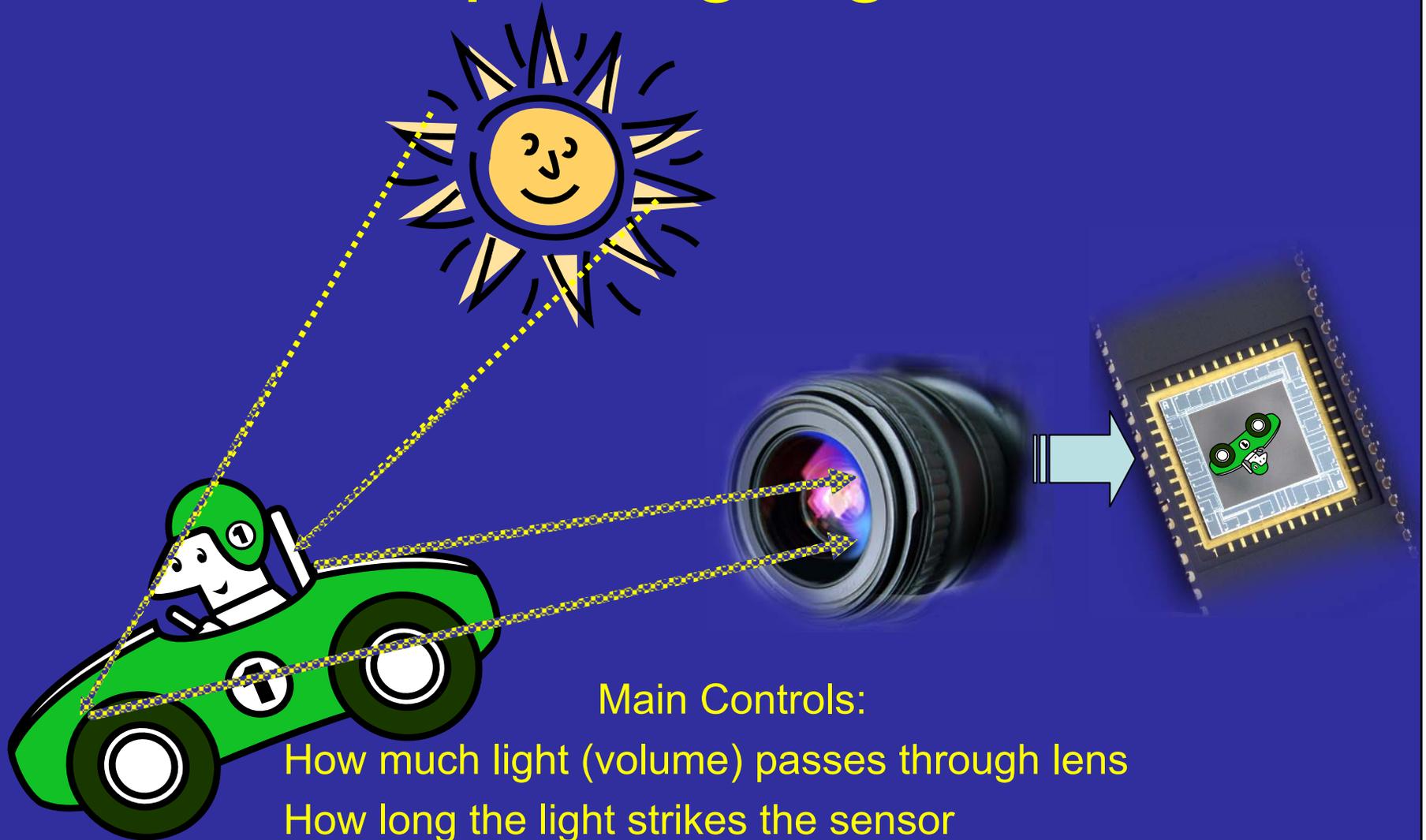# Digital Photography

Taking Pictures

A Technical Overview

Prepared for
WACUG & OPCUG
Computer User Groups
at
OLLI Tallwood Facility

17 October 2009

By
Dan Feighery

Capturing Light

Main Controls:

How much light (volume) passes through lens

How long the light strikes the sensor

What is in focus

Positioning of the image on the sensor

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Primary Types – *(Most Used)*

Point & Shoot

❖Camera body

integrated

Includes Lens

Includes Flash

Factory did the thinking

➤Single unit

➤Easier to use

➤Less control

You capture an Image

You do the thinking

You make a photograph

Digital **S**ingle **L**ens **R**eflex (DSLR)
Components

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3

Each has a Purpose

Point & Shoot

Quick & Easy
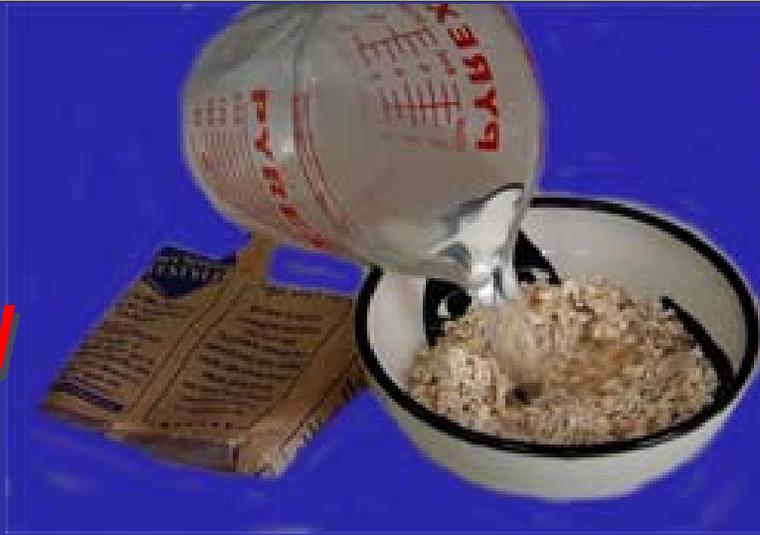
Satisfies a need

Digital **S**ingle **L**ens **R**eflex (DSLR)

A little more effort may yield more satisfying outcome

4

Each has a Purpose

Quick & Easy

Satisfies a need

A little more effort may yield more satisfying outcome

Primary Types – *(Most Used)*

Point & Shoot

Factory did the thinking

You capture an Image

You Do The Thinking

You Make a Photograph

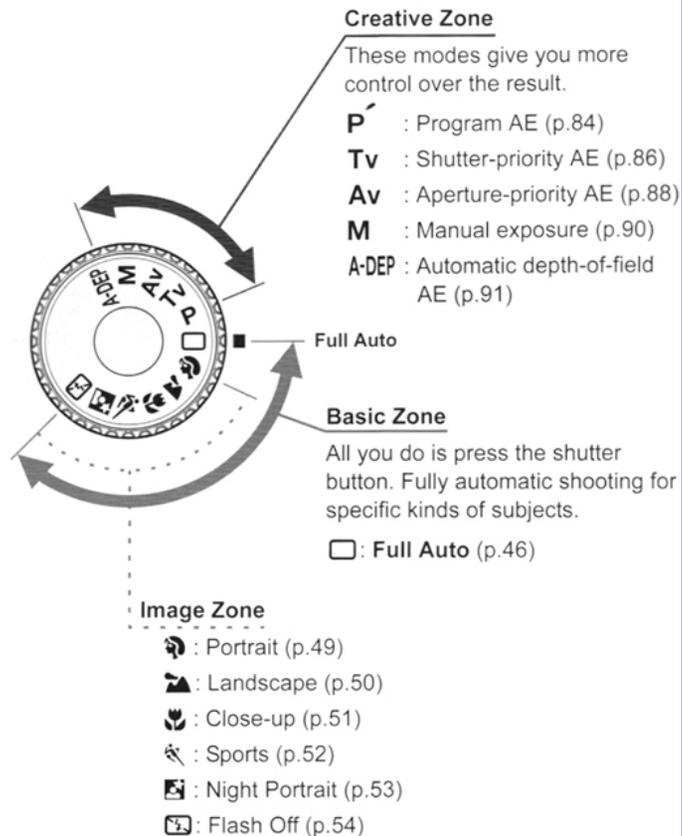## **D**igital **S**ingle **L**ens **R**eflex (DSLR)

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150 11 ISO 400 74

Start on Auto or Program Mode

Mode Dial
The Mode Dial has the Basic Zone modes and Creative Zone modes.

Camera User Settings

Creative Zone
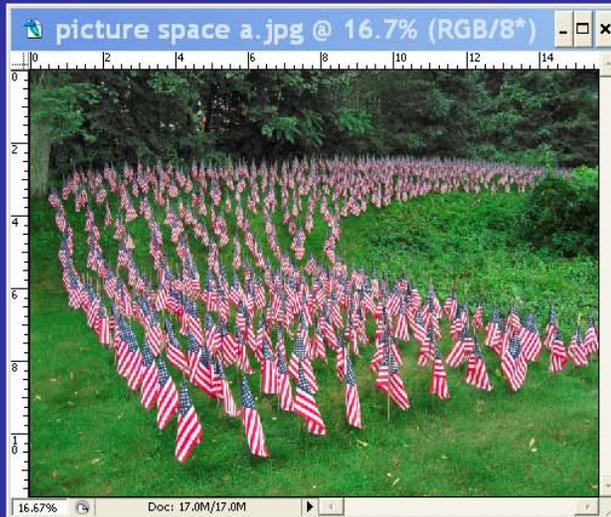These modes give you more control over the result.

P : Program AE (p.84)
Tv : Shutter-priority AE (p.86)
Av : Aperture-priority AE (p.88)
M : Manual exposure (p.90)
A-DEP : Automatic depth-of-field AE (p.91)

Full Auto

Basic Zone
All you do is press the shutter button. Fully automatic shooting for specific kinds of subjects.

□ : Full Auto (p.46)

Image Zone
🔹 : Portrait (p.49)
🏔 : Landscape (p.50)
🌷 : Close-up (p.51)
🏃 : Sports (p.52)
🌃 : Night Portrait (p.53)
🚫 : Flash Off (p.54)

extract from Canon 40D User Guide

Automatic mode

Size of Picture Space Differs

Camera Canon D5

Camera Canon SD700

picture space a.jpg @ 16.7% (RGB/8*)

16.67% Doc: 17.0M/17.0M

Picture space B.jpg @ 16.7% (RGB/8*)

16.67% Doc: 35.6M/35.6M

2816 x 2112 pixels
(about a 1.33 ratio)

Print size 4x5.33, etc

4368 x 2912pixels
(about a 1.5 ratio)

Print size 4x6, etc

Try to carefully select and position all elements in whatever picture space your camera provides

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Plan Use of Picture Space (1)

Try to carefully select and position all elements in whatever picture space your camera provides

Camera Canon SD700

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Plan Use of Picture Space (2)

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Try to carefully select and position all elements in whatever picture space your camera provides

Remember Film

- A range of Sensitivity Ratings (*ASA & later ISO*)
  - •• ISO 50, 100, 200, 400, 1600, 3200 etc.
    - ••• Black & White, Color, Print film, Slide film
- We can buy tungsten rated film or outdoor film

Digital lets us adjust chip sensitivity to brightness and compensate for the character of light source

- But not always with the forgiveness (latitude) of some film.

