

Digital Photography

An Overview

Presented By Dan Feighery

For

OLLI Personal Computer User Group (OPCUG)
Washington Area Personal Computer User Group (WACUG)

Feb 2012

- We'll plow across several acres
 - But only go a few inches deep



Photo from ruralblacksmith.blogspot.com

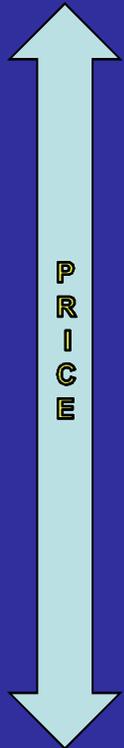
What We'll Cover

- **Digital Cameras General Concepts**
 - Camera types & specifications
 - Basic Auto picture taking + Bundled Software overview
 - Histogram
 - Pixels & Aspect Ratio
 - Color Management
 - White Balance
 - Grain
 - Lens: (Focal Length, Crop Factor, Angle of View, Zoom ratio)
 - **Exposure Triangle** (Aperture, Shutter Speed, Chip Sensitivity)
 - Depth of Field
 - Discussion

TYPES & SPECIFICATIONS

Large Variety of Cameras

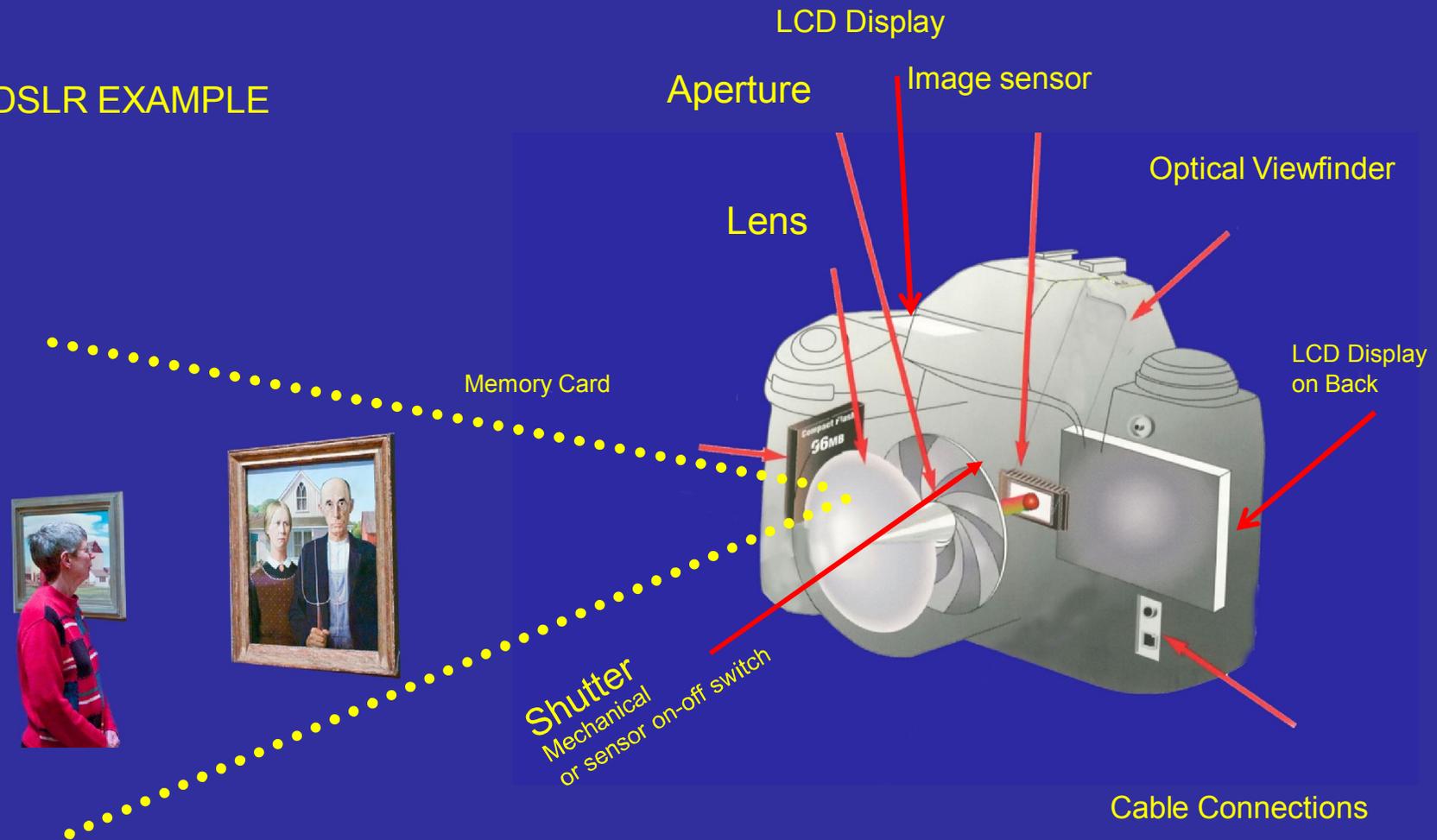
Over \$40,000.00



Less than \$100.00

The Camera

DSLR EXAMPLE



Note: Four Thirds format cameras have no mirror / optical viewfinder but do have interchangeable lens. (allows for smaller size camera)

Camera drawing from
A short Course in
Photography
7th Edition

Digital Single Lens Reflex Camera

- A Mechanical, Digital & Optical Marvel



Primary Types (1)

Pocket Camera (Point & Shoot)



Factory did the thinking



You capture an image

You Do The Thinking

You Make a Photograph

Digital Single Lens Reflex (DSLR)



Dan Feighery



Primary Types (2)

Pocket Camera (adjustable)



Single Retracting lens

3.93 x 2.34 x 1.05 inches
Weight 6.1 oz

Specification Highlights

12.1 MP CMOS Sensor
5x Optical Zoom - 24-120 mm Equivalent
3.0" TFT Color Display
DIGIC 5 Image Processor
1920 x 1080p HD Video W/Stereo Sound
Fast f/2.0-5.9 Lens for Low Light Photos
Control Ring for Easy Manual Control
ISO Up to 6400
Intelligent IS Image Stabilization
33 Shooting Modes for Better Control

http://www.bhphotovideo.com/c/product/822124-REG/Canon_PowerShot_S100_Digital_Camera.html

Micro Four thirds



Interchangeable lens

4.88 x 3.53 x 2.98 INCHES
Weight 13.82 oz Body only

Specification Highlights

16.05MP Live MOS Sensor
3" Free-Angle LCD W/460,000 Dots
1920x1080 60i HD Video
MEGA O.I.S. (Optical Image Stabilizer)
Fastest Level of Light Speed AF
High Sensitivity Up to ISO 12800
Touch Screen Control for Stills/Video
iA (Intelligent Auto) Mode Stills/Video
Dust Reduction System
Dolby Stereo Sound W/Video

http://www.bhphotovideo.com/c/product/736365-REG/Panasonic_DMC_GH2K_K_Lumix_DMC_GH2_Digital_Camera.html

Specifications

Example Highlights

- **Canon EOS 5D MK II**
(\$2175.00 body only)
- 21.1 Megapixel Full-Frame Sensor
- 3.0" High Resolution LCD Display
- Live View Mode
- 1080p Movie Mode
- Dust & Weather-Resistant
- Self Cleaning Sensor
- Broad ISO Range (50-25600)
- 3.9 fps Burst Mode
- **Canon Powershot A 800**
(\$79.00)
- 10MP Resolution
- 3.3x Optical Zoom Lens 37-122mm Equiv
- 2.5" TFT LCD Monitor
- Up to 3200 ISO for Low Light Photos
- Multiple Shooting Modes
- Red-Eye Correction
- Low Light, Vivid, Kids & Pets Modes
- Macro Close-up Photography
- Portrait Mode
- Blur Reduction

Check Web Sites for full details

http://www.bhphotovideo.com/c/product/583953-REG/Canon_2764B003_EOS_5D_Mark_II.html

http://www.bhphotovideo.com/c/product/750174-REG/Canon_Powershot_A800_Digital_Camera.html

Basic Automatic Picture Taking

Study User Guide For Your Camera

S
le
V
W
B

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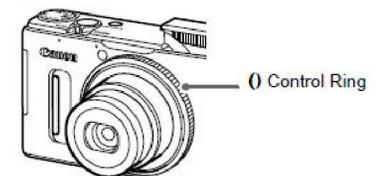
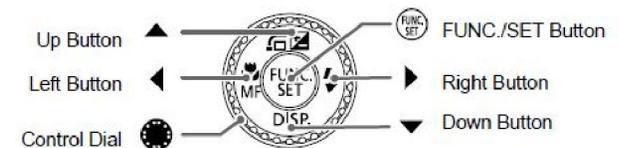
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Conventions Used in This Guide

- Icons are used in the text to represent the camera buttons and dials.
- Language that displays on the screen appears inside [] (square brackets).
- The directional buttons, control dial, FUNC./SET button and control ring are represented by the following icons.



- ⓘ: Things you should be careful about
- ❓: Troubleshooting tips
- 💡: Hints for getting more out of your camera
- 📖: Supplemental information
- (p. xx): Reference pages ("xx" stands for a page number)
- This guide assumes all functions are at their default settings.
- The various types of memory cards that can be used in this camera are collectively referred to as memory cards in this guide.

Study User Guide For Your Camera

• Image Quality, RAW & “Special Scenes”

Changing the Recording Pixel Setting (Image Size)

You can choose from 4 recording pixel settings.



1 Choose the recording pixel setting.

- After pressing the button, press the to choose .

2 Choose an option.

- Press the or turn the to choose an option, then press the .
- The setting will appear on the screen.
- To restore the original setting, choose in Steps 1 – 2.



The digital zoom (p. 50) can only be used in an aspect ratio of 4:3.

Changing the Compression Ratio (Image Quality)

You can choose from the following 2 compression ratios (image quality): (Fine), (Normal).



1 Choose the compression ratio setting.

- After pressing the button, press the to choose .

2 Choose an option.

- Press the or turn the to choose an option, then press the .
- The setting will appear on the screen.
- To restore the original setting, choose in Steps 1 – 2.



