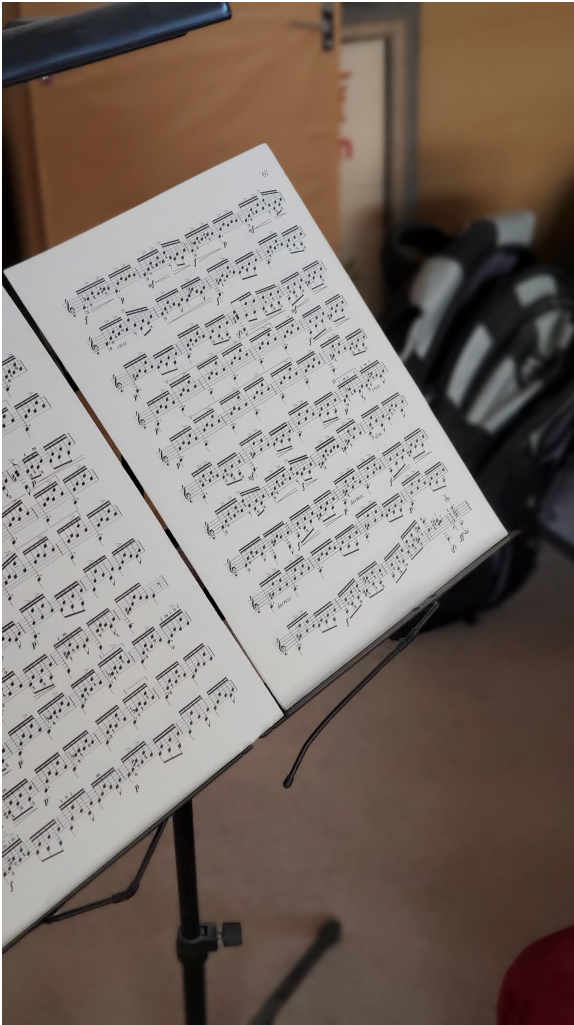


# Shallow Depth of Field



Notice how your eye goes to the sharp parts and tends to ignore the fuzzy parts

# Cell Phone Blur vs Lens



Note above (DSLR) how the blur starts on the right side of the page.



# Focus Stacking

- Take several images focused at different locations
- Combine in Photoshop to increase apparent depth of field
- Some cameras can do this automatically

# Shot at F2.8 – 8 Images



# Depth of Field Math

- $DOF \approx \frac{2d^2Fc}{f^2}$

- Where

- $d$  = distance to subject

- $F$  = f-stop

- $c$  = circle of confusion constant

- $f$  = lens focal length

# Try at home

- Take several images at different F-Stops without changing the focus point (manual focus) and see how the depth of field is affected



# Hyperfocal Distance (H)

- Focus setting that allows everything from  $H/2$  out to infinity to be in acceptable focus
- For wide angle lenses can be very great
- [wikipedia.org/wiki/Hyperfocal\\_distance](http://wikipedia.org/wiki/Hyperfocal_distance)

# Easy Way to Set Hyperfocal

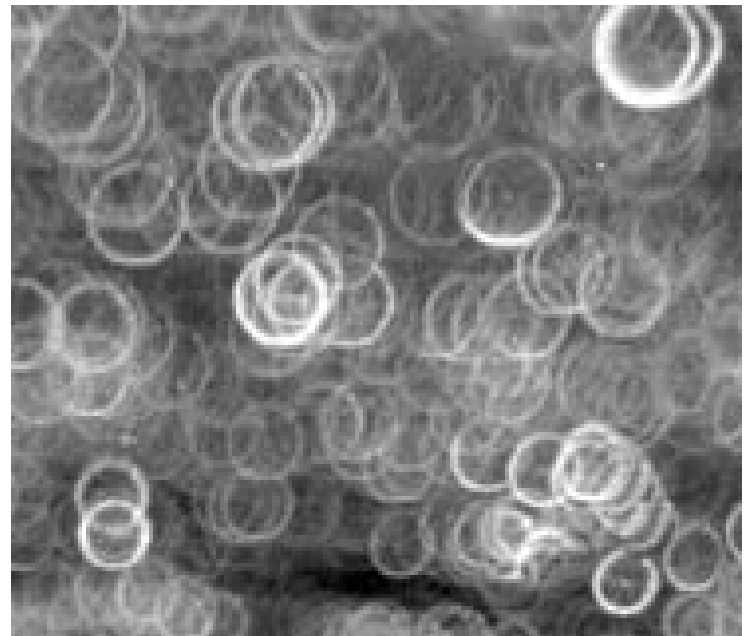
- Manual focus to near object, then move focus to infinity until distance sharp
- This will give you maximum DOF
- Verify close objects for sharpness, might need to change aperture
- **NOTE:** you must set your camera to preview F-Stop, normally aperture is open



# Two Example Bokeh Types

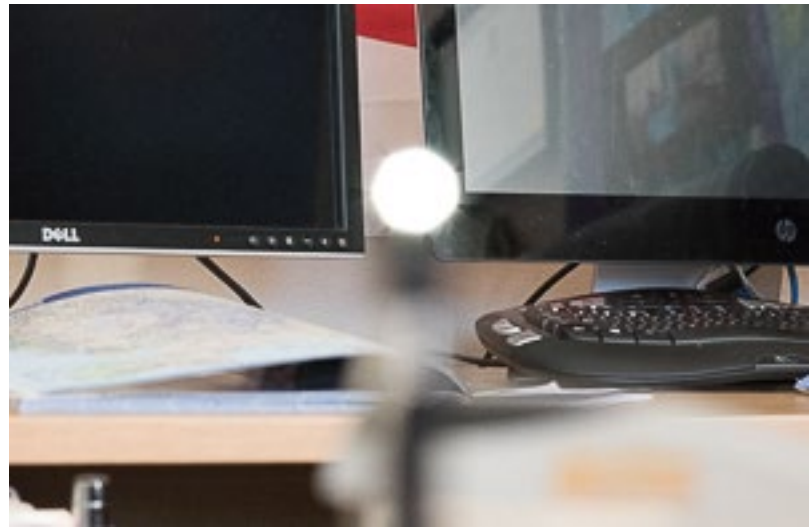


Smooth round bokeh

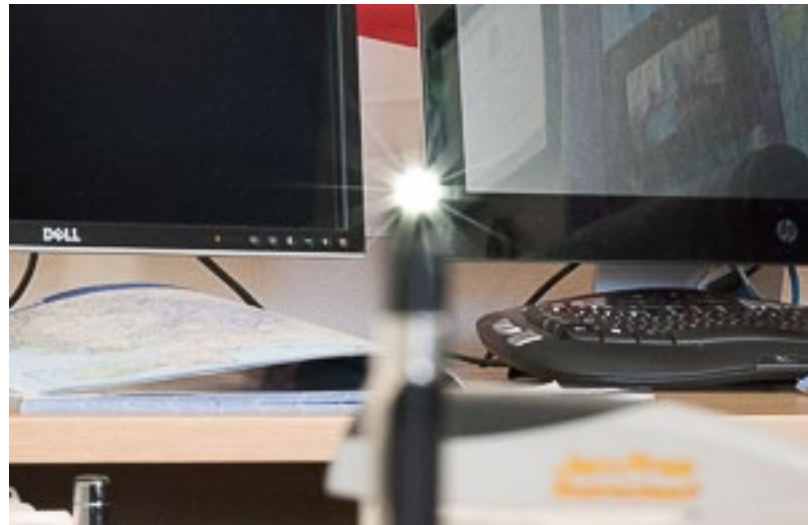


Soap bubble bokeh  
from mirror lens

Diffraction effect  
depends on aperture



F5



F14

# Other Aperture effects

- Smaller apertures and shorter focal lengths also cause the star effect seen in the last slide
  - This can be used creatively
  - It is a diffraction effect
  - The number of edges is related to the number of aperture blades

# Try at home

- Have some small bright lights
  - Christmas tree!
- Focus on something closer than the lights
- Look at what is around the bright lights
- Try different F-Stops and see the effect

# Lens Resolution

- Lens quality can affect image detail as much or more than the number of megapixels
  - See [dxomark.com](https://www.dxomark.com) (sharpness-apparent Mpixels)
- Image quality largely determined by lens quality today, we have plenty of Mpixels, better than 35mm film
- 6MP with a good lens makes a better image than 20MP with a poor lens
- Spend your money on good glass!

# Lens Classifications

- Prime – Single Focal Length
- Zoom (optical) – Range of Focal Lengths
- Normal
- Wide
- Fish-Eye (super-wide but distorted)
- Telephoto
- Macro/Micro (for close-ups)
- Portrait
- Specialty Lenses (example: shift/tilt)

# Zooming

- Change the focal length of the lens
  - Usually a ring on the lens but can sometimes be controlled by buttons on the camera
- Changes the angle of view

# Digital Zoom

- Marketing trick to expand zoom range
  - Amazing zoom range to tout as a feature
  - Expands pixels, lowers details
  - Disable if your camera has this “feature”



# Focal Length Effects

- Long (telephoto) lenses
  - Get you closer to the subject
  - More sensitive to shake
  - Compress perspective
  - Have short depth of field
- Short (wide angle) lenses do the opposite

# Telephoto Compression

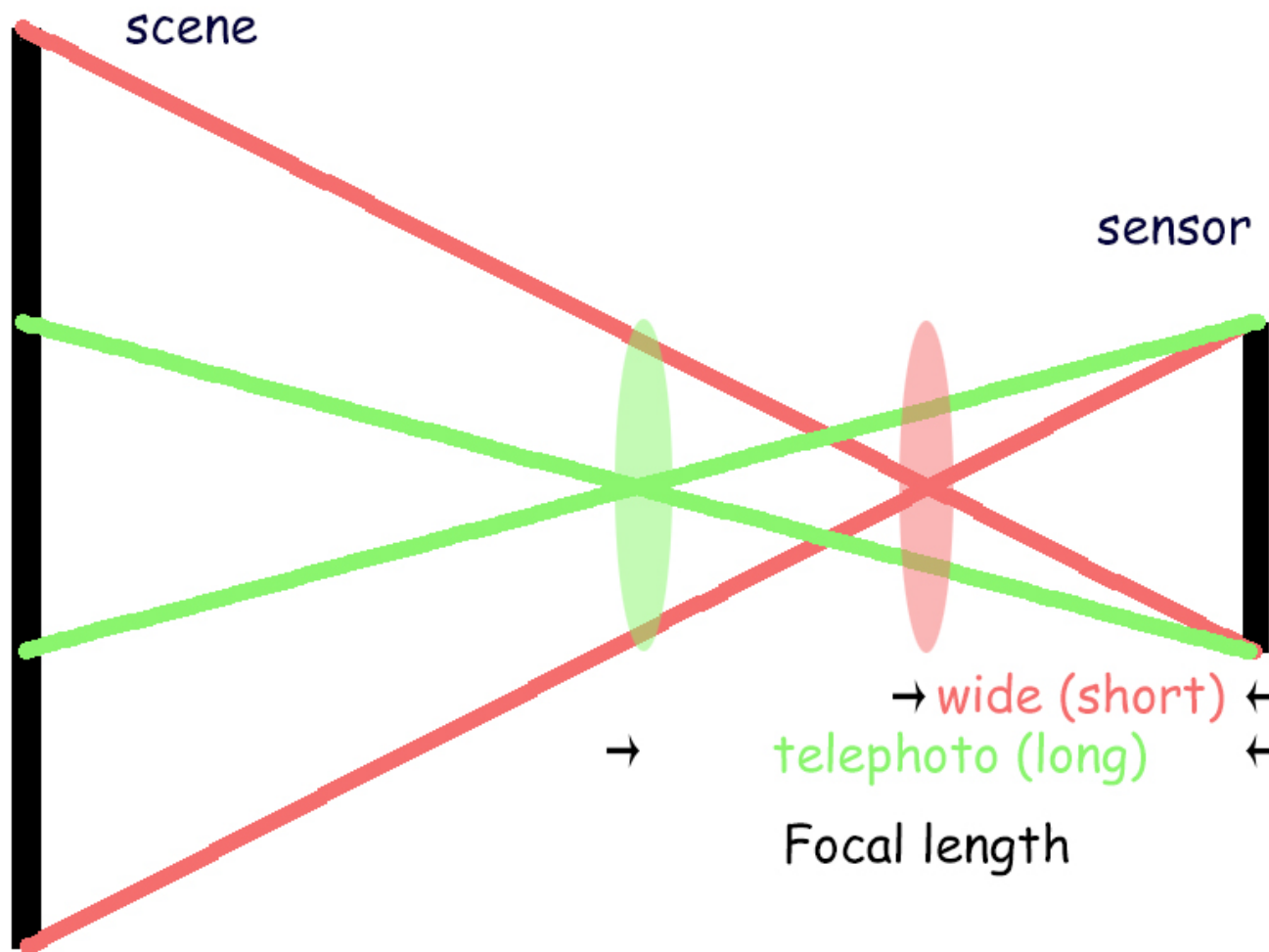


# Wide angle, front flowers pop



Wide angle lenses are especially useful to emphasize a foreground subject because the background is pushed away.

# Focal length affects field of view



# Sensor Sizes

- Full-frame is same as 35mm film
  - 24 x 36 mm
- APS-C – smaller sensor
- Lens designations
  - Nikon uses FX for full frame, DX for smaller
  - Canon uses EF and EF-S

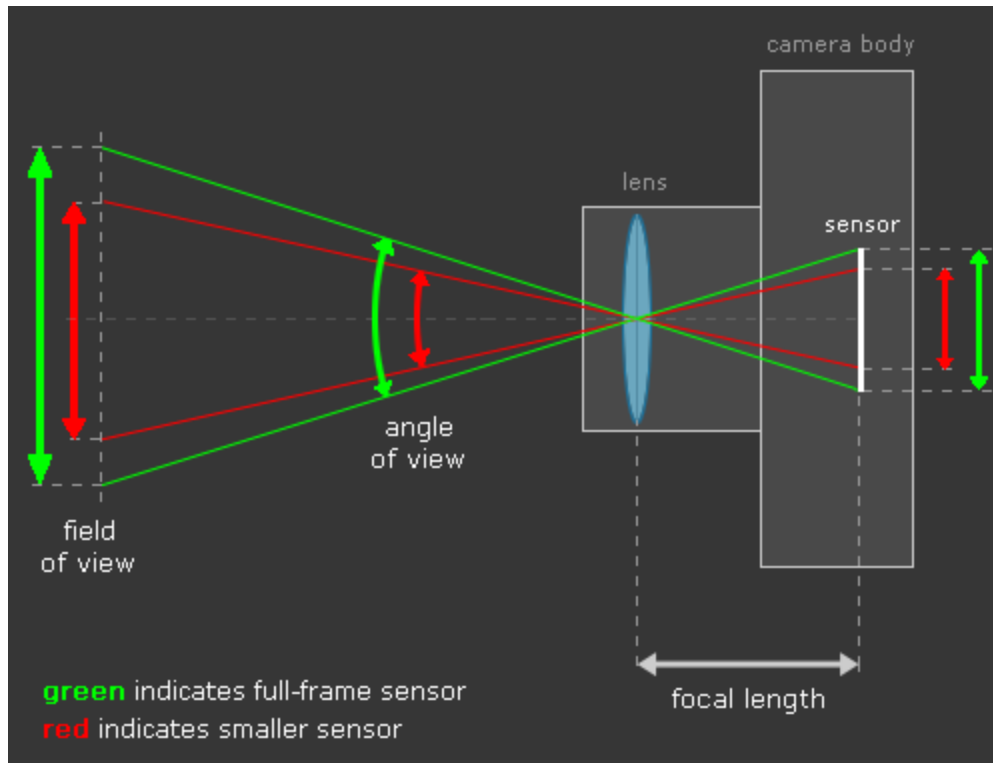
# Sensor Size Effects

- Normal focal length is 1.414 times the longest side of the sensor
  - ~50mm for a full frame sensor 24x36 mm
- Many cameras have smaller sensors
  - 50 mm normal lens acts like a slight telephoto
  - ~1.6 for some sensors, 100mm acts like 160
  - Easy to get longer lenses
  - Harder to get really wide angle lenses

# Depth of Field and Sensor Size

- Smaller sensors create more depth of field
- This is one reason why cell phones have very large depth of field while full frame cameras have less

# Smaller sensors make lenses act longer





# Wide vs Telephoto

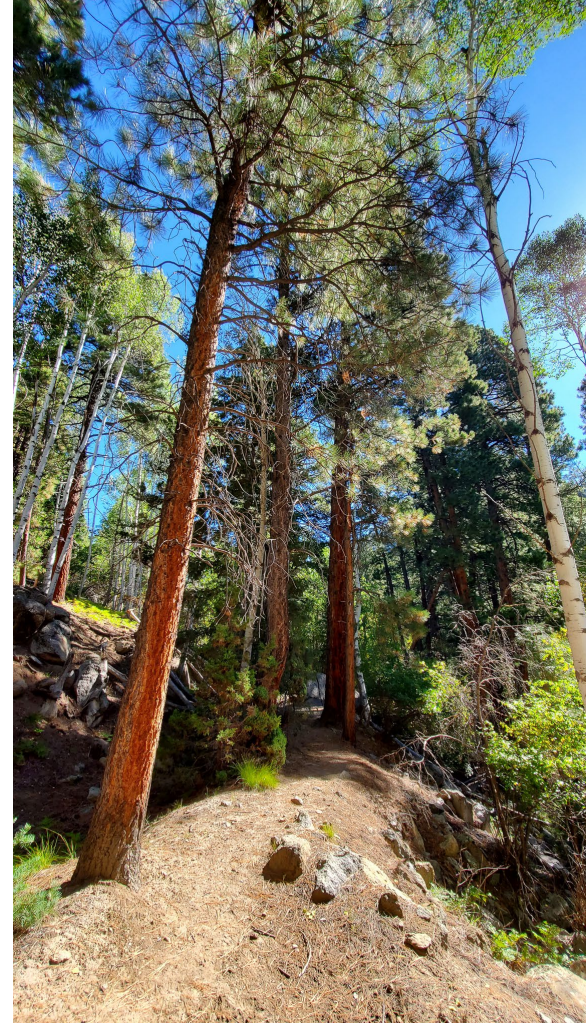


300mm

28mm



# Tilted Wide Angle Tilts Angles



# Choosing a Lens Length

	Wide Angle (short)	Normal	Telephoto (long)
Perspective	Spreads things apart	Normal	Makes things appear closer
Depth of Field	Deep (long)	Normal	Shallow
Shake sensitivity	Low	Normal	High, tripod
Size	Short and wider	Normal	Long and often heavy
Vertical lines	Tend to tilt and curve	Normal	Tend to stay straight

# Modern Lens Features

- Auto/manual focus
- Anti-shake
  - VR (vibration reduction) by Nikon
  - IS (image stabilization) by Canon
  - It may be known by other names
- Mirrorless bodies often move the sensor
  - Works with any lens (aka IBIS)



# Filters

I like my rose-colored glasses!



# What Size Filter?

- Buy for your largest lens diameter
- Use step rings to adapt to smaller lenses

# Filters

- UV/clear may protect lens from scratches
  - [UV Filters Are NOT Designed to Protect Your Lenses, Manufacturers Confirm | PetaPixel](#)
  - DSLR's already block UV
    - [Why UV Filters are Basically Useless on Modern Cameras | PetaPixel](#)
  - Lens hood helps to protect lens
- Skylight, warming and cooling filters
  - Easily done during editing

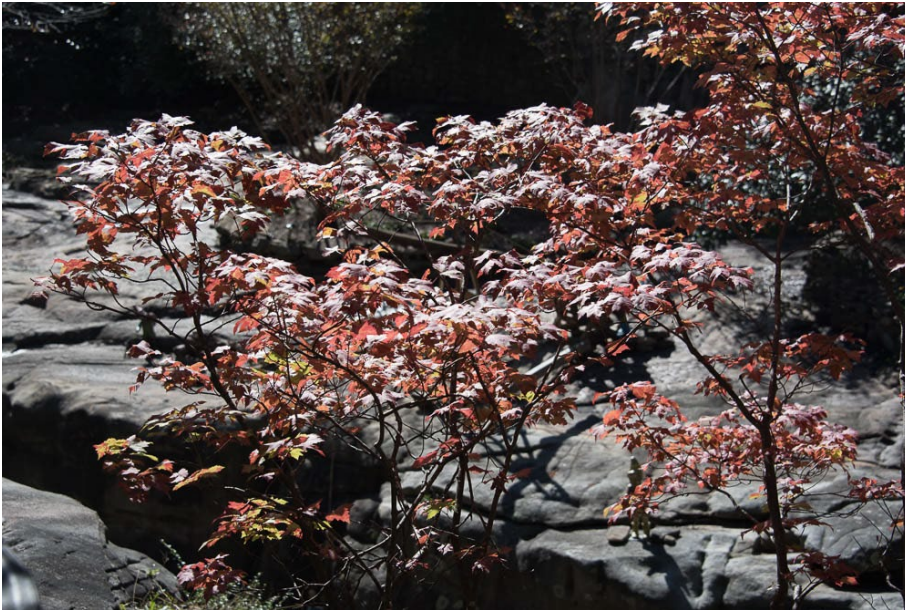
# Circular Polarizer

Can't simulate later in Photoshop

- Works best at  $90^\circ$  ( $\pm \sim 15^\circ$ ) to light source
- Removes glare and reflections, good on shiny things, glass, water, leaves and rainbows
- **Note:** Old Linear polarizers will not work
- Thread onto front of lens, **rotate to adjust**
- Available for cell phones as a clip-on



# Polarizer Example



With rotated polarizer





With polarizer







Left is normal, bottom is with polarizer. Subtle differences, but notice shadow detail in bush and mountain is better. The mountain rock color is also slightly better.



# ND (Neutral Density) Filter

- Available in different densities or adjustable
- Used to reduce light when exposure needs to be modified outside of limits based on the brightness of the light
  - Example: allowing a slow shutter speed in bright light, often used for waterfalls

# More Filters

- Close up, actually a magnifier lens
- Graduated ND
  - Useful in landscapes to darken sky
- Clear glass
  - Smear Vaseline to make fuzzy areas
    - Easier to do on the computer now!
- Special effects
  - Stars and prism effects



# The Shutter

Open the curtains and let the sunshine in

# Two Kinds of Shutters

- Mechanical
  - Makes the shutter sound we all know
- Electronic
  - No noise, common on mirrorless and usually on DSLR's using LiveView
- Some mirrorless have both and some have only electronic



# Shutter Speed

- May be shown as an inverse number
  - 125 means  $1/125$  of a second
- Safe handholding rule of thumb
  - 1/focal length
    - 50mm lens – about  $1/60$
    - 135mm lens – about  $1/125$
  - IS/VR makes this better by at least 2-4 stops

# Effect of Speed

## Fast

- Allows less light, use when lighter
- Stops motion
- Easy to handhold

## Slow

- Allows more light, use when darker
- Shows motion
- Steady hand or tripod



Shutter speeds from  $\frac{1}{4}$  to  $\frac{1}{500}$  second.  
The fan was running at a constant speed!



1/2000



1/100



1/20



1/6

# Handling Slow Shutter Speeds

- Wall
- Strap
- Stand/kneel
  - Avoid crossing legs, use both knees
- Use stable hand positions
- Monopod/Tripod
- IS/VR lenses or mirror-less sensor shift

# Exercise

- Try different shutter speeds on moving things and notice how the blur changes
- A good way to see the effect is to take pictures of a ceiling fan using different shutter speeds



# ISO

Give me light, but not too much or too little, just the right amount please, I'm sensitive

Call me eye-soh or eye-es-oh, both are OK

# ISO

- In the past was ASA, then ANSI
- DIN was German equivalent
  - 100 ASA = 21 DIN
- Combined in the 80's to just plain ISO
  - Approximately shutter speed sunlight at F16
- Higher values have more noise
  - Best to stay below 800



# More Details on ISO

- Native, Amplified, and simulated
- Excellent article here:
  - <https://www.bhphotovideo.com/explora/photography/tips-and-solutions/understanding-iso>
  - The comments about “higher voltage” are not actually correct (it is really gain or amplification that is increased), but the result comments are correct

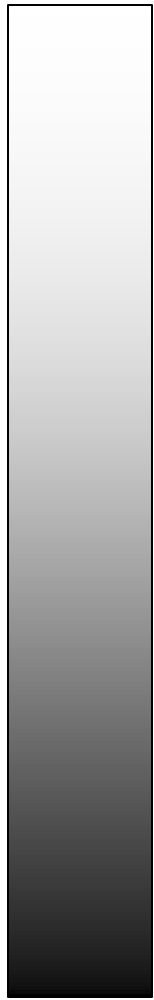
# Sensor Noise

- Smaller sensors have more noise
  - Modern sensors are very good
- Two kinds
  - Luminance (brightness)
  - Chrominance (color)
- Temperature affected, cold is better



# Consider Audio Tape Hiss

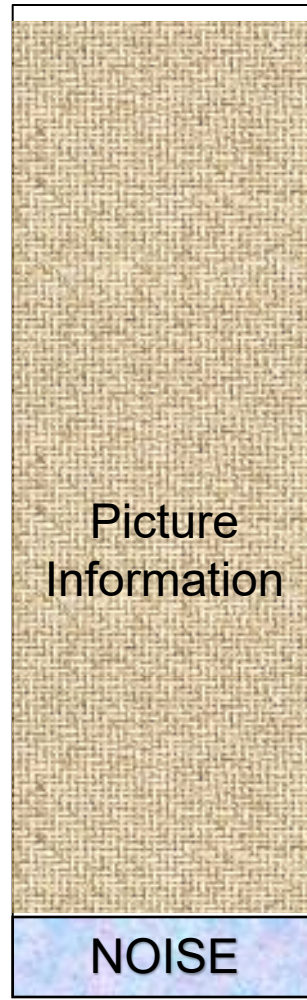
- Remember that hissing in the background of taped music?
- You could really hear it in the quiet sections of the music
- During the loud sections it wasn't noticeable