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Take Camera off Automatic

You can take control

- Av - you control
  - Amount of Light

- Tv - you control
  - Duration on Exposure

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Exposure Duration

How long the light strikes the sensor

- Determined by how long shutter is open

- Shutter Speed (fractions or # of seconds)

- 1/120, 1/60, 1/30, 1/15, 1, 2, 4, etc

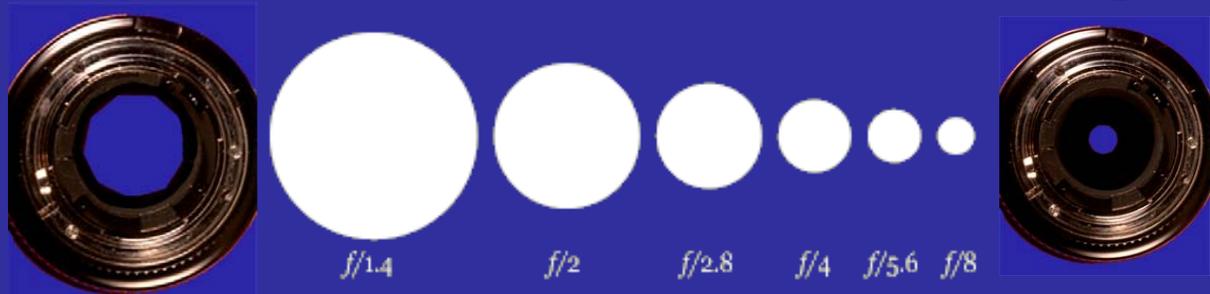Long duration (slow shutter speeds) are OK
If there is little or no movement

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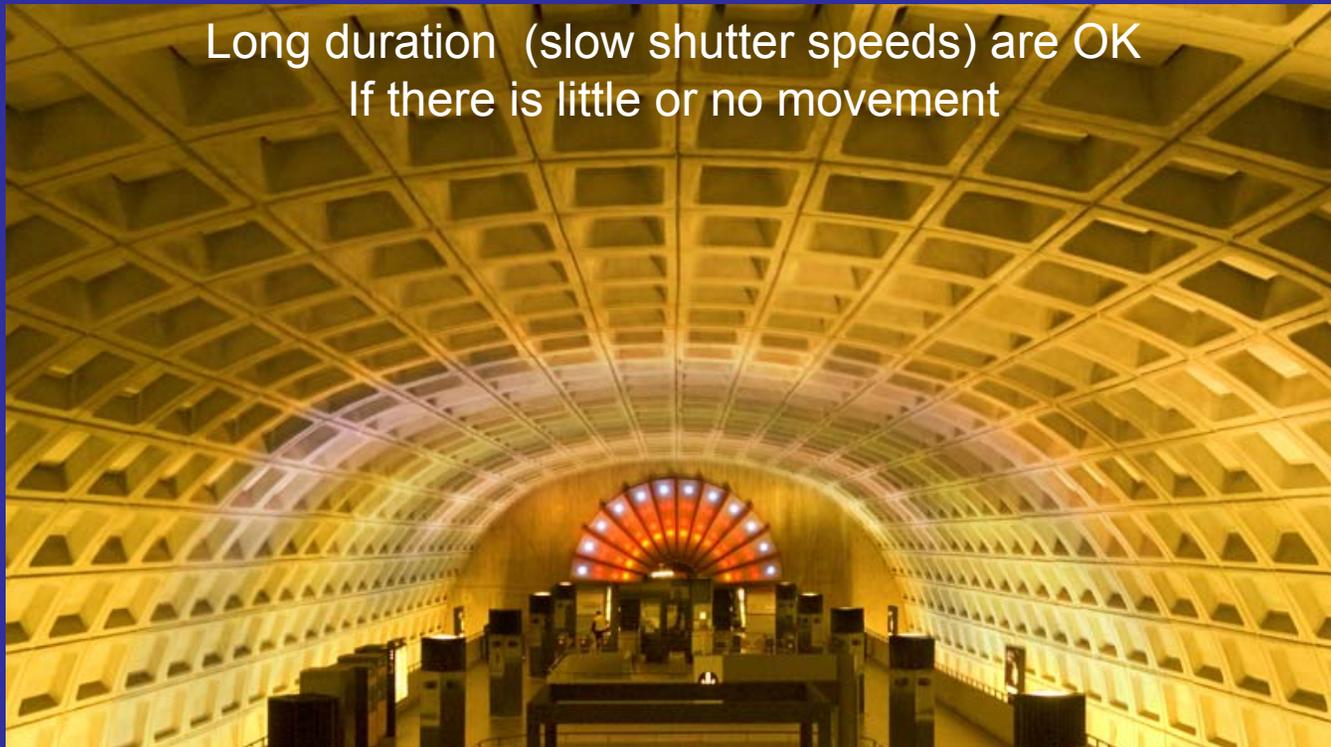
How Much Light *(Volume)*

How Much Light (Volume) passes through lens

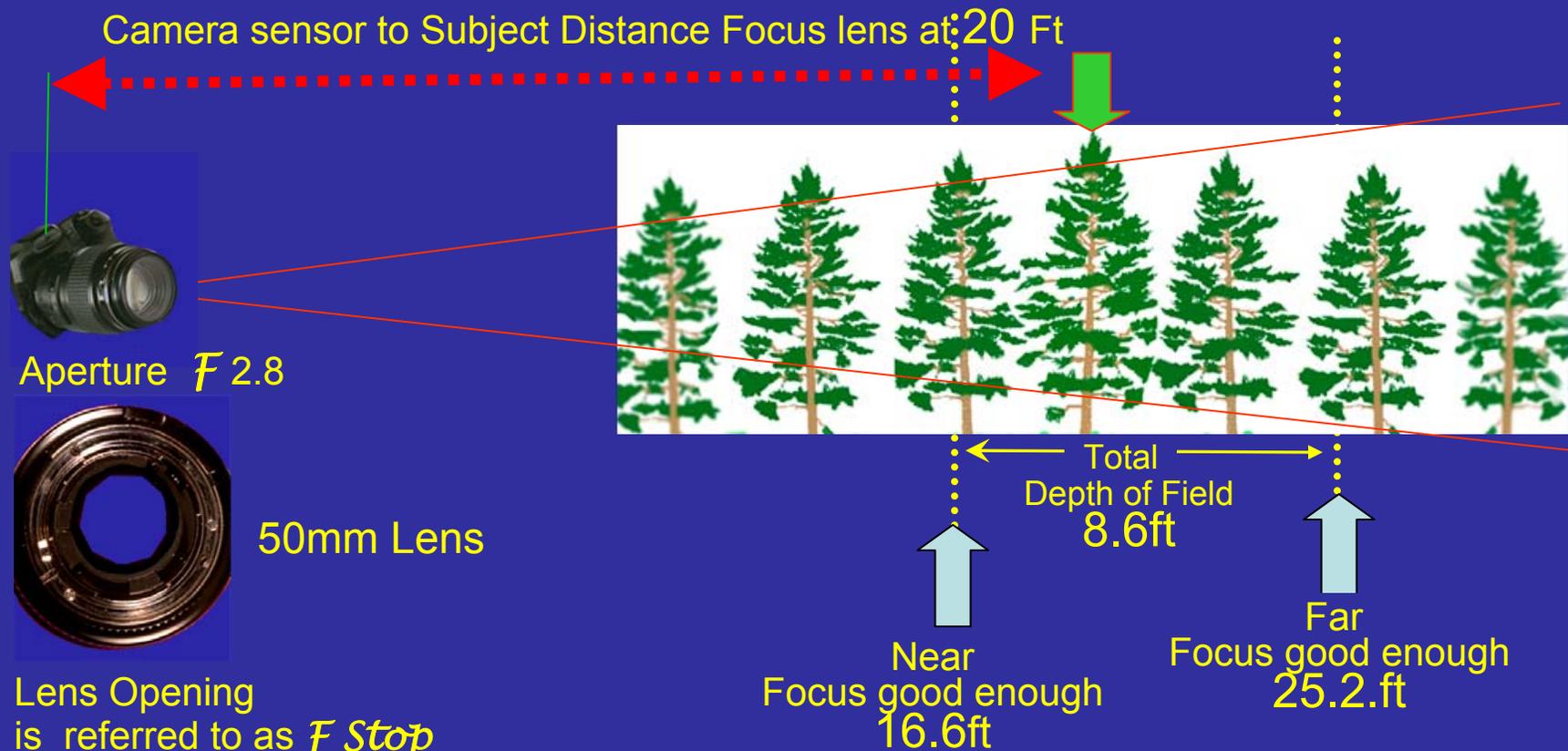- Determined by the size of the opening

  - *F* stop

f/1.4 f/2 f/2.8 f/4 f/5.6 f/8

Standard full stop numbers = *F # 1.0, 1.4 2, 2.8, 4, 5.6, 8, 11, 16, 22, 32, 45, 64,*

Many cameras also give ½ or 1/3 stop increments

F Stop Dtermines Depth Of Field

Depth of Field Consideration (1)

Camera sensor to Subject Distance Focus lens at 20 Ft

Aperture F 2.8

50mm Lens

Lens Opening
is referred to as F Stop

√ Small **number**

√ **Large** Opening

√ **Narrow in-focus depth**

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Total
Depth of Field
8.6ft

Near
Focus good enough
16.6ft

Far
Focus good enough
25.2.ft

Diagram not to exact scale

15

http://www.dofmaster.com/dofjs.html

Depth of Field Consideration (2)

Camera sensor to Subject Distance
Focus lens at 20 Ft

Aperture *F 11*

50mm Lens

Total
Depth of Field
100ft

Near
Focus good enough
11ft

Far
Focus good enough
111.6.ft

Lens Opening
is referred to as *F Stop*
√ **Larger** number
√ Smaller **Opening**
√ **More in-focus depth**

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Diagram not to exact scale

16

http://www.dofmaster.com/dofjs.html

Depth of Field Consideration (3)

Camera to Subject Distance

Focus lens at 20 Ft

Aperture *F* 22

50mm Lens

Total
Depth of Field
infinity

Near
Focus good enough
7.5ft

Far Focus
good
To infinity
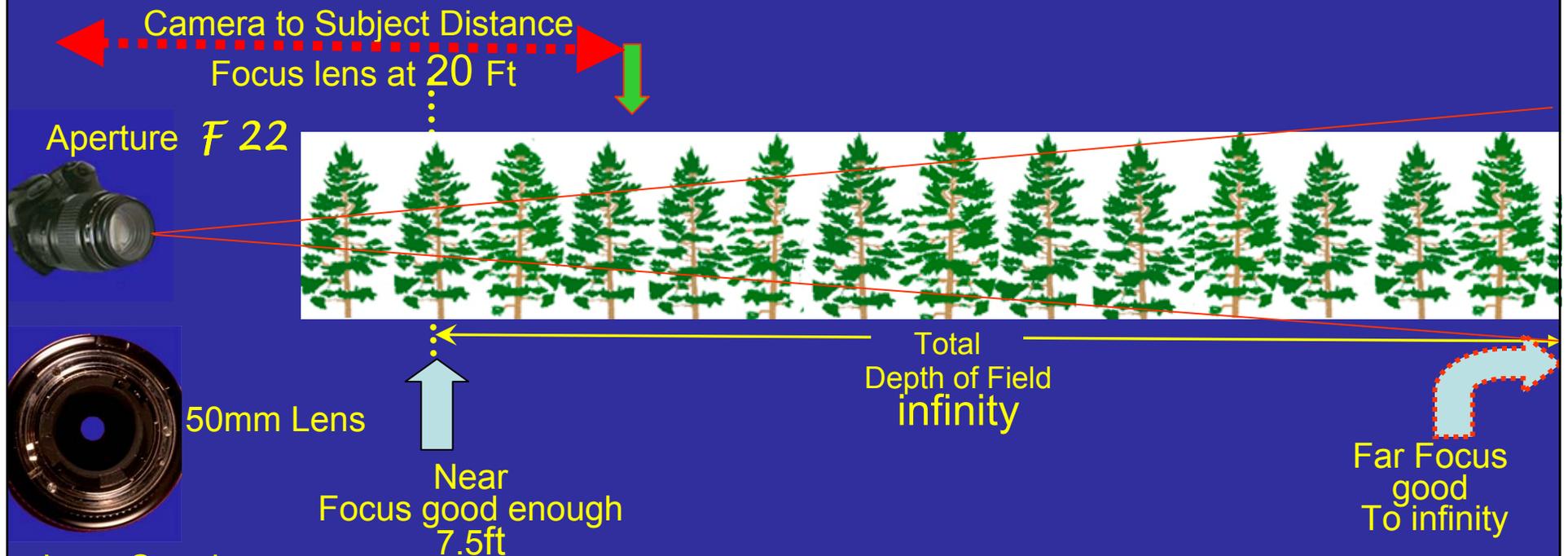
Lens Opening
is referred to as *F Stop*

√ **Largest** number

√ Smallest **Opening**

√ **Max in-focus depth**

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NOTE: Most Lenses are less sharp
at smaller lens opening (higher F stop #).