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Changing the Compression Ratio (Image Quality)

Approximate Values for Recording Pixels and Compression Ratio (for 4:3 Aspect Ratios)

Recording Pixels	Compression Ratio	Single Image Data Size (Approx. KB)	Number of Shots per Memory Card (Approx. shots)	
			4 GB	16 GB
L (Large)		3084	1231	5042
12M/4000x3000		1474	2514	10295
M1 (Medium 1)		1620	2320	9503
6M/2816x2112		780	4641	19007
M2 (Medium 2)		558	6352	26010
2M/1600x1200		278	12069	49420
S (Small)		150	20116	82367
0.3M/640x480		84	30174	123550

- The values in the table are measured according to Canon standards and may change depending on the subject, memory card and camera settings.
- The values in the table are based on 4:3 aspect ratio. If the aspect ratio is changed (p. 55), more images can be shot because the data size per image will be smaller than with 4:3 images. However, since **M2** 16:9 images have a setting of 1920 x 1080 pixels, their data size will be larger than 4:3 images.

Approximate Values for Paper Size (for 4:3 Aspect Ratios)

A2 (16.5 x 23.4 in.)	L
A3 – A5 (11.7 x 16.5 – 5.8 x 8.3 in.)	M1
5 x 7 in. Postcard size 3.5 x 5 in.	M2

- S** For sending images as e-mail attachments.

Throws away data from the already compressed jpg Image

- Take test shots & Compare
- Buy Highest # card camera will accept

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Study User Guide For Your Camera

• Image Quality, RAW & “Special Scenes”

Changing the Noise Reduction Level (High ISO NR)

Shadow Correct



Choose **AUTO**.

- Follow Step 1 on p. 87 to choose , then press the **MENU** button.
- Press the **◀▶** buttons or turn the  dial to choose **AUTO**, then press the  button.
- ▶ Once set,  will appear on the screen.

Changing the Noise Reduction Level (High ISO NR)

You can choose from 3 levels of noise reduction: [Standard], [High], [Low]. This function is especially effective when shooting at high ISO speeds.



Choose a noise reduction level.

- Press the **MENU** button to choose [High ISO NR] in the  tab, then press the **◀▶** buttons to choose an option.

- High ISO NR settings are not applied to movies.
- Not available in **RAW** or **RAW+JPEG**.

Shooting RAW Images

A RAW image is raw data recorded with nearly no deterioration in image quality resulting from image processing inside the camera. You can use the supplied software to adjust the image in any way you like with minimal loss in image quality.



1 Choose **JPEG**.

- After pressing the  button, press the **▲▼** buttons to choose **JPEG**.

2 Choose an option.

- Press the **◀▶** buttons or turn the  dial to choose **RAW** or **RAW+JPEG**, then press the  button.

JPEG Records a JPEG image. When JPEG images are recorded, the images are processed inside the camera for optimum image quality and compressed. However, the compression process is irreversible, meaning that the raw data cannot be recovered once it has been compressed. Moreover, the image processing may result in a deterioration in quality.

RAW Records a RAW image. A RAW image is raw data recorded with nearly no deterioration in image quality resulting from image processing inside the camera. This data cannot be used as is for viewing or printing on a computer. The supplied software (Digital Photo Professional) must first be used to convert the image data to a JPEG or TIFF file. When converting the image data, you can adjust the image with minimal deterioration in image quality. Recording pixels will be fixed to 4000 x 3000, and data size of a single image will be approximately 17076 KB.

RAW+JPEG Two images, a RAW image and a JPEG image, will be recorded with each shot. Since a JPEG image is also recorded, you can print the image or view it on a computer without using the supplied software.

 Be sure to use the supplied software when transferring both the RAW images and the JPEG images that were recorded at the same time to a computer (p. 34).

How do you erase images shot with **RAW+JPEG**?

If you press the  button (p. 29) while viewing a **RAW+JPEG** image, you can choose from [Erase **RAW**], [Erase JPEG] or [Erase **RAW**+JPEG].

- The digital zoom (p. 50) and date stamp (p. 52) are not available when shooting in **RAW** or **RAW+JPEG**.
- The file extension for JPEG images is “.JPG”, and the extension for RAW images is “.CR2”.

Study User Guide For Your Camera

- Image Quality, RAW & “Special Scenes”

- The Camera engineers did the thinking

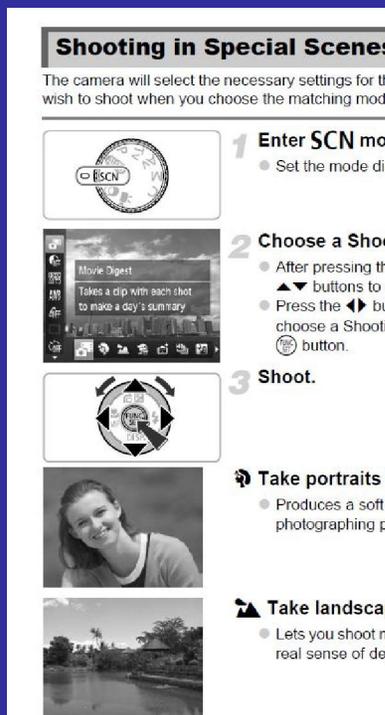
- The latter part of this presentation will help you understand how you can use manual, shutter priority and aperture priority settings

Shooting in Special Scenes

The camera will select the necessary settings for the wish to shoot when you choose the matching mode.

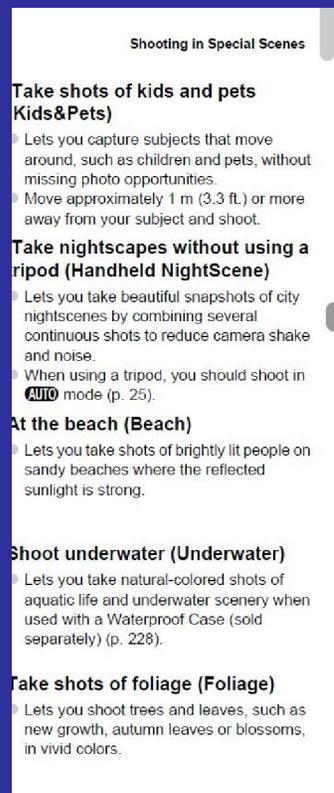
- 1 Enter SCN mode**
 - Set the mode dial to the SCN mode.
- 2 Choose a Special Scene**
 - After pressing the **SCN** button, use the **▲▼** buttons to choose a Special Scene.
 - Press the **▶◀** buttons to choose a Shooting Mode.
- 3 Shoot.**

- Take portraits (Portrait)**
 - Produces a soft photographing effect.
- Take landscape (Landscape)**
 - Lets you shoot with a real sense of depth.



Shooting in Special Scenes

- Take shots of kids and pets (Kids&Pets)**
 - Lets you capture subjects that move around, such as children and pets, without missing photo opportunities.
 - Move approximately 1 m (3.3 ft.) or more away from your subject and shoot.
- Take nightscapes without using a tripod (Handheld NightScene)**
 - Lets you take beautiful snapshots of city nightscapes by combining several continuous shots to reduce camera shake and noise.
 - When using a tripod, you should shoot in **AUTO** mode (p. 25).
- At the beach (Beach)**
 - Lets you take shots of brightly lit people on sandy beaches where the reflected sunlight is strong.
- Shoot underwater (Underwater)**
 - Lets you take natural-colored shots of aquatic life and underwater scenery when used with a Waterproof Case (sold separately) (p. 228).
- Take shots of foliage (Foliage)**
 - Lets you shoot trees and leaves, such as new growth, autumn leaves or blossoms, in vivid colors.



Basic Automatic operations

- For “Point & Shoot” Camera

- Buy & insert chip
- Charge & insert Battery
- Press “ON” button
- Select “AUTO”
- Point camera at subject
- Adjust zoom control
- Hold camera still
- Press shutter button half way
- Observe FOCUS & content OK
- Press shutter the rest of the way
- Take chip to photo store for prints
- Or upload on computer.



Don't Forget Your Software User Guide

➤ Most digital camera boxes also include software

Things to Remember	Mastering the Basics	More Advanced Techniques	Appendices
Table of Contents			
About this Manual			
Precautions for Connecting the Cam			
■ Things to Remember			
CameraWindow and ZoomBrowser			
CameraWindow and ZoomBrowser			
ZoomBrowser EX's Main Window			
How to Display the Main Window			
Names of the Main Window Parts			
How to Perform Tasks			
Selecting Tasks and Task Window P			
■ Mastering the Basics			
Transferring Images			
Transferring Images by Connecting			
Printing			
Printing a Single Image on a Single			
Index Print			
How to Use CameraWindow			
First Menu Screen to Open			
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How to Use ZoomBrowser EX's Main			
Main Window			
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Editing Images			
Red Eye Correction			
Auto Adjustment			
Color/Brightness Adjustment			
Adjusting Sharpness – Emphasizing			
Trimming – Cropping a Portion of a			
Inserting Text			
Using Other Editing Software			
Attaching Sounds			
Creating Panoramic Images – Photo			
Editing Movies			
Converting RAW Images – Digital P			
Exporting			
Changing Image (Stills) Sizes and Types			
Changing Movie Sizes and Types			
Extracting Stills from Movies			
Exporting Shooting Information			
Creating Computer Screen Saver Images			
Creating Computer Wallpaper Images			
Saving to CDs			
GPS			
Using GPS Information – Map Utility			
Uploading Movies to YouTube			
Uploading to YouTube – Movie Uploader for YouTube			
Email			
Attaching Images to Email			
Slide Shows			
Viewing Images in Slide Shows			
Image Management			
Changing File Names in Batches			
Sorting Images into Folders by Shooting Date			
Configuring Image Information Settings			
Setting Ratings			
Inserting Comments			
Assigning Keywords			
Searching, Filtering and Sorting Images			
Searching Images			
Filtering Images			
Sorting Images			
Comparing Images			
Comparing Multiple Images			
My Camera Settings			
Changing the Shutter Sound and Start-Up Image			
Transferring Images			
Transferring Images to a Camera			
CANON IMAGE GATEWAY			
About CANON IMAGE GATEWAY (for U.S.A. customers only)			
Registering			
Available Services			
Preference Settings			
Customizing ZoomBrowser EX			
Customizing the Task Buttons			
■ Appendices			
List of Available Functions			
Supported Image Types			
Updating the Software			
Uninstalling the Software			
Memory Card Folder Structure			
Troubleshooting			