Light Intensity



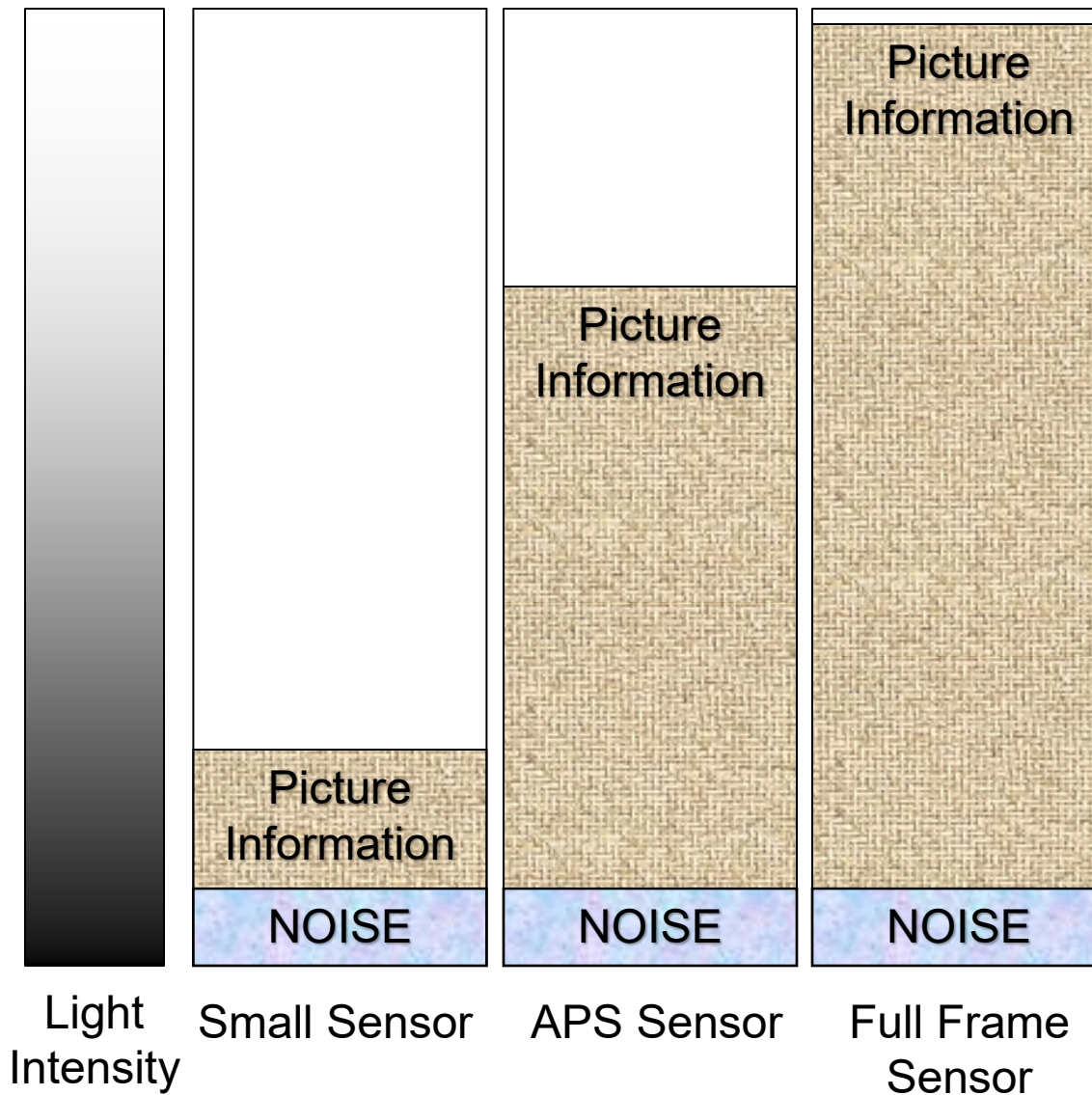
Under exposed



Normal exposure

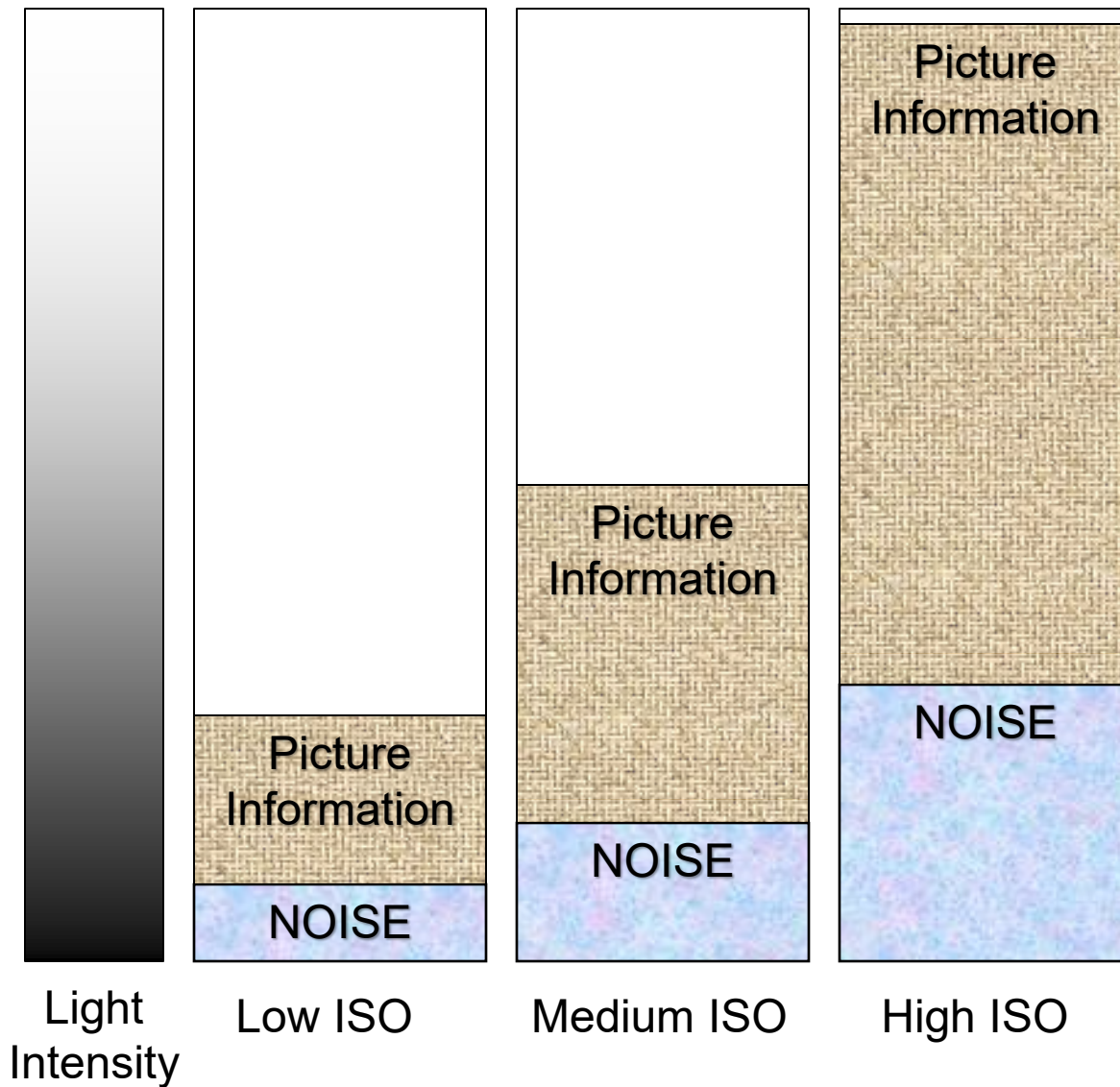
The noise is more noticeable when the sensor does not get enough light. This is the under exposed condition.

Noise is a function of the sensor design, its size, the number of mega-pixels, and the temperature.



Larger sensors “see” more light so they have a stronger signal. The noise is more or less independent of the pixel size. Larger sensors have a better SNR (signal to noise ratio).

Cell phones use software techniques to improve the noise. Of course DSLR’s can also do that! In addition you can do noise reduction on your computer later.



The ISO on the camera is raised by amplifying the signal electronically. But this also amplifies the noise!

Sensors have a base or native ISO sensitivity typically around 100, but not published. There is also simulated ISO that is done by software in the camera attempting to get even higher ISO's with less noise.

# Digital Noise vs Film Grain

## Film Grain

- Higher ISO
- See everywhere
- Used creatively, had nice look

## Digital Noise

- Higher ISO
- Less in bright area
- Doesn't look as nice

# Digital Noise

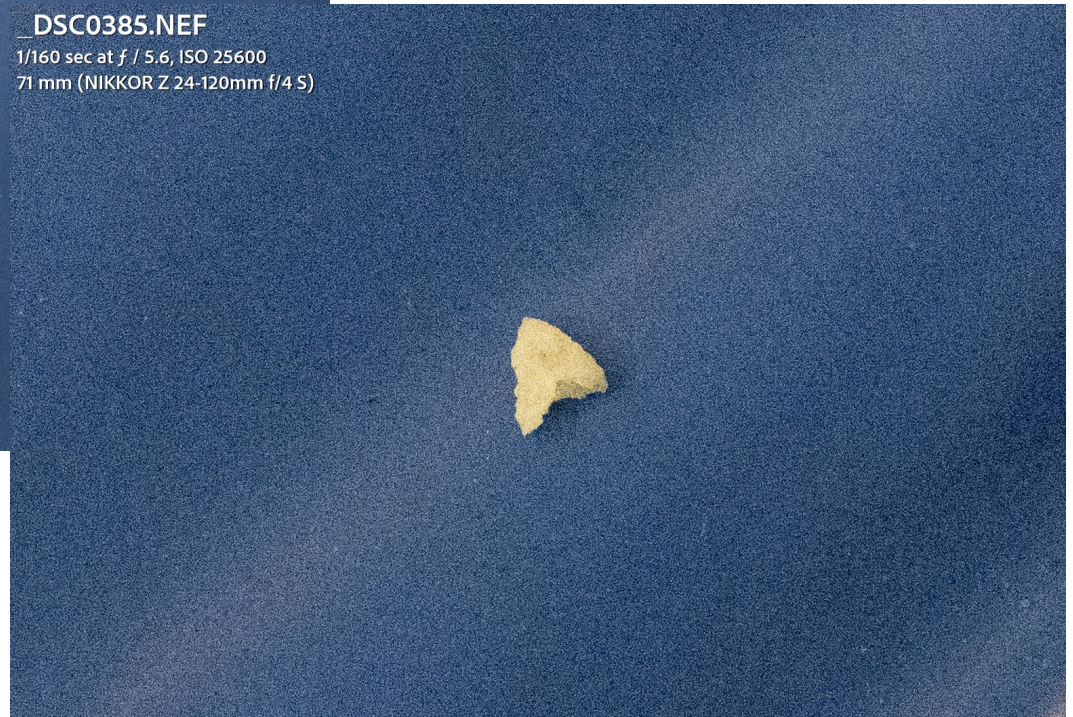
\_DSC0384.NEF

1/10 sec at *f* / 5.6, ISO 1800  
71 mm (NIKKOR Z 24-120mm f/4 S)



\_DSC0385.NEF

1/160 sec at *f* / 5.6, ISO 25600  
71 mm (NIKKOR Z 24-120mm f/4 S)





# High ISO Noise



Don't see much in really dark areas here because blacks have been clipped which masks the noise



# Color Noise Example



Notice how there is very little noise in the brightest areas of the image

Label is wrong, this is actually a fleam.

# After a Makeover in Lightroom



Notice how the image is not as sharp, it is a little bit "soft", detail has been lost



# High ISO and Sharpness

- Higher ISO images are not as sharp
  - Especially if noise reduction is on
- Until AI that is...

DSC0352.NEF

0.5 sec at  $f / 4.0$ , ISO 25600

24 mm (NIKKOR Z 24-120mm  $f/4.5$ )

Direct from camera with noise reduction off and very high ISO

DSC0352-Enhanced-NR.dng

0.5 sec at f / 4.0, ISO 25600

24 mm (NIKKOR Z 24-120mm f/4 S)



Adobe Lightroom AI noise reduction. Unlike tradition noise reduction, there is very little sharpness lost. Only works with raw images!

# High ISO from Camers



\_DSC0204.NEF  
1/100 sec at *f* / 5.0, ISO 9000  
120 mm (NIKKOR Z 24-120mm f/4 S)

# Adobe AI Noise Reduction





# Manual Sharpening



Notice how the image is not as sharp as the AI version

# Camera Noise Reduction

- High ISO noise reduction
  - Only affects jpg, not raw image
  - Trade-off between noise and details
  - Turn off, computer AI is much better
- Long exposure noise reduction
  - Takes a “dark frame” exposure equal in time and subtracts from real image
  - A 10 second exposure will take 20 seconds

# Minimizing Noise

- Lower ISO (might make exposure longer!)
- Collect as much light as fast as possible
  - Move histogram right without clipping hi-lights
  - Use larger aperture (smaller F number)
    - Note: this reduces depth of field
  - Use shorter exposure time, sensor heat noise
- Use camera noise reduction feature



# AI is Game Changer

- The noise reduction is amazing in Adobe Lightroom, Topaz Labs, etc.
- Note that RAW format is often required



258x333 pixel image!



1452x1911 pixels from  
Topaz AI Sharpener

# Summary Thoughts

- ISO noise is a result of amplifying the sensor signal, noise also gets amplified
- Minimize with the lowest ISO setting, I.E. get as much light as possible to sensor
  - Get the most light to the sensor that we can, longer shutter speeds and larger apertures
    - Just remember that shutter and aperture are constrained by artistic and blur-avoidance issues
    - The most important issue is to “get the shot”



# Sharpness

Look sharp, everybody!

# Sharpness Advice (1/2)

- Buy good lenses (see: [www.dxomark.com/lenses](http://www.dxomark.com/lenses))
- Use best focus mode, AF-C (Canon AI-Servo) for moving things, or AF-S for still
- Use fast enough shutter speed
  - 1/focal length
  - holding method (hand or tripod)
  - IS or IBIS improves often > 2 stops



# Sharpness Advice (2/2)

- F-Stop, 1 or 2 above wide open and at least that much below max
- Shutter delay, self-timer, lets vibration stop with slow shutter speeds
- No strap when using tripod, wind can move it around
- Lower ISO is better

# Cell Phones

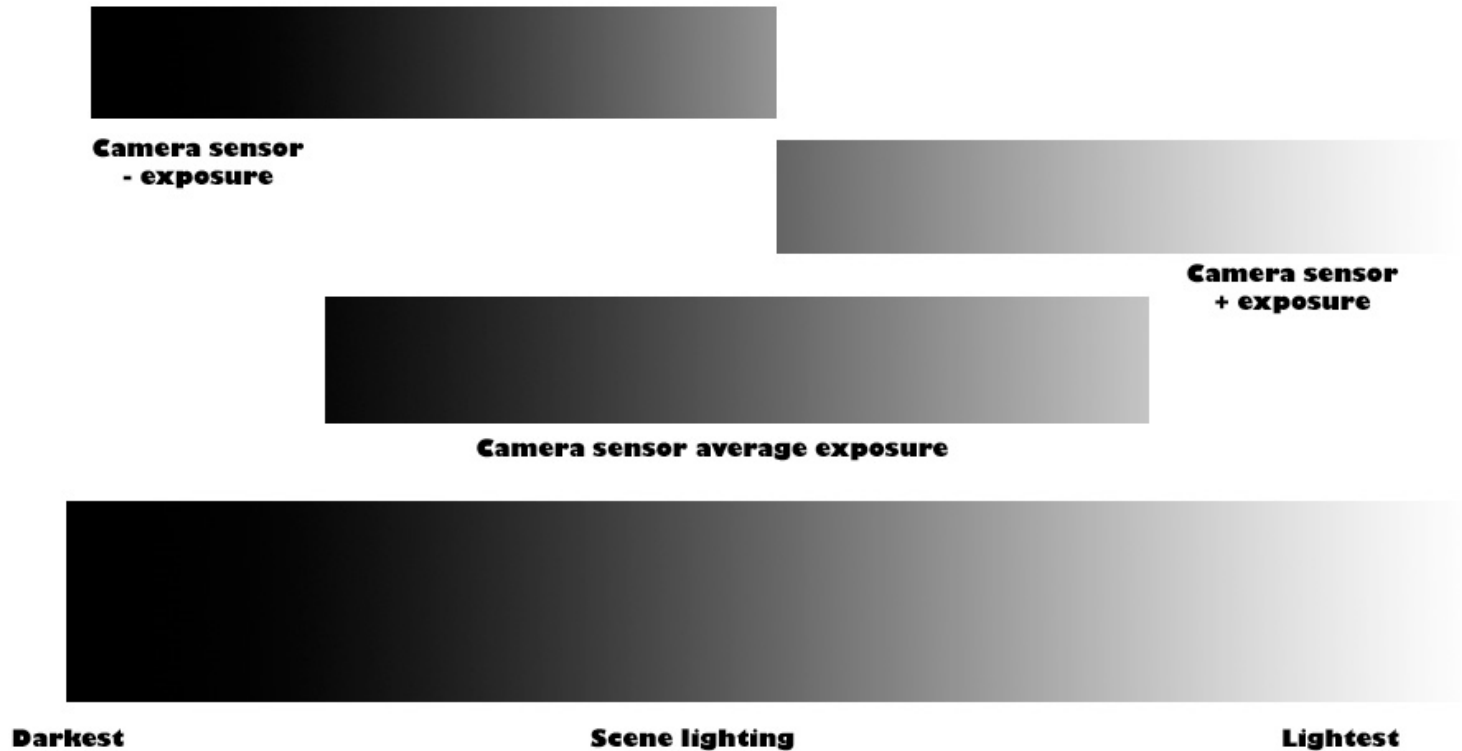
- Images look sharp on small screens even when they aren't really sharp
- DSLR's are much less forgiving of focus errors



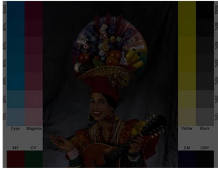
# Exposure

Getting the correct amount of light to the sensor

# Dynamic Range Scene/Sensor



# Things Affecting Exposure



## Exposure

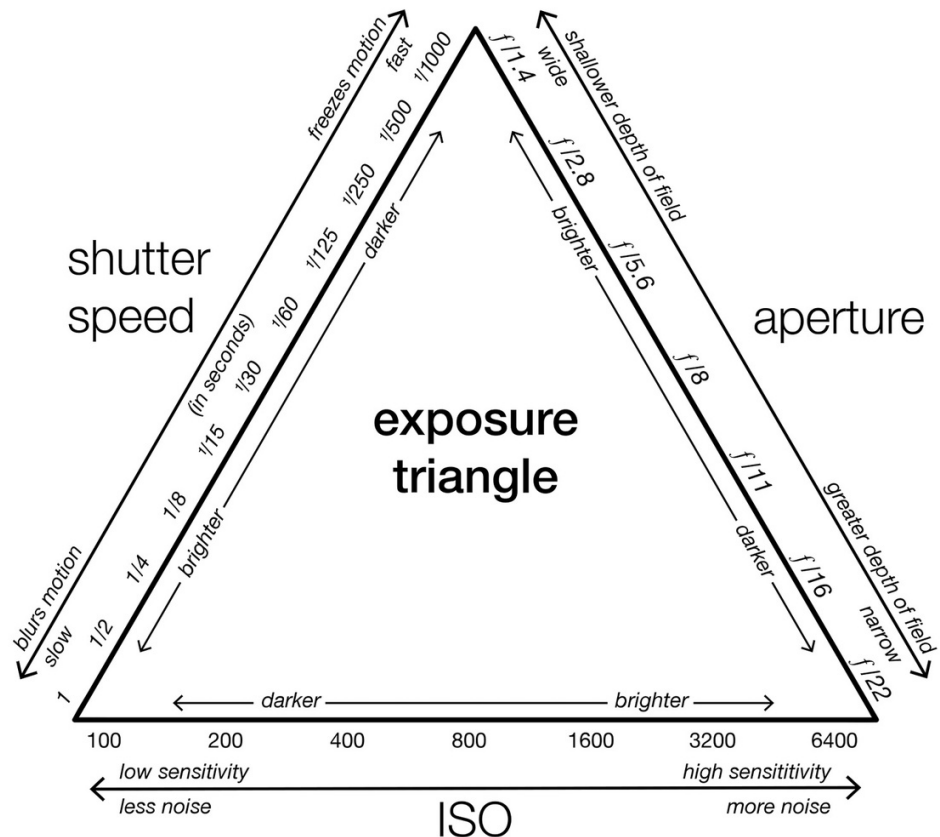
less noise **ISO** more noise

more depth of field **F-Stop** less depth of field

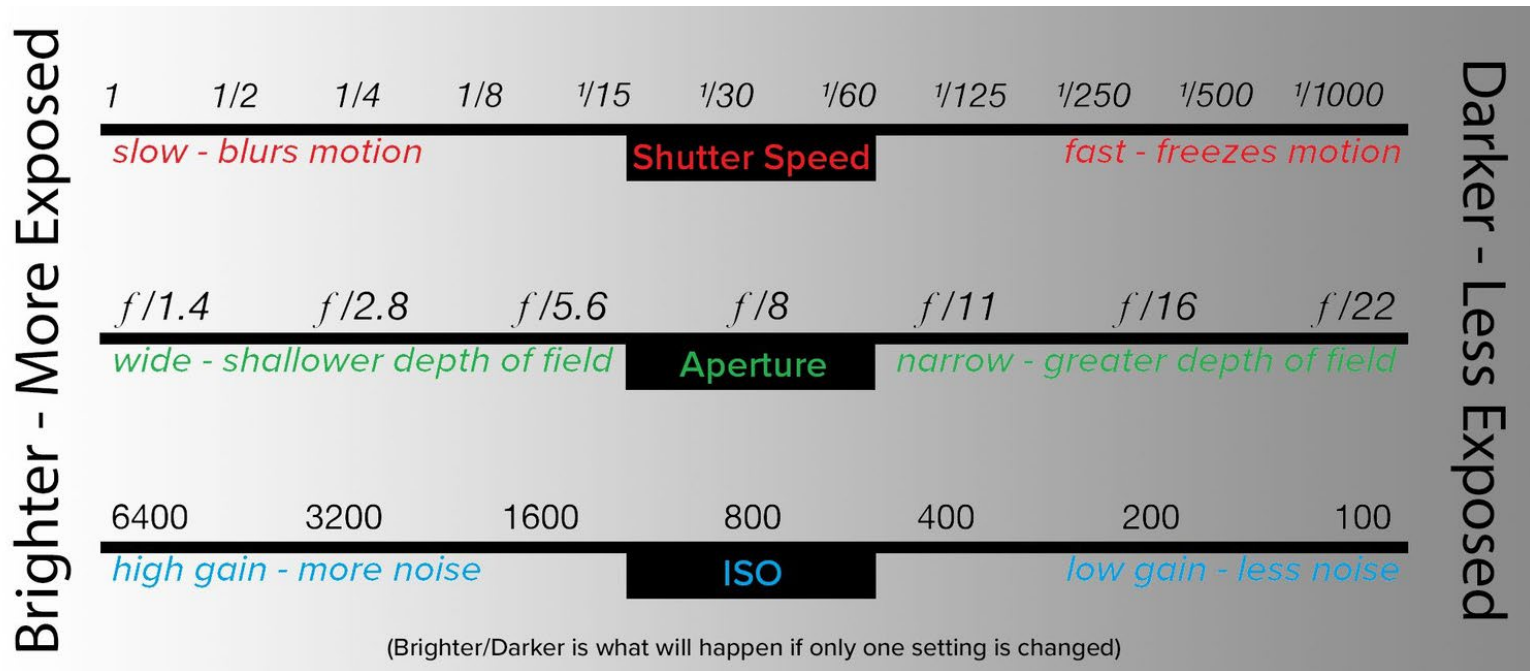
stop motion **Shutter Speed** motion blur

# Exposure Triangle

You will find this many places. I don't like it because it doesn't really show the relationships between the 3 settings. It gives no indication of where the correct exposure is. It is just 3 things arranged in a triangle!



# A Better Diagram



This shows how things get brighter one way and darker the other way. If you adjust one, then you must adjust one or both of the others to get the brightness correct again.

Credit to Mike Dixon

# An Analogy – water like photons and sensors like buckets

## Water

- Pressure
- Hose size
- Time on
- Bucket size
- Noise
- Blooming

## Light

- Light strength
- F-stop
- Shutter speed
- ISO
- Scattered drops
- Overflow



# Exposure

- Light can be measured in EV units
  - Each unit represents a doubling or halving
  - Light meters can show, but digital cameras rarely show this
- Correct exposure is controlled by
  - ISO, how much light each element needs
  - Shutter speed, how long the shutter is open
  - F-Stop, how much light the lens lets through

# EV

- Makes every number equivalent to a stop
  - $+1 = 2 \times \text{light}$
  - $-1 = 1/2 \times \text{light}$
- 0 is F 1 at 1 Second
- Cameras often show focus or sensitivity in EV using ISO 100

# The Math (Won't be on test!)

- $EV = \log_2 \frac{F^2}{t}$
- F is F-stop, t is shutter speed (in seconds)
- Using  $\log_2$  results in each integer step being a halving or doubling of light



# Sensor needs right amount of light

- Too much = highlight detail loss
- Too little = shadow detail loss
- Sometimes you have to accept one or both of the above

# 4 shades of gray over-exposed

[ 0%    25% ]  
[ 50%   100% ]



Over expose by 1 stop, I.E. a doubling of light  
This results in these new values

[ 0%    50% ]  
[ 100%   100% ]



Note that the difference between the two spots on the bottom is now lost.  
And there is no operation that can bring back that detail!  
All you can do is make everything a bit darker, the detail is lost.



# 4 shades of gray under-exposed

$\begin{bmatrix} 0\% & 25\% \\ 50\% & 100\% \end{bmatrix}$



Under expose by 1 stop, I.E. a halving of light  
This results in these new values

$\begin{bmatrix} 0\% & 12.5\% \\ 25\% & 50\% \end{bmatrix}$



Now we see that we can recover by multiplying by 2 again!  
But... noise and other artifacts might also be increased.

This shows why it is often preferable to under-expose slightly.

# Two Ways to Measure Light

## Reflectance

- What your camera does
- Least accurate
  - Affected by the properties of your subject

## Incidence

- What a light meter does when at the location of your subject
- Most accurate
  - Measures the actual light, not what is reflected

# Grey Card

- 18% reflectance
- Your palm is ~36% (your results may vary)
- The world is gray?
  - The camera looks at the world as if it is gray when deciding the exposure, this will result in some pictures not being exposed correctly
    - Consider a black cat in a coalbin or a white cat in a snowstorm!



# Rules for Exposure

It often depends on the scene!