Diagram not to exact scale

17

http://www.dofmaster.com/dofjs.html

An Analogy

Filling bucket of water

Too much water = Spill of floor

Exposing sensor to Light

Too much light = Blown out image

f/1.4   f/2   f/2.8   f/4   f/5.6   f/8

Fire
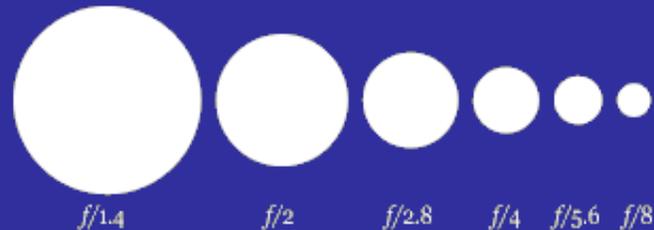
Too little is ineffective.   Too much, to fast, is just wasted.

Image Underexposed.   *Image overexposed – blown out*   18

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The Triangle (2)

The Triangle (4)

Tradeoffs

Higher ISO causes Grain

Larger Lens opening reduces in-focus area both in front of and behind the plane of focus.

(not always bad)

Smallest Lens opening usually less sharp and give less contast

Longer exposure allows motion blur

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- ## Stop the baseball traveling about 80 mph
  - ### Requires a fast shutter speed
    - #### Suggesting a large aperture opening
      - But that may not be sufficient
        - » So increase ISO (chip sensitivity) on digital

Canon D40
Lens Canon 70-200
At 78mm
Burst 6.5 fps
ISO: 1600
F 4.0
Shutter: 1/1600 sec.
Focus on batter
Press shutter as
pitcher winds-up

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- I wanted have the row of buildings as well as the photographer on the beach in focus.
  - Anticipate using small lens opening (high aperture #)
  - May require too long of an exposure to hand hold camera
  - So use tripod, or increase ISO -- or both!

Canon 5D
ISO 400
Focal Length
40mm
Aperture F32
Shutter 2 sec.

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Tradeoff – Same Exposure
ISO 400 with 2 sec. exposure
Vs.
ISO 1600 With ½ sec. exposure
Expect more grain and less contrast at Higher ISO.

Focus Points (1)

Shows areas in focus (Selectable in some cameras)
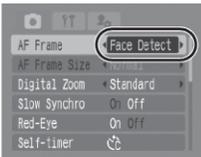

Select [AF Frame].

1. Press the (MENU) button.
2. In the [⬛] menu, use the ⬆ or ⬇ button to select [AF Frame].

AF Frame — Face Detect
AF Frame Size — Normal
Digital Zoom — Standard
Slow Synchro — On Off
Red-Eye — On Off
Self-timer

Accept the setting.

1. Use the ⬅ or ➡ button to select an AF frame option.
2. Press the (MENU) button.
- Changing the AF Frame Size (p. 99).

AF Frame — Face Detect
AF Frame Size
Digital Zoom — Standard
Slow Synchro — On Off
Red-Eye — On Off
Self-timer

Camera can automatically focus on closest subject

Or

You can select an autofocus point

Note: These will vary by camera make and model

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Focus Points(2)

Selectable in many cameras

Focus Points (3)

Don't let it fall on the wrong spot and ruin your shot

Selected Autofocus Point

Metering Modes

Evaluative: splits the view into zones and averages them to get a good overall exposure of the entire scene. It may lean towards the area around the active focus point. *This is will work most of the time.*

Partial: looks at about 9% of the view in the center circle displayed in the viewfinder.
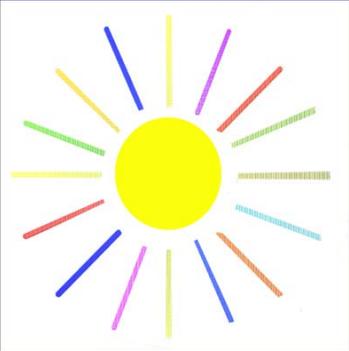
Center-weighted: looks at the entire scene but weighs heavily to the general center of the view.

Spot: Most of the meter sensitivity is concentrated on selected spot. Some cameras use the selected focus point and others the center of the focusing screen
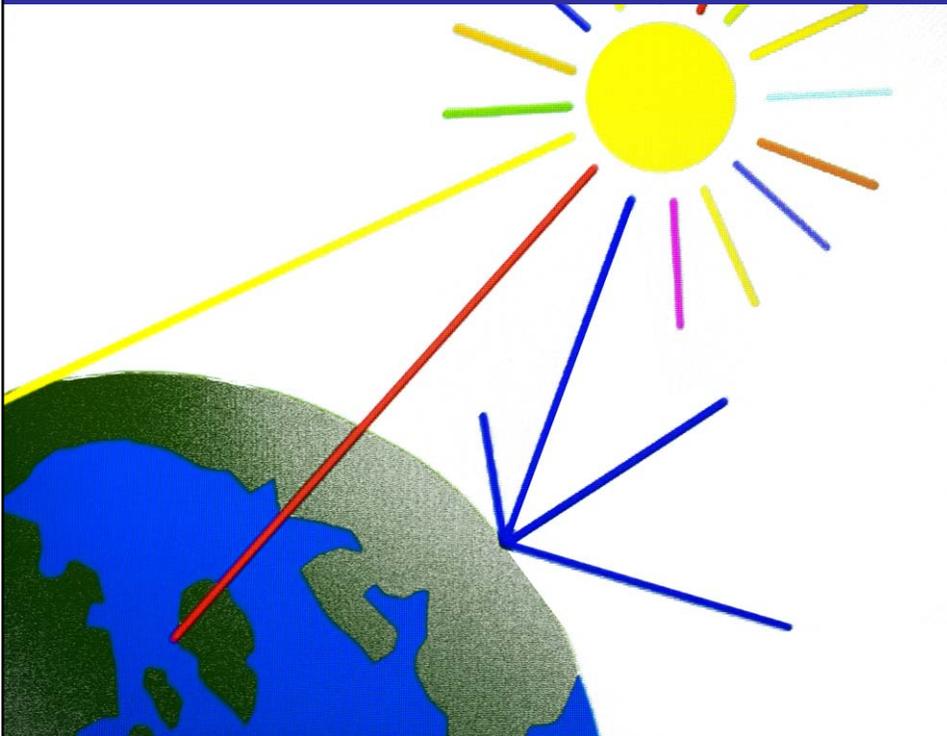
Note: These will vary by camera make and model

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White Balance (1)

- ## Sun emits spectrum of Light (all colors)
  -- White Light (~ 5200°K)
- ## Spectrum partially lost in atmosphere

EXAMPLE

- Sun low on the horizon
- Short wavelengths scattered
- More "golden light"
  -- Color Temp is lower (~2900°K)

√ On AUTO camera may give improper adjustment

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White Balance (2)

Adjusting for composition of the light spectrum

Colors the eye sees

may not be what the camera records

●● Using film, to compensate we changed from <u>tungsten</u> to <u>daylight</u> film
   --- or used filters

   ●●● With digital cameras, we adjust the White Balance
      --- Either before taking the shot
         --- e.g., Auto, Day Light, Shade, Cloudy, Tungsten, Fluorescent, Flash, Custom
      ---- Or in post-processing (Raw Images)

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White Balance (3)

Indoor shot under incandescent light
but camera was left on daylight setting

Indoor shot under incandescent light
with camera set for incandescent

White Balance (4)

Adjusting for composition of the light spectrum

Color Temp set to 3000° K

Color Temp set to 4000° K

Color Temp set to 5000° K

Color Temp set to 6000° K

Color Temp set to 7000° K

Color Temp set to 8000° K

White Balance (5)

Approximate color temp of light sources

- 1000K   Candles; oil lamps
- 2000K   Very early sunrise; low effect tungsten lamps
- 2500K   Household light bulbs
- 3000K   Studio lights, photo floods
- 4000K   Clear flashbulbs
- 5000K   Typical daylight; electronic flash
- 5500K   The sun at noon near Kodak's offices
- 6000K   Bright sunshine with clear sky
- 7000K   Slightly overcast sky
- 8000K   Hazy sky
- 9000K   Open shade on clear day
- 10,000K   Heavily overcast sky
- 11,000K   Sunless blue skies
- 20,000+K   Open shade in mountains on a really clear day

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Immediacy

- Photographer decides when the picture is taken
  - Distinct aesthetic characteristic of photography
    (Yes, I know you can Photoshop something in later)

- But there is a delay in camera response
  - Lag time between pressing shutter and actual exposure
    - Total Lag = autofocus lag + shutter lag
- Example shutter lag for our cameras:
  - Canon 1N RS (film) .006 sec (six milliseconds)
  - Nikon F-5 (film) .043 seconds (43 milliseconds) milliseconds
  - Canon D5 Digital SLR .059 sec
  - Canon D40 Digital SLR .075 sec

- Not a big concern with many of today's digital cameras
  - But lag is critical in some instances

  - For lag in various digital cameras see:
    http://www.Impulseadventure.com/photo/shutter-lag.html

- Burst Rate (how many frame per second) is different from lag time
  -- a function of how fast the built-in computer saves the image

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Immediacy / Exposure Duration

- Baseball pitch at 80 mph= 422,400 ft / 3,600 sec.
  - that is about 117.3 ft per second
    (Home plate to pitcher about 60ft)
  - In a 1/100th sec. exposure, ball moves 1.27 ft.
  - In a 1/1000th sec. exposure, ball moves ~1½ inches
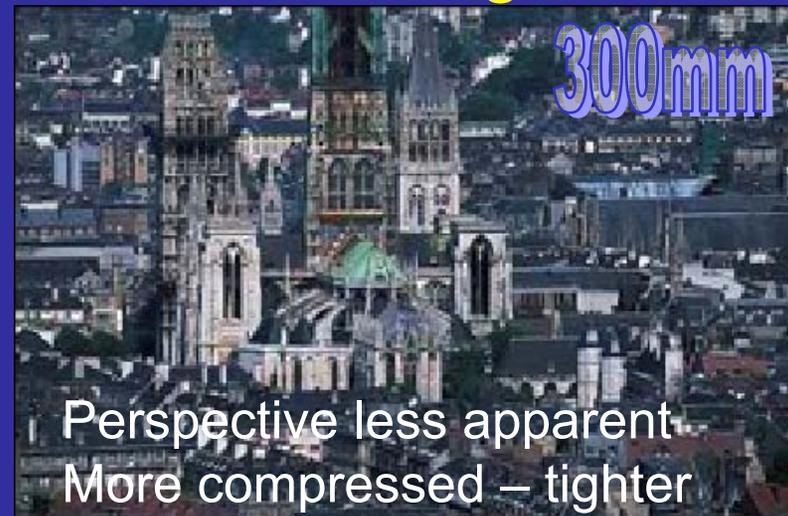 - Press the shutter button at the wind-up