Basic View of Bundled Software

- Review Image Data

Digital Photo Professional - [U:\DCIM\101_01]

File Edit View Bookmark Label Adjustment Tools Window Help

Edit image window Folder view Tool palette Info Select all Clear all Rotate left Rotate right Quick check Stamp Trimming /Angle Batch process

Folder: Collection(0) Check mark 1 2 3 4 5 Rating * * * * *

IMG_0522.JPG

Item	Value
File Name	IMG_0522.JPG
Camera Model Name	Canon PowerShot S100
Shooting Date/Time	1/5/2012 10:21:05 AM
Shooting Mode	Program AE
My Colors Mode	Off
Tv (Shutter Speed)	1/200
Av (Aperture Value)	4.0
Light Metering	Evaluative
Exposure Compensation	0
ISO Speed	100
Lens	5.2 - 26.0mm
Focal Length	5.2mm
Digital Zoom	None
IS Mode	On
Image Size	4000x3000
Image Quality	Fine
Flash	Off
White Balance	Auto
AF Mode	Single AF
Parameters	Contrast Normal Sharpness Normal Saturation Normal
Color Space	sRGB
High ISO NR	Standard
File Size	3664KB
Drive Mode	Single Shot
Satellite signal status	OK
Date/Time(UTC)	1/5/2012 3:23:16 PM
Latitude	38 49 51.3 N
Longitude	77 18 37.7 W
Altitude	
Geographic coordinate sys...	WGS-84
Owner's Name	Dan Feighery
Comment	

Editing with Bundled Software

- Some RAW as well as JPG post processing

Digital Photo Professional - [U:\DCIM\101_01\IMG_0522.CR2 *]

File Edit View Label Adjustment Tools Help

Main window Thumbnails Tool Palette Grid Info Fit to window 50% view 100% view 200% view Previous image Next image Rotate left Rotate right Stamp Trimming Angle Batch process

IMG_0522.CR2

Item	Value
File Name	IMG_0522.CR2
Camera Model Name	Canon PowerShot S100
Shooting Date/Time	1/5/2012 10:21:05 AM
Shooting Mode	Program AE
My Colors Mode	Off
Tv (Shutter Speed)	1/200
Av (Aperture Value)	4.0
Light Metering	Evaluative
Exposure Compensation	0
ISO Speed	100
Lens	5.2 - 26.0mm
Focal Length	5.2mm
Digital Zoom	None
IS Mode	On
Image Size	4000x3000
Image Quality	RAW
Flash	Off
White Balance	Auto
AF Mode	Single AF
Parameters	Contrast: Normal Sharpness: Normal Saturation: Normal
Color Space	sRGB
High ISO NR	Standard
File Size	14704KB
Drive Mode	Single Shot
Satellite signal status	OK
Date/Time(UTC)	1/5/2012 3:23:16 PM
Latitude	38 49 51.3 N
Longitude	77 18 37.7 W
Altitude	
Geographic coordinate sys...	WGS-84
Owner's Name	Dan Feighery
Comment	



RAW RGB NR/Lens/ALO

Brightness adjustment: 0.00

White balance adjustment: 1 2 3 Register...

Shot settings: Tune...

Picture Style: Standard Browse...

Contrast:(0) Highlight:(0) Shadow:(0) Linear Color tone:(0) Color saturation:(0) Sharpness Sharpness:(?)

RAW / sRGB High quality

Canon Map Utility

- Link to Google Map – IF GPS was on
– Requires On-Line access to Google Maps

Digital Photo Professional - [I:\]

File Edit View Bookmark Label Adjustment Tools Window Help

Edr Image window Folder view Tool Palette Info Select all Clear all Rotate left Rotate right Quick check Stamp Trimming Angle Batch process

Folder: Collection(0) Check mark: 1 2 3 4 5 Rating:

IMG_0522.JPG

Shooting Information Metadata

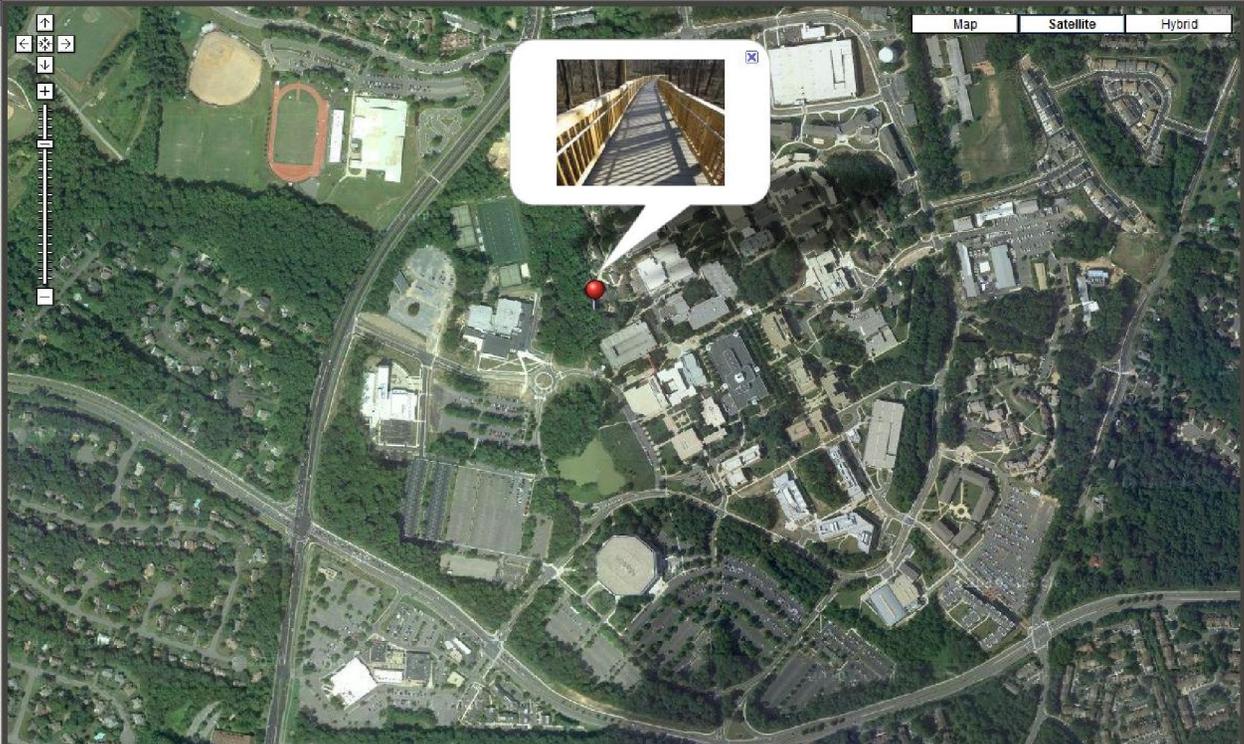
Item	Value
File Name	IMG_0522.JPG
Camera Model Name	Canon PowerShot S100
Shooting Date/Time	1/5/2012 10:21:05 AM
Shooting Mode	Program AE
My Colors Mode	Off
Tv (Shutter Speed)	1/200
Av (Aperture Value)	4.0
Light Metering	Evaluative
Exposure Compensation	0
ISO Speed	100
Lens	5.2 - 26.0mm
Focal Length	5.2mm
Digital Zoom	None
IS Mode	On
Image Size	4000x3000
Image Quality	Fine
Flash	Off
White Balance	Auto
AF Mode	Single AF
Parameters	Contrast Normal Sharpness Normal Saturation Normal
Color Space	sRGB
High ISO NR	Standard
File Size	356-KB
Drive Mode	Single Shot
Satellite signal status	OK
Date/Time(UTC)	1/5/2012 3:23:16 PM
Latitude	38 49 51.3 N
Longitude	77 18 37.7 W
Altitude	
Geographic coordinate sys...	WGS-84
Owner's Name	Dan Feighery
Comment	

Map Utility

File Edit View Tools Help

Images GPS log files Search map

Map Satellite Hybrid

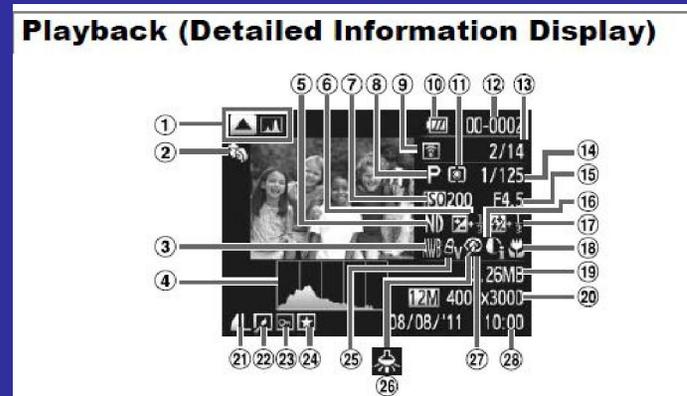


The screenshot displays the Canon Map Utility interface. On the left, a metadata panel for 'IMG_0522.JPG' lists various camera settings and GPS data. The main window shows a satellite map of a campus area with a red pin indicating the photo's location. A white speech bubble overlay shows a thumbnail of the photo taken from that location. The interface includes a search bar, navigation tools, and map style controls (Map, Satellite, Hybrid).