## ■ Film

- Expose for shadows and develop for highlights

## ■ Digital

- Expose for highlights and live with whatever shadow detail you can get
- It is usually best to expose for the dark or light that matters most when the dynamic range is exceeded

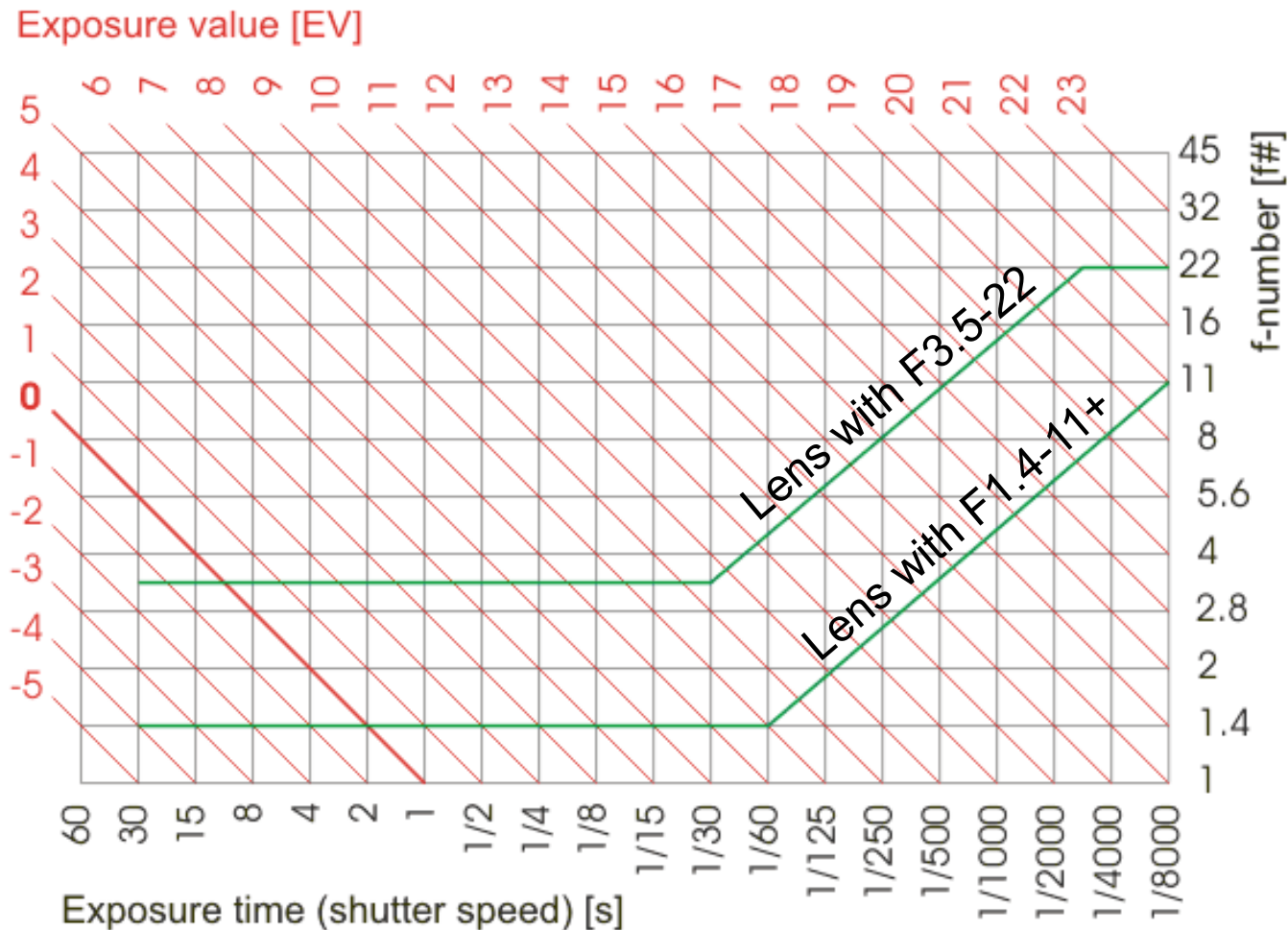
# F-Stop Shutter Variations

- These all give the same amount of light
- Choose the combination that is the best compromise for artistic or technical need
- Note: shutter speeds directly affect the amount of light, but F-Stop is a diameter, so the amount of light is a squared value
  - $\frac{1}{2}$  shutter speed matches  $\sim 1.4$  larger F-Stop

Aperture	F16	F11	F8	F5.6	F4	F2.8	F2	F1.4
Shutter	1/15	1/30	1/60	1/125	1/250	1/500	1/1000	1/2000

# EV vs F-Stop & Shutter Speed

Red lines are combinations, green lines are camera automatic settings



# Summary - Choosing Settings

Setting	Effect	Comments
<b>ISO</b>	How much light is needed by the sensor	Higher values result in more image noise but let you use faster shutter speeds and/or slower lenses. Use 100-200 outside and 1200+ inside. This setting is fine to use in automatic mode.
<b>F-stop Av or A</b>	The amount of light the lens allows through	Smaller numbers give a smaller depth of field. Should also be used in low light. Larger numbers create more depth of field, but require more light or a slower shutter or higher ISO.
<b>Shutter speed Tv or S</b>	How long the shutter lets light through to the sensor	Slower speeds show motion and blur. Higher speeds can be used to stop motion.



# Summary of exposure effects

- ISO
- Shutter speed
- F-Stop/Aperture
- Noise
- Motion blur
- Depth of field

# What is 'Correct' Exposure?

## ■ Technical intent

- At least 6 “correct” values

  - F stop/shutter combinations

  - Camera will pick one for you in automatic

## ■ Artistic intent

- Depth of field to isolate subject or include all

- Shutter speed for motion, blur or freeze



# Artistically Correct Exposure

- Isolate subject with DOF
- Make everything sharp
- Freeze motion
- Show or imply motion with blur
- Show motion with panning
- Darken or lighten for mood or atmosphere

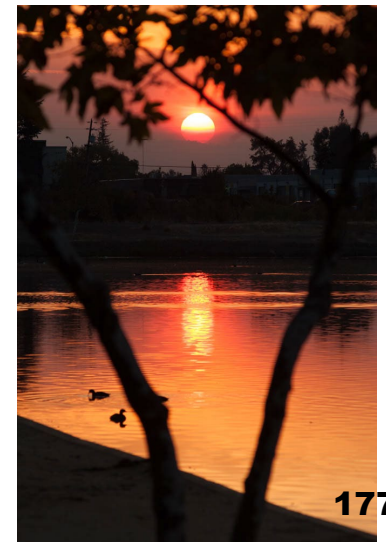


# Artistic Settings

Choosing the correct F-stop and/or shutter speed to get the image you want, the camera is not always right!

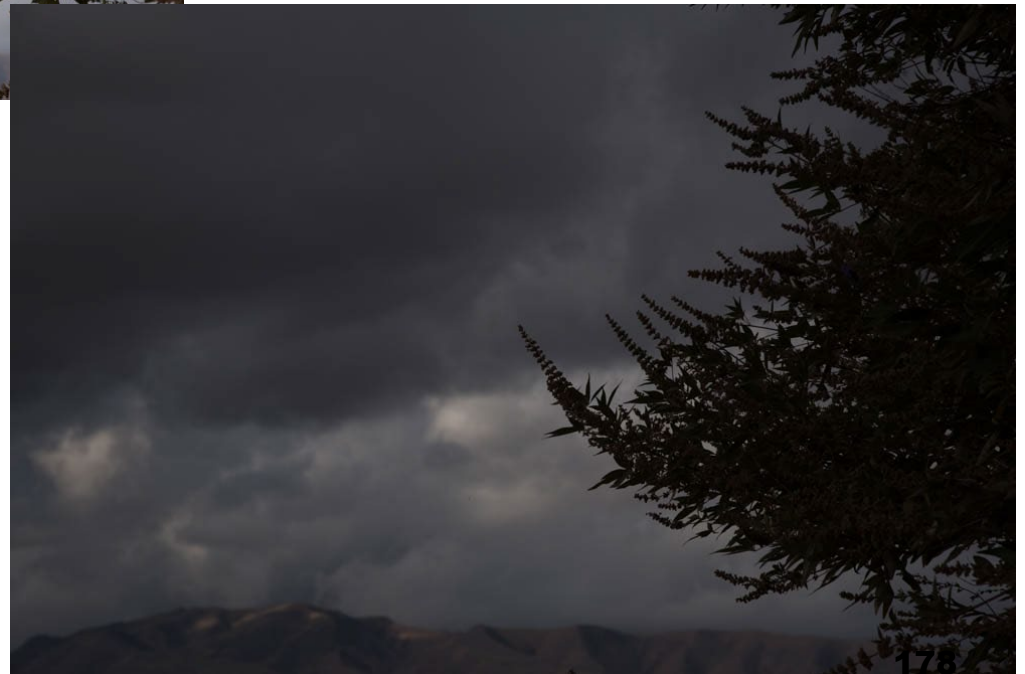


# Dark and Light Mood



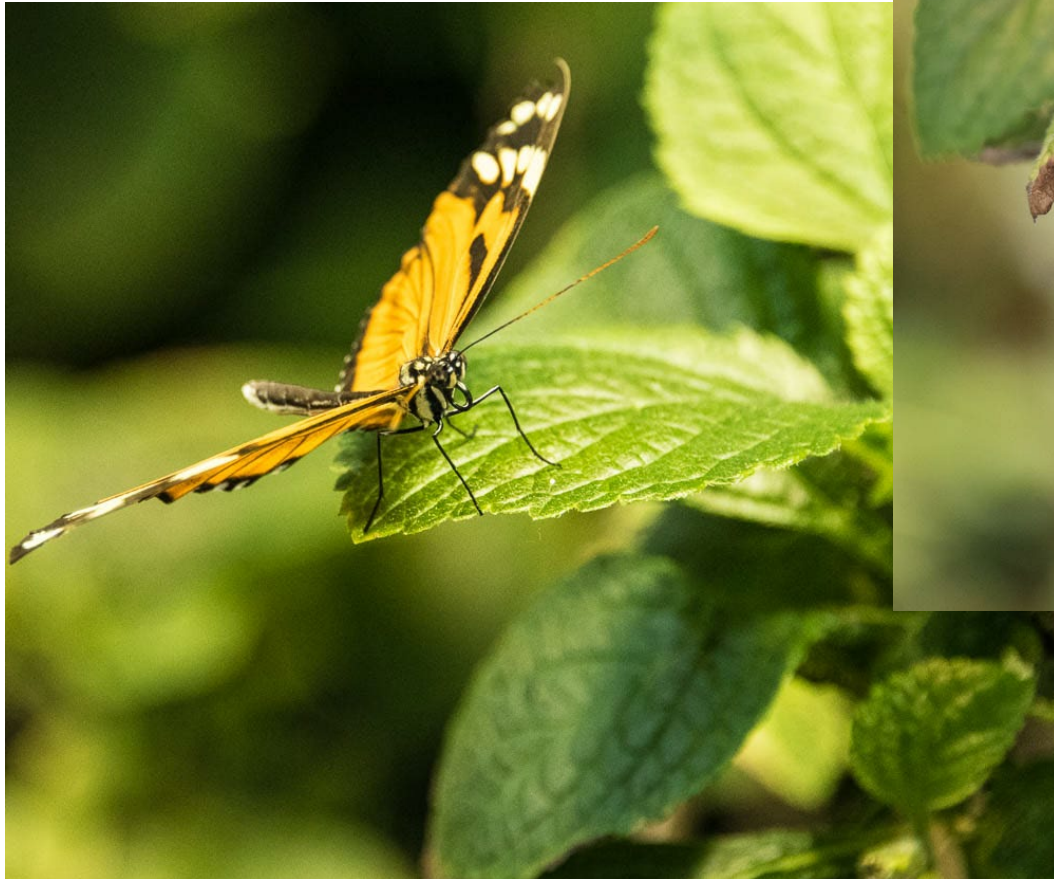


“correct exposure”



“-2 stops”

# Depth of Field Isolation



Notice how there is almost a 3D effect?

# Glass Wing Butterfly



# Everything Sharp



# Freeze Motion





Fast shutter freezes the water while large aperture creates shallow depth of field to isolate subject and separate it from the background.

# Imply Motion with Blur

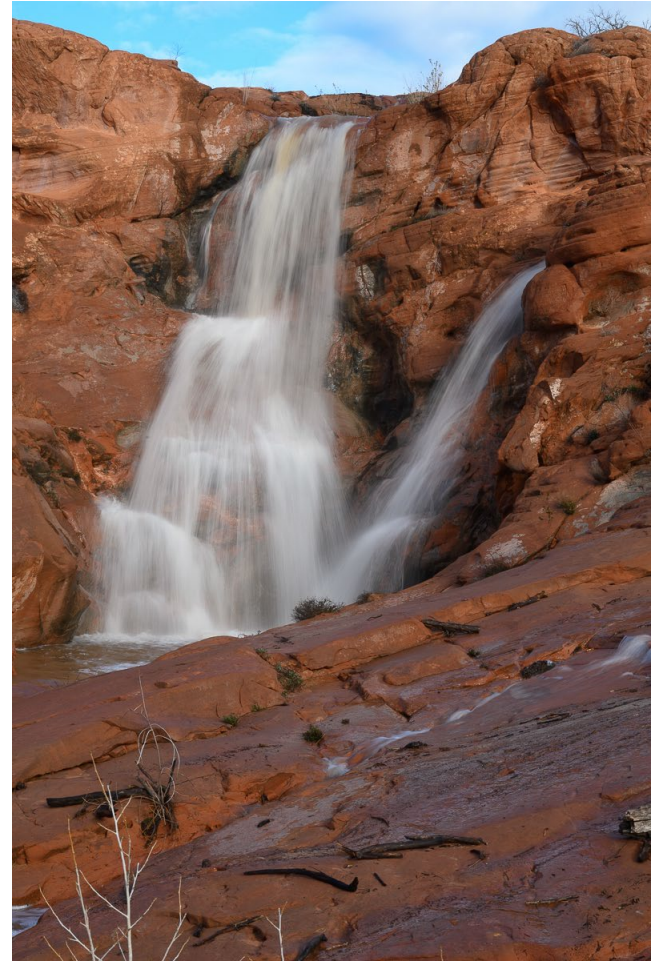




# Slow Shutter Shows Motion



# Waterfalls, blur with slow shutter



# Sometimes less blur is better



# Panning



# Panning Film 1970





# Panning Film 199x



# Pan and Slow Shutter







# The Histogram

Show me how I'm exposed, and don't get hysterical

# Histogram

- An important tools to understand
- It's just a bar graph showing the count of pixels at each brightness level
  - Black on left
  - White on right
  - Grays in between
- A glance will tell you much
- Keep your eye on it while editing



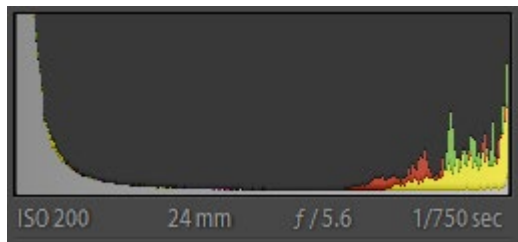
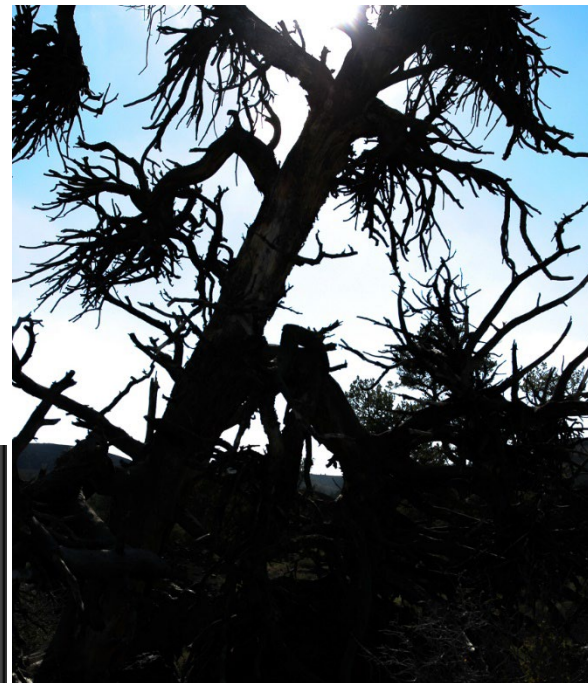
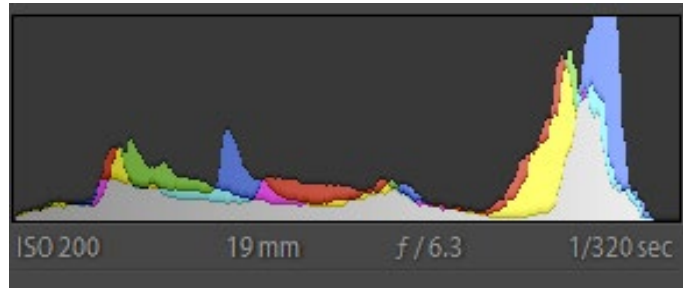
# More Histogram

- Some cameras also show the RGB values
- Can see shadow and highlight issues
- Can see overall exposure
- A tool to analyze exposure quickly

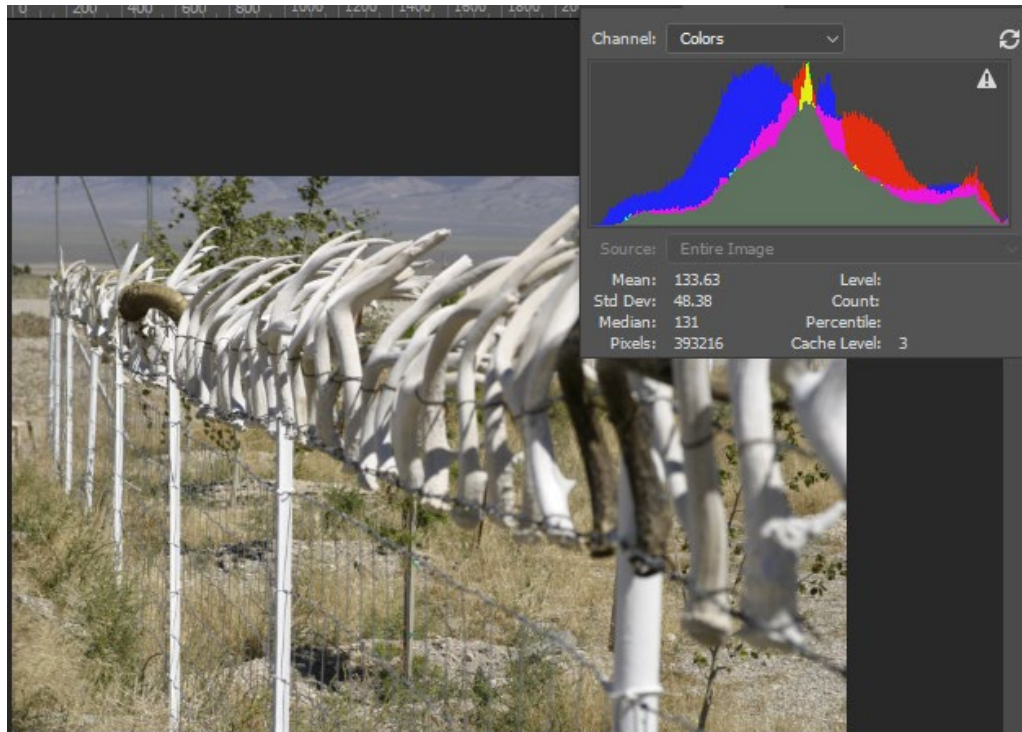
# Histogram Analysis

- Spikes show loss of data when adjacent pixels combined
- Holes show loss of data when pixels spread
- Crowding on black side shows poor shadow detail
- Crowding on white side shows poor highlight detail

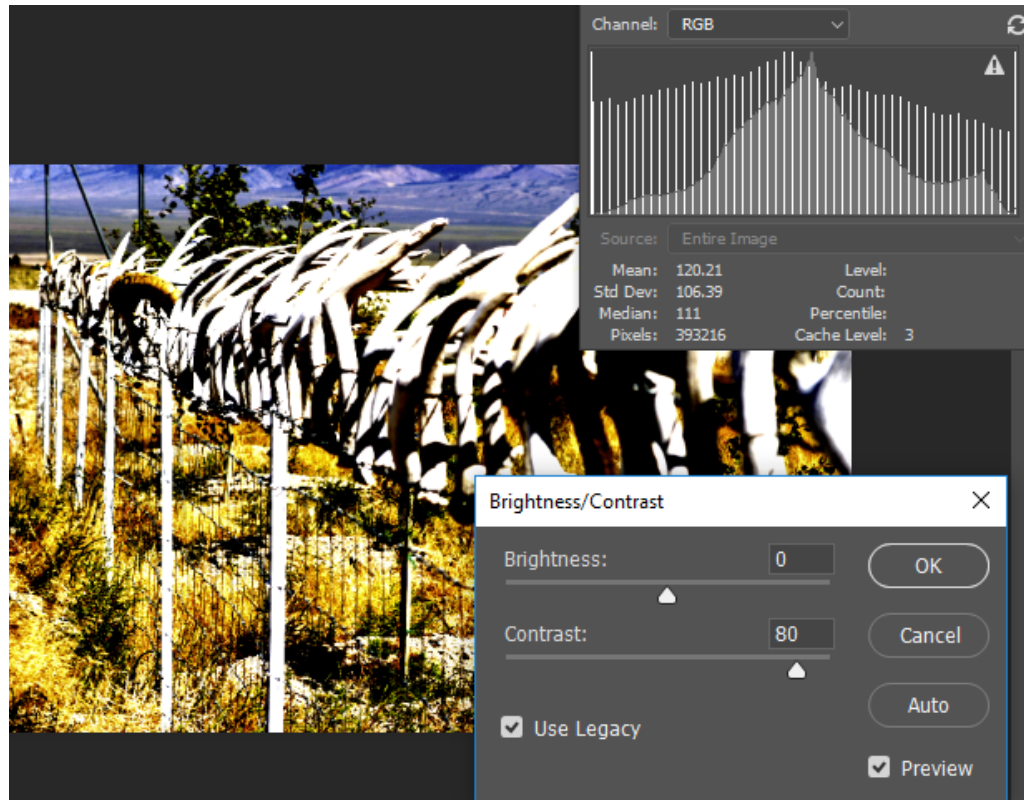
# Histogram example 1



# Histogram example 2



# Histogram example 3



# 8 vs 16 bit, notice spikes

The screenshot shows the Histogram panel with the Channel set to Luminosity. The histogram displays a distribution with many sharp, narrow spikes, particularly in the lower intensity range. Below the histogram, the following statistics are shown:

Source:	Entire Image		
Mean:	75.85	Level:	246
Std Dev:	67.49	Count:	21030
Median:	52	Percentile:	92.57
Pixels:	24160256	Cache Level:	1

The Levels panel below shows the Channel set to RGB. The Input Levels histogram also shows a distribution with many sharp spikes. The Input Levels are set to 0, 1.00, and 50. The Output Levels are set to 0 and 255. The Preview checkbox is checked.

The screenshot shows the Histogram panel with the Channel set to Luminosity. The histogram displays a distribution with a smooth, continuous curve, indicating a higher bit depth. Below the histogram, the following statistics are shown:

Source:	Entire Image		
Mean:	75.86	Level:	248
Std Dev:	67.46	Count:	20481
Median:	53	Percentile:	92.74
Pixels:	24160256	Cache Level:	1

The Levels panel below shows the Channel set to RGB. The Input Levels histogram shows a smooth distribution. The Input Levels are set to 0, 1.00, and 50. The Output Levels are set to 0 and 255. The Preview checkbox is checked.



# ETTR Histogram Exposure

- Expose To The Right
- Get as much detail on right side but without over-exposing any important highlight areas
- Avoids some digital noise, since noise is more noticeable on the dark (left) side
- Controversial... may look too bright
  - Fix later

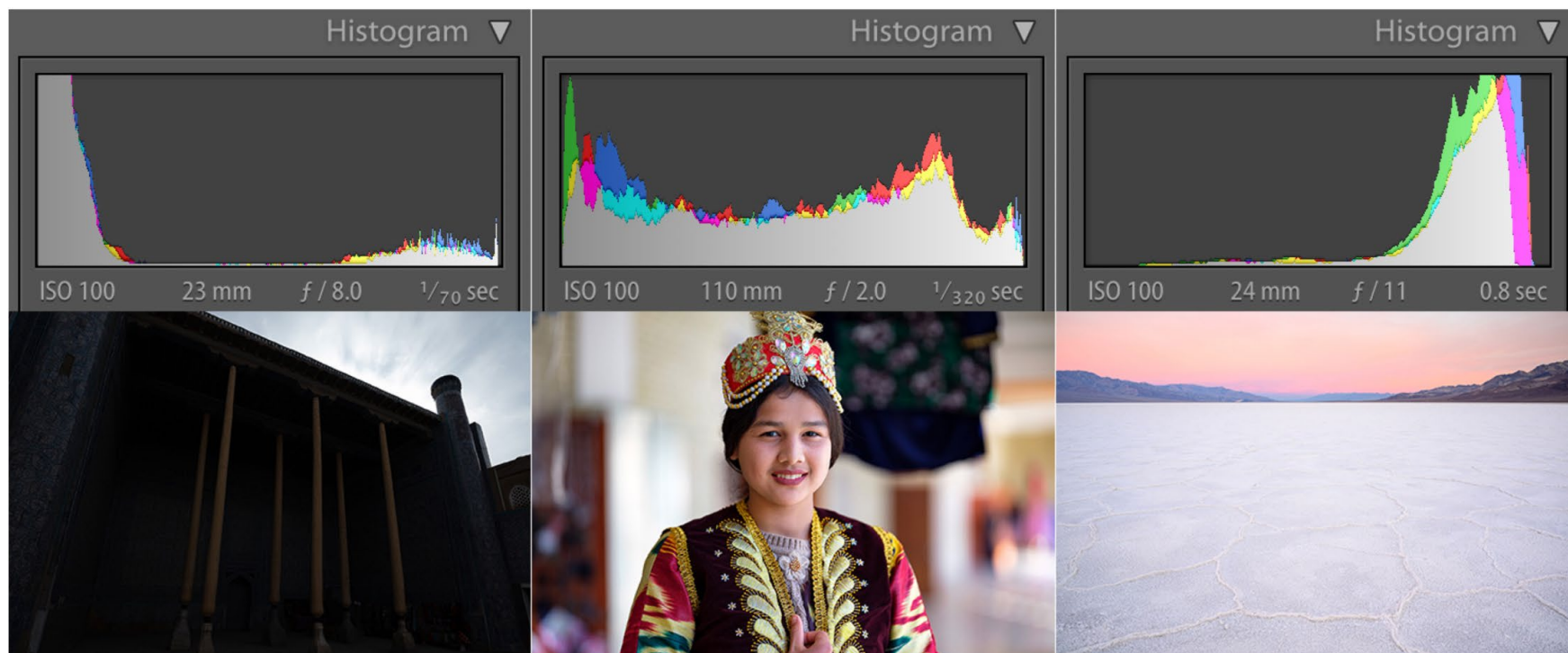
# More ETTR

- Sometimes the contrast range is too great and detail will be lost in brights or shadows
- ETTR does NOT mean the histogram curve will be to right of center, it might be that most of the image information is in the darker half
  - Don't sacrifice highlight details

From excellent article:

[The Myth of "Exposing to The Left"](http://photographylife.com) (photographylife.com)

Exposing to the left is better for film, but not digital.



The camera would have lightened this image if left in full automatic exposure mode, possible losing sky details

The camera would have darkened this image if left in full automatic exposure mode

# Ideal Histogram

- Well, it depends...
- Dark images will be crowded on left
- Light images will be crowded on right
- Average ones will be spread across
- Look on the left and right spikes to see where detail is lost, then decide which one is most important and expose for that



# Live View & Histogram

- Many DSLR cameras can show a histogram in Live View, this is useful to check the exposure
- Mirrorless cameras can show the histogram in the view finder or the display



# Camera Controls

Unless you tell me what to do, I will make all the decisions for you, but I don't always make the best choice!

# Camera Controls Summary

## On dial, menu, or button

- ISO
- Shutter speed
- Aperture (F-Stop)
- Exposure comp
- Metering mode
- Focus Modes
- Flash modes
- White balance
- ISO
- S Nikon, Tv Canon
- A Nikon, Av Canon
- +/-
- Often a rectangle
- Description
- Icons
- Icons



# Other Camera Controls

- There are usually many options in menus
- Programmable buttons
- User settings
- Exposure lock modes
- Focus locations
- Flash controls
- ...



# Fully Automatic Modes

- Auto, the camera decides everything
- Creative Zone or Scene, giving a hint
  - Flowers
  - Landscape
  - Portrait
  - Night
  - Stage
  - Sports
  - Etc.