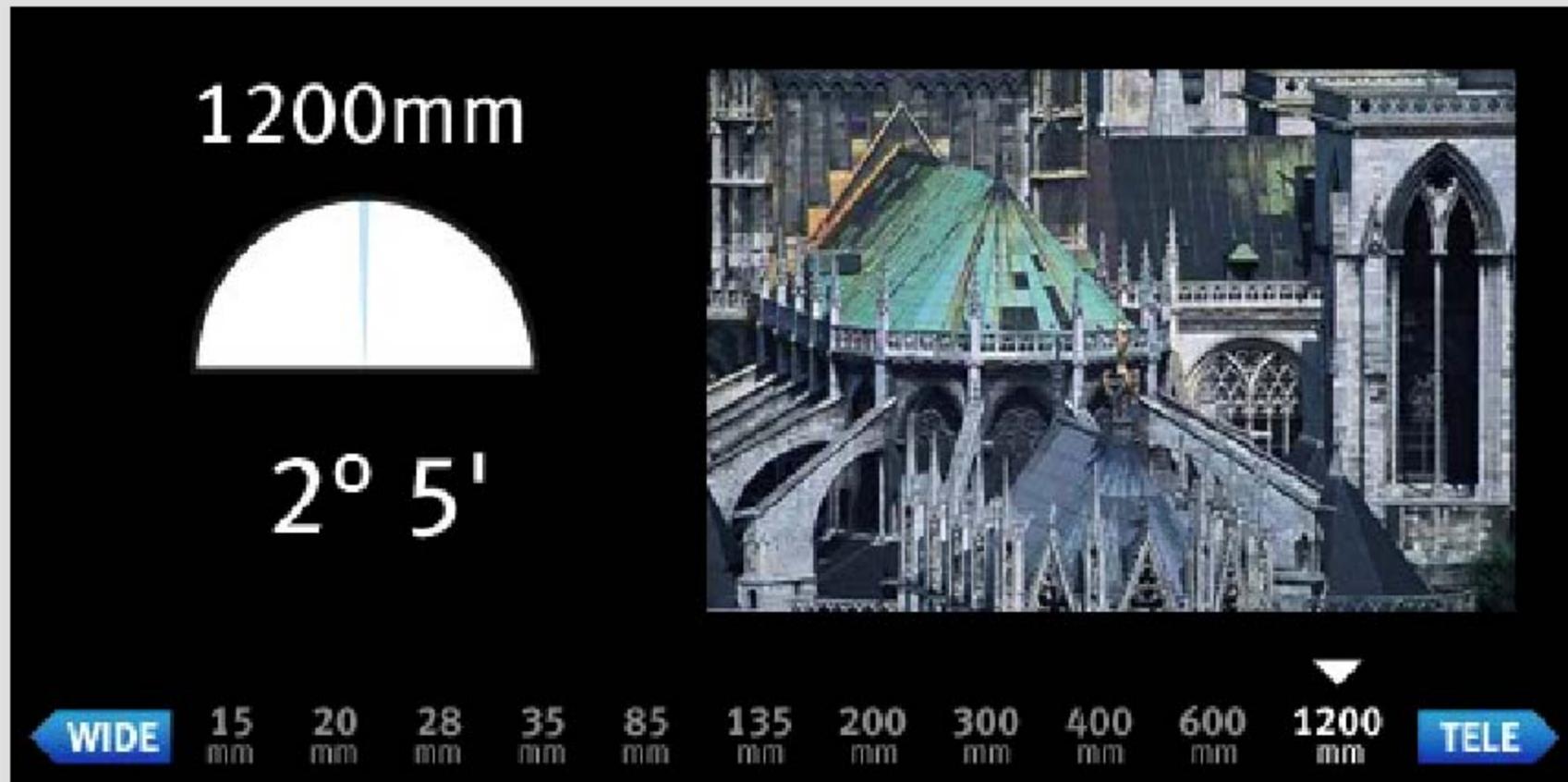Dan Feighery

Many Lens Types Available

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Lens selection – Focal Length

- Focal length -> reference point for Lens categories
  - Single focal length Lenses have one focal length
    - 50mm focal length approximates to what eye sees.
  - Zoom Lenses have a range of focal lengths

• <u>shorter</u> focal length called <u>wide-angle</u>	• <u>longer</u> focal length called <u>telephoto</u>
-- wide angle of view	-- narrow angle of view

15mm

300mm

Perspective more apparent

Perspective less apparent
More compressed – tighter

Wide Angle to Telephoto

Compare 28mm -> 500mm

Wide Angle Lens separates objects (Close vs Far)

Telephoto lens compresses distance

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Crop Factor (1)

Rectangle is
what falls on the full
size (36mmx24mm) sensor

Circle is
what the
Lens Sees

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Crop Factor (2)

15x22.5 APS-C "crop"

Focal length of lens did not change
but apparent angle of view did

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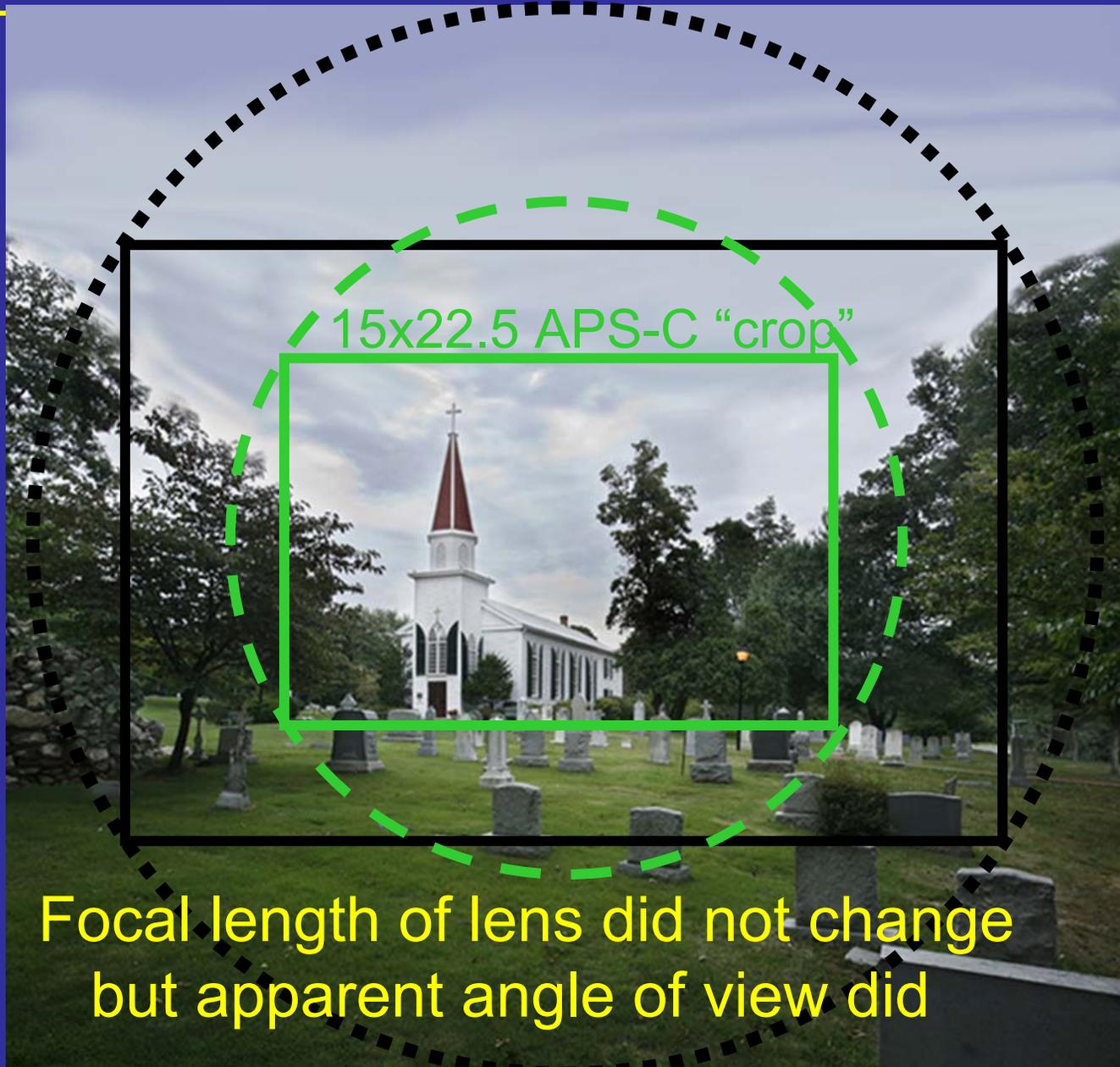
Crop Factor Example (1)

Angle of View varies with sensor size resulting in "Crop Factor"

Example: A 50mm lens fitted to our D5 camera (full frame) acts like a 80 mm lens when used on our 40D camera that has a smaller chip -- resulting in a 1.6 crop factor

50mm lens acts like 80mm (50 + (.6 x 50)) = 80

Helps Some shots

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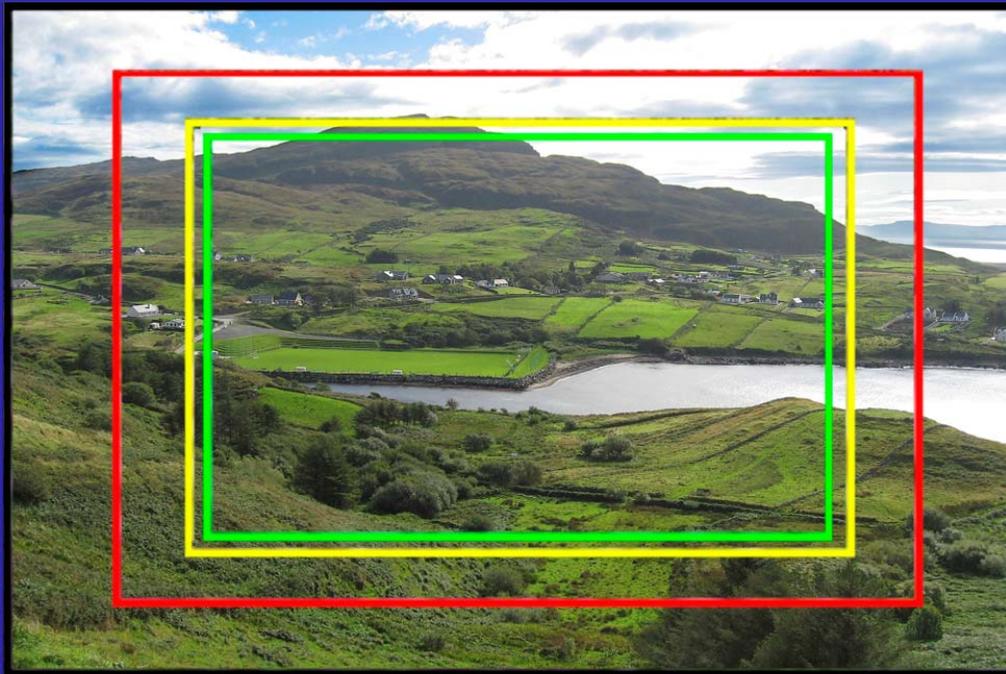
Canon D1-series=1.3,   Nikon DX= 1.5,   Canon Consumer Series 1.6