Histogram

Check Image Capture (Histogram)

- Understand what your camera can display
 - And how to find it



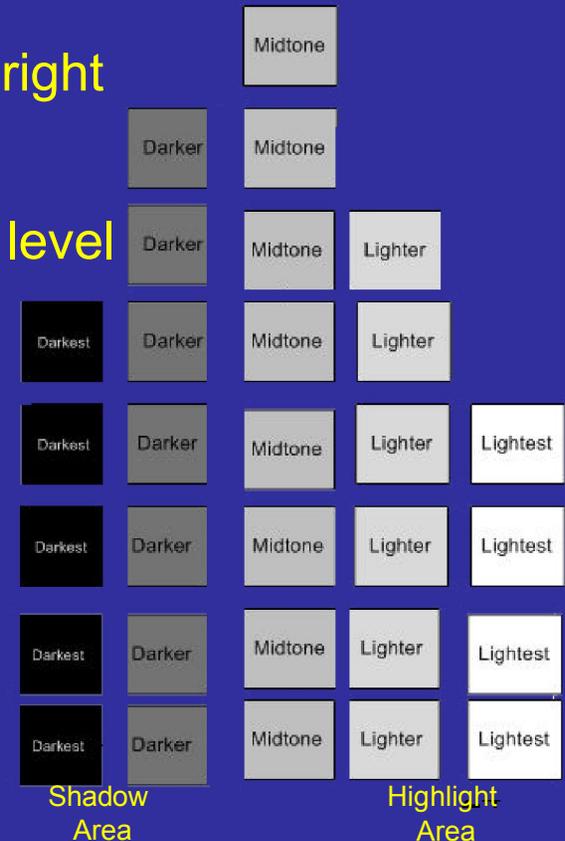
- One of the MOST Important pieces of information
 - The Histogram
 - A frequency distribution of pixel brightness



Check Image Capture (Histogram)

- What is a histogram
 - Graph showing all the brightness levels
 - Horizontal Axis:
 - Various levels of pixel brightness
 - » Very dark on left, very bright on right
 - Vertical Axis:
 - how many pixels a given brightness level

Darkest	Lightest	Lighter	Midtone	Darker	Midtone
Lighter	Midtone	Darker	Midtone	Lighter	Darkest
Darkest	Darker	Lightest	Darker	Midtone	Lighter
Midtone	Lightest	Darker	Lightest	Lighter	Darkest
Midtone	Darkest	Darker	Midtone	Lighter	Darker

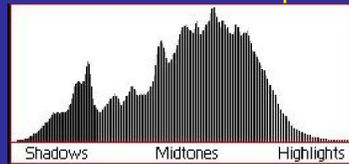


Check Image Capture (Histogram)

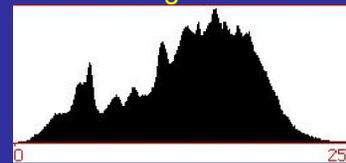
Properly exposed image



Illustrative stacks of pixels



Histogram



Under exposed (TOO DARK)

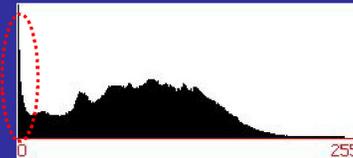
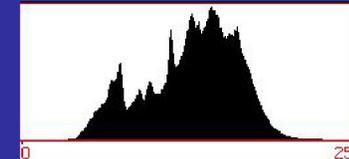
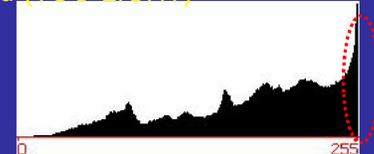


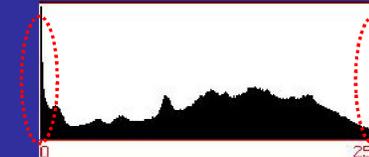
Image captured only the midtones – lacks contrast



Over exposed (TOO LIGHT)



Shadows and Highlights clipped- Dynamic range of scene greater than Dynamic Range of camera



Above images from dpreview,. See Link:
http://www.dpreview.com/learn/?/Glossary/Digital_Imaging/Histogram_01.htm

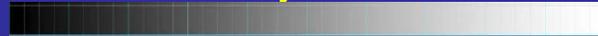
Check Image Capture (Dynamic Range)

- Dynamic Range: Ratio of the highest (lightest) signal it can record to the lowest (darkest) signal

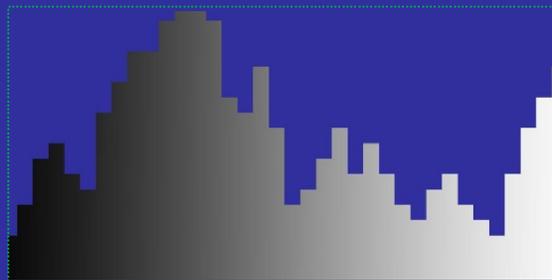
A Simplified Understanding

Consider an imaginary scene that might contain tones from the blackest black to the bright white

- For this example consider only several dozen levels of brightness



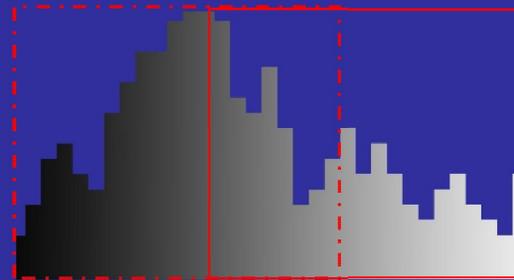
- We make a graph by stacking pixels of the same intensity level in the scene



Our eyes can discern perhaps this range of dark to bright

A camera sensor may only capture this range of intensity

But is selectable



← "Blown Out
No detail"

Software can not recover blown out highlights!!!

Check Image Capture (Highlight Warnings)

- Playback may highlight blown out areas
 - Be sure it is turned on in Menu
 - In addition to Histogram off the right edge,
 - Blown-out areas will blink on and off



Check Image Capture (Histogram slightly to right)

- Assume 12 bit image & range of 5 F -stops

- It can capture 4096 discrete tonal values with each recording half the light value of the previous one.

Within the first F /Stop, which contains the Brightest Tones	2048 levels available
Within the second F /Stop, which contains Bright Tones	1024 levels available
Within the third F /Stop, which contains the Mid-Tones	512 levels available
Within the fourth F /Stop, which contains Dark Tones	256 levels available
Within the fifth F /Stop, which contains the Darkest Tones	128 levels available

- If you don't use the right hand 5th of histogram for recording some of your image – you waste about half the encoding levels
 - Bias exposure so histogram is toward the right, BUT don't blow out highlights



- The RAW Image may appear to bright -> In RAW converter adjust brightness level and contrast so data is spread out and the image looks right.

Note: You have to try it to see if it works on your camera. It only works in 16bit space (12 bit recording) in a RAW converter before using Photoshop or other post processing

Pixels & Aspect Ratio

Pixels & Aspect Ratio ⁽¹⁾

- Understand the # in a # Megapixel Camera
 - A Megapixel = 1 million pixels
 - A Pixel is the smallest single component of an image
 - Also used as a measure of image resolution
 - (# of pixels across image) x (# of pixels in image height)
 - Examples (DSLR cameras) (aspect Ratio 2:3)
 - 3888 x 2592 = 10,077,696 (Canon 40D)
 - 5616 x 3744 = 21,026,304 (Canon D Mk II)
 - Examples Macro Four Thirds Camera (aspect Ration 4:3)
 - 4000 x 3000=12,000,000 (Panasonic Lumix G1)
 - Examples (Pocket Camera (S-100) – Also called point & shoot)
 - 4000 x 2248 = 8,992,000
 - 4000 x 2264 = 9,056,000
 - 4000 x 3000 = 12,000,000
 - 2992 x 2992 = 8,952,064
 - 2400 x 3000 = 7,200,000

- Aspect Ratio = $\frac{2592 \text{ pixels in image height}}{3888 \text{ pixels across image}} = 2/3$

Pixels & Aspect Ratio (2)

Are All Pixels the Same?

- **Trade-off: pixel size and digital noise**

A smaller pixel size allows more pixels to fit in a given size chip (field size), increasing resolution.

However as the pixel size becomes smaller, fundamental physical limits become increasingly important, placing a practical lower limit on pixel size.

Ability to capture photons changes with pixel size

More photons captured in an exposure time means lower noise.

Signal to noise ratio increases directly with an increase pixel pitch,
so larger pixels will provide higher useful ISO ratings for a digital camera.

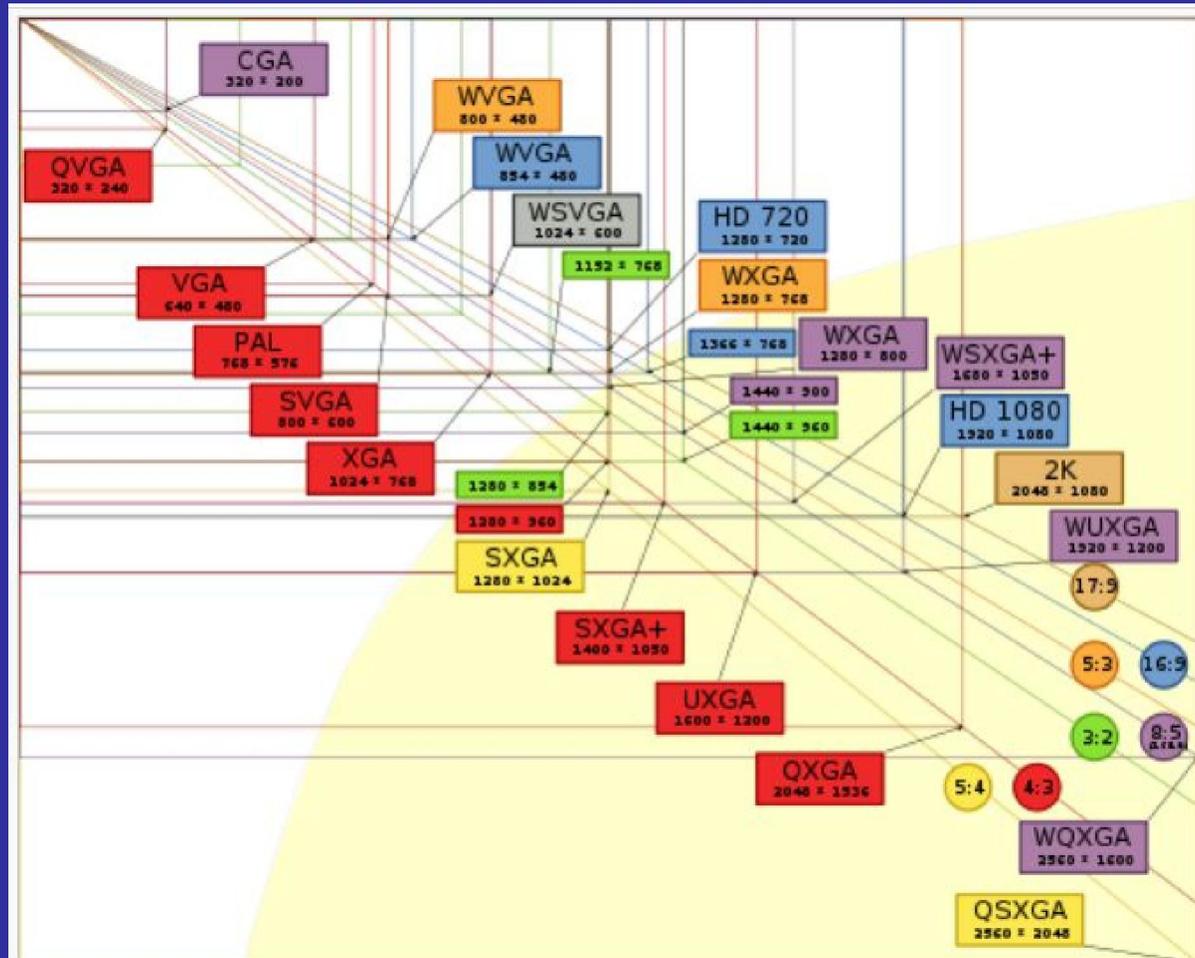
- For detailed reading see:
- http://www.outbackphoto.com/dp_essentials/dp_essentials_02/essay.html