# Semi-automatic Modes

- A, Av (aperture priority)
  - You pick aperture, camera picks shutter speed and possibly ISO
- S, Tv (shutter priority)
  - You pick shutter speed, camera picks aperture and possibly ISO
- P (program)
  - Camera picks shutter and aperture but you can choose a different set

# Manual Settings

- You pick shutter and aperture
- The camera will adjust the ISO if auto-ISO
  - Usually something will blink if your chosen combination cannot give proper exposure
- A “light meter” usually displays somewhere showing what the camera thinks is correct
  - ISO might have to be adjusted (non-auto)

# Metering

- Where to look for light in the image
  - Matrix (Nikon) Evaluative (Canon)
    - Uses AI to figure out what kind of scene this is
  - Center weighted
    - Looks mostly at the middle
  - Average
    - Looks everywhere and takes an average value
  - Spot
    - Looks only at a tiny spot, usually where the focus is



# Where Automatic Metering Fails

- Backlight and sidelight
- Large dark areas
- Large light areas
- Low contrast scene
- High contrast scene

# White Cup in Snow Sunshine



Camera auto



Compensation +1



Compensation +2



Camera auto exposure

-2 stops from what camera wanted to do



# Exposure Bracketing

- The camera takes 3 or more at different values
- You can later choose the best one or combine parts from different ones
- Some cameras have HDR mode that takes 2 or more exposures at different values and combines them



# Camera ISO Settings

- Manual

- You decide what ISO to use

- Automatic

- The camera decides

- Usually has a maximum and minimum value

- Higher values give more noise

- Might be needed for F-stop & shutter speed

# Manual Exposure

- You get to choose F-stop and shutter
  - If auto ISO is then the camera will still try and get the exposure it thinks is correct, so you can't really control the actual exposure value unless ISO is also set to manual

# Exposure Compensation 1/3

- In most/all of the automatic exposure modes the exposure compensation control can be used to **lighten or darken** the image to match your creative vision
- Either a dial or a menu on your camera
  - Touch and slide on cell phone
- I use this frequently, it is very convenient

# Exposure Compensation 2/3

- Use in backlight situations, windows or sun behind subjects
  - Could use spot metering but it is often just as easy to dial the compensation until the subject looks good
  - The background will be very light, but that is not the subject so it is often ok

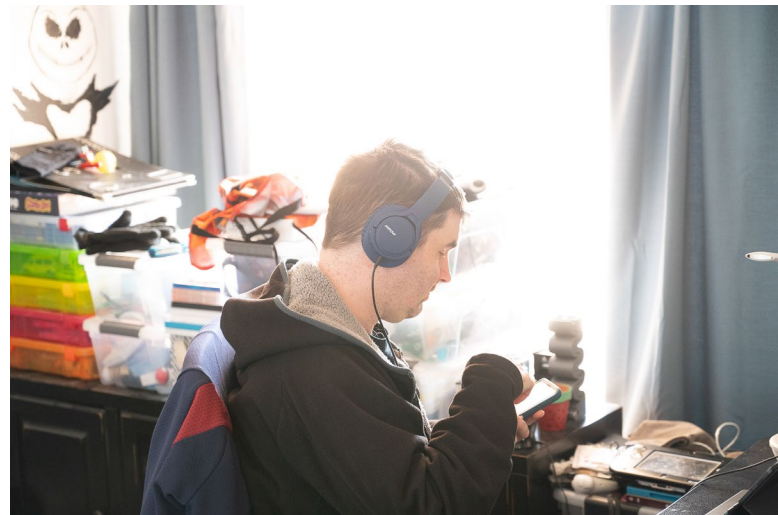
# Exposure Compensation 3/3

- Automatic exposure is very good on modern cameras, I trust it frequently
- But... often the image needs to be adjusted lighter or darker
  - Exposure compensation dial is perfect for this
  - NOTE: remember to turn it back to 0 when done, some cameras do this automatically



The strong window light makes the subject dark.

Dial the exposure compensation up until it looks better. You may lose details in bright areas.



# Completely Manual

- Set aperture/shutter to M
- Turn off auto ISO
- You can use the meter to see how close you are to what the camera thinks is correct
  - The viewfinder only shows the effect partially and “exposure preview” must be on
  - Examine the histogram to discover the truth



# Class Demo

- We now know enough about exposure, let's see how the different modes work on your camera



# So What Do I Use?

- Mostly M (manual with auto ISO)
  - Lets me control motion blur and depth of field
  - I accept the noise of high ISO
- M with manual ISO for night
- Exposure compensation when needed
- Mostly matrix metering
  - Stage and backlit often use spot metering
  - Some cameras have a special stage setting

# Try at home

- Experiment with the manual settings
- Notice how the images get darker and lighter
- Experiment with the automatic settings
  - Find and use the exposure compensation button or menu that will adjust the exposure, usually something like: +/-

# Automatic Focus

- One of the greatest inventions
- Two kinds (maybe three: dual pixel)
  - Contrast detection
    - Not as good in dim light, also slower
    - Used in live view mode
  - Phase detection
    - Better in dim light, also much faster
    - It uses a second smaller sensor and processor
    - Not found on lower cost cameras



# Focusing Area

- Manual, you choose
- Autofocus
  - Spot
  - Auto
  - Group
  - 3D
  - Others

# Focus Modes

- Press shutter release halfway down
  - Useful to focus on something, then reframe
- Single
  - Focus stays, even if camera is moved
- Continuous
  - Keeps adjusting focus constantly
- Auto
  - Focus will try and track the object it was focused on if it moves

# Notes About Focus Spot

- Auto mode picks a spot from a large area
  - Not always where you want it
- Spot mode, we often leave in center, focus and then recompose the image
  - This is sometimes a bad idea since the exposure is tied to the focus spot, it might end up being wrong, move the focus spot instead



# Where Automatic Focus Fails

- Low light
- Low contrast
- Many potential objects to focus on
- Fast moving objects

# Focus Peaking

- Some cameras can show sharpness by putting colored outlines around sharp edges, this is very easy to see sharpness
- Only works in LiveView mode or with mirror-less camera view finder





# Try at home

- Learn the focus modes of your camera
- Experiment with how they work
- Practice using the press half-way focus lock



# White Balance

What color is that really?

# White Balance

- Light sources have some color
  - Sunlight and shade are different
  - Incandescent and fluorescent are different
- Some cameras can measure from a gray or white card, custom white balance
- Shooting “raw” images allows adjustment later, as the image isn’t adjusted until “de-mosaicking” process

# Our Eye/Brain White Balance

- Your eye calibrates to the room you are in, so white paper will look white, faces look right, I.E. it adjusts to the ambient light
- Camera sensor sees “real” colors
  - White balance attempts to fix this
- Looking at a print, our eye still uses the room calibration, so colors may be off

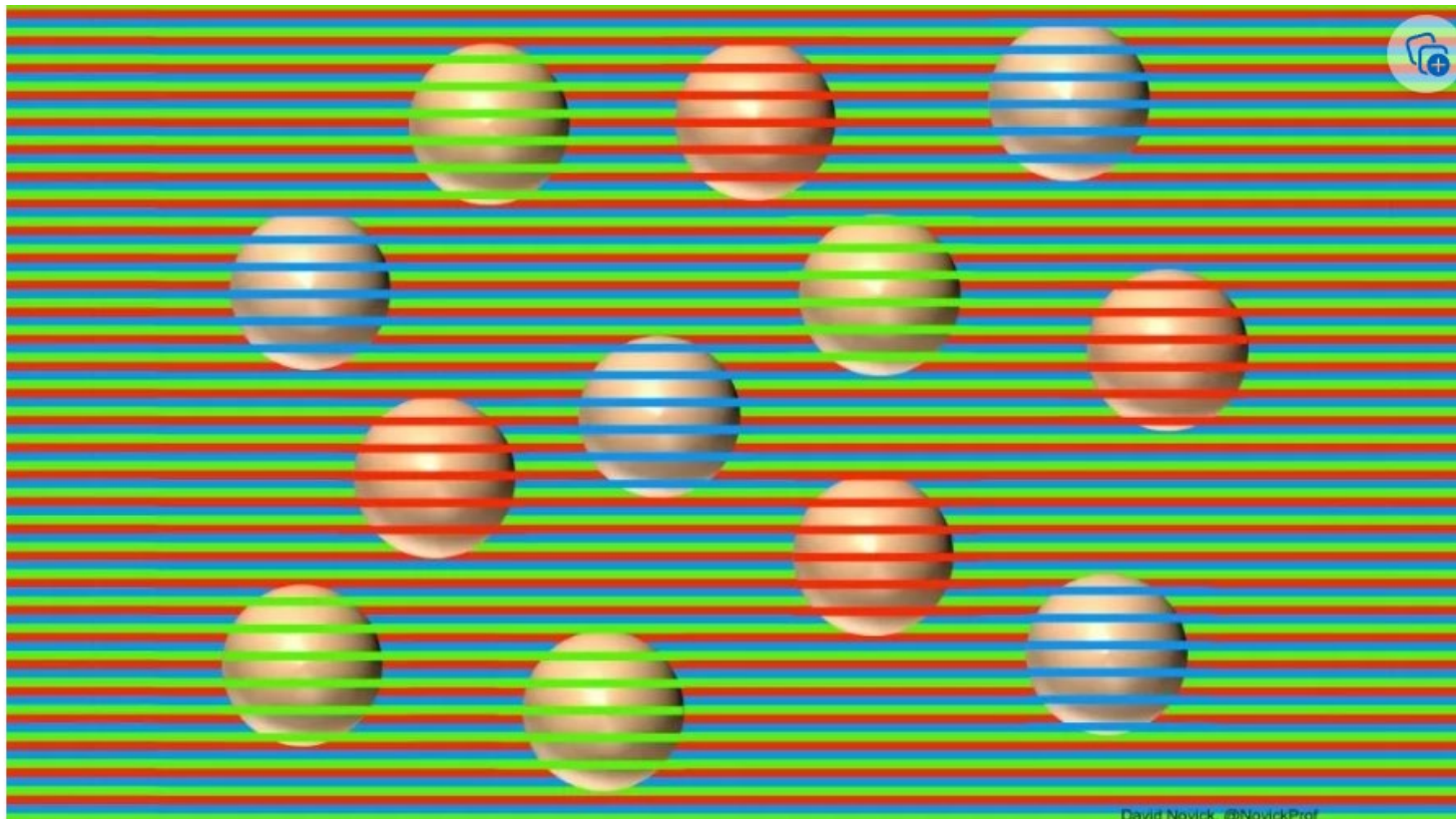
# To Make Things Even Harder

- Color monitors must be calibrated to display colors correctly
- Few of them are correct ☹
  - The controls can also be set incorrectly

# And to Make it Really Hard...

- Each of us sees color differently
  - The white-gold, black-blue dress controversy raised scientific questions about visual perception, but the way our eyes and brains work explain the illusion (msn.com)

# And Even Harder!

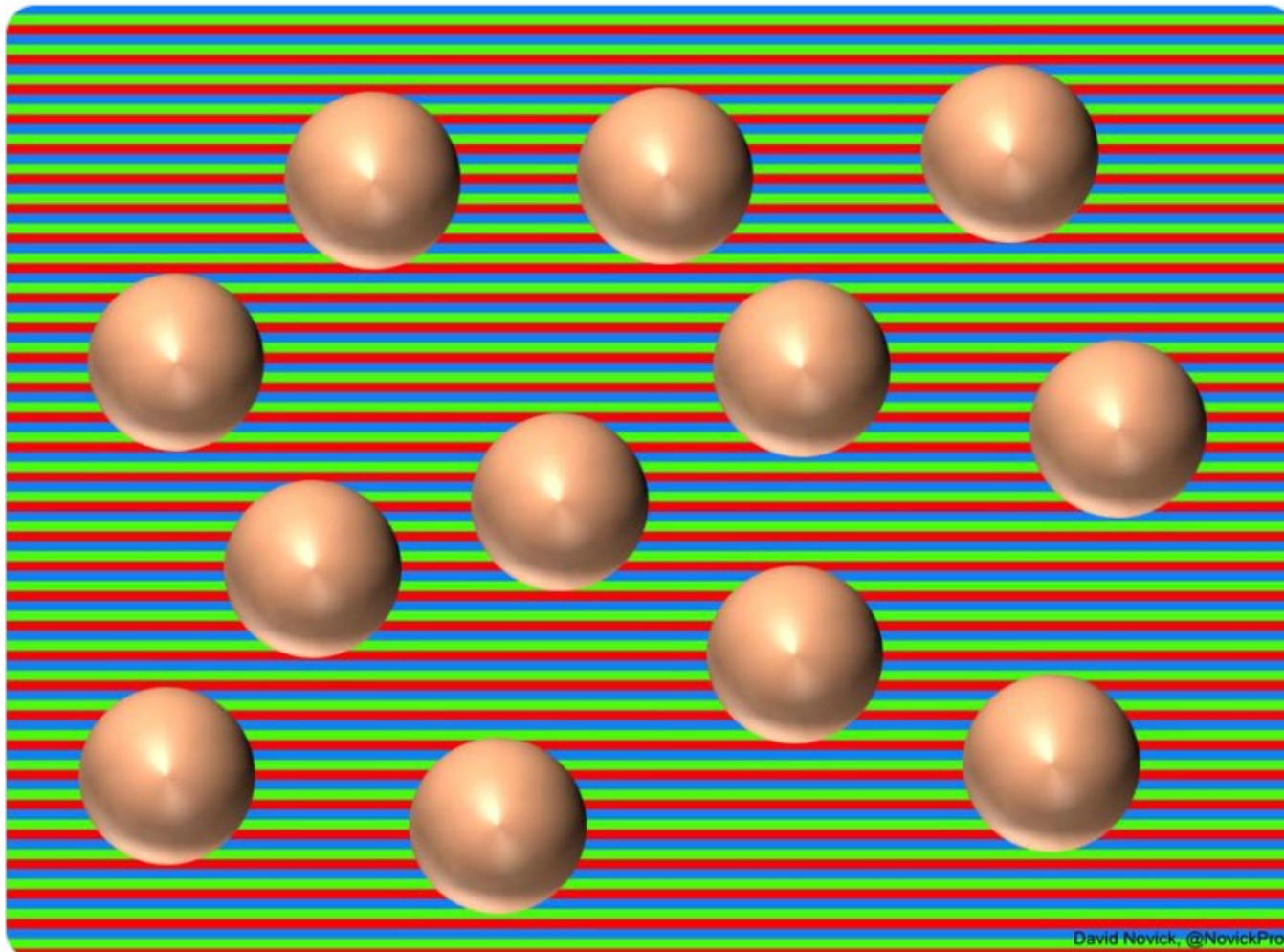


Munker-White  
Illusion

The balls are all the same color.

See here: <https://www.livescience.com/confetti-munker-white-optical-illusion.html>

# With Colored Bars Removed



David Novick, @NovickProf



# Color Test Photo – Test Display

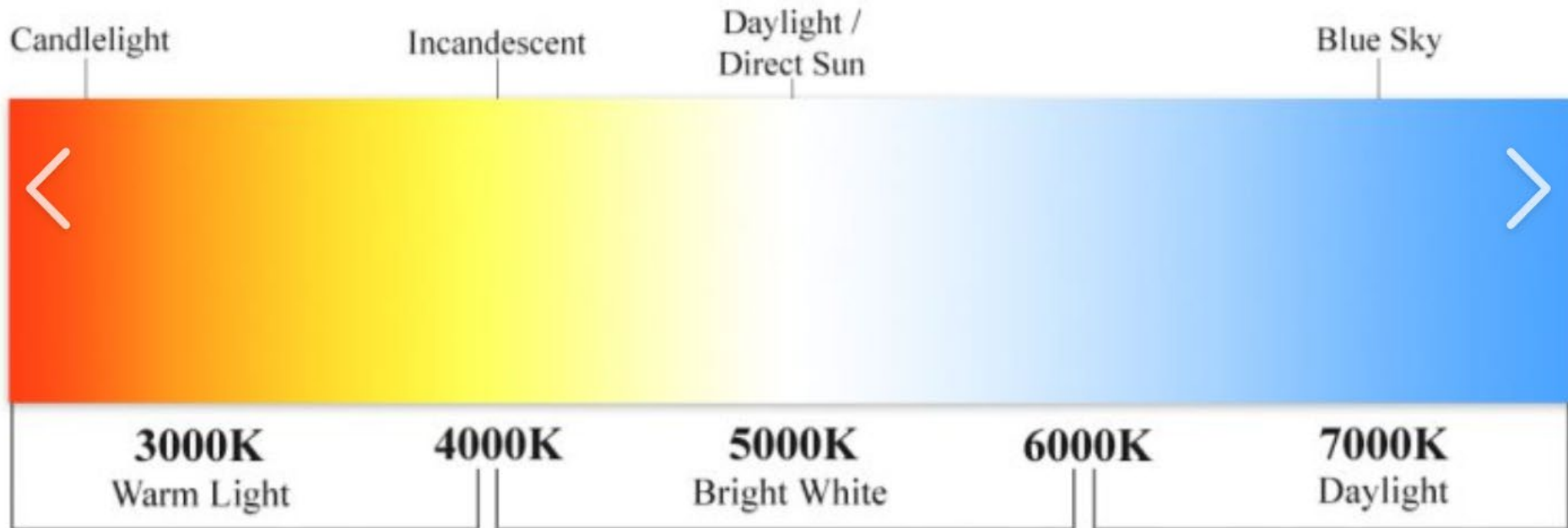


# Color Card – Shoot on site

## Use later to correct colors



# Color Temperature Scale

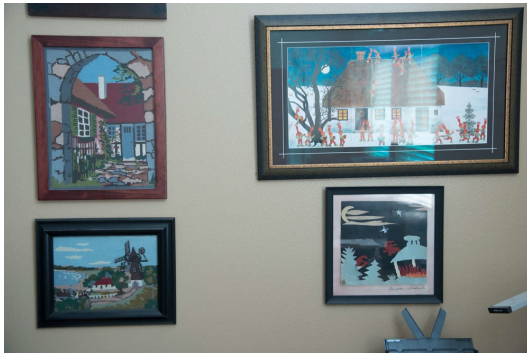


# White Balance Example



- Left is original, has too much orange light, right is corrected
  - If we were in a room with incandescent light it would look fine
- Strangely our eye/brain system corrects when we are there, but not looking at a picture, that is why we must correct the images

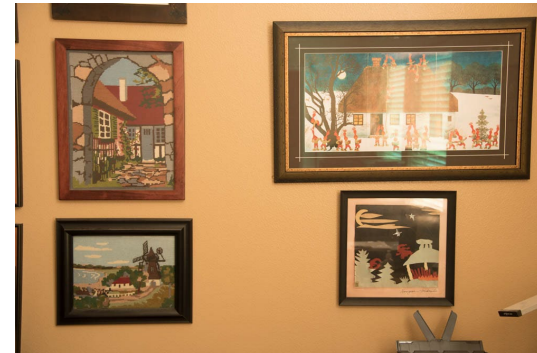
# Camera White Balance Settings



incandescent



fluorescent

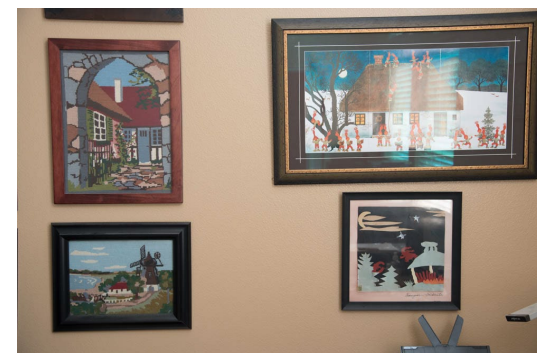
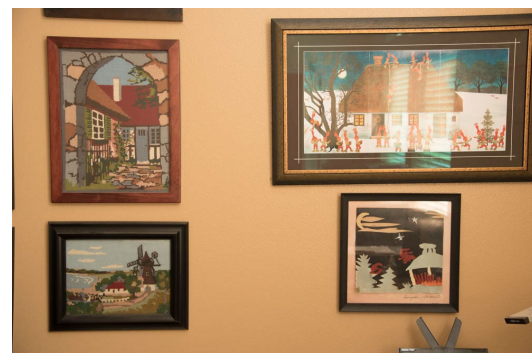


cloud

shade

Sun (this one is closest)

auto



# Camera White Balance Settings



incandescent



fluorescent



cloud

shade



sun



auto



Note how auto desaturates the colors!

# Auto White Balance challenges

- Camera will try to make grey!
  - Dominant colors will get muted
  - I.E. Do not use automatic setting
- Mixed light
- Different fluorescents
- Use gray card

Notice the warm (yellowish) candle light, with the cold (bluish) light from outside. This can often make interior pictures challenging to get correct colors.





# Correct Color

- Once again, it depends...
- Should be accurate for fashion & products
- Can be considered creative interpretation
- Color can change the mood of the image
- I often use “sunlight” setting and fix later
  - This gives an image close to what was there



# Try at home

- Take images of the same scene with different white balance settings
- Notice how the colors change



# Two Uses of White Balance

- Use to correct color accuracy
- Use creatively to make better image



# White Balance Conclusion

- After all the above technical stuff, just make it look right to you!



# Things About Light

Photography is mostly about light!

# Light Quality

- Source size affects shadow edge fuzziness
- Direction affects where the shadow falls
- Light color affects the overall color of the image, least noticed in the shadows and really bright areas
- Strength affects the bright/shadow ratio

# Types of Light Sources

## ■ Sunlight

- Overcast (blue)
- Shade (cold blue)
- Direct (warm yellow)

## ■ Artificial

- Incandescent (warm yellow/orange)
- Flourescent (varies, but often greenish)
- Led (cold blue, but varies greatly)

# Light Direction

- Frontlight (flat, soft)
- Sidelight (strong shadows)
- Backlight (Useful for halos)
- Toplight (outside causes dark eyes)
- Bottomlight (used in horror films)
- Portraits often combine several of these



# Controlling Light

- Shadows hide or outline objects
- Reflectors brighten dark areas
- Wait for sun, better “mood” or position
- Flash
- Move around to change your position



+1 Stop exposure compensation



Ceiling light on



ordinary



flash



# To Do

- Walk around and watch light behavior
- What do bright things look like?
- What do shadows look like?
- Notice the interaction of shadows and lights and how they define shapes and objects to create interesting scenes

# Try at home

- Use light from window or a single light shining on a face in a dark room
- Move around and take images from different positions
- Notice how the shadows change

# Lightning



# Several Methods

- Luck, press the button at the right time
- Better luck, leave shutter open longer
- Use a camera that pre-captures images
- Connect a lightning detector
  - Many available for less than \$200



# Flash

My own little instant sun machine

# Flash Myths

- **Complicated**
  - Modern cameras have greatly simplified
- **Not natural**
  - Often used to augment light
- **Expensive**
  - Chinese flashes have lowered the costs
- **Only for dark**
  - Fill/augment flash very useful



# Some Challenges

- Can't see the effect
  - Use modeling lights or flash modelling
- Exposure
  - Modern cameras are very good at this
- Light modifiers
  - Reflectors, gobos, snoots, gels etc.
- Learning
  - Effective use takes practice



# Using Flash

- Sometimes you must use a flash
  - Too dark
  - Available light is poor quality
  - Some important areas are too dark
    - Faces, could expose for face and lose background
- Creative lighting
  - Greater control of scene/portrait lighting

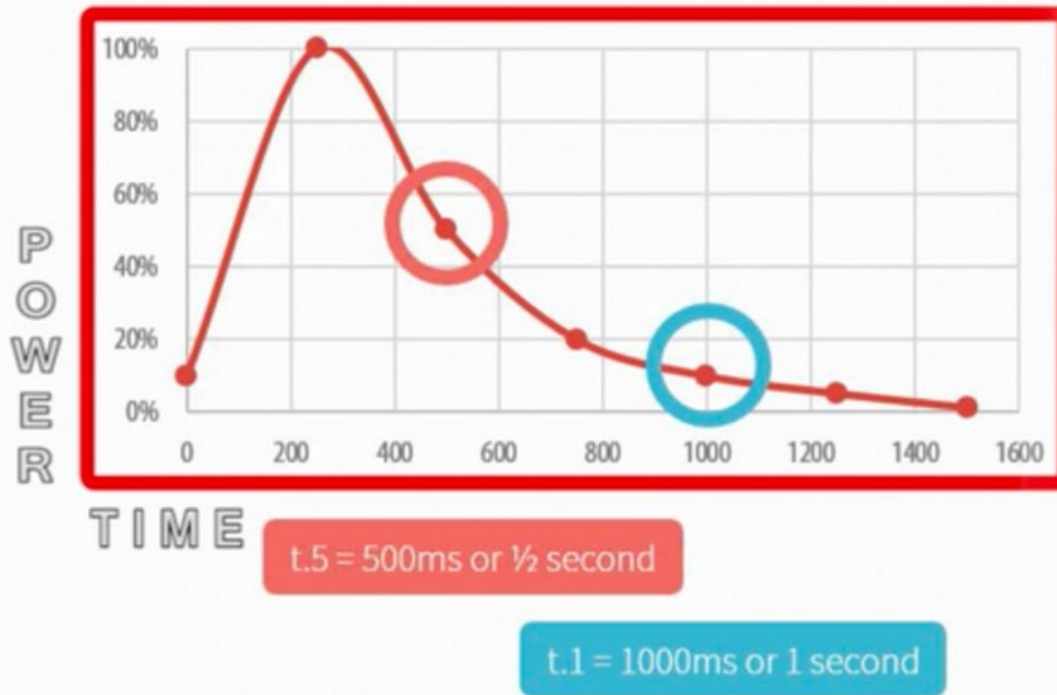
# Inverse Square Rule

- The flash (actually any light) strength is reduced by the inverse of the distance squared
  - Every time the distance from the subject to the flash is doubled the light intensity is divided by 4 (2 squared)
- The flash intensity drops off much faster than you might think intuitively

# Flash Intensity VS Time

- t.5 Time for 50% dissipation
- t.1 Time for 90% dissipation

Less expensive flashes are often slower. Higher power is usually also slower.



# Flash

## Problems

- Disturbing
- Harsh shadows
- Distance limits
- Too light foreground

## Advantages

- Can light up dark
- Fill light outside if faces too dark
- Can stop motion
- Special effects
- Multiple lights
- Can add catchlight

Foreground is light, background is dark,  
harsh shadows, on camera flash is the worst





# Well, Most of the Time!

- Sometimes the sharp harsh light is what you need for an “edgy” portrait

# Flash TTL

- Fires a tiny pre-flash to measure light
- Performs some calculations and then fires the real flash and takes the picture



# Basic Camera Flash Modes

- Off or never
- On or always
- If needed
  - The camera decides
- There is also often a red-eye setting
  - This fires a pre-flash to make the iris close

# Advanced Camera Flash Modes

- Fill flash
  - Automatically balances foreground and background light, usually uses F-Stop and adjusts shutter speed to expose background
- Flash compensation
  - Adjust how strong the flash is
- Control external flash units
- When curtain opens or before it closes
- Multiple flashes, strobe light mode

# Flash Exposure in Manual Mode

- Shutter speed does not affect flash light
  - Change shutter speed to modify ambient light contribution only, flash light is not affected
- The aperture and ISO affect all light
- This lets you balance flash and available light for better exposure
  - Useful for foreground background balance

# Flash Modifiers

- Color filters or “gels”
- Shapers, gobos, grids, snoots
- Scrims (diffusers) to soften
- Reflectors bounce the light, change angles
- Commercial kits like “Magmod”

# Useful Gel, CTO

- Color Temperature Orange
- Makes flash match sunset or incandescent for better color matching (white balance)
  - Needed because two different light colors can spill onto subject (face?) and look bad

# Flash Background

Normal flash mode



Nikon “slow” setting  
Canon can also do this



Note that the porch lights are on in both photos.  
One has a longer time exposure to show the background.  
1/30 vs 2 seconds. F4 on both.