Crop Factor Example (2)

Angle of View varies with sensor size resulting in "Crop Factor"

Example: A 50mm lens fitted to our D5 camera (full frame) acts like a 80 mm lens when used on our 40D camera that has a smaller chip -- resulting in a 1.6 crop factor

50mm lens acts like 80mm (50 + (.6 x 50)) = 80

Dan Feighery Canon D1-series=1.3,   Nikon DX= 1.5,   Canon Consumer Series 1.6
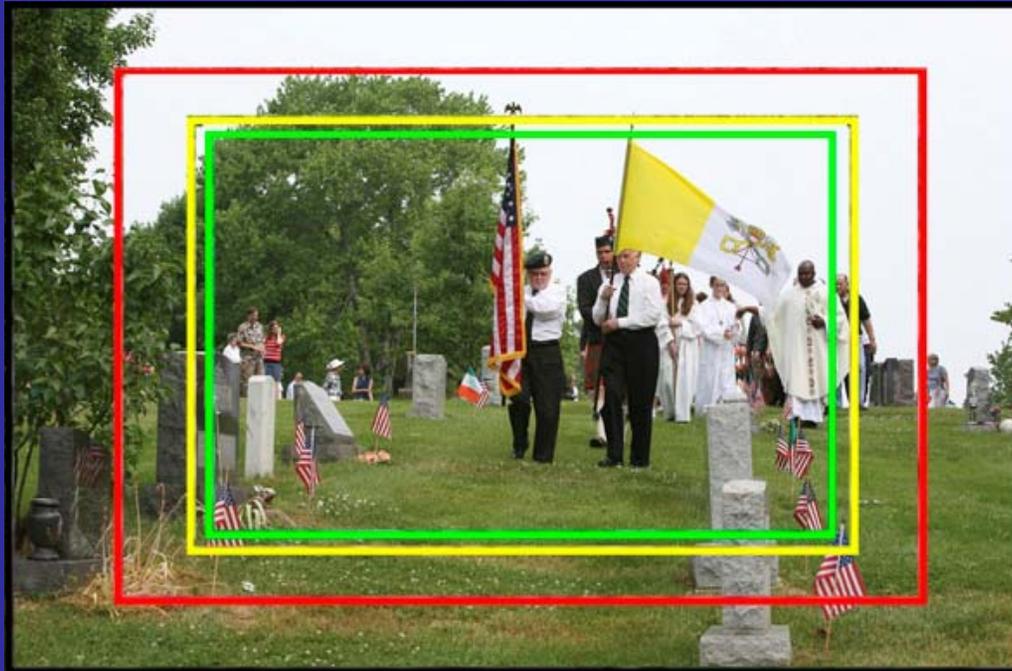
ZOOM - Getting Close (1)

Optical vs. Digital

10X Optical Zoom   10X Digital Zoom

http://www.cambridgeincolour.com/tutorials/image-interpolation.htm

Zoom # (e.g.,10X) is simply an equivalent focal length ratio

500mm/50mm=10x zoom   200mm/20mm= 10x zoom 100mm/10mm=10x zoom

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Zoom - Getting Close (2)

Optical vs. Digital

This shot taken with 500mm lens

Optical vs. Digital
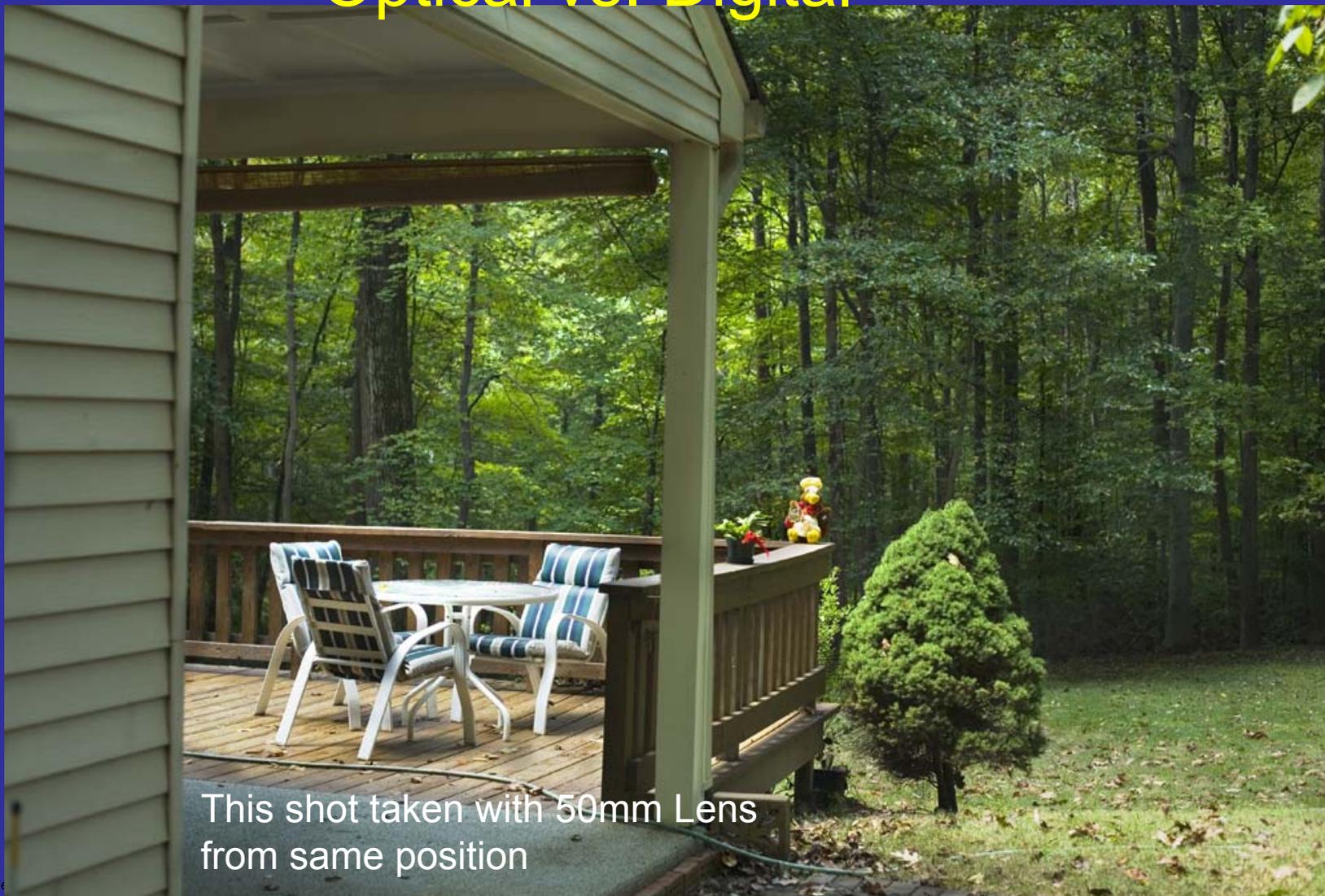
This shot taken with 50mm Lens from same position

ZOOM - Getting Close (4)

Compare

Digital Zoom From 50 MM lens

This shot taken with 500mm lens

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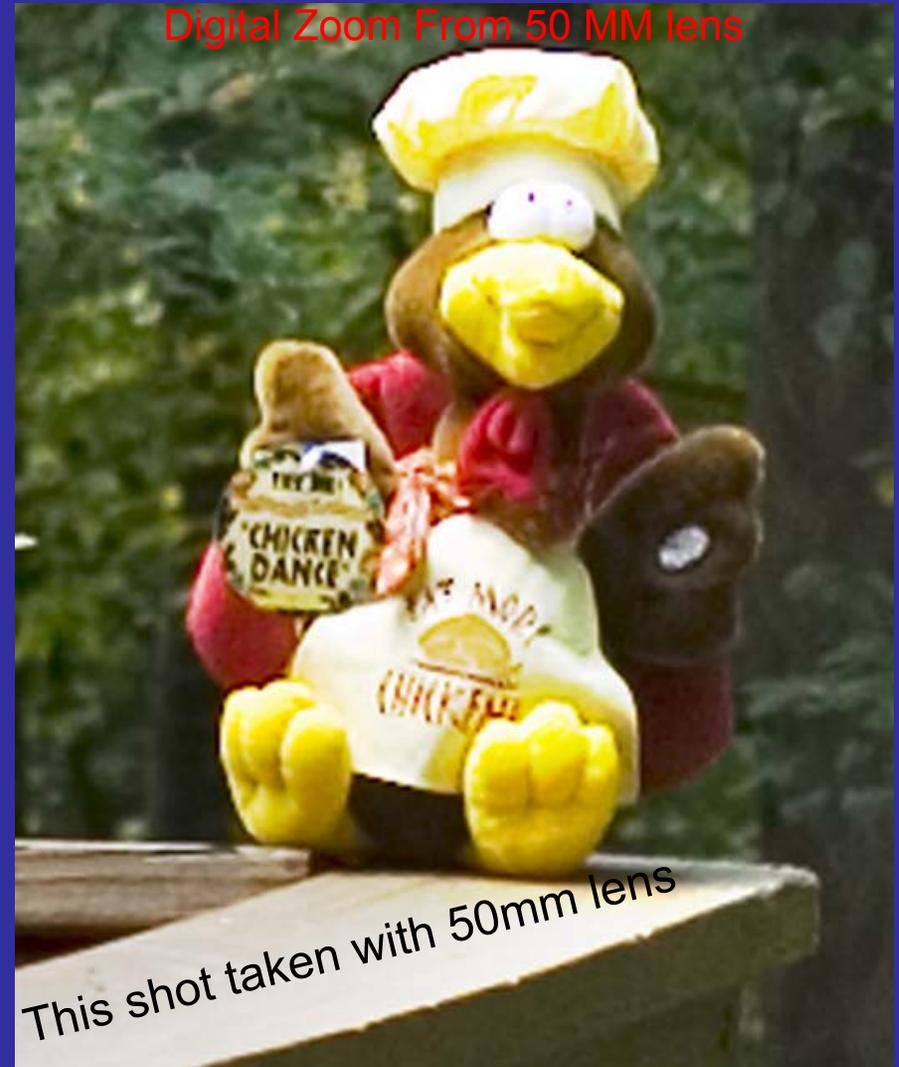
This shot taken with 50mm lens

Image Sizes

File Format options: Jpg, RAW, RAW + Jpg
-RAW provides more processing options
-- Requires study on software options and use
--- All RAW formats are not the same
- Camera processes the raw data to get jpg image