Pixels & Aspect Ratio (2)

Many Cameras offer selectable aspect ratios
-- Examples are from Canon S-100 camera



Some Common Display Resolutions



- Color of each type indicates display ratio

– Wikipedia : http://en.wikipedia.org/wiki/Display_resolution 33

How Many Megapixels do you want / need (1)

- OK for most Computer monitors: 1024 x 768
- For WEB: 800x600 often recommended
- For digital projector:
 - 1024 x 768 (XGA) \$
 - 1280 x 800 (WXGA) \$\$
 - 1400 x 1050 (SXGA+) \$\$\$ (e.g. Hatachi CPSX 635 in TA-1)
 - 1920 x 1200 (WUXGA) \$\$\$\$
- Free Download program for Downsizing JPGs



<http://www.irfanview.com/>



Monitor pxls		& usage % of
Width	Height	Internet Users
1024	768	22.63
1366	768	15.63
1280	800	14.55
1280	1024	7.96
1440	900	6.92
1680	1050	3.75
1920	1080	3.70
1600	900	3.12
1360	768	2.65
1024	600	2.37
1152	864	1.91
1280	768	1.84
1280	720	1.66
800	600	1.44
1920	1200	1.04
2560	1600	

Source: Wikipedia

- For Printing: Depends on print size
See following slide

How Many Megapixels do you want / need ⁽²⁾

➤ For Printing: It depends on print size.

Note: For purposes of this discussion we'll equate dots per inch to Pixels per inch.

Megapixels	Pixel Resolution*	Print Size @ 300ppi	Print size @ 200ppi	Print size @ 150ppi**
3	2048 x 1536	6.82" x 5.12"	10.24" x 7.68"	13.65" x 10.24"
4	2464 x 1632	8.21" x 5.44"	12.32" x 8.16"	16.42" x 10.88"
6	3008 x 2000	10.02" x 6.67"	15.04" x 10.00"	20.05" x 13.34"
8	3264 x 2448	10.88" x 8.16"	16.32" x 12.24"	21.76" x 16.32"
10	3872 x 2592	12.91" x 8.64"	19.36" x 12.96"	25.81" x 17.28"
12	4290 x 2800	14.30" x 9.34"	21.45" x 14.00"	28.60" x 18.67"
16	4920 x 3264	16.40" x 10.88"	24.60" x 16.32"	32.80" x 21.76"

Downsizing for upload

FLOUR CLOSEUP.jpg - IrfanView (Zoom: 1505 x 1003)

File Edit Image Options View Help

3/20

Resize/Resample image

Current size: 5616 x 3744 Pixels
New size: 5616 x 3744 Pixels

Set new size:

Width: 5616 Height: 3744

Units: pixels cm inches

Set new size as percentage of original:

Width: 100 % Height: 100 %

Preserve aspect ratio (proportional)
 Apply sharpen after Resample

DPI: 72 (auto calc. for cm/inches)

Some standard dimensions (pixels):
New size: (ratio option used)

640 x 480 Pixels
 800 x 600 Pixels
 1024 x 768 Pixels
 1920 x 1080 Pixels
 Best fit to desktop
 Desktop size (no aspect ratio)

Half Double

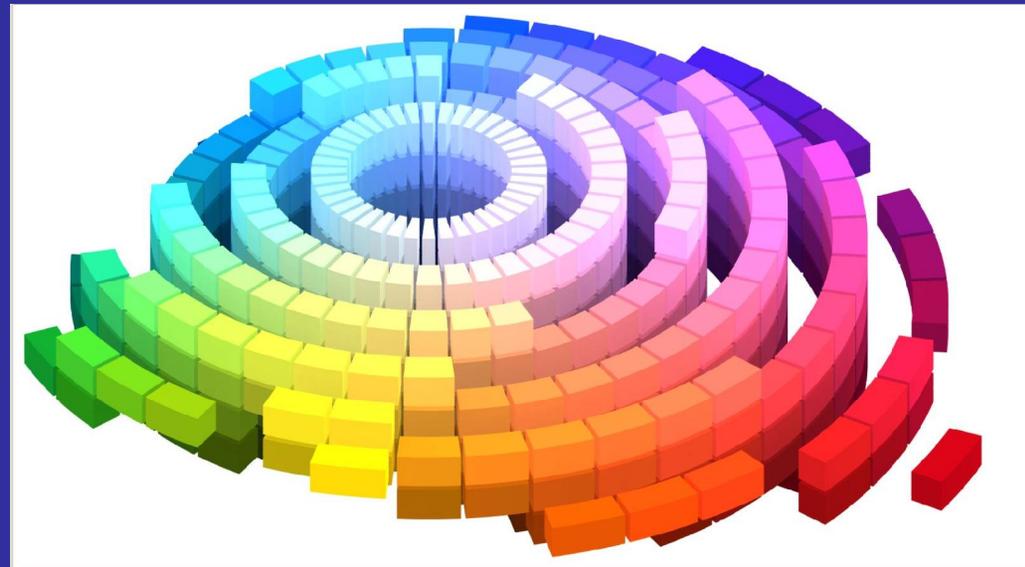
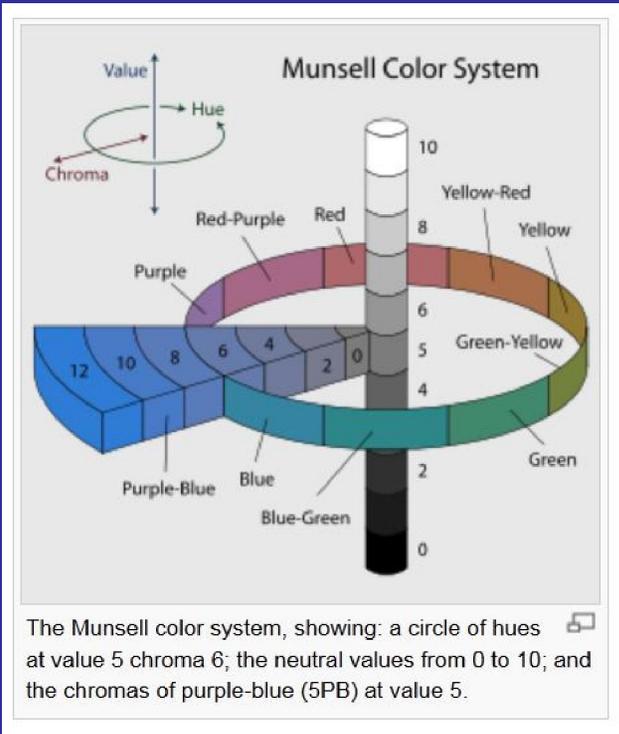
Size method:
 Resample (better quality)
Resample filter (enlarging only):
Lanczos (slowest)
 Resize (faster)