# Flash Synchronization (1/2)

- As shutter speeds get faster, the closing curtain closely follows the first curtain which results in the curtains not exposing the entire sensor at once but will instead act like a moving slit across the sensor
  - This means a bar will be exposed by the flash because the flash is not on for the entire exposure time, it is too fast



# Flash Synchronization (2/2)

- The flash does not last as long as the slit takes to travel the sensor, there will only be part of the sensor that sees the light
- Usually about 1/125 is the fastest speed
  - Some cameras go to 1/250
- FP setting is sometimes available on the flash, but the effective distance decreases

# Fill Flash

- Use when strong backlight (or sky light) would cause too dark foreground
- Often a smaller F-Stop is used, so the shutter speed can be longer
  - The ISO must be low enough to keep the shutter speed slower than the synchronization limit (often 1/125-1/200), or an ND filter can be used

# Fill Flash



Note the too dark face with backlight



The flash lightens the face

# Multiple Flash Units, Many Uses



# Catchlights to Highlight Eyes



# Catchlights add Sparkle



# Rear Curtain Sync

- Normally the flash fires when the shutter opens
- With RCS the flash fires when curtain starts to close
- Interesting effects

# Rear Curtain Flash, 10 seconds



I counted to 8 seconds while standing in the image, then I jumped away and the flash exposed the kitchen.



# Rear Curtain Flash After Walking



# Guide Number

- How strong the flash can flash
- GN is typically in the 20-40 range and is given as distance/F-Stop at 100 ISO
  - Example: for GN 20 it will reach 10 feet at F2 and 5 feet at F4
  - To reach further increase the ISO
    - For each doubling of ISO multiply GN by 1.414, GN of 20 becomes 40 for ISO 400

# Try at Home

- See how far your flash reaches
- Experiment with your cameras flash modes to see how they work
- See if you can balance foreground and background light
  - Nikon calls this “slow mode”, Canon also has
  - Usually only works in aperture priority



# Panoramas

Really wide or tall or both pictures

# Shooting Panoramas (DSLR)

- Take multiple pictures and stitch together
- Best job needs tripod and special head
  - Can turn on foot if careful
- Lock exposure on brightest part of the scene
  - Manual settings with non-auto ISO
  - Or press lock exposure button if available

# Shooting Panoramas (Cell)

- Select pano mode
- Usually vertical (portrait) is best
  - Use landscape for vertical panning
- 2x tele lens often better
- Start at the brightest part and lock exposure
- Try to follow horizon, I.E. don't go up/down



# Cell Panorama

- OR... just ignore the previous rules and experiment!
- E.G. have a person move during recording, they will show up several times!

## Solving the parallax problem



Move the camera back to rotate around the lens no-parallax point (often incorrectly called nodal point)







# Creating DSLR Panoramas

- Lightroom
- Photoshop
- Photoshop Elements
- Many other software packages





# Real Estate Photography

Make the homes look great, sounds easy, but usually isn't!

# Two Parts with Challenges

- Interior
  - 2 wall and 3 wall
  - Rooms aren't designed for photos, tripod corner?
  - Windows sunlight
- Exterior
  - Day, evening, and night shots to show off lighting
  - Landscaping

# Indoor Lighting Challenges

- Sunlight in windows is contrast problem
  - Shoot evening or light when sun is gone
  - HDR multiple exposure bracketing can be used, BUT: it often doesn't look real, color shifts and weird fringing at times
  - Bring interior lights up to match sun!
    - Multiple remote control flashes
  - Can combine two shots, one for room and other for windows, merge in Photoshop



# Outdoor Lighting Challenges

- Sunny day is ok, but often twilight is better
  - Showcase landscape lighting



Which one looks most inviting?





# What to Show

- Emphasize the lifestyle of the property,
  - Show the amenities, not just the house



# Lenses

- Mostly wide angle, but not fish-eye
  - 20-24mm (full-frame equivalent) is best
  - Be careful about keeping the camera level, tilting makes walls appear to lean!
    - Can be fixed later, but try to minimize first



# Business Considerations

- Must be efficient with time to make money
- Learn what sells
- Solve lighting problems quickly
- Work with staging experts
- Having the right equipment helps, but your skill is more important



# Many Books available

- My favorite is a series by Nathan Cool
  - Amazon has them as books or e-books



# Better Pictures

Photography as Art and Visual Fun

Some people feel the rain while others just get wet

- Bob Marley



# Why Do We Take Pictures?

- Pure enjoyment of images
- Help us remember event, places and people, it's like a time machine!
- Share with others
- Get published, sell
- Ansell Adams “Two people in every photo, the photographer and the viewer”

# See and Feel

- Capturing what you see is easy
- Capturing what you feel is not so easy
- Art is evoking feelings
  - Easy when it is our own memories
  - If you can get the viewer to experience the same feelings as you, then you have truly succeeded in producing art



# Sharing Photos

- Very easy now, especially from phone
- “bragging” about great photos
- Telling a story about family events
- Bring family closer together, bonding

# Camera as Artist Tool

- Even cell phones can be great tools
- It's a poor artist who blames his failures on his brushes!
  - A bad rower blames his oars! (Icelandic proverb)
  - Your tools may limit the kinds of art you do, you can't do watercolors with oil paints!
- Many people look, but not all see
  - Practice the art of seeing



# G.A.S

- A common problem among hobbyists
- Gear Acquisition Syndrome
  - If I just had this lens or this camera I could do much better work!

# Let the Camera Decide!

Using what it learned about quality photos, the Prosthetic Photographer AI identifies scenes worth capturing and trains the human behind the camera to recognize them. To do this, the AI triggers a small electric shock delivered through electrodes on the handgrip, which forces the photographer's finger to press a button and capture said ideal scene.





# Another Trend in Automation

- [www.witharsenal.com](http://www.witharsenal.com)
- There is a facebook page about arsenal

# First Some Excuses

- I'm just an amateur
- I'm not creative
- I don't have the right equipment
- This has been done before, I'll never be as good as those
- I don't do portraits, or I don't get up early, or I can't stay up late, or I can't can't can't

# Portraits and Posing

- Not in this class! Not enough time
- Many books available
  - Picture Perfect Posing
  - Master Posing Guide for Photographers
  - The Portrait Photographers Guide to Posing
  - From Snapshots to Great Shots
- Look on Amazon

# Portrait Technical Advice

- 75mm (50mm on smaller sensor)
- Spot focus on eyes
- Aperture priority (or manual)
- Open F-stop (smaller number)
- Mostly don't put face in middle of picture
- Turn off the flash on top of your camera
- Be friendly and relaxed
  - Even though you might be terrified inside!



# Don't Worry, be Happy

- Don't worry too much about what others think of your work, please yourself first
- It's great if others like your work, but don't stop taking pictures the first time somebody doesn't like one of your images

# Vision & Technology

- Easy to teach mechanics of focus and exposure and white balance
- Teaching the 'eye' is different
  - Many people look, but only some see
  - Consider what children see
    - Example: Rain!
      - We see mud, mess, inconvenience, they see rain drops, puddle, rainbows, fun. Learn to think like a child again!



# Miksang

- <https://www.miksang.com/>
- Literal translation: “good eye”
- Practice of taking a natural situation, seeing it clearly and applying discipline to keep it that way

# Location

- Exotic locations are easy
- Interesting images are close to home
  - You may need to travel the same road many times to see the beauty and interest
  - Revisit the same places in different moods
    - Both yours and the places
  - Sometimes you will see what others miss



# Why Take Pictures

- Memories
- Art
- Emotions
- Illustrations
- History
- Etc.

# Taking Better Pictures

- Your picture tells a story, or maybe it is fun to look at, or maybe it is just beautiful or interesting or attention holding
  - Topic – example nature scene
  - Subject – example a tree
  - Composition – how elements are arranged
  - Technique – the mechanical stuff, exposure, focus, lens, etc.



# Topics

- Portrait
- Landscape
- Sports
- Flowers
- Trees
- Abstract
- Insects
- Weddings
- Events
- Weather
- Adventure
- Travel
- Animals
- Etc.



# Learn From Others

- Look at images that move you and figure out why
- Study the work of others and try to understand how it was done
- Martha Stewart started with a cookbook
- You will eventually discover your own “style”

# My Approach

- Look at scene with one eye or viewfinder
- Analyze why I find the scene interesting
- Emphasize the subject or story
  - Move around, angles
  - Declutter
  - Exposure
  - Focus



# Composition

Arranging elements for maximum visual impact

You are striving to make the eye linger on the image



# Some Advice

- Take lots of pictures with different compositions and even exposures
  - Remember, they are free!
- Look at the images on your computer and make note of which ones jump out at you and get your attention
  - This will improve the kinds of images you take in the future so you can spend less time shooting, editing, and organizing

# Composition

- Light and dark areas
  - Light areas attract the eye, so do dark ones if surrounded by light
- Colors
  - Bright saturated colors attract the eye
- Lines and shapes
  - Leading lines, circular, diagonal, patterns
  - Direct the eye
- Rule of thirds, golden mean, golden spiral

# Clutter

- Anything that doesn't belong or detracts from the message or story of the image
- It must be removed or minimized



# Lines, Shapes, and Frames

- Always look for these graphic elements in your photos, emphasize them to make more compelling images

# Layers

- Foreground, middle, background
- Build up the image with layers of different things

# Frames Within Frames



# Contrasting Shapes & Colors



# More Composition

- Point of view, don't stick to eye-level
  - Low is often good for children and animals
  - Flowers against sky are good
- Don't be afraid to walk around looking for a better angle
- Pay attention to background
- Look at all the elements in the photo
- Framing, use something as a frame
- Use light and shadows



# Techniques 1

- Selective focus
  - F-Stop and the correct focal length
- Exposure
  - Dark, light
- Lens choice
  - Wide, tele, normal, fish-eye
- Vignettes
- Adjusting colors

# Techniques 2

- Shutter speed
  - Slow to let things blur, fast to freeze them
  - Water is usually good with slow shutter
  - Sports sometimes needs fast shutter
- Panning can blur background while letting a moving subject remain sharper

# So What?

- Ultimately images are less about technique than they are about the feelings they invoke
- Techniques are necessary but don't think that technique alone will make an enjoyable image
- Practice techniques so you don't have to think about it while creating images

# Left and Right Brain

## Left - logical

- Exposure settings
- Lens choice
- Lighting

## Right - emotions

- What do I feel when I see the image?
- Do I linger while viewing it?

You need to balance both of these, the left is used to improve the right

# Inspiration and Creativity

- They ebb and flow, even great artists have “dry” periods where they aren’t inspired
- Try “jump-starting” with a challenge
  - Take 12 pictures from the same spot
  - Make 12 abstracts from the same object
  - Limit yourself to 24 exposures on a day trip
  - Walk around with no camera looking for art
  - Etc etc

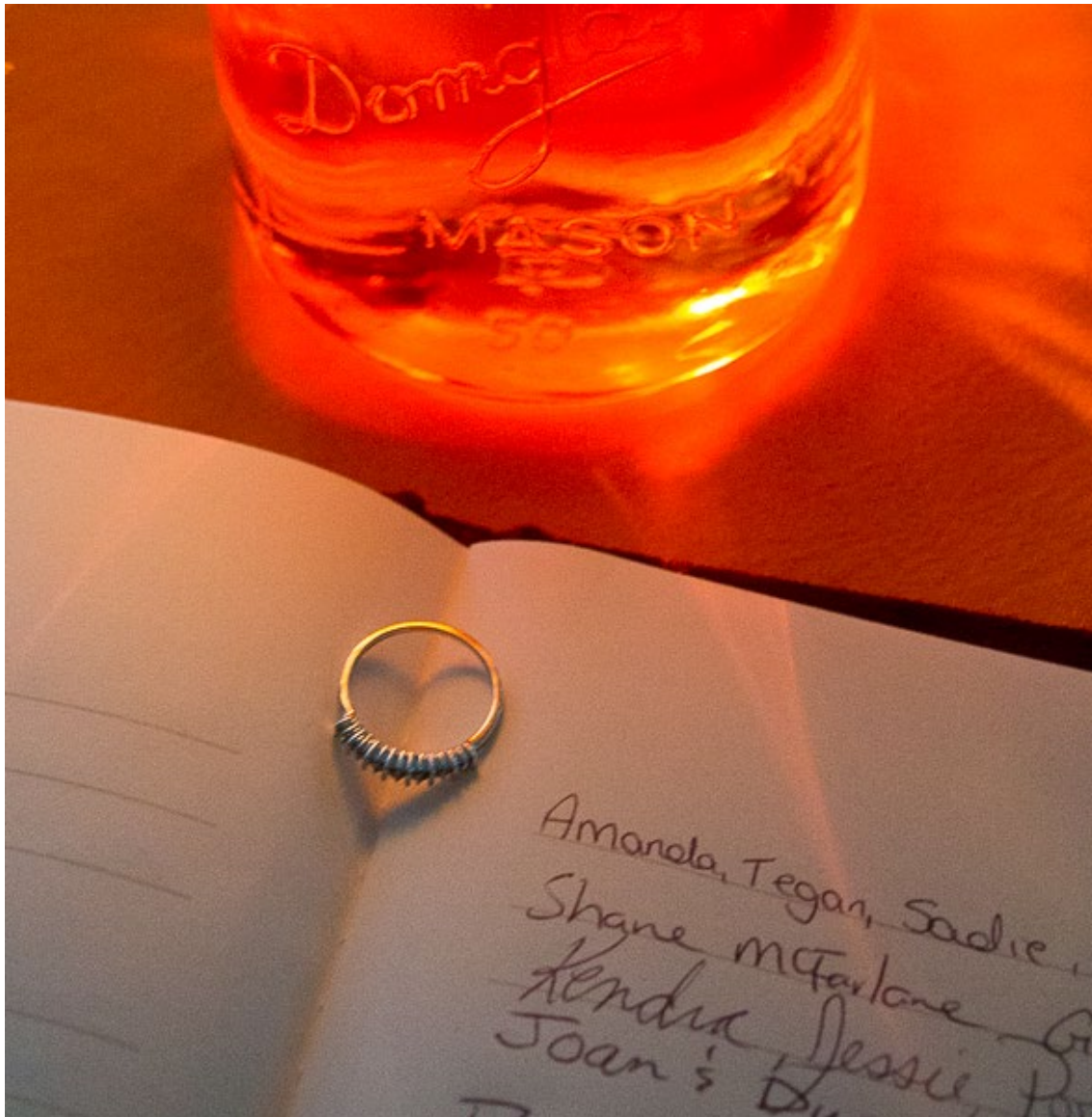
# Books on Creativity

- Many of them, a couple I like
- “Extraordinary Everyday Photography” and “Creative Nature & Outdoor Photography”, Brenda Tharp & Jed Manwaring
- “Bryan Peterson Photography School” and “Understanding Color in Photography” by Bryan Peterson



# Light and Shadows

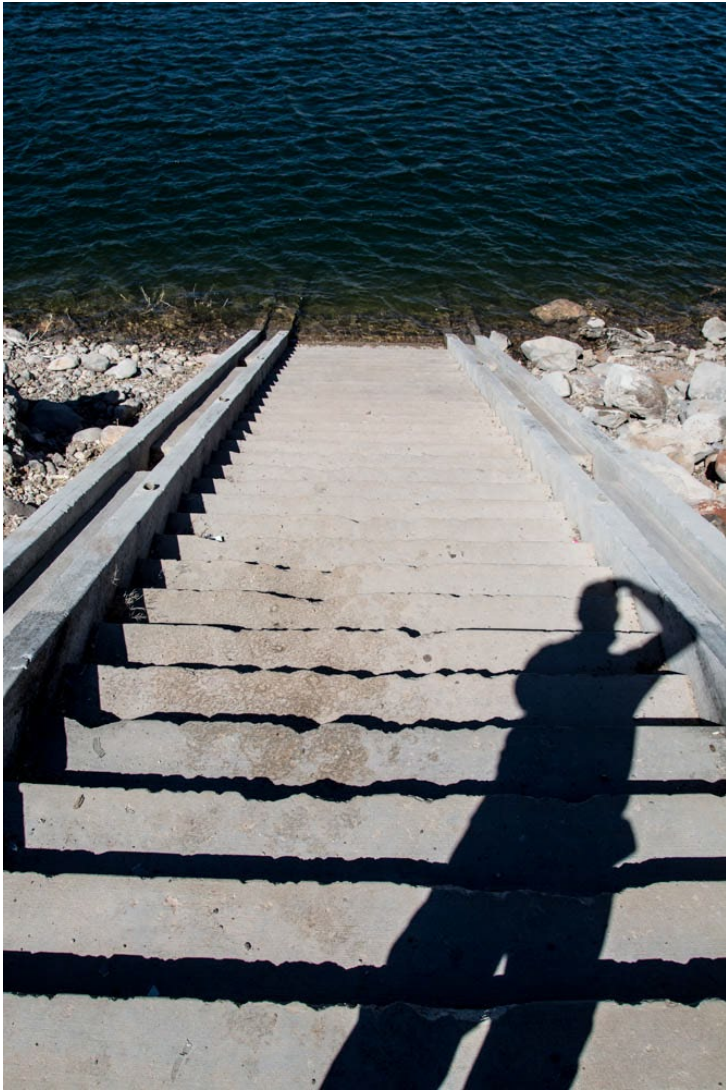
- Photography is about light
- Study the effect of light every day
  - Sidelight – emphasize texture
  - Shadows – give depth
  - Colors
  - Time of day
  - Brightness



Shadows are often interesting, notice the wedding ring shadow



# Steps, lines, and shadows



Always look for interesting shadows



# Sometimes you need to add shadows

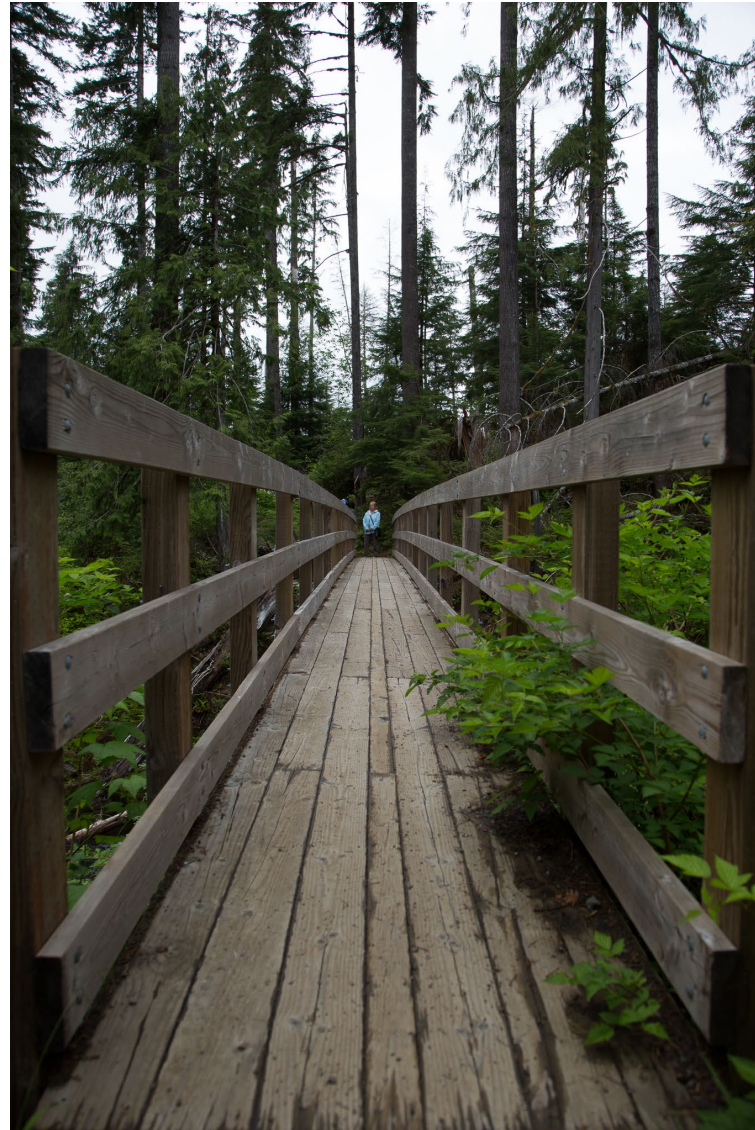


# Leading Lines





Note how the image on the right draws you in with more power.







Water reflections  
and leading lines  
are powerful  
compositional tools





# Bright Colors & Leading Lines





# Another leading line

With leading lines it is often good to have something to stop the eye from leaving the image. You will notice this on other images with lines. In this case the sidewalk leads you to the lighthouse.

# B&W Lines and branches to hold the bottom left



# Rule of thirds, put objects at intersections of thirds



# Thirids and Animate/Inanimate Contrast



# The Rock and Lady at Thirds



# Center and thirds example







# Thirds Help from Camera

- Some cameras display a grid showing the thirds lines on the screen

# Change your position just a little



# Position Really Matters!



# Look for different views

Don't be afraid to climb  
or lay on the ground.



# Panning, choose shutter speed



# Selective focus removes clutter



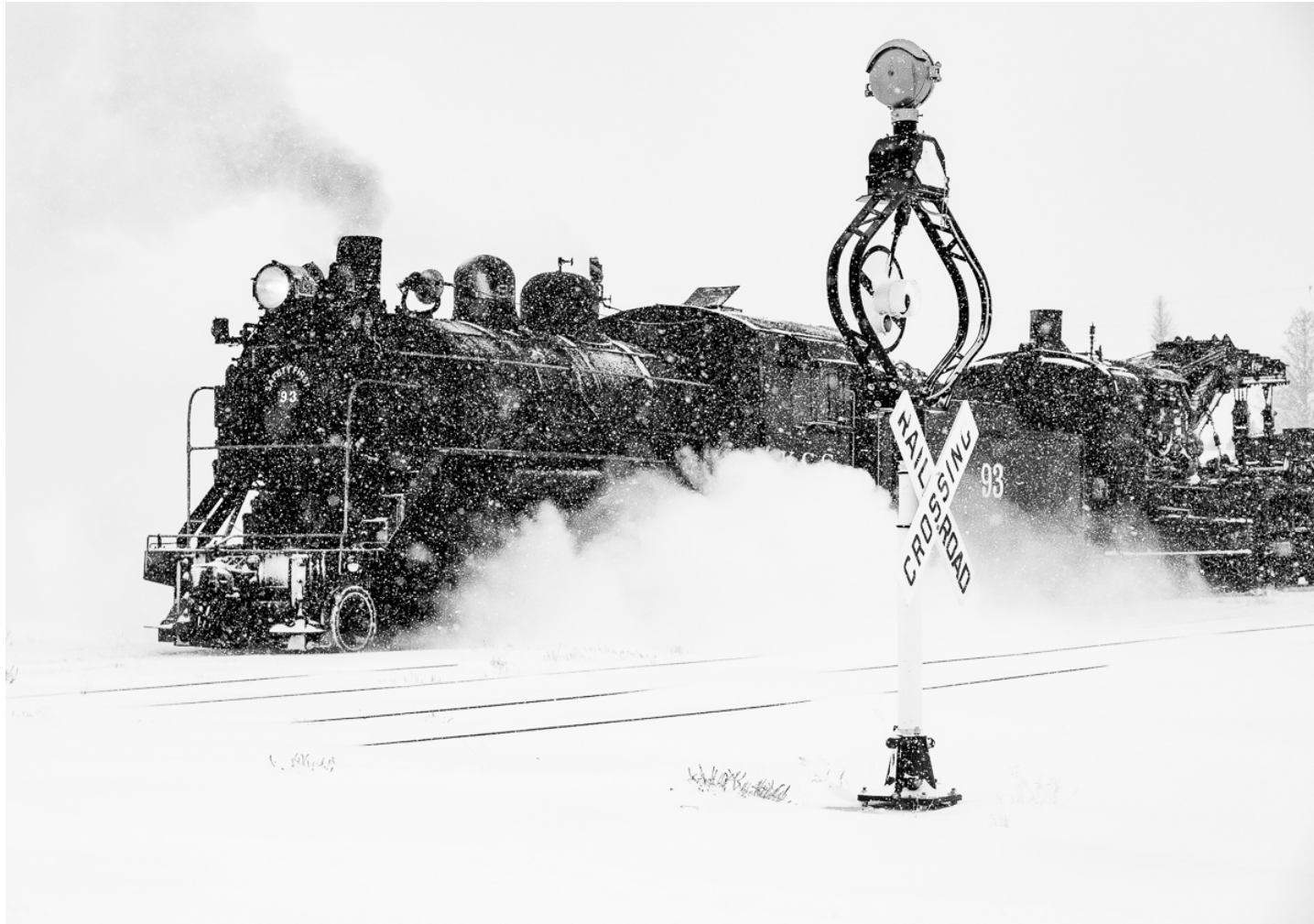




Notice how your eye isn't interested in the background. Also notice the leading line that moves your eye to the dragon fly, the real subject.



# Uncluttered Train



# Radial with vignette



# Contrasting Shapes



Notice how the bricks lead the eye but the wheel stops the eye from leaving the image. This picture was originally reversed, but since we read left to right it is often better to arrange the elements that way.

# Original – note different feel



# Different Shapes



Visually jarring

# Things Looking Like Other Things



# Add Size Indicator



# Collections of Things





# Spring Time



# Fall Grouping





# Juxtaposition

- Combine elements that are opposite to emphasize the differences or whatever they might have in common
- Could be shapes, colors, function, brightness, etc.