ILLUSTRATIVE FILE & IMAGE SIZES

J P G
Large: Approx. 17.90 Megapixels (5,184 x 3,456)
Medium: Approx. 8.00 Megapixels (3,456 x 2,304)
Small: Approx. 4.50 Megapixels (2,592 x 1,728)
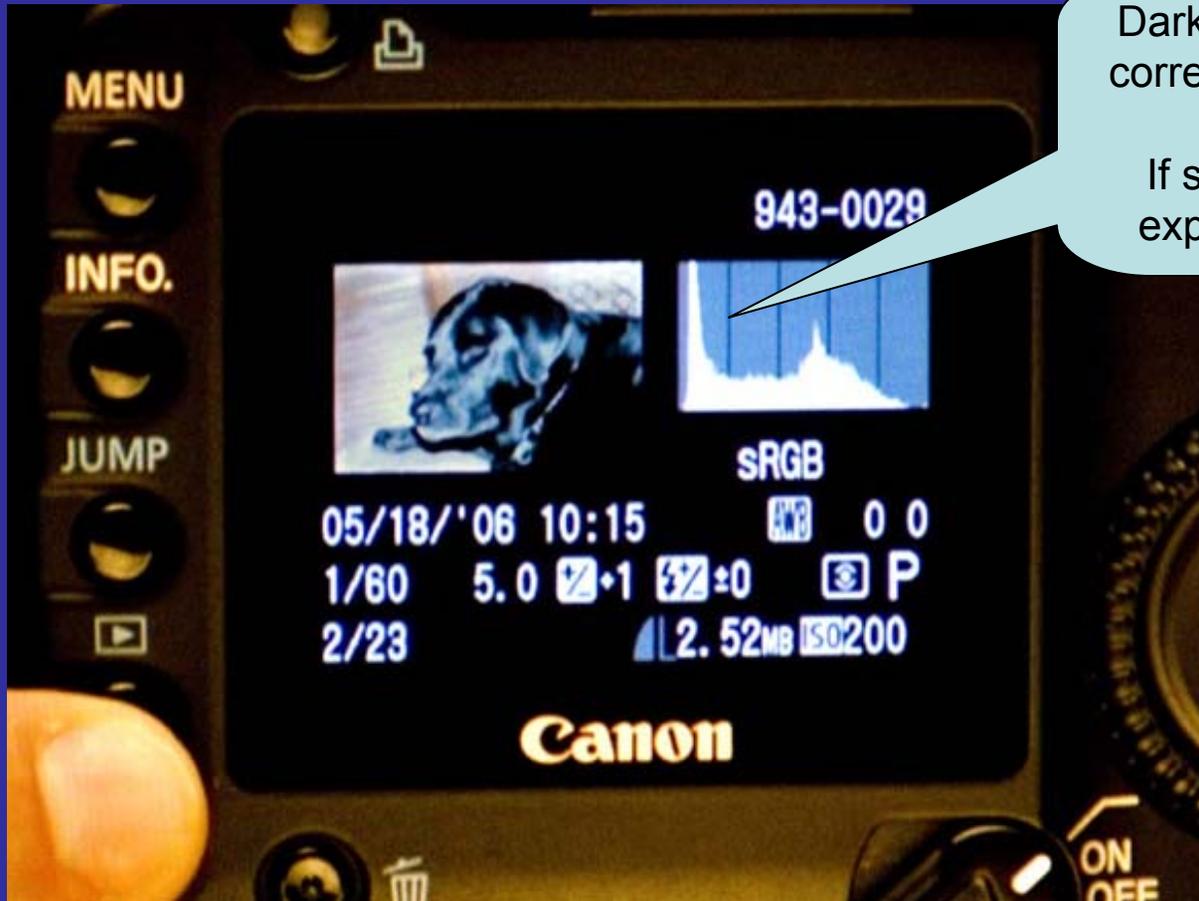
R A W
RAW: Approx. 17.90 Megapixels (5,184 x 3,456)
M-RAW: Approx. 10.10 Megapixels (3,888 x 2,592)
S-RAW: Approx. 4.50 Megapixels (2,592 x 1,728)

Exact file sizes depend on subject, ISO speed, Picture Style, etc.

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Histogram – (Review after each shot)

- Examine camera image info
  - Picture and Histogram
    - Reshoot if desired

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Exposure Test – Setup (1)

Real world examination of Exposure and Color Temperature

- ## Subject:
  - Toy dog with jet black fur on light cream color cloth
  - Bowl of artificial white daisy flowers
  - Bright turquoise backdrop
  - Two Eiko brand photoflood bulbs (Type: BCA)
    - Bulb color temperature specification: 5000°K

Camera Settings for Test

Camera: Canon 5D

Lens: Tamron 28-75mm F2.8 Macro

Color Temp: set at 5000K

Aperture: set F16

Shutter speed: varied 0.8 to 4.0 sec.

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Note: Above photo taken with Canon SD700 on Auto (with Flash)

Exposure Test – Setup (2)

Varied exposure Approximately + & - 1 stop of light

Camera Settings for Test

Camera: Canon 5D

Lens: Tamron 28-75mm F2.8 Macro

Color Temp: set at 5000K

Aperture: set F16

Shutter speed: varied +/- 1 f-stop
- - 0.8 to 4.0 sec.

-1   About Half   0.8 second

-2/3 --------   1.3 second

-1/3 --------   1.6 Second

0   Mid-point   2 seconds

+1/3 --------   2.6 seconds

+2/3 --------   2.3 seconds

+1   About Double   4.O seconds

Note: Above photo taken with Canon SD700 on Auto (with Flash)

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"Right Exposure" from your meter?(1)

ISO 100, color temp set to 5000K F16 .8 sec

ISO 100. color temp set to 5000K F16 1.3 sec

ISO 100, color temp set to 5000K F16 1.6 sec

ISO 100, color temp set to 5000K F16 2 sec

"Right Exposure" from your meter? (5)

5

ISO 100, color temp set to 5000K F16 2.6 sec

6

ISO 100, color temp set to 5000K F16 3.2 sec

ISO 100, color temp set to 5000K F16 4.0 sec

"Right Exposure" from your meter?

"Right" Color Temperature?

Color Temp Camera set 5000k   Bridge reads "As shot" 4750K

Color Temp Camera set 5000k   Bridge: reset 4750K to 4000k

Color Temp Camera set 5000k   Bridge: reset 4750K to 3850K

RAW IMAGE ADJUSTED

Used F16 3.2 sec exposure and adjusted Color Temp Only

60

Composite

Point & Shoot or Single Lens Reflex

Choosing

Choose Point & Shoot if you need:

- Ease of use
- Portability
- Modest price

Choose SLR if you need:

- Very high quality images
- Quick response
- Better low-light performance
- Creative control

From Consumer Reports July 2008

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Comparisons

Digital point-and-shoot cameras

Lightweight subcompacts are easy to use and small enough to fit in a pocket, but most don't have manual controls. Compact cameras are a bit bigger and, along with superzooms, are more apt to have manual controls and RAW-file capability. Superzooms, with 10x or longer zoom, are ideal for sports and nature shots, but they're fairly large.

Type	Brand & model	Price	Overall score
Subcompact	**Canon** PowerShot SD1200 IS Elph	$200	71
	Fujifilm FinePix F200EXR	360	70
	Casio Exilim Card EX-S12	200	69
	Canon PowerShot SD780 IS Elph	230	68
Compact	**Canon** PowerShot A1000 IS	150	71
	Panasonic Lumix DMC-TS1	400	70
	Canon PowerShot D10	330	68
Superzoom	**Canon** PowerShot SX1 IS	570	75
	Sony Cyber-shot DSC-H20	260	71
	Canon PowerShot SX110 IS	300	69
	Samsung HZ10W	260	69

Look for new Ratings in the December issue.

▶ **SPOTLIGHT**

The Casio Exilim Card EX-S12, $200, is one of the thinnest and lightest subcompacts. It's just over a half-inch thick and weighs only 5 ounces. In our tests, it was speedy and did very well in low light.

From Consumer Reports Nov 2009

SLR cameras

Single-lens reflex cameras are for serious shooters. Big and fairly heavy, they use interchangeable lenses and have lots of features and manual controls. That adds to complexity and cost, though some new models are modestly priced. All prices below are for the body only, except the Canon EOS Rebel T1i, which includes a lens.

Type	Brand & model	Price	Overall score
Basic	**Canon** EOS Rebel T1i	$ 850	69
	Nikon D5000	730	67
	Pentax K200D	700	67
Advanced	**Nikon** D300	1,600	78
	Olympus E-3 Digital	1,250	77
	Canon EOS-40D Digital	900	76

Look for new Ratings in the December issue.
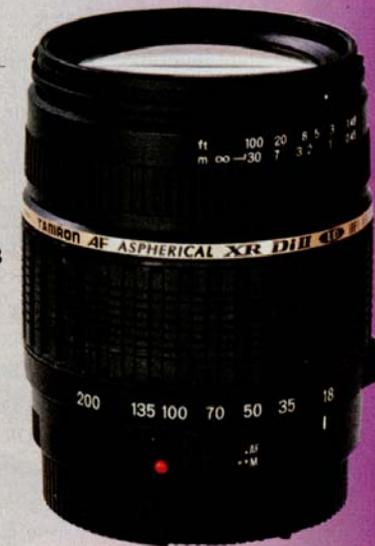
Canon EOS Rebel T1i

Olympus E-3 Digital

▶ **SPOTLIGHT**

Two great lenses for Canon, Nikon, Pentax, and Sony SLRs: the Sigma 18-200mm f3.5-6.3 DC and the Tamron AF18-200mm f3.5-6.3 Di II LD Aspherical (IF) Macro (shown). Each costs $300, half as much as big-brand lenses.
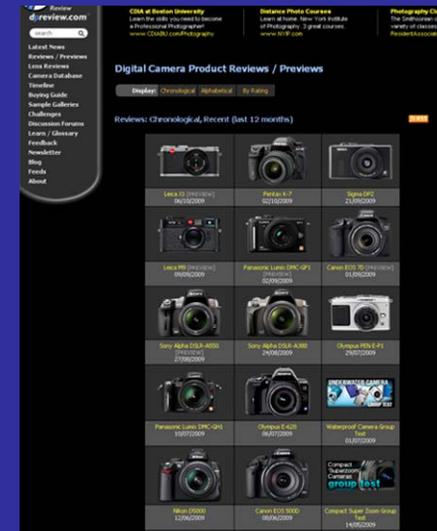
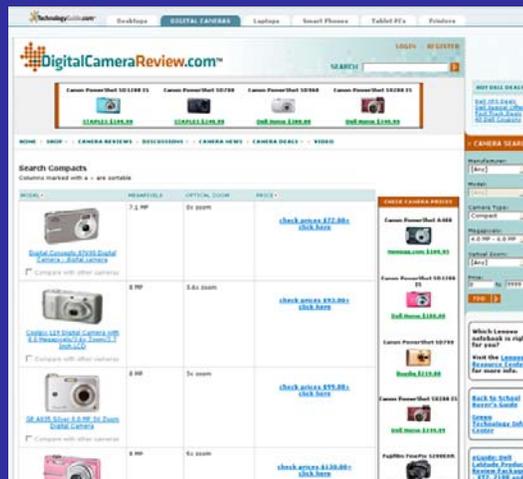*Look for new Ratings in the December issue.*