OK Cancel

5616 x 3744 x 24 BPP | 3/20 | 27 % | 6.37 MB / 60.16 MB | 2/8/2012 / 12:36:16

Color Management

Color Components



Munsell hues; value 6 / chroma 6



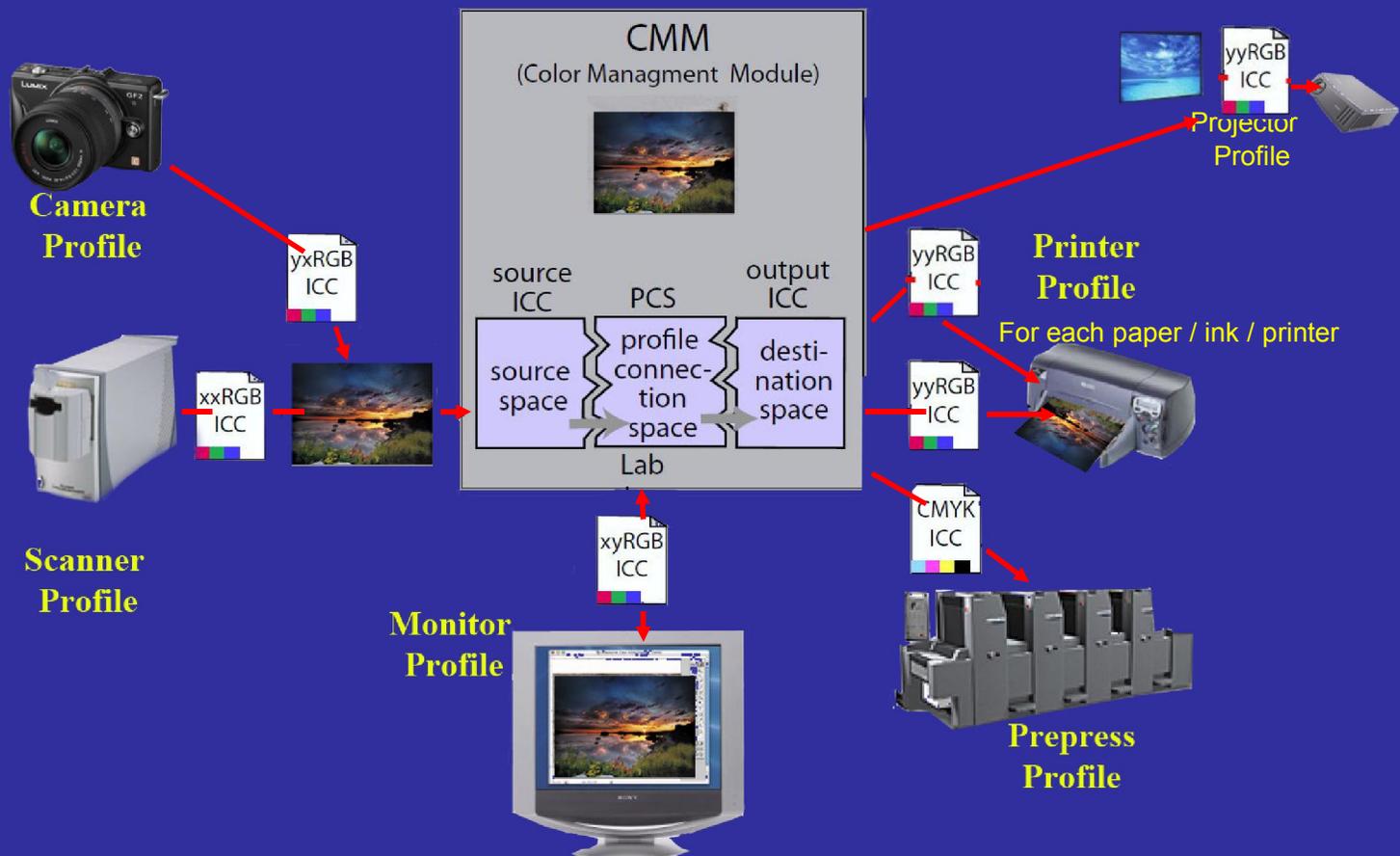
Color Checker Card (RGB)

81,66,52	160,138,116	94,102,134	74,86,56	118,111,154	128,168,157
164,117,48	79,75,140	143,84,80	68,51,83	144,168,74	184,155,61
59,48,126	85,123,67	122,58,46	200,188,68	142,83,123	76,108,145
241,241,241	190,190,190	145,145,145	104,104,104	67,67,67	37,37,37

Note: The illuminant will change our eye's perception of colors

Color Management

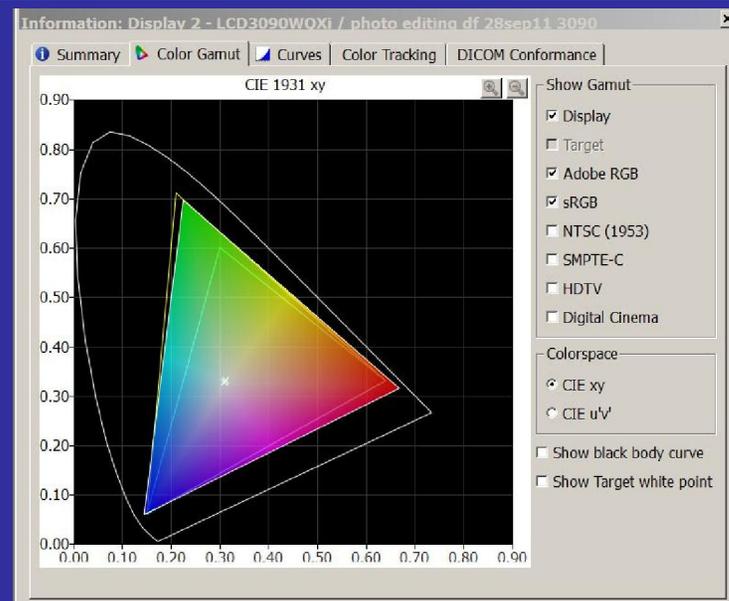
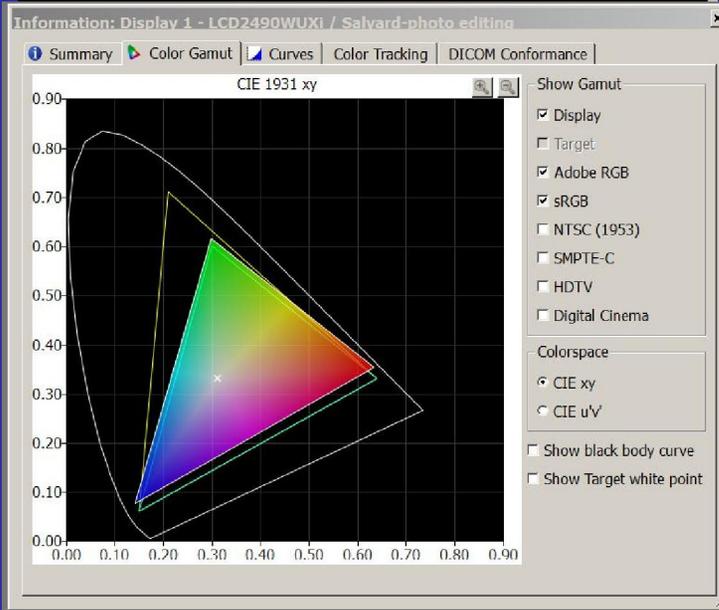
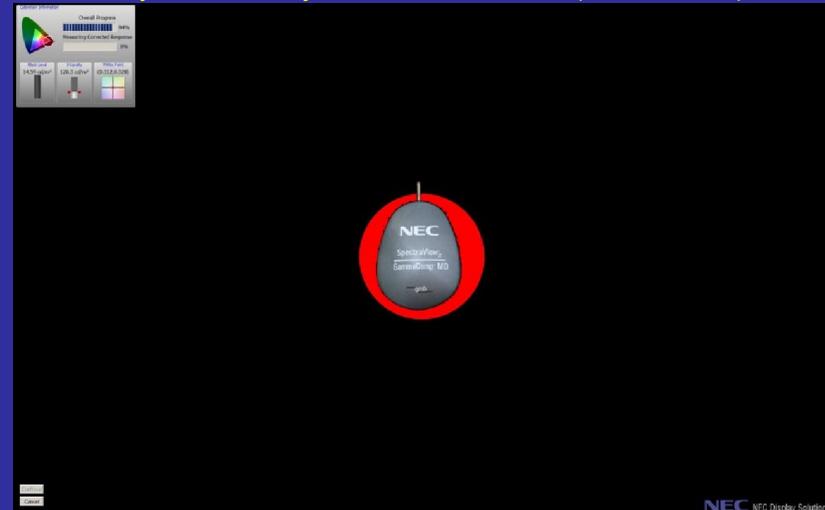
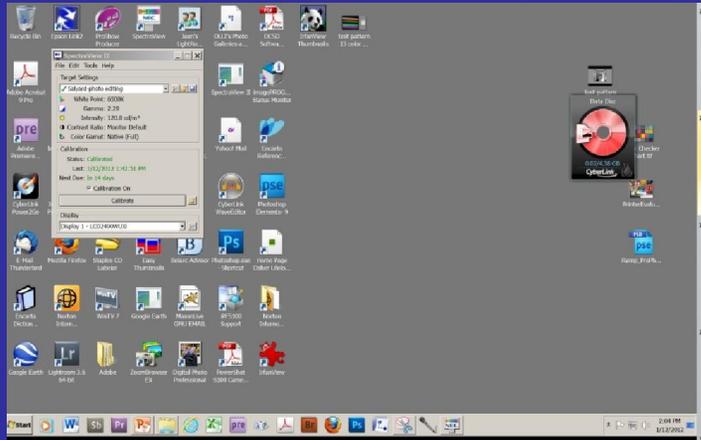
- Color Management helps reproduce colors as truthfully as possible across different devices



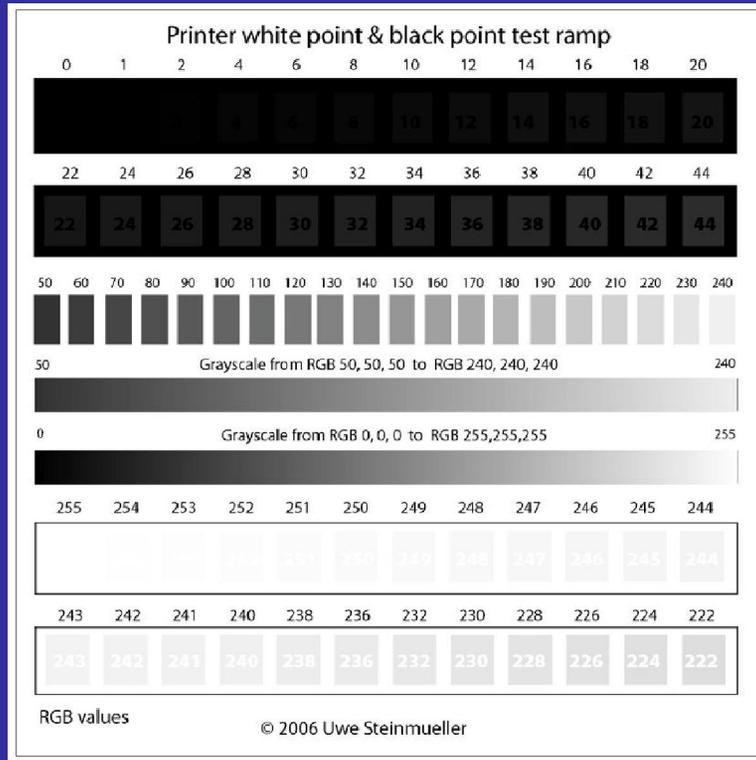
Monitor Calibration

My NEC Multisync LCD 2490 WQXI (2560 x 1600)