# Patterns Juxtaposition



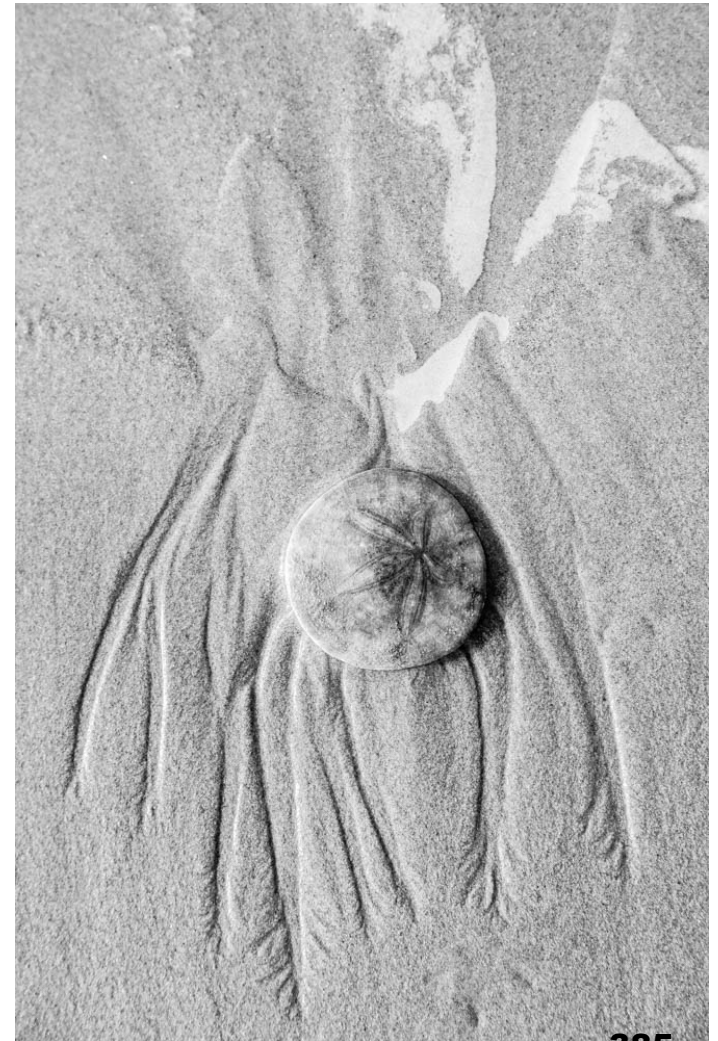
# Yep, Dangerous (note sign)



# How Many Locks to Keep Cows In?



# Sand Patterns – Side Light



# Out of Place (juxtaposition)





# A Glimpse of History



# Backlight



# Water with slow shutter



# 1/60 vs 1/2 second



# Try at home

- Take several images at different shutter speeds of something moving, like a fan
  - Notice how the blur amount changes
  - This will give you a feel for different shutter speeds and amount of blur

# Panning Practice

- Rotate around your waist, keep camera level
- Cars, try shutter speeds around 1/30
  - I don't recommend police cars
- Children, they're always running somewhere and don't stop much

# Reflections















Shapes with different zooms,  
also notice background layer





Notice the guiding lines in ground and sky, and the contrast between sky and ground. There are also solid rocks on the bottom to anchor the image.

Layering of foreground and background. Note the shadow that echoes the pole shape. The center of the cross is close to a “thirds point”.





Background layer is blurred to focus your attention on the foreground. Diagonal composition with a root part sticking out to the left to provide balance. The small flowers on the bottom left serve to anchor and to provide scale.



Water acts as a leading line to the subject. Bottom left greenery balances with upper greenery. Note the stump at the “thirds” point, bottom right and of course the other “thirds” is the subject. Tree to the left of subject delineates and frames. Always watch for branches sticking out of heads!





Many leading lines and reflections to capture your interest, and a little bit of mystery at the bottom of the water.

Lines, lines everywhere! Note also “thirds” at lower left, bottom of grass. Grass points to sun and sky. Clouds stop your eye after grass leads the eye up.



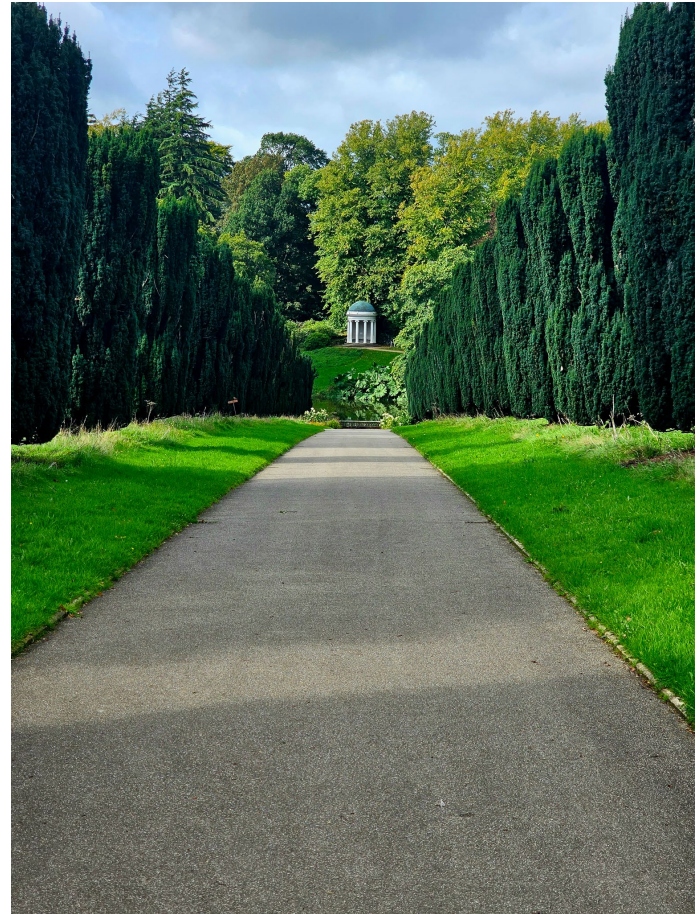
See the “thirds” objects? Notice the layers (at least 3)? There is also a solid anchor at the left bottom. Diagonal lines?



Layers and framing. Water is always interesting in photos.







Same subject with leading lines. Two different positions.



Leading lines with tight framing.



Lines pointing at each other.





Lines crossing.

Thirds, lines  
and reflections.  
Note the layers  
also, rocks and  
grass/water.



The nice straight lines become confused and jumbled as they exit the bottom of the image. Or perhaps the jumble becomes organized and less chaotic as you rise through the image!



Holding up the rainbow! Note the contrast between the straight fence and the curved rainbow and how they both frame the subject.



Perspective distortion.  
Spoon size boy! Also, can  
you see the “thirds” and  
how it provides balance?



# Night Photography

- Tripod
  - Use self-timer to avoid shake
- Meter from sky for starting values
- Long shutter speeds
- Extreme dynamic range
- More image noise
- I offer a separate class on this

# Dusk, almost night





# Extreme Dynamic Range



Clipped shadows and blown-out highlights (the moon and sun)

But does this really matter?



# Night Sky, Multiple Exposures

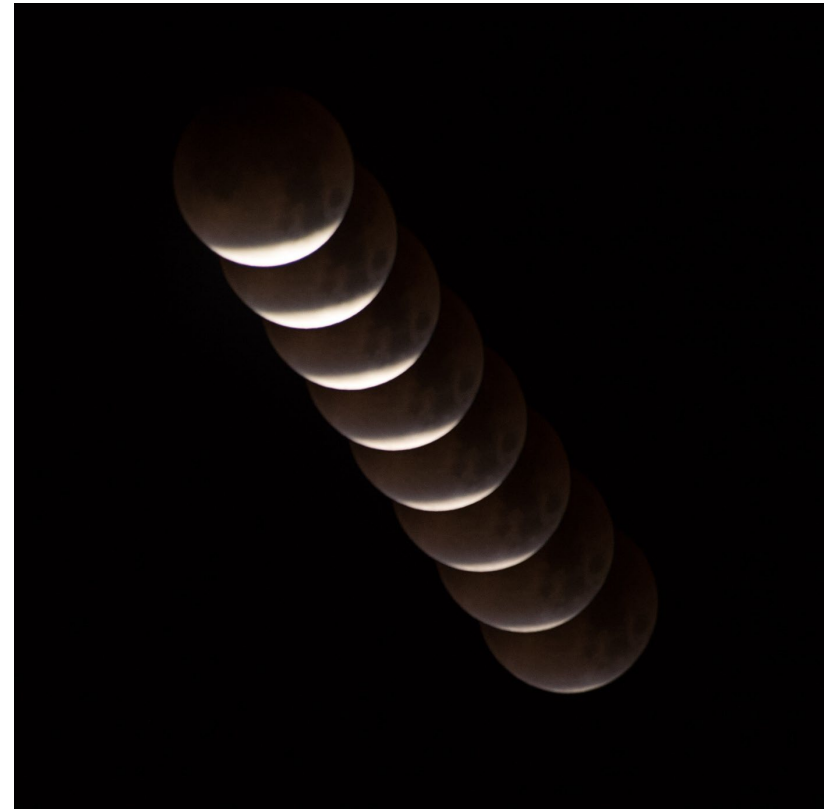
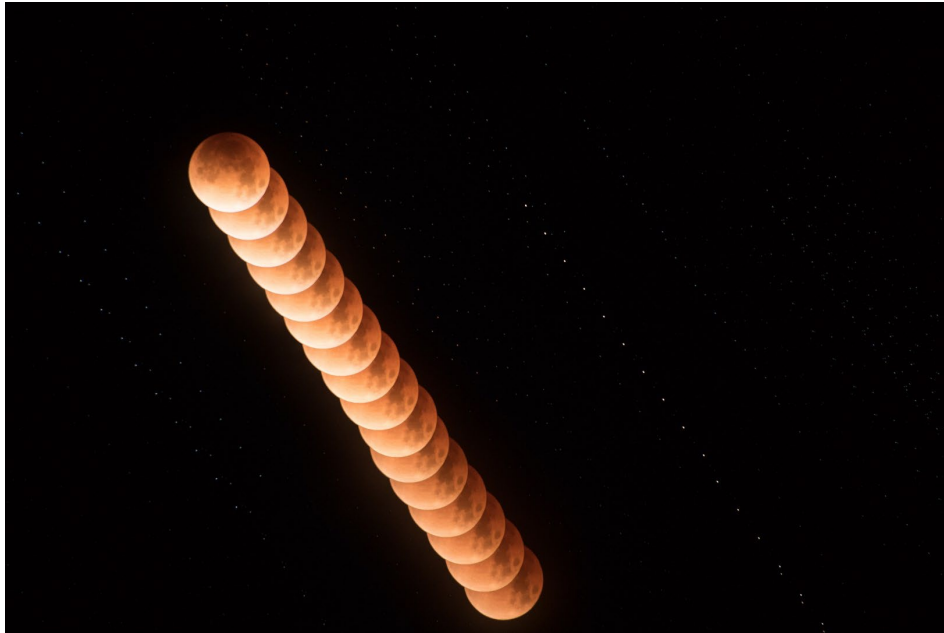




Shot with 3 exposures, +/- 2 stops.  
Combined as HDR in Lightroom.  
It is usually best to use a fixed f-stop and vary the shutter speed to keep edges the same between images.

It is also possible to change the ISO instead of the shutter speed.  
In general moving objects are problematic and should be avoided, except water of course.





Lunar Eclipse 31JAN2018

# Deer in Lights



Southern  
Utah  
Art  
Guild

Red Cliff Gallery

Photography

1st  
PLACE

# Landscapes Look Easy

- You're hiking somewhere, you see a fantastic view, you whip out your camera and take that great shot!
- Later you look at it, and disappointment strikes, it just doesn't look inspiring at all
- You want the photo to give the same emotions as when you were there
- Maybe landscapes aren't easy at all





# 3 Kinds of Photographers

1. Please you is enough
2. Need accolades from others
3. Professionals: need to sell!

# Landscape Technicals

- Tripod sometimes, lets you concentrate
- Foreground
  - Often need something to establish scale
- Background
  - Will be hazy, due to dust and heat
- Middleground
- Often wide dynamic range sky & ground

# Foreground, middle, and background



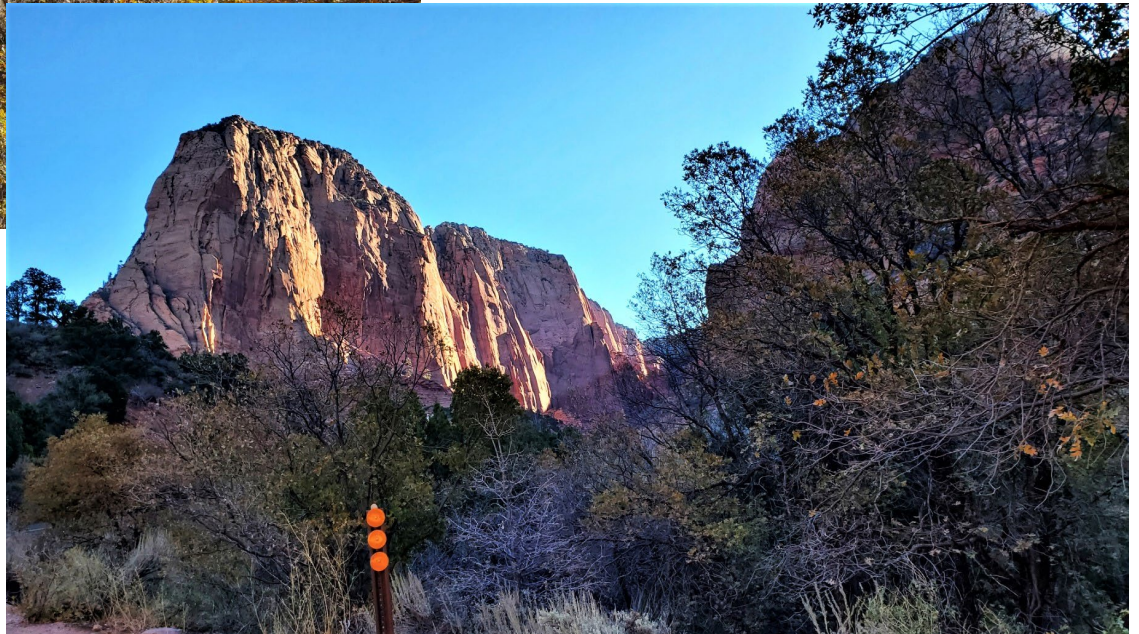
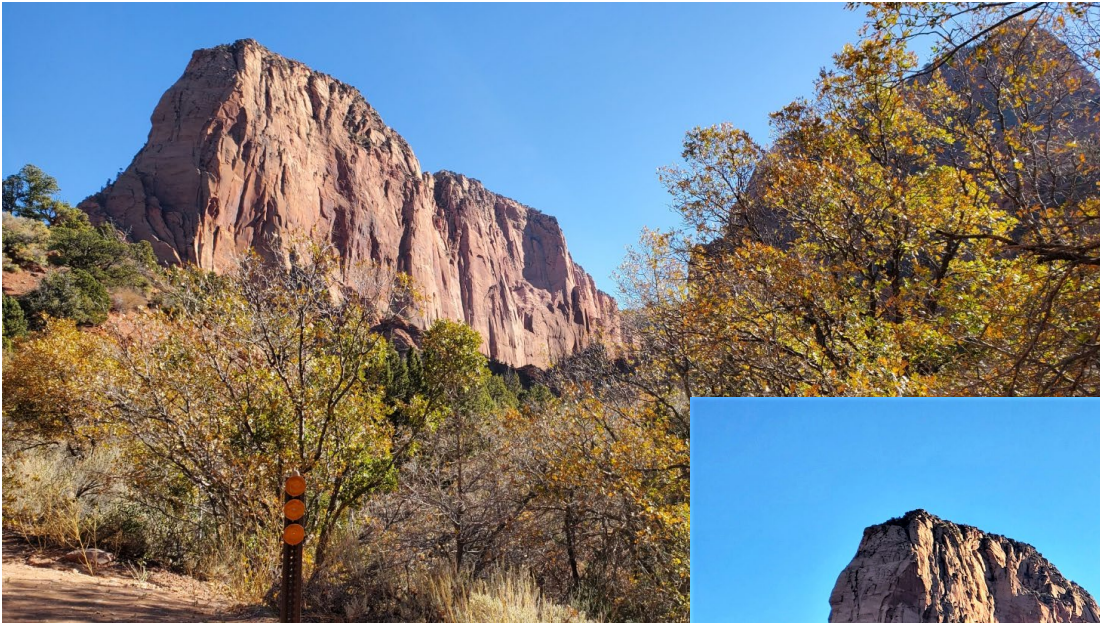
# Foreground can Anchor and Balance the Image



# Landscapes Often Need Sidelight



# Light Direction



# That was just a touch of landscape ideas

- Orton Effect still popular (hated by some)
- Many websites offer help
  - <https://www.capturelandscapes.com/>

# Why Landscape Photos Fail

- Depth perception, 3D to 2D
  - Image is flat, scene isn't
- Limited dynamic range
  - Range of brightness has been compressed and relationships lost
  - Example: snow turns gray instead of intense white
- Limited sensory input, no smell, wind, birds, warm sun, etc.
- Correct color relationships
  - White balance can be lost, especially due to ambient viewing light
- Clutter
  - In real life we ignore things that are not interesting, but looking at pictures we tend to think everything is important, so we need to remove objects that aren't important
  - We think we see everything in one big gulp, but our eyes only see details in a very small area
- Focus
  - Our eyes are moving all over the place and noticing things of interest, & ignoring clutter



# Clutter and Our Eyes

- Our eyes are actually fluttering about constantly, ignoring stuff in between the interesting things
- High resolution fovea only covers about as much as a 1000mm lens, very tiny spot
- We don't "see" the clutter in real life
- On a print or image we tend to focus on everything, including clutter

# Brightness Issues

- Snow is white and our eye/brain will fix it
- We see bright areas as bright white
  - Camera will average the light and this makes the whites too dark, snow becomes gray
  - Our eye is calibrated to the room we are in, not the photo we are looking at
  - Overexposure often necessary



# Sensory Input, smell, sound, etc

- Look through the view finder and ignore the smells, sounds, birds, bees, wind, sun, etc. and just look at the image, is it still interesting?
- If not, it will be difficult to fix later

# Clutter, no interest spots



# Interest, leading line, less clutter



# Best one?



# 3D to 2D

- This is probably the biggest problem
- We see 3D, photograph in 2D for people to look at in 3D with 2D retinas
- Use techniques to trick our eye/brain system into perceiving 3D
  - Leading lines
  - Depth of field
  - Size/position relationships
  - Shadows

# OK, What Makes Landscape Photos Succeed?

- *How Advertising (Sometimes) Works*, by Bruce Hall
  - Relevance and subconscious decisions
- *The Experience of Landscape*, by Jay Appleton
- Next slide...





# Our Instinctual Preferences

- Open spaces of low grasses with bushes and tree groupings
- Presence of water
- Unimpeded view of the horizon
- Evidence of animal and bird life
- Diversity of greenery, flowers and fruits
- Element of mystery
- Hazard and refuge symbols

# Ultimately

- We want the viewer to experience an emotion response
  - This is also what mostly sells things

# Forests

- Often need to ignore the ground, cluttered
  - Unless the ground is the subject!



# Forest Floor





In this example the forest floor is important.

Also watch the background very carefully, you don't want any trees growing out of their heads.

# Look up



# Barking up the Tree

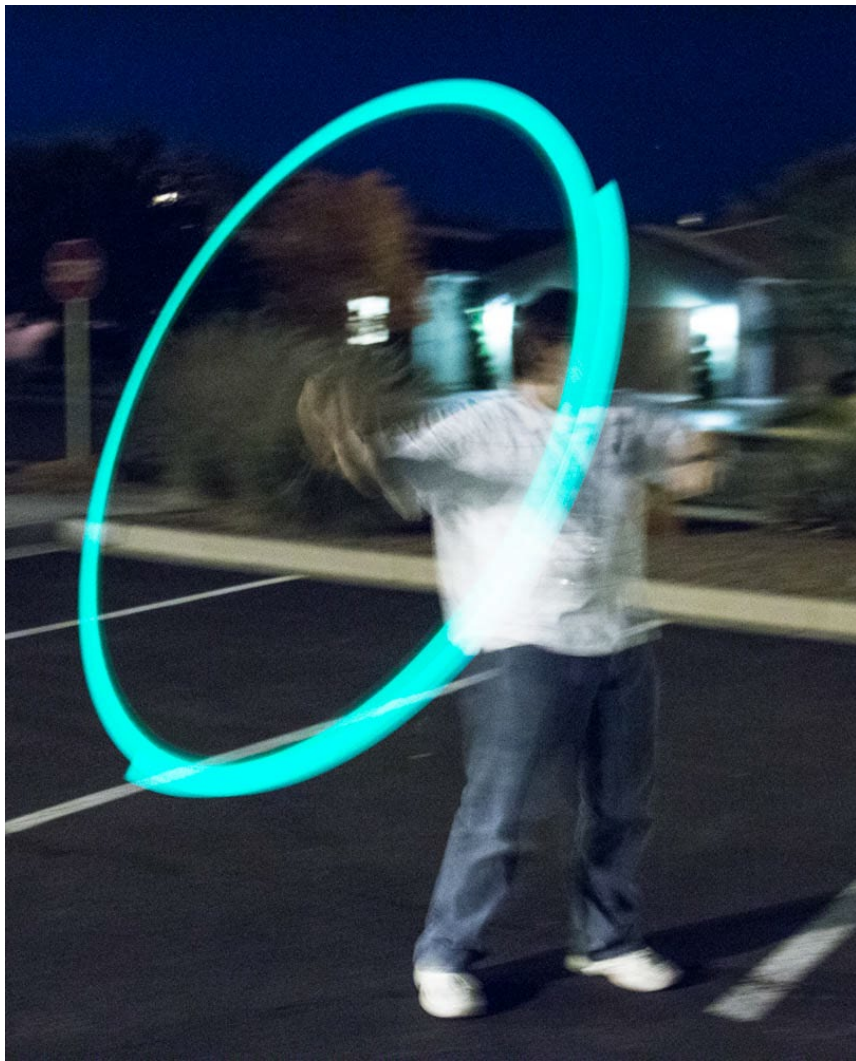


# Don't be afraid to experiment





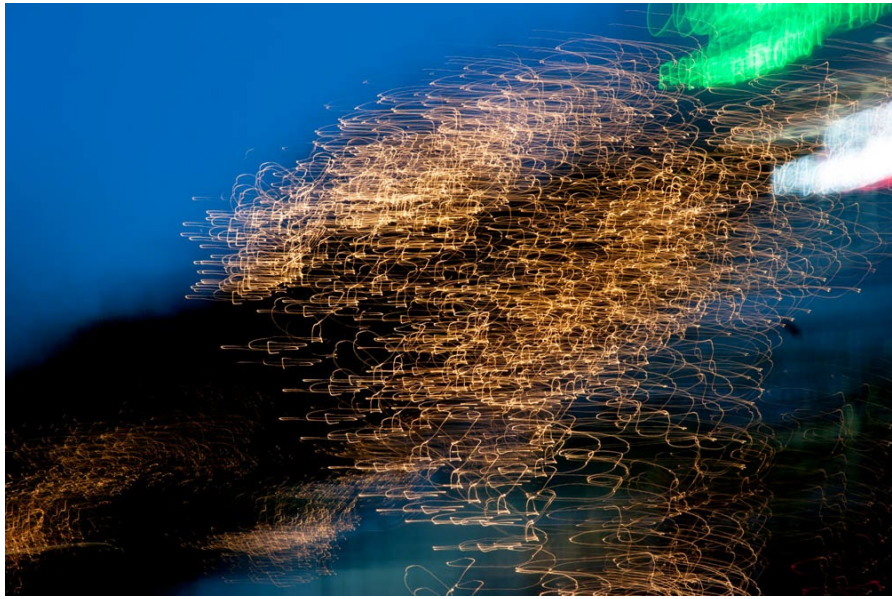




In automatic mode the camera won't let you do things like this. It will try to pop up the flash because there isn't enough light!

# Abstracts can be fun





# Life Metaphors





Isolate color to focus attention

# Flowers are Always Popular

- Try different angles (like sky)
- Use depth of field to blur background
- Colored backdrop, reflector or cardboard
- Get close, sometimes really close!
- Look for bees and other insects
- Carry spray bottle for moisture droplets
  - Water with some glycerin
- Grab your flashlight and shoot in the dark

# Bright Colors Attract the Eye

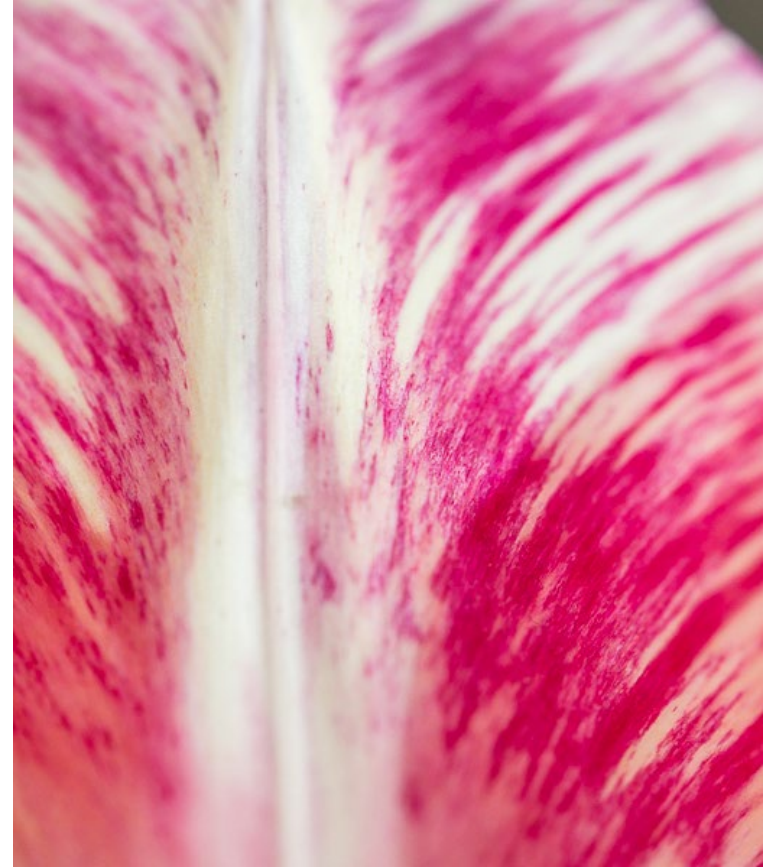




# Different Backgrounds







# Fun Night Flowers







# People

- Eyes in focus if face is seen
- Doing interesting things
- Sometimes need reflector or flash to keep face from being too dark



# Children

- Get down to their level
- Catch their expressions and activities
- Place in interesting surroundings
- Getting cooperation can be challenging





# Pets and Animals

- Focus on eyes
- Sometimes need room in front so they don't look trapped in the image

# Eyes are Important



# Even Bug Eyes Important



# In Context

“Go ahead, climb up here and get me!”