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Check the Reviews

http//www.photozone.de

http//www.dpreview.com

http//www.Digitalcamerareview.com

http//www.Fredmiranda.com

Some Visual Design Considerations

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Placement & Separation
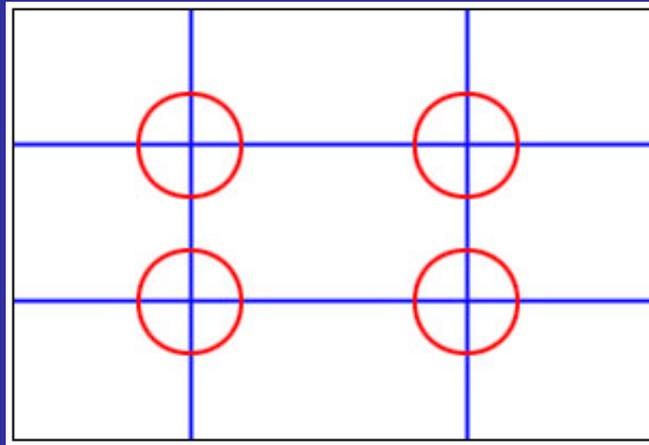
- **Isolate!** **Isolate!** **Isolate!**
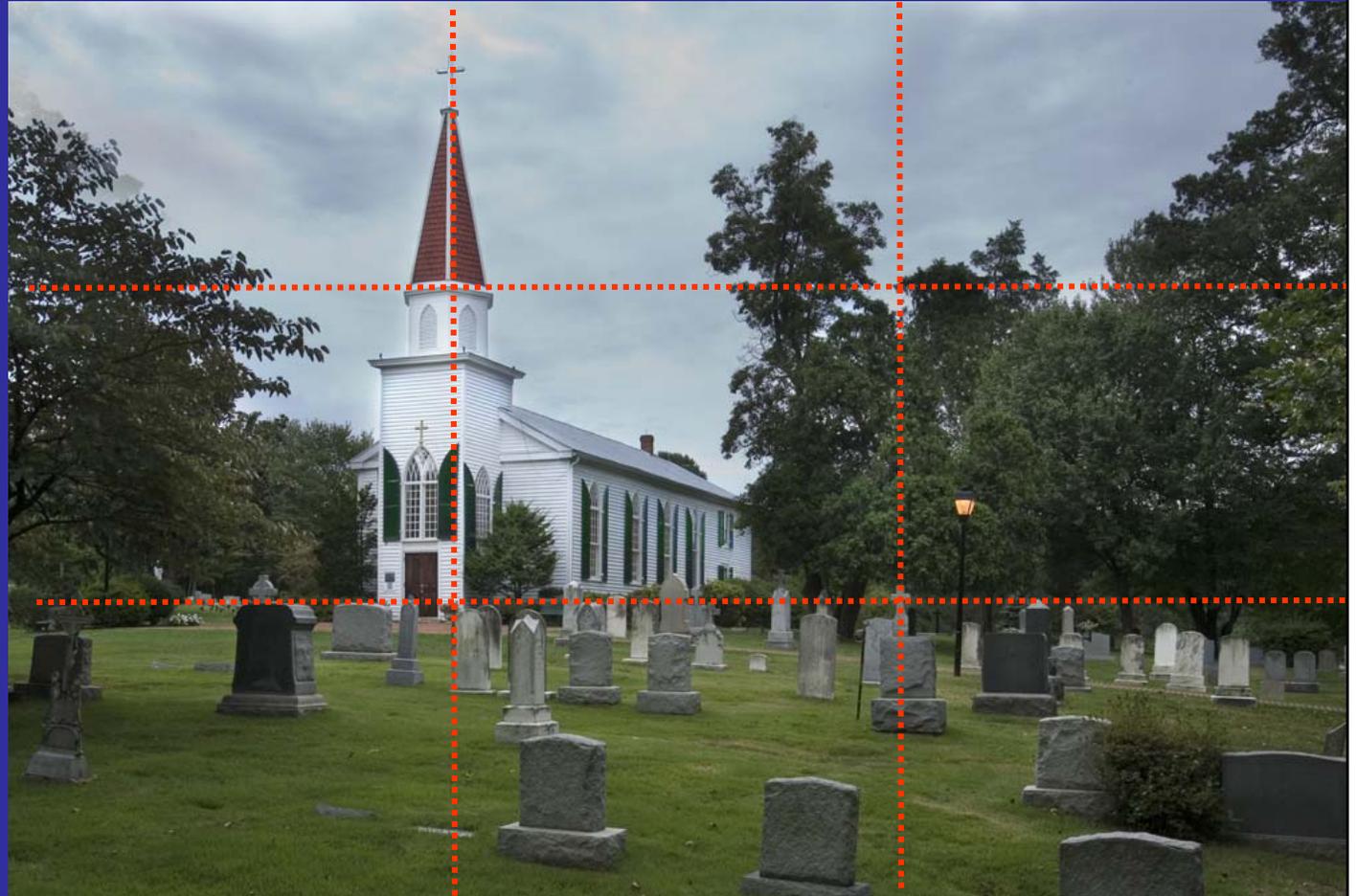 - Zoom in or crop to avoid clutter and distraction

Placement & Separation

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Rule of Thirds (1)
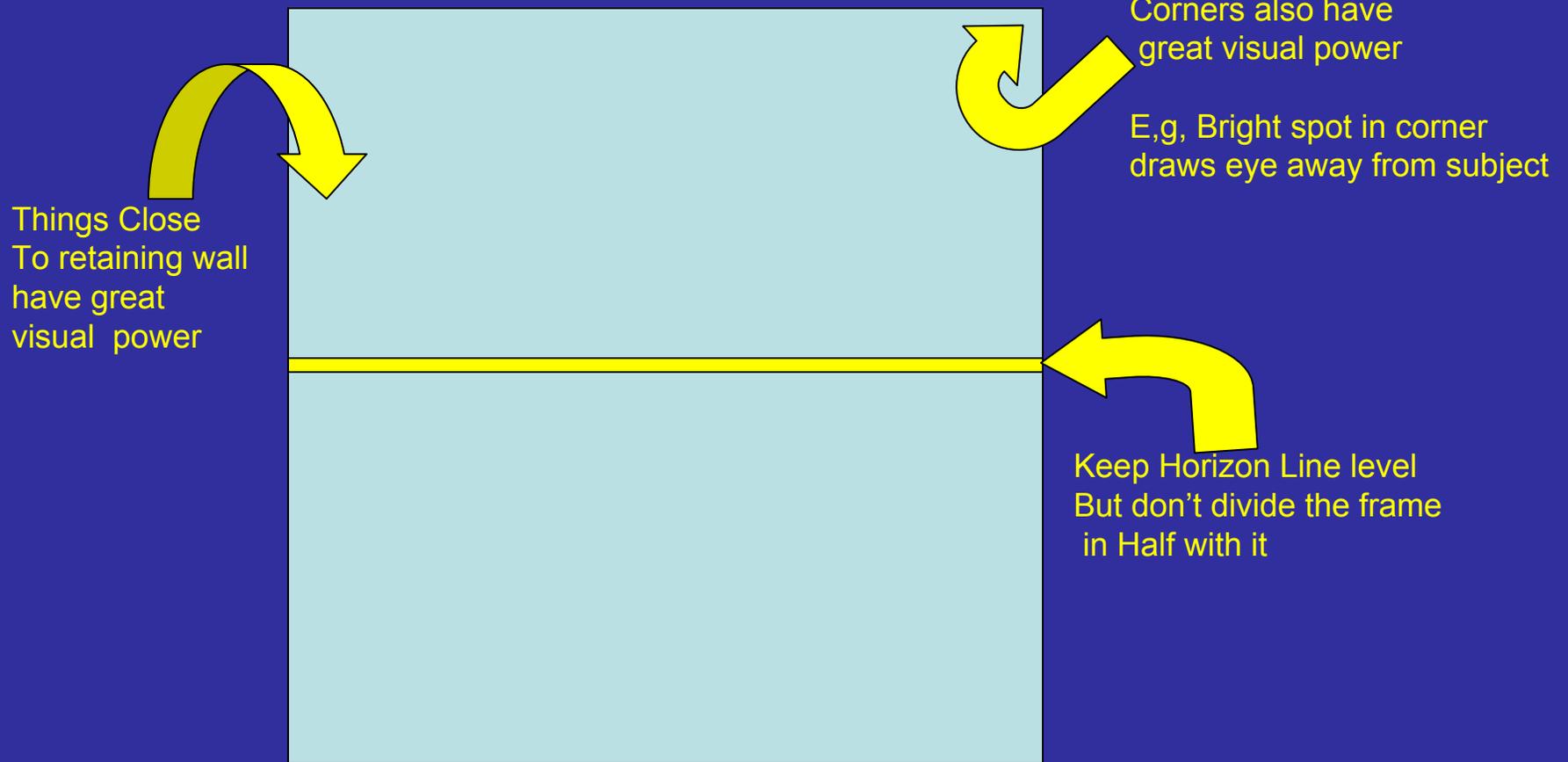

Rule of Thirds

- Often, the best place for the subject is at the intersections on imaginary tic-tac-toe board in our viewer

- Try variations of placements, points of views, lens zoom
  - Eye movement is generally left to right, so try an initial placement on the "right" to 'stop' the viewer's glaze

- Of course, sometimes it makes more sense to put the subject in the center
  - Symmetry, etc..

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Rule of Thirds (2)

- Divide image into thirds

- Place subject at intersection

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Elements of Visual Design (1)

Corners also have
great visual power

E,g, Bright spot in corner
draws eye away from subject

Things Close
To retaining wall
have great
visual power

Keep Horizon Line level
But don't divide the frame
 in Half with it

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Elements of Visual Design (2)

What is the trouble
with this image?

Softer Focus of background would help

Wing Clipped by Retaining Wall

Head is

Dead Center

Dark growth in this corner is distracting

Light Area of Corner Draws eye toward it

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Basic post-processing
Digital Darkroom

(Workflow)

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Basic Post-Processing Workflow

√ Make a duplicate copy to work
   (Save the Original - -rename the copy)

√ Adjust color temp if needed
   (for Raw Images)

√ Rotate & crop
   (Ensure horizon is horizontal)

√ Clean it up
   (Remove dust, scratches

√ Adjust tone

   (Adjust for details in light & dark areas)

√ Refine above 4 as needed

√ Sharpen

   (Print, mat & frame)

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Basic Post-Processing Workflow (2)

Adjust Color Temp of RAW file

As shot 5500 deg K

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Canon EOS 5D: _MG_0081.CR2 (ISO 800, 1/125, f/2.8, 16-35@16.0 mm)

• Adjust Color Temp of RAW file

Move to 3250 Deg K

Basic Post-Processing Workflow
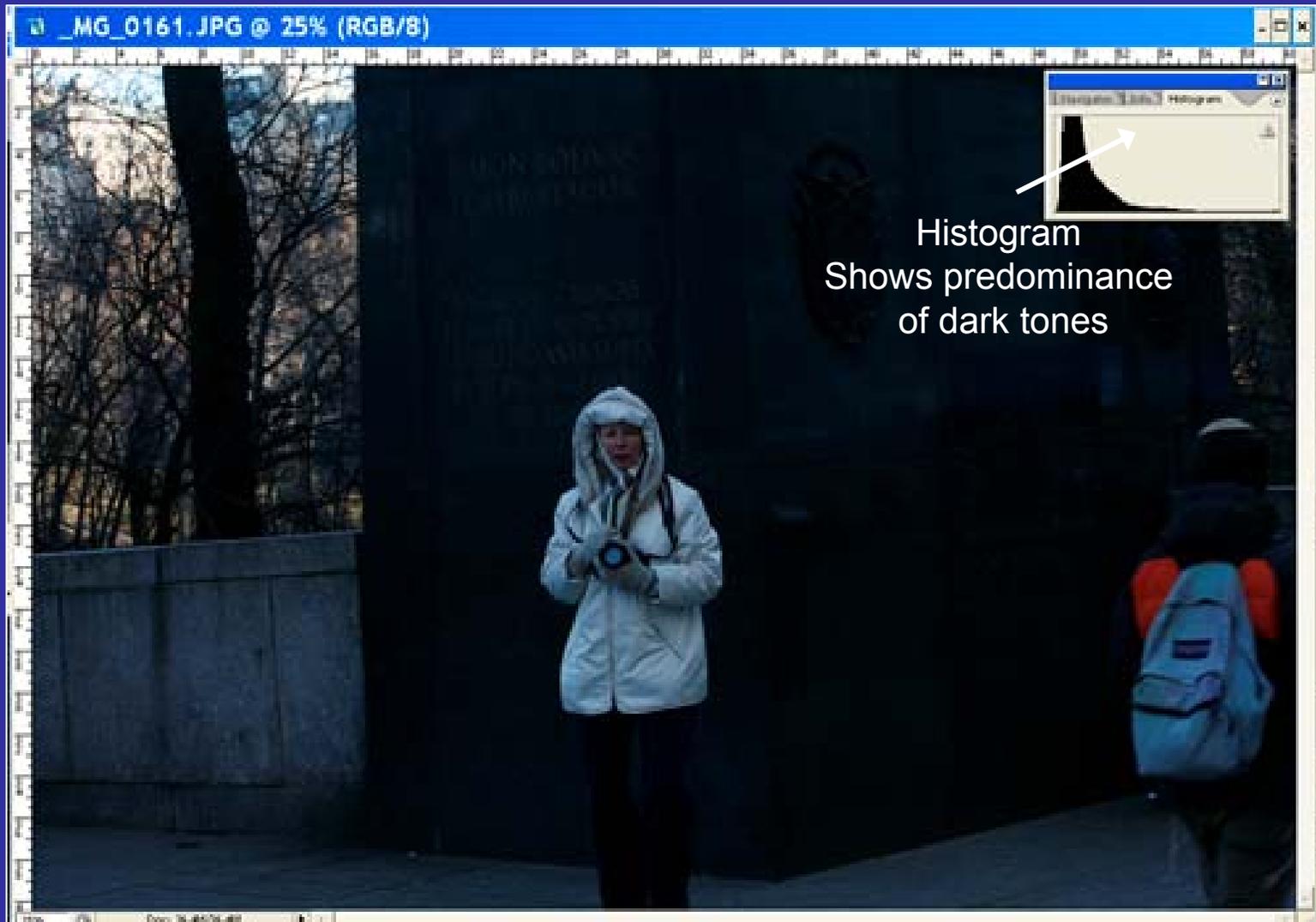
- Rotate & crop (& Ensure horizon is horizontal)