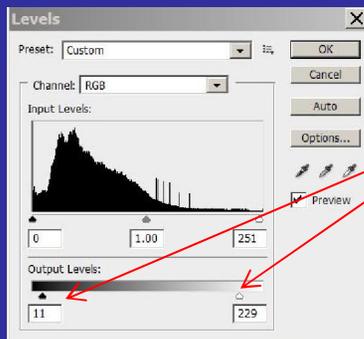
My NEC Multisync LCD 2490 WUXI (1920 x 1200)



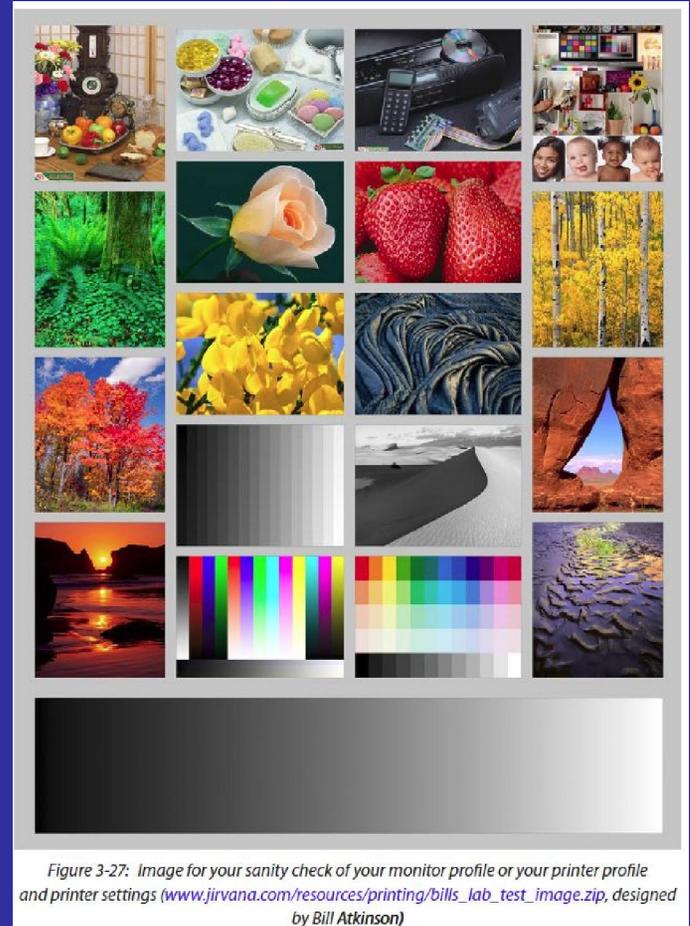
Test Images



Printer Ramp used to determine how your printer prints black & white



Can adjust output in
Photo Shop LEVELS control

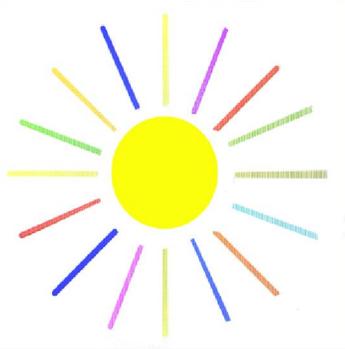


Note: Images from The Art of Digital Fine Art Printing
By Steinmueller & Gulbins

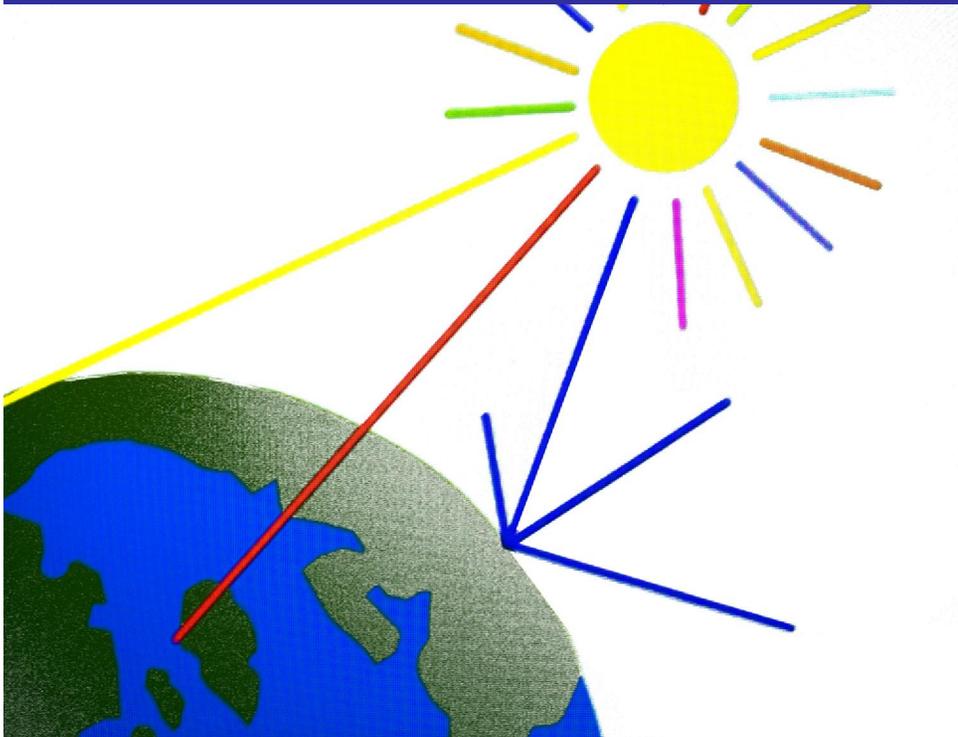
White Balance

White Balance (1)

Adjusting for composition of
the light spectrum



- Sun emits spectrum of Light (all colors)
 - White Light ($\sim 5200^{\circ}$ K)
- Spectrum partially lost in atmosphere



EXAMPLE

- Sun low on the horizon
- Short wavelengths scattered
- More "golden light"
 - Color Temp is lower ($\sim 2900^{\circ}$ K)

√ On AUTO camera may
give improper adjustment

White Balance (2)



Colors the eye sees may not be what the camera records

Adjusting for composition of the light spectrum



1900 K
Candle light

3200 K
tungsten

5000 K
direct sun

6500 K
overcast

8000 K
shade

10,000 K
Pt. cloudy



- 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)

Increasing Color Temperature ↓

	Auto White Balance
	Custom
	Kelvin
	Tungsten
	Fluorescent
	Daylight
	Flash
	Cloudy
	Shade

Note: White Balance (Blue-Amber) is just one of the two axes. The other is **tint**, from green to magenta.
 -> Some cameras allow shift & bracket on both axes



White Balance (3)



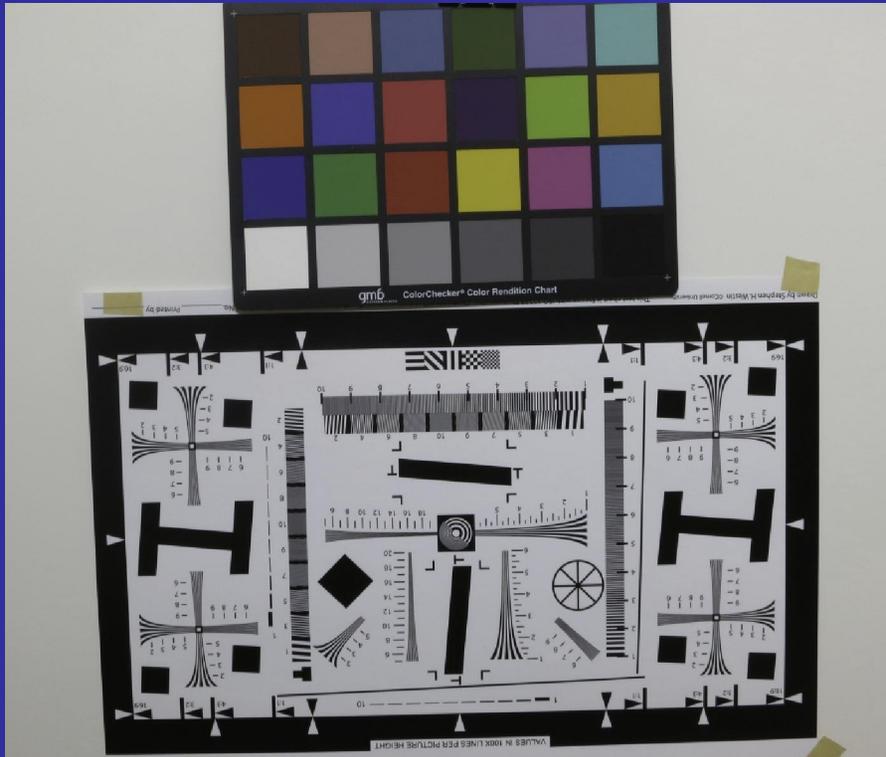
Indoor shot under incandescent light
but camera was left on daylight setting



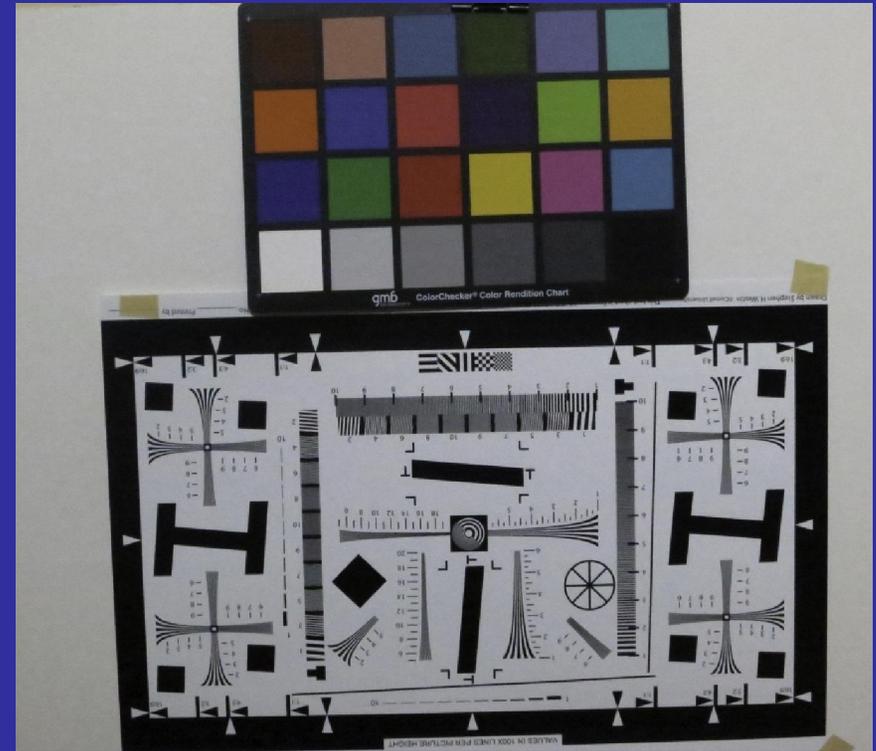
Indoor shot under incandescent light
with camera set for incandescent

Grain

Low vs. High ISO (1)



S-100 camera
Jpg file
ISO=100



S-100 camera
Jpg file
ISO=6400

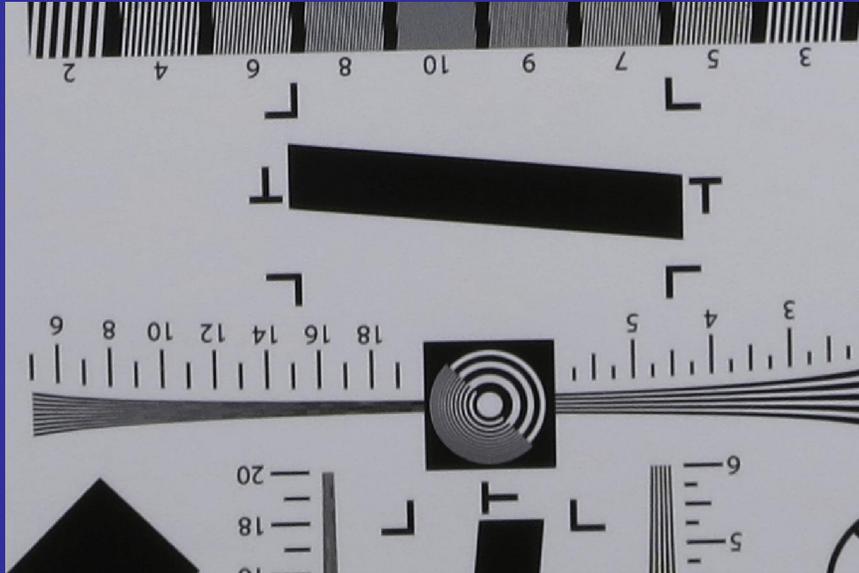
Low vs. High ISO (2a)



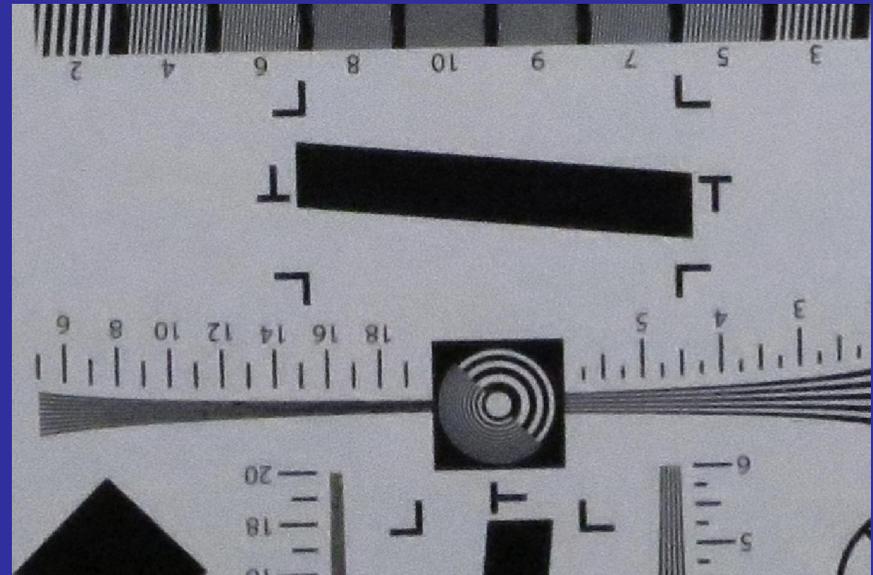
S-100 camera
Jpg file
ISO=100

S-100 camera
Jpg file
ISO=6400

Low vs. High ISO (2b)



S-100 camera
Jpg file
ISO=100



S-100 camera
Jpg file
ISO=6400

Look Closely at Noise

As Shot RAW (.CR2) File - not adjusted



ZOOM In on As Shot RAW (.CR2) File - not adjusted



Camera Adjusted (.jpg) File



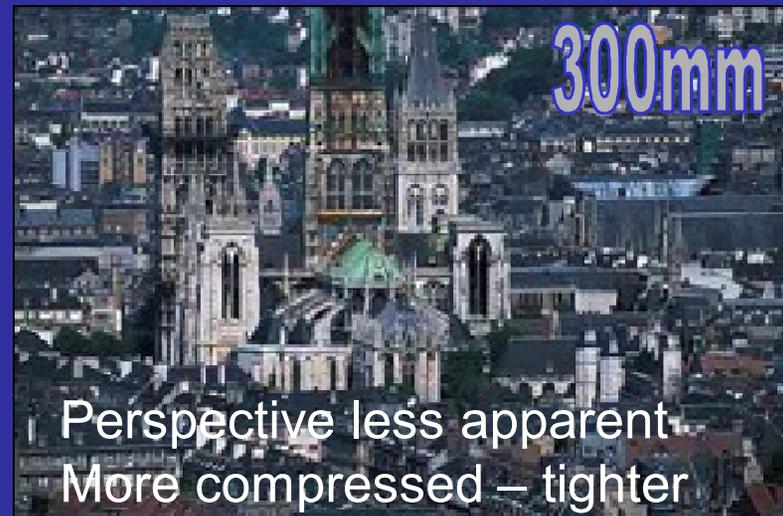
Zoom In on Camera adjusted (.jpg) File



Lens: Focal Length,
Crop Factor, Angle of View,
& Zoom Ratio

Lens 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
- shorter focal length called wide-angle
 - wide angle of view
- longer focal length called telephoto
 - narrow angle of view



Full Frame & Crop Factor

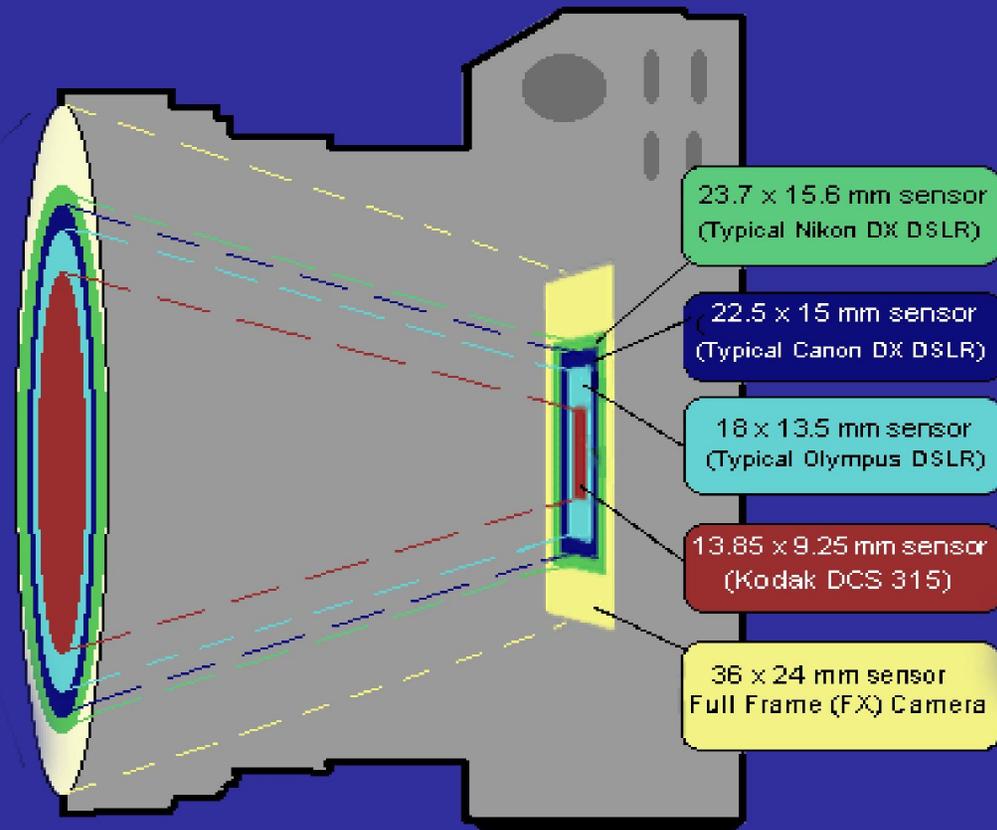
- A Digital Single Lens Reflex (DSLR) Camera with sensor the size of a 35mm film frame (36x24mm) is called a full frame camera
 - For some DSLR cameras, the ratio of the width to height of the sensor remains $24/36 = 4x6$
 - In many DSLRs you'll find that the size of the sensor is smaller than 36 x 24 mm
 - If you take a photo with a smaller sensor and the same lens it will only show a smaller area of the scene.
 - The difference is called the camera's "Crop Factor"

SLR Crop Factor

Cropped capture area has a reduced Field of View (angle), creating what is often called a “Multiplier Effect”

	1.3x	1.5x	1.6x	2.0x
10mm	13mm	15mm	16mm	20mm
17mm	22.1mm	25.5mm	27.2mm	34mm
28mm	36.4mm	42mm	44.8mm	56mm
35mm	45.5mm	52.5mm	56mm	70mm
50mm	65mm	75mm	80mm	100mm
105mm	136.5mm	157.5mm	168mm	210mm
135mm	175.5mm	202.5mm	216mm	270mm
200mm	260mm	300mm	320mm	400mm
400mm	520mm	600mm	640mm	800mm
600mm	780mm	900mm	960mm	1200mm

Example: If the sensor is half the size, the same lens will seem to give twice the magnification