Sharp Not Always Necessary,  
also notice space ahead of bird





# Allow Room in Front to Fly Into



# Get close





# Closeups Show Details



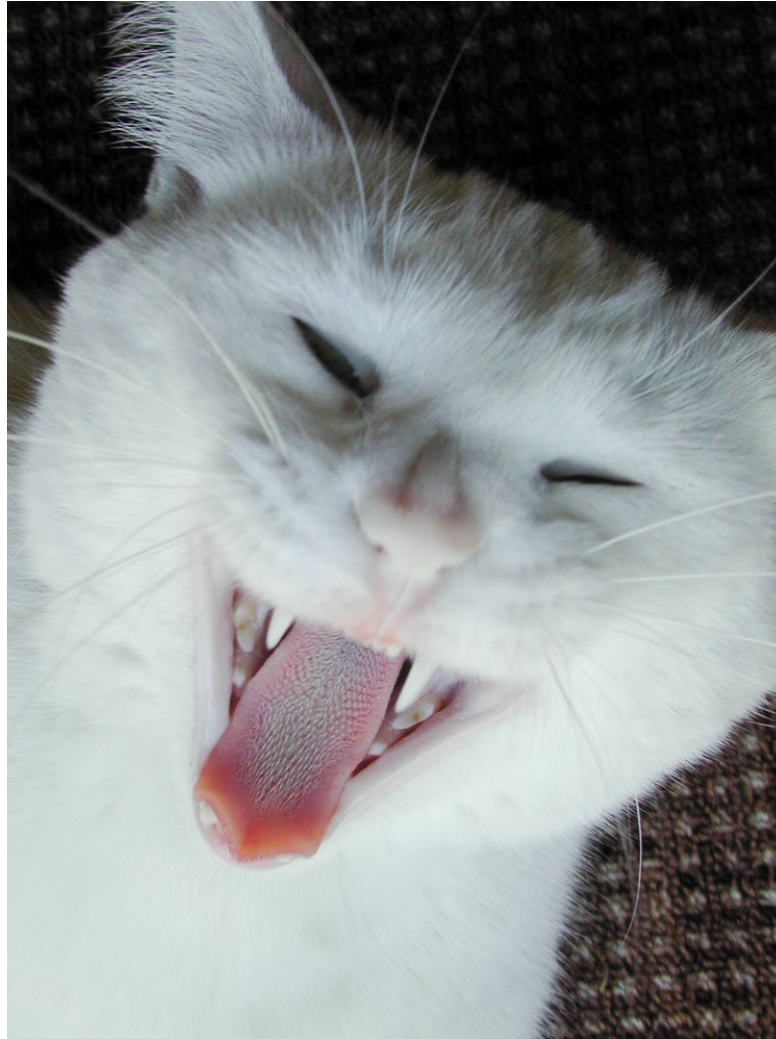
# Interesting Background and Lines



# Fast moving animals are fun



# Funny expressions



# Rainbows

- Use polarizer filter to improve colors and darken sky
- Don't try to get the whole rainbow in one photo
  - Too small and polarization doesn't work on complete rainbow
- Light behind you, rain in front
- 42 degrees light, two hand rule





# Sunset/Sunrise

- Silhouettes always interesting
- Underexpose and warming can improve
- Editing can also improve
- We saw some examples earlier







# Street Photography

- Images of people doing normal (or abnormal) things as they go about their daily activities
- Study people, anticipate actions
- Must be quick, no posing!
  - Pre-focus using hyperfocal distance

# Feed the birds



# Framing



Not my photo, but I like it



# Sports

- Get close, see the face
- Show movement, panning, shutter speed
- Or, freeze the important moment
- Mostly need long lenses











# Look for Details



# Backlight

- Silhouettes and semi-transparent things



# Close-ups

- Many things look interesting up close



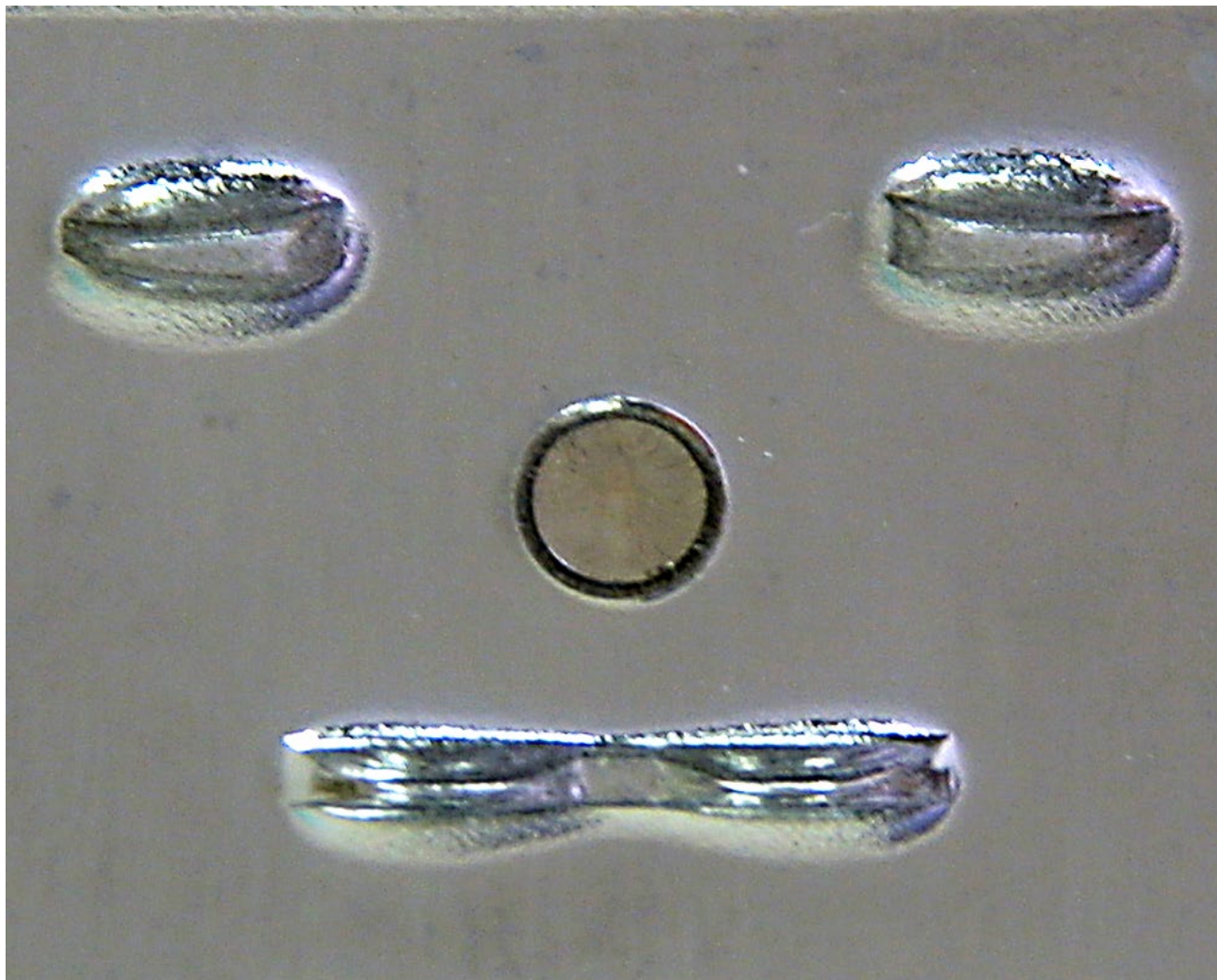




# Paper behind to de-clutter



# Smile





# Framing – Classic but still good









# Buildings

- Architecture is always interesting
  - Interiors can be challenging
  - Extreme light and dark
  - Sometimes no flash or tripods allowed
  - Restrictions on standing locations
  - Don't forget about exterior details
- Exception: DO NOT photograph government buildings anywhere!



# You don't always need the whole building





Soft lighting, fog.





# Perspective Corrections



# Creative Copying



# Creative Distortions



Created with distort | polar coordinates filter in Photoshop

# Staging



Very static, nothing going on



Can you feel the wind now?

# Declutter by getting closer



This still tells the story of a long hard life but with less visual clutter

# Black and White

- Many cameras have a B&W setting
  - I don't recommend it
    - Common for yellow to be too dark
  - B&W involves mapping different colors to different gray ranges
  - Photo editing software give you more control to make better images
  - B&W film wasn't equally sensitive to all colors, so each film had a unique "look"



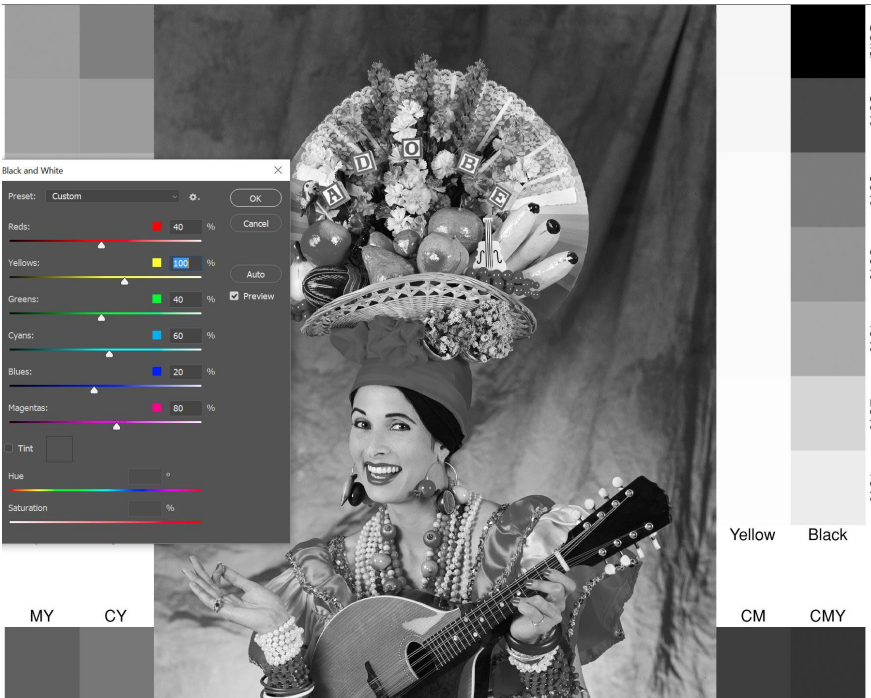
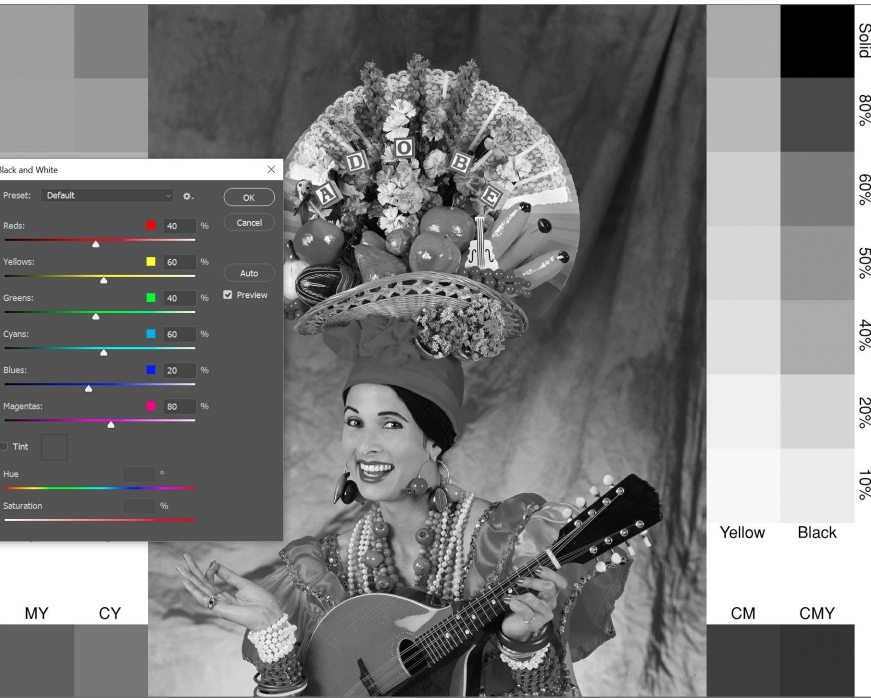
# Advantages to Black & White

- Colors don't matter
- Harsh mid-day light often looks better
- Gives a “classic” look to photos
- White balance is irrelevant
- Concentrate on shapes rather than colors
- Often works well in poor light

Mapping the different colors to gray values is mostly an artistic decision that the camera has no idea about how to do. So it is best to shoot color and adjust later.

See how the bananas are too dark?

Light them up by adding yellow.





In Lightroom use the B & W panel to modify color mapping.

The screenshot displays the Adobe Photoshop Lightroom Classic CC interface in the Develop module. The central workspace shows a black and white photograph of a woman in traditional Indian attire, smiling and playing a stringed instrument. She is holding a large, ornate basket filled with various fruits and vegetables, including bananas, apples, and oranges. The basket is decorated with letters spelling 'H D O B'. The image is surrounded by two vertical grayscale calibration charts: one on the left with labels 'Solid', '80%', '60%', '50%', '40%', '20%', and '10%', and another on the right with labels 'Solid', '80%', '60%', '50%', '40%', '20%', and '10%'. Below these charts are color calibration options: 'Cyan' and 'Magenta' (MY, CY) on the left, and 'Yellow' and 'Black' (CM, CMY) on the right. The right-hand panel features a 'Histogram' at the top, followed by 'Reset Presence' sliders for Clarity, Dehaze, Vibrance, and Saturation. Below that is the 'Tone Curve' section, and the 'B & W' section is expanded to show 'Reset Black & White Mix' sliders for Red, Orange, Yellow (+35), Green, Aqua, Blue (-37), Purple, and Magenta. The 'Split Toning', 'Detail', and 'Lens Corrections' panels are also visible. The bottom of the interface shows a grid of thumbnails for other photos in the library, with the current photo selected.



# Travel

- Keep record of where you've been
- Try and find angles or lighting that you haven't seen before, otherwise you might as well buy the postcards/books



# Today there is a push for local

- Create images close to home
- Look for interesting things constantly
- Keep an open mind and eye, there are interesting things to be found everywhere



# Look Around You

- Look around for interesting things
- Look in books and magazines for what has been done and what is popular

# Common Mistakes

- Putting the face or other subject in the middle of the image, sometimes ok
- Take time to think about what the image story or interest is, don't rush
- Don't try to cram too much in the image, simplify, declutter, figure out what belongs
- Improper exposure, get it right! Don't always trust the camera

# More Common Mistakes

- Watch the background
  - Trees growing from head
- Blurry images, focus or shutter speed
- Try other viewpoints
  - Like eyelevel, experiment
- Edit too much, a little might be good
- Cutting subject parts off

# How to get better images

- Practice practice practice
  - Think about images as you go about your daily life
    - What do I see? What story can I tell?
- Take lots of picture, digital has almost no cost per image
- Edit photos and impress your friends

# Assignment

- Pick a topic and bring a photo to show
- Take several images to illustrate
  - Depth of field
  - Simplification of image
- Constructive comments appreciated
- Negative criticism frowned upon
  - We're trying to improve, not be discouraged





# Ideas 1

- Walk the streets
- Try different angles
- Sports
- Festivals
- Rain
- Night
- What you love

# Ideas 2

- Restaurants and shops

- Food, items and décor
- Cell phone light on glass
- Reflections

- Ambience

- Throw some sand or dirt in the air
- Add water to get reflections



# Ideas 3

- Twist your zoom lens
- Light painting at night
- Night lights, sharp and defocus

# Ideas 4

- Give yourself an assignment
  - Numbers
  - Patterns
  - A single lens
  - Window shopping
  - Colors
  - Shapes

# Ideas 5

- Big pictures, landscapes
- Details, look closely
  - Once on a hike we found some 2mm flowers
  - Architecture is often full of little details



# Archiving

Let's keep things safe!

# Archiving Those images

## ■ Film

- Shoeboxes or better
  - Negative sheets
- Write on paper
  - Can get lost
- Not always easy to find images once stored

## ■ Digital

- Hard disk or better
  - CD/DVD etc
- Metadata
  - Can follow images
- With good software it can be easy to find stored images



# Where are your images?

- Are they important to you?
  - How would you feel if they were all lost?
- Are they safe?
- Do you have them saved in more than one place?



# Where to Keep Image Files

- Camera
- Hard disc on computer
  - It will fail someday
- External network drives
- USB hard drives
- USB flash drives
  - 10 year life
- Cloud
  - Trust others to not lose images, keep local
- Optical

# Cloud Fees – Monthly unless noted yearly

## Google Drive

<b>FREE</b>	<b>\$1.99</b>	<b>\$9.99</b>	<small>starting at</small> <b>\$99.99</b>
15GB	100GB	1TB	10TB+

## Microsoft OneDrive

Office 365 Home with Premium OneDrive Features	Office 365 Personal with Premium OneDrive Features	Storage only OneDrive 50 GB	Storage only OneDrive Basic 5 GB
\$99.99/year	\$69.99/year		Free

## Apple iCloud

**50GB: \$0.99**

**200GB: \$2.99**

**2TB: \$9.99**



# Sharing Photos

Online is popular and easy

# Places to Share

- [www.eyefi.com](http://www.eyefi.com)
- [www.facebook.com](http://www.facebook.com)
- [www.flickr.com](http://www.flickr.com)
- [photos.google.com](http://photos.google.com)
- [www.Instagram.com](http://www.Instagram.com)
- [www.photobucket.com](http://www.photobucket.com)
- [www.pinterest.com](http://www.pinterest.com)
- [www.smugmug.com](http://www.smugmug.com)
- [www.thislife.com](http://www.thislife.com)

# Considerations

- Will they stay around?
  - How do they keep the lights on?
- Easy to share?
- Easy to get photos back?
- Costs?
- Upload always easy, download maybe



# Possible Organizing Methods

## 1. By date

1. Date named folders, date names for files
  1. Maybe folders using years, months, days

## 2. By topic

1. Trees, flowers, lakes, rivers, waterfalls, etc.

## 3. By content, Fred, George, Smiths, etc.

## 4. Date folders containing the above

## 5. Or topic or content containing dates

# Possible Tree

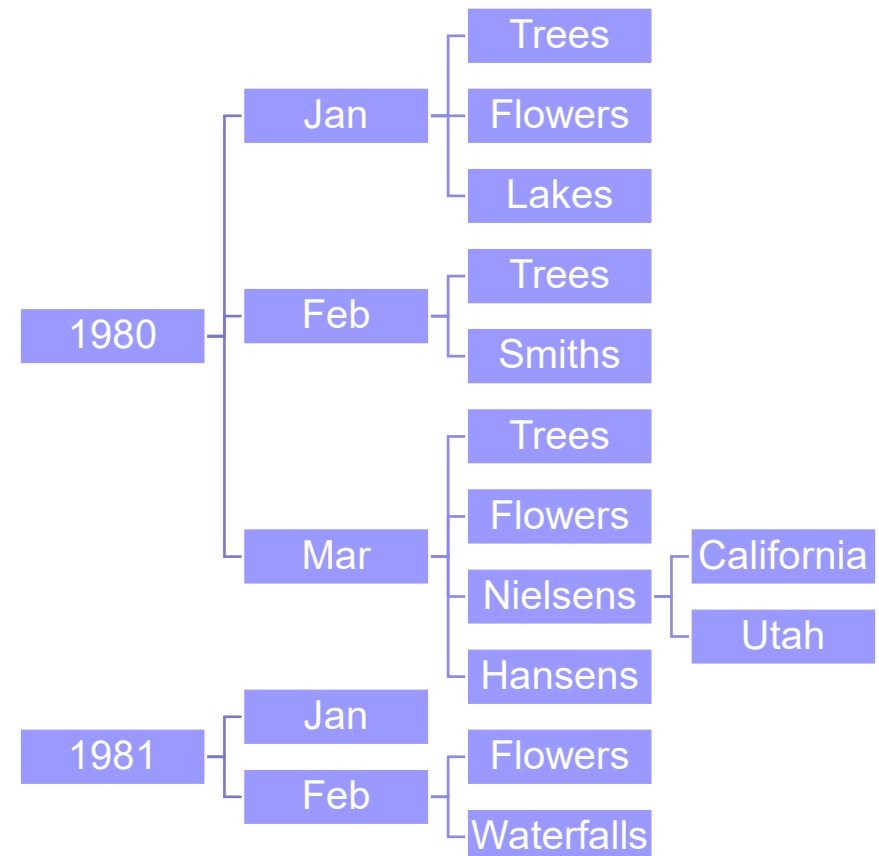
These are folders with each folder containing images that match the folder path.

So this is pretty cool! It's easy to find what I want just by walking down the tree. Or is it? What if I want to find all the "Trees" pictures? Wait a minute! They are found 3 (or more of course) different places.

Oh yeah, and where do I put pictures of waterfalls with trees and flowers at the Niensens in Utah? Duplicates? Triplicates? Quads?

You could use "symbolic links" so at least the files aren't duplicated, but this still gets kind of crazy real fast.

You could change this hierarchy any way you want, maybe have trees, flowers, etc. as the top level (on the left).



# Stop and Think for a Moment



What is the real problem I'm trying to solve?  
Hmmm, what I want is to be able to find pictures based on some description of the picture. It might be date, it might be names, it might be contents, actually it might be just about anything that describes the image.



If I could attach the information to each image file then I wouldn't really care what folder the file is in, I could simply search through the descriptions for what I am looking for.

This is easily done on a computer with the magic of metadata and a database catalog.



# Organizing

## ■ Original way

- Sort in named folders like date, trees, lakes, flowers
- This breaks down if you have a picture of trees and flowers in front of a lake

## ■ Better way

- metadata tags
- Index using trees, flowers, and lakes
- Easy to find using any tag word

# How am I Organized?

- I started with named folders, some dates, some places, and some things
  - It got messy!
- When I started using Lightroom I just left the folders in place, Lightroom doesn't care where things are
- I started adding keywords to new and old photos

MN Photos

Home Share View

Clipboard: Pin to Quick access, Copy, Paste, Copy path, Paste shortcut

Organize: Move to, Copy to, Delete, Rename

New: New folder, New item, Easy access

Open: Properties, Open, Edit, History

Select: Select all, Select none, Invert selection

Address bar: This PC > WORKING (D:) > MN Photos > Search MN Photos

Name	Date modified	Type
2008		File folder
2009	12/10/2012 11:35 AM	File folder
2010	11/14/2017 1:10 PM	File folder
2011	12/10/2012 11:39 AM	File folder
2012	12/22/2012 12:02 PM	File folder
2013	8/28/2017 10:16 AM	File folder
2014	8/28/2017 10:53 AM	File folder
2015	8/28/2017 11:14 AM	File folder
2016	8/28/2017 11:36 AM	File folder
2017	12/16/2017 12:23 PM	File folder
Abstract	11/14/2017 9:54 AM	File folder
Alberta	12/10/2012 11:39 AM	File folder
Alberta2001	11/14/2017 9:58 AM	File folder
Andrew Hill	11/14/2017 10:05 AM	File folder
Animations	12/10/2012 3:19 PM	File folder
Art	11/14/2017 10:05 AM	File folder
Automotive AC	10/7/2010 2:30 PM	File folder
Barnstormers Football	11/14/2017 10:05 AM	File folder
Birds	11/14/2017 1:10 PM	File folder
books	12/10/2012 11:40 AM	File folder
Bridges	12/10/2012 3:18 PM	File folder
BunkBeds	11/14/2017 10:07 AM	File folder
ByeByeBirdie	10/16/2010 10:58 AM	File folder

255 items | 1 item selected



# Photo Editors

Because change can be good!

# First Things First

- Do you need to buy a photo editor?
- No if
  - Only do simple edits and not very often
- Yes if
  - Enjoy improving images and want the best
  - Want to do more complex editing
    - Compositing, object removal, major repairs, etc.

# Free Editing

- Windows, Linux, & Mac have basic editing
  - Apple best in my opinion
    - iPhoto (discontinued) -> Photo
  - Windows is adequate for simple operations
    - Cropping and color changes
  - Picasa (Google – discontinued) -> [photos.google.com](https://photos.google.com)
- Others...



# Photo Managers

It should be easy to archive,  
sort, edit, and find images

# Backup to USB

- PhotoStick and Picture Keeper
  - USB memory with app to save images
  - Read the reviews carefully!
- OSX TimeMachine and Windows Backup
  - Work reliably




# Image Managing Software

- ACDSee, Lightroom Classic CC
- Google Photos (replaced Picasa)
- Cyberlink PhotoDirector, Corel Paintshop
- Zoner, Luminar, On1, Capture One, Exposure X5, etc.
- [www.mylio.com](http://www.mylio.com)
- Look for the features you need
  - Easy searching and browsing
  - Editing, and printing (if needed)



# Managers are More than Edits

- Archiving collections
- Easy format changes
- Indexing for ease in searching collection
  - Keywords and other metadata



# Google Photos (replaced Picasa)

- Automatic tagging
  - Works amazingly well
  - Matches faces
- Non-destructive image editing
- Excellent price! Free, but photos must be on Google drive, you may need to buy space eventually

# Example Prices (sometimes on sale)

- On1, \$89.99 (200GB), \$179.99 (1TB)/year
- Capture One, \$179/year or \$299 license
- Lightroom/Photoshop bundle, \$9.99/month
  - There is also a 1TB cloud for more money
- Luminar, \$149 license
- Cyberlink PhotoDirector, \$69.99 license
- ACDSee, \$149.99 license or \$89/year
- Zoner, \$49/year

# Cell Phone Photo Apps

- Built-in, Gallery (Samsung), iPhone photos
- Adobe Lightroom, free or part of Adobe photographer suite for \$9.99/month
  - For more money, 1TB cloud with LR only
- Google Photos, free but photos must be in google cloud drive
- Snapseed (Google), free or \$4.99 for pro
- Many others are also available

tractors

Aug 18, 2016



Jul 3, 2016



Feb 6, 2016



Aug 13, 2015




<https://photos.google.com/search/tractors/photo/AF1QipP4yJV6CAs4P33kVpkBzTS2YQQHVy2Z1hcXsv04>



### Info

Add a description

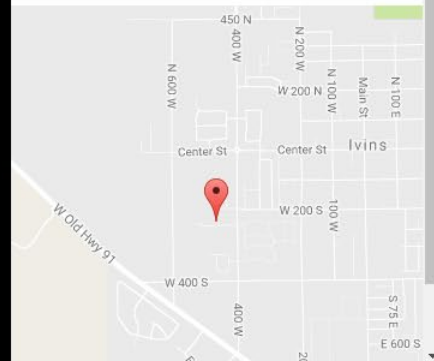
#### Details

 **Aug 18, 2016**  
Thu, 12:26 PM

 **20160818\_122655.jpg**  
12.2MP 4032 x 3024 3.4 MB

 **SM-G930V**  
f/1.7 1/1584 4.2mm ISO50

 **Ivins, UT**  
37.164, -113.69





# Adobe Bridge

- Instead of Windows Explorer/Apple Finder
- Image oriented
- Different views
- Easy searching and filtering
- Handle metadata nicely
  - Search, browse and edit
- Included with Photoshop/Lightroom



**Pictures** File Edit View Stacks Label Tools Window Help

Desktop > This PC > Local Disk (C:) > Users > Martin > Pictures

Essentials Filmstrip Metadata Keywords Search Adobe Stock

Sort Manually

Content

2012 2014 2016 2017 Camera Roll Dixie ebay email etsy

KSL LifeCam Files Lightroom Saved Pictures Scouts sculpture Skelton SNM SNM IDs

VueScan \_DSC0039-Edit.jpg \_MN04026.jpg \_MN04223-Edit.jpg 3d tutorial.psd 0001402.jpg 2015-mutual-theme-er-1.psd 20160322\_165331.jpg 20160322\_173832.jpg

20160715\_093852.jpg Axel Nohr on Nimbis.jpg Beck SNM Card.psd beetle.psd boat001.tif Family picture 201...wam.jpg Family picture 201...wam.psd family.psd finish banner.ai

img001.jpg img003.jpg Joe Vs Toby.ai lamp.3ds pear.psd red mountain snow.jpg Rimage QD.tif SNM Halloween Leaders.psd start banner.ai

Toby Turtle

47 items, 1 selected - 43.71 MB

Preview Publish

Family picture 2012 wigwam.psd

Metadata Keywords

f/--	--	3000 x 3000
--	--	43.71 MB 72 ppi
--	ISO--	sRGB RGB

File Properties

**Filename** Family picture 2012 wigwam.psd  
**Document Type** Photoshop document  
**Application** Adobe Photoshop CC 2014 (Windows)  
**Date Created** 3/25/2013, 2:13:58 PM  
**Date File Modified** 11/16/2014, 8:25:39 PM  
**File Size** 43.71 MB  
**Dimensions** 3000 x 3000  
**Dimensions (in inches)** 41.7" x 41.7"  
**Resolution** 72 ppi  
**Bit Depth** 8  
**Color Mode** RGB  
**Color Profile** sRGB IEC61966-2.1

**Creator**  
**Creator: Job Title**  
**Creator: Address**

**Pictures** File Edit View Stacks Label Tools Window Help

Essentials Filmstrip Metadata **Keywords** Search Adobe Stock

Desktop > This PC > Local Disk (C:) > Users > Martin > Pictures >

Sort by Filename

**Favorites**

- Libraries
- This PC
- Martin
- Desktop
- Documents
- Pictures**
- My PaperPort Documents
- Projects






Drag Favorites Here...

**Keywords** Filter

Assigned Keywords:

- Dell
- Events 3
  - Birthday
  - Graduation
  - Wedding
- People 2
  - Matthew
  - Ryan
- Places 5
  - New York
  - Paris
  - San Francisco
  - San Jose
  - Tokyo
  - Taxes
  - Utilities

**Content**

	<p>0001402.jpg</p> <p>Date Created: 2/6/2014, 9:16:21 AM Date Modified: 9/5/2016, 8:53:18 AM 7.92 MB Document Type: JPEG file 2400 x 3000 @ 150 ppi</p>	Color Profile: sRGB IEC61966-2.1
	<p>2015-mutual-theme-poster-1.psd</p> <p>Date Created: 9/4/2014, 3:10:27 PM Date Modified: 3/5/2015, 1:08:32 PM 30.11 MB Document Type: Photoshop document 2400 x 3600 @ 150 ppi</p>	Color Profile: sRGB IEC61966-2.1
	<p>20160322_165331.jpg</p> <p>Date Created: 3/22/2016, 4:53:31 PM Date Modified: 3/22/2016, 4:53:31 PM 3.61 MB Document Type: JPEG file 1/350 s at f/1.7, ISO 50</p>	<p>Focal Length: 4.3 mm 4032 x 3024 @ 72 ppi Color Profile: sRGB IEC61966-2.1</p>
	<p>20160322_173832.jpg</p> <p>Date Created: 3/22/2016, 5:38:32 PM Date Modified: 3/22/2016, 5:38:32 PM 3.40 MB Document Type: JPEG file 1/120 s at f/1.7, ISO 80</p>	<p>Focal Length: 4.3 mm 4032 x 3024 @ 72 ppi Color Profile: sRGB IEC61966-2.1</p>
	<p>20160715_093852.jpg</p> <p>Date Created: 7/15/2016, 9:38:52 AM Date Modified: 7/15/2016, 12:34:48 PM 792 KB Document Type: JPEG file 1/4000 s at f/1.7, ISO 50</p>	<p>Focal Length: 4.2 mm 675 x 900 @ 300 ppi Color Profile: sRGB IEC61966-2.1 Android Phone</p>

47 items, 1 selected - 3.61 MB

Favorites Folders

- Libraries
- This PC
- Martin
- Desktop
- Documents
- Pictures**
- My PaperPort Documents
- Projects

Filter Collections

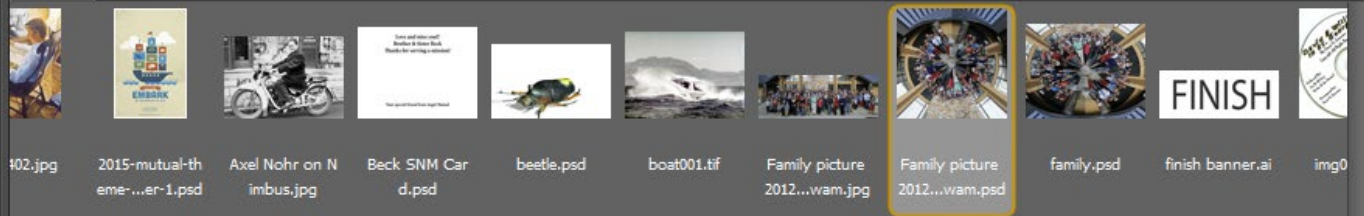
Filter	Collections
<b>ISO Speed Ratings</b>	
No ISO Speed Ratings	43
50	2
80	1
100	1
<b>Exposure Time</b>	
No Exposure Time	42
1/60 s	2
1/120 s	1
1/350 s	1
1/4000 s	1
<b>Aperture Value</b>	
<input checked="" type="checkbox"/> No Aperture Value	42
f/1.7	3
f/2.8	1
f/9.0	1
<b>Focal Length</b>	
<b>Focal Length 35mm</b>	
<b>Lens</b>	
<b>Model</b>	
<b>Serial Number</b>	
<b>White Balance</b>	

Preview



Family picture 2012 wigwam.psd

Content





# ACDSee

- Excellent and affordable
- Has many LR features and even some things that are better
- Does not have the create book and a couple of other things

File Edit View Tools Help  
Workspaces Import Batch Create Slideshow Send Editors Actions Buy Now! Manage Photos View Develop Edit 365

Network > MARTIN-I7-V2 > Users (\MARTIN-I7-V2) > Martin > Pictures > Quick Search

Filter Group Sort View Select

Properties - Metadata

Metadata Presets (Ctrl+M) Apply

Default Metadata View

— IPTC

Field	Content
Title	
Headline	
Description	
Description Writer	
Keywords	
IPTC Subject Code	
Contact	
Creator	
Job Title	
Address	
City	
State/Province	
Postal Code	
Country	
Phone(s)	
Email(s)	
Web URL(s)	
Copyright	
Copyright Notice	
Rights Usage Terms	
Image	
Intellectual Genre	
IPTC Scene Code	
Location	
City	
State/Province	
Country	
Country Code	

Preview SeeDrive

SM-G930V 4032x3024 3.4 MB

P -- [ ] [ ] --

ISO 80 f/1.7 1/120 s 0.00 eV 4.25 mm

3/22/2016 5:38:32 PM

finish banner.ai img001.jpg img003.jpg Joe Vs Toby.ai lamp.3ds

Total 47 items (171.1 MB) | JPG | 20160322\_173832.jpg | 3.4 MB, Date Taken: 3/22/2016 5:38:32 PM | 4032x3024x24b

# Adobe Photoshop Elements

- It is a perfectly good image editor
- It includes an image browser/organizer
- \$99 list
  - Remember that upgrade versions cost \$69 and are release every 12 to 18 months
- Compare to Adobe Lightroom/Photoshop for \$9.99/month

# Mylio.com

- Organize photos, search tools
- Automatic backups
- Website works across all your devices
- Basic editing tools, non-destructive
- Handle jpg, raw, and others
- \$9.99/month



# Lightroom Tour

LR is an excellent tool available on both Mac and PC



# Two Lightrooms

## Lightroom Classic

- Files stored anywhere
- Full featured editing, printing, exporting, etc.

## Lightroom (new)

- Cloud based
  - Images stored in cloud
- Not as full featured as classic, but is constantly getting better



# Photoshop and Lightroom

- Work together very well
  - Included in same price
- We will learn basic editing and image management

One or more drives with images

Photoshop  
Edits  
original  
image files

Export

- Files
- Printer
- Web

## Parametric Editing

Original image  
Never modified

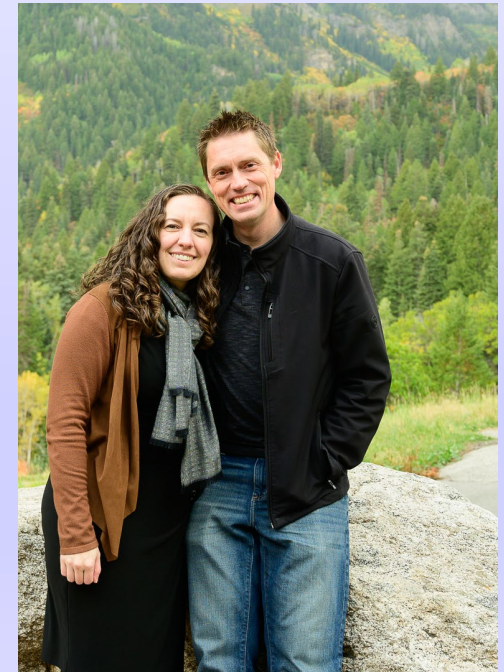
### Image Edit Commands

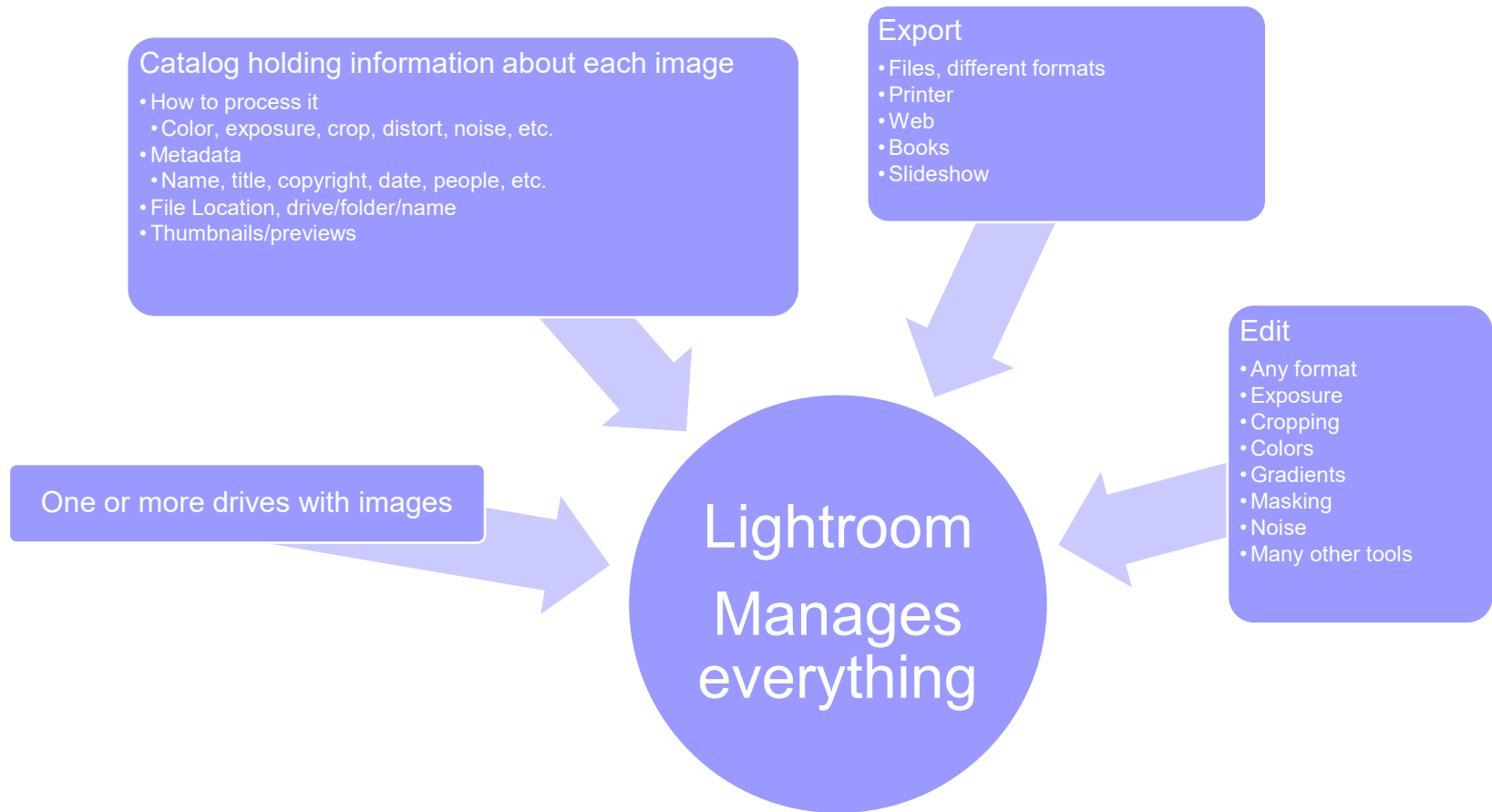
- Brighten
- Contrast
- Color adjust
- Crop

What the user sees  
on the computer

Displayed image  
Shows changes

- Stored in catalog
- Kept until explicitly deleted
- Can be edited





# Adobe Lightroom

- Great tool for managing and editing a photo collection
  - Import, export, store, tag, locate, display, compare, edit, print, map, web, photo book, slide shows, and more
- Keyword/metadata searching
- Excellent editing tools
- Virtual copies, tiny disc space

# Image Editing

- Shows the edited image
  - All formats including raw are handled transparently, you don't have to convert
- **Never changes image files**
  - All editing operations are saved automatically, you don't have to "save" your work
  - Changes can be undone at any time, even a later session



# Lightroom

- Can get Photoshop and Lightroom for \$9.99/month
- Runs on OSX and Windows



# Non-destructive Editing

**Instructions**  
**Stored in Lightroom**  
**Can be changed anytime**

**Original - it is never modified**



- Crop
- Correct Perspective
- Make Black and White



**Final Result**



# Lightroom Modules

- Import (get the images into LR)
- Export (get images out of LR)
- Library (browsing, searching, comparing)
- Develop (editing)
- Map (shows location, requires GPS)
- Book (coffee table books)
- Slideshow
- Print
- Web (photo collections)



# Lightroom Workflow

1. Import images
2. Add keywords to aid searching later
3. Examine images
  1. Delete bad ones, improves your reputation!
4. Select some for editing
5. Output to web, PDF slides, print, or book
6. Later: search collection for further work



# Lightroom Demo

- Do in class



# Neat Features

- Handles video
- The new auto tone control is very good
- HDR and Panorama works well



# Printing

Not as important as it used to be

# Printing Photos

- Wide variety of paper and ink
  - Canvas and metal prints are available now
- Archival quality is possible
  - Not a big issue since the image can always be reprinted from the original image, which doesn't fade!

# Printer types

- Laser

- Much improved, but still not photo quality

- Dye-sub

- Good but expensive

- Inkjet (Glicee is high-class)

- Dye

- 1 to 75 years depending on paper and ink

- Pigment

- 100 years?



# How many pixels do we need?

- Well, it depends
  - Viewing distance
  - Image size
  - Artistic intent
  - Paper type
  - Contrast
  - Visual acuity of viewer
  - Lighting level

# Printing and Pixels

- Note that the number of pixels has nothing directly to do with the print size
  - It relates to how much detail is stored in the image
- Print resolution is measured in PPI, pixels per inch
  - This is different than DPI, the huge number printer manufacturers like to advertise
  - It is rarely necessary to print above 300/360 PPI

# Viewing distance

- Normally about 1.5 to 2 times the diagonal of the artwork
- The eye can resolve about 1 minute of arc
  - $1/60^{\text{th}}$  of a degree
  - Sharp eyes under ideal lighting twice as good, I.E. half that angle

# Optimal Viewing Distance

- A side-effect of this is that slightly greater than 3 Mpixels can make an enlargement of any size that will look the same as long as it is viewed at 2 times the diagonal
- Since most people look at pictures at about 15 inches we only need to print at 240 ppi

# So Why So Many Pixels?

- Cropping
- Sometimes we like to stand really close to a print and see all the detail, we are in effect only looking at part of the image
- Pixel count is a good marketing tool

# For the Math Majors

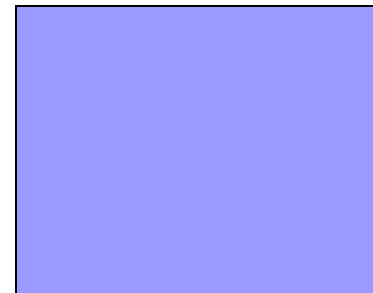
$$PPI \cong \frac{360 \times 60}{2 \times \pi \times d \times 1}$$

$$d = 1.5 \times \sqrt{L^2 + W^2}$$

The 1 is an arc minute, 1/60<sup>th</sup> of a degree, average visual acuity. For really good eyes could be 0.5.



Viewing distance -  $d$



Height -  $H$

Width -  $W$

# Pixels For Really Sharp Prints

- For 300 PPI an 8x10 needs  $8 \times 300 \times 10 \times 300$  or about 7 MPixel.
- This does not mean you can't make bigger prints! If you view them from farther away it still looks the same.
- Image quality is very subjective
  - We just don't want to see the printer dots



# Accurate Color Printing

- Must use ICM profiles
  - Some printers come with them
  - Can make your own
  - 3<sup>rd</sup> party inks can be very different
- Paper and ink combinations affect color



# Printing Workflow

- Edit image and save
  - In Lightroom just make the changes
- Resize (causes some softness)
  - Use 300 PPI for HP/Canon and 360 for Epson
- Sharpen (Lightroom does this for you)
  - Unsharp mask, old original way
  - Photoshop has several different sharpening filters
  - LAB luminosity or high pass layer
- Possible final color/contrast correction
- Print

# Accurate Color Editing

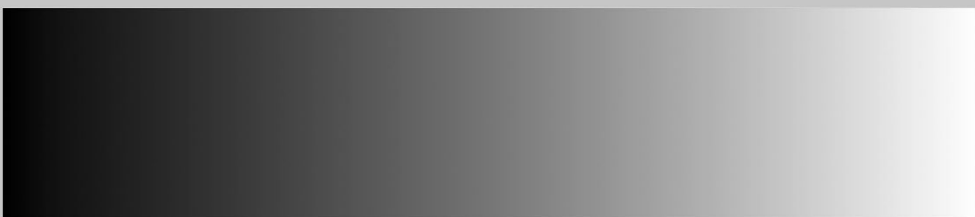
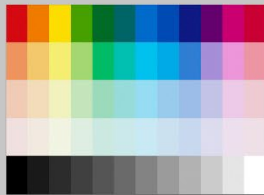
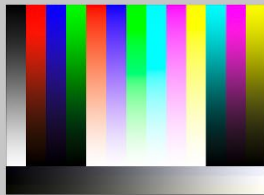
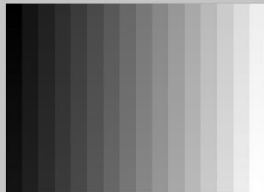
- Must have a color calibrated monitor (ICC file)
  - Use Adobe Gamma at the very least
  - Windows 7 and later has built-in tool (not 100% accurate but better than nothing)
  - Colorvision Spyder or other calibration tools are much better
- Work in a dark room and wear black clothes!
- Lower cost LCD's are not color accurate
  - You can calibrate or buy Adobe certified monitor (\$\$\$)

# Accurate Color Starts Early

- Use gray cards and color swatches whenever possible
  - This is especially important under mixed lighting conditions
- Build an image collection of accurate skin tones so you can see RGB or CMYK values that are pleasing

# Test Prints

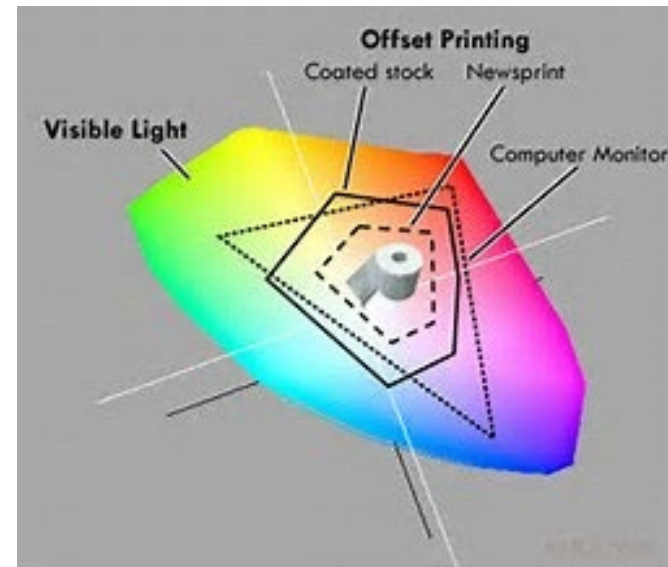
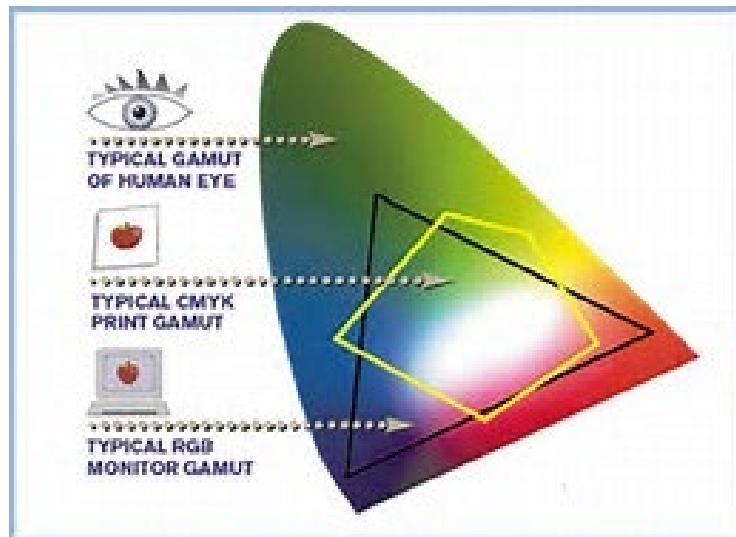




# Printing Dynamic Range

- We said earlier that digital has serious limits in dynamic range
- Printers have an even narrower range
  - Images sometimes need to have the range compressed for good printing
  - Photoshop or Lightroom soft-proofing is great for this

# Gamut





# Displaying What Will Print

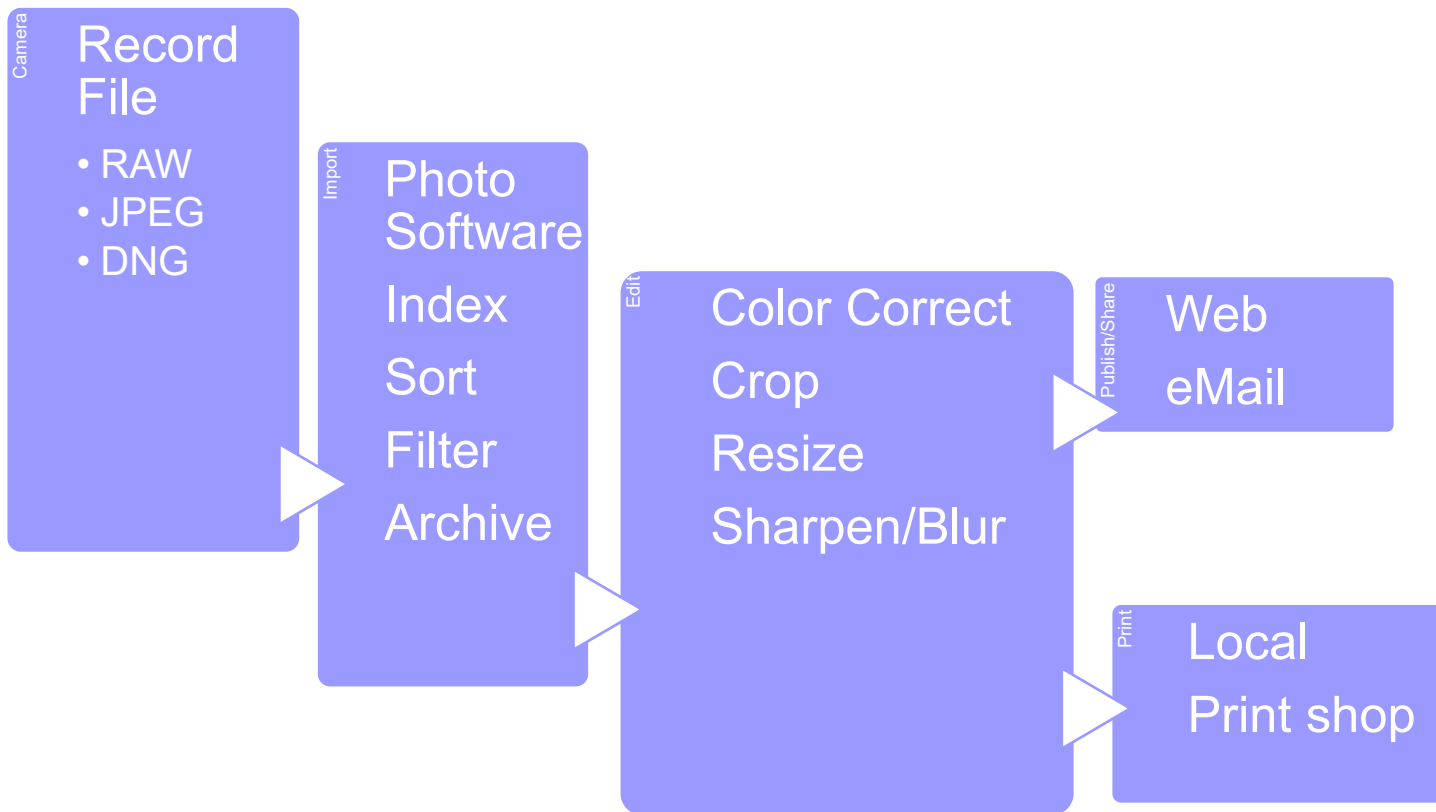
- Both Lightroom and Photoshop can use the printer ICM file to simulate the print image
- Paper prints cannot match the gamut of a glowing display!



# Ways to Handle Dynamic Range

- Take multiple exposures at different settings and combine in Photoshop (HDR)
- Use layer luminance masking
  - Create different layers to bring out details for shadows and highlights
- Do several RAW conversions at different settings and combine in Photoshop
- Use the shadow/highlight adjustment tool

# Digital Workflow



# Websites

- [www.uglyhedgehog.com](http://www.uglyhedgehog.com)
  - Great photography blog site
- [www.bhphotovideo.com](http://www.bhphotovideo.com)
  - Videos and equipment
- [www.ppsop.com](http://www.ppsop.com)
  - Videos and classes
- [www.asa100.com](http://www.asa100.com)

# More Websites

- [www.eyem.com](http://www.eyem.com)
  - Photo sharing
  - Phone app
- [www.davemorrowphotography.com](http://www.davemorrowphotography.com)
  - Excellent tutorials
- [www.picturecorrect.com](http://www.picturecorrect.com)
  - Many fun and educational ideas

# Popular Sites

- [www.eyefi.com](http://www.eyefi.com)
- [www.facebook.com](http://www.facebook.com)
- [www.flickr.com](http://www.flickr.com)
- [photos.google.com](http://photos.google.com)
- [www.instagram.com](http://www.instagram.com)
- [www.photobucket.com](http://www.photobucket.com)
- [www.pinterest.com](http://www.pinterest.com)
- [www.smugmug.com](http://www.smugmug.com)
- [www.thislife.com](http://www.thislife.com)

NOTE: some sites don't store full resolution images



# Landscape Photography Sites

- [Maxrivephotography.com](http://Maxrivephotography.com)
- [Ryandyarphotography.com](http://Ryandyarphotography.com)
- [Marcadamus.com](http://Marcadamus.com)
- [lanplant.com](http://lanplant.com)
- [Davidthompsonphotography.com](http://Davidthompsonphotography.com)
- [Codyscapes.com](http://Codyscapes.com)
- [Bright-images.com](http://Bright-images.com)
- [Milesmorganphotography.com](http://Milesmorganphotography.com)
- [Twowanderers.com](http://Twowanderers.com)

# Landscapes/Flowers

- <https://www.digitalfieldguide.com/>
  - Harold Davis
  - Landscapes and flowers
  - Multiple exposures, layered



# Photoshop and Lightroom Tools

- Goodlight.us
  - Action panel
- NIK collection Dx0
  - Nice B&W conversions
  - Excellent noise reduction