Basic Post-Processing Workflow

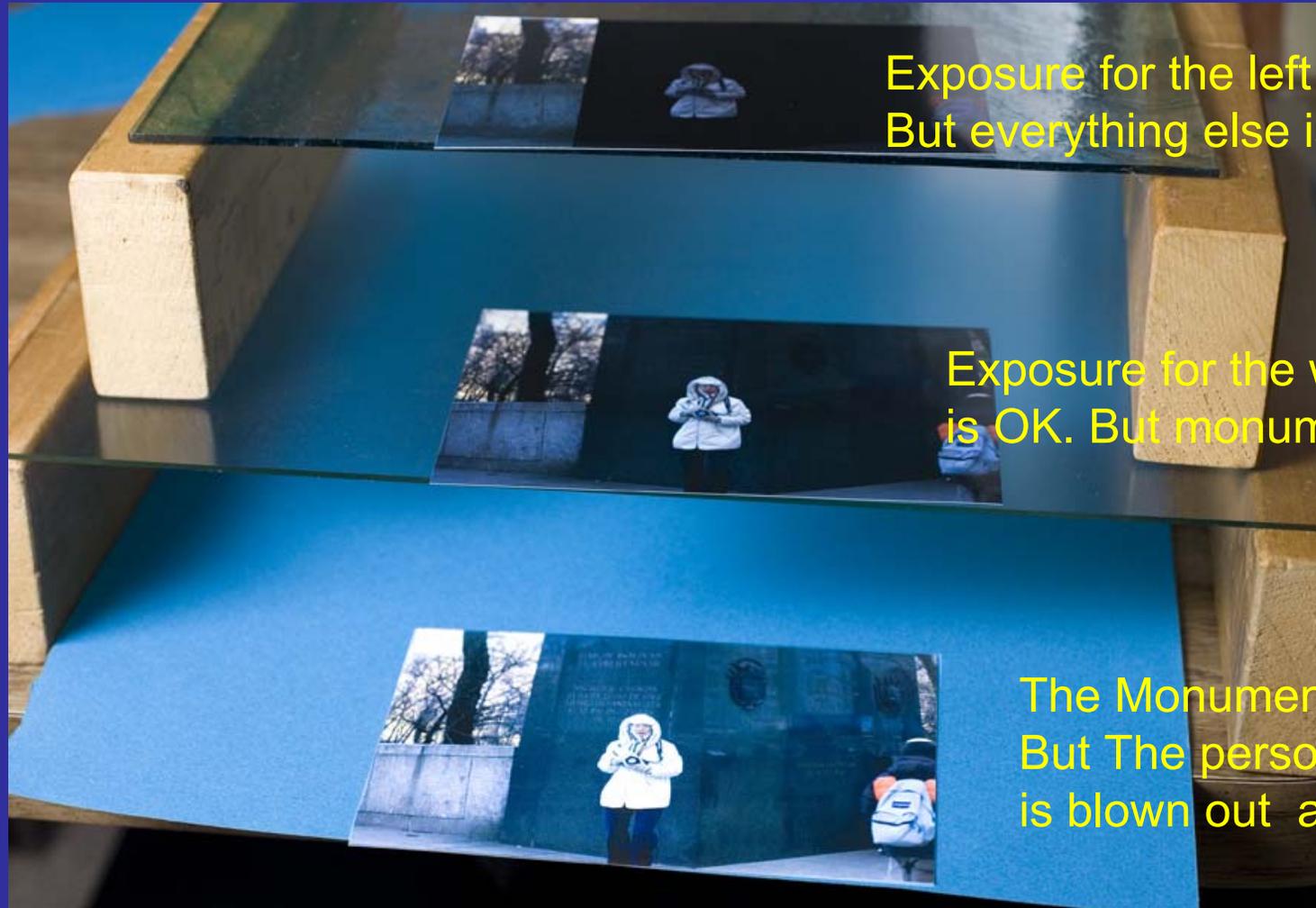- Adjust Tone (adjust for details in light & dark areas)

Extreme Example

Histogram
Shows predominance
of dark tones

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Layers (1)

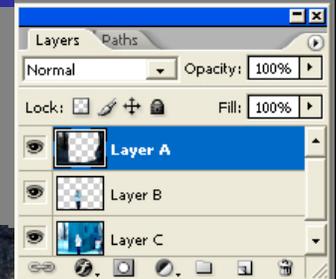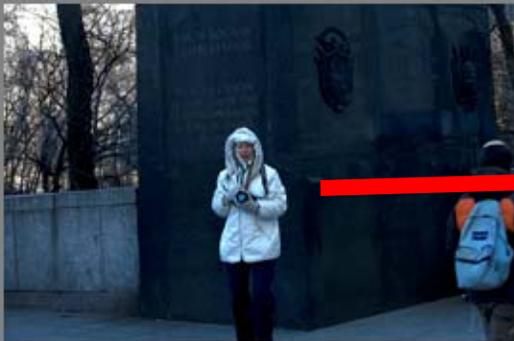Imagine Three Prints – each with ok exposure for part of image

Exposure for the left side is OK
But everything else is too dark

Exposure for the white jacket
is OK. But monument is too dark

The Monument is OK
But The person in white jacket
is blown out as in the Left side

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Layers (2)

Erase partial image areas -> let part of lower layer show thru

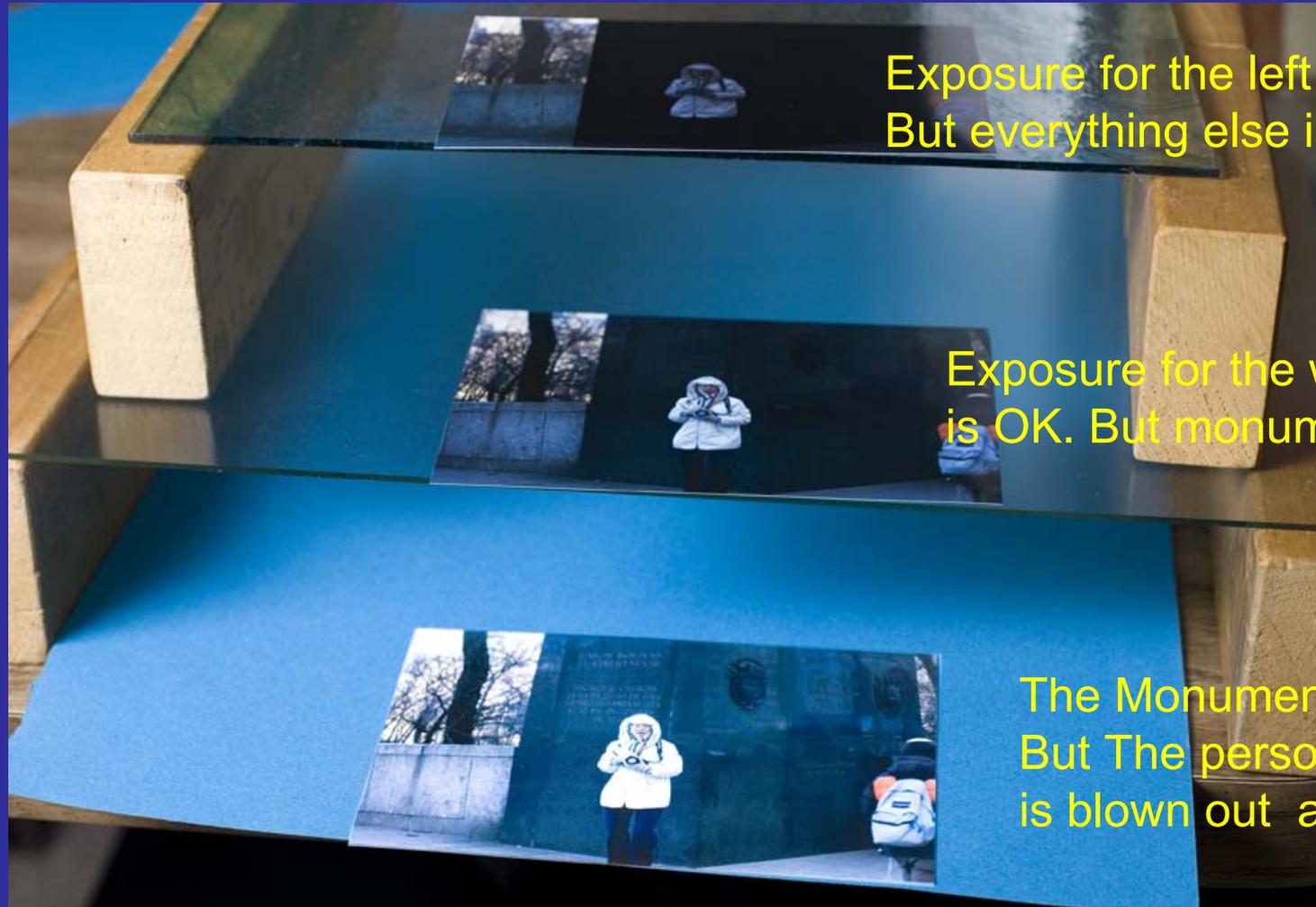# Layers (3)

Original vs. Adjusted

Original .jpg file

Finish with slight rotate and crop

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Layers (4)

Imagine Three Prints – each with ok exposure for part of image

Exposure for the left side is OK
But everything else is too dark

Exposure for the white jacket
is OK. But monument is too dark

The Monument is OK
But The person in white jacket
is blown out as in the Left side

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Study the Instructions

READ YOUR USER Guide

Even though it may seen difficult at times

Example: How close can you focus on a subject

	Subject to sensor DIstance
Canon MP-E 65mm F2.8	9.4 inches
Nikon: 17-35 f2.8:	10.8 inches
Canon EF 28-135mm F3.5-5.6 :	19.7 inches
Canon EF 180mm F3.5 Macro	18.9 inches
Canon EF 500mm	14.8 ft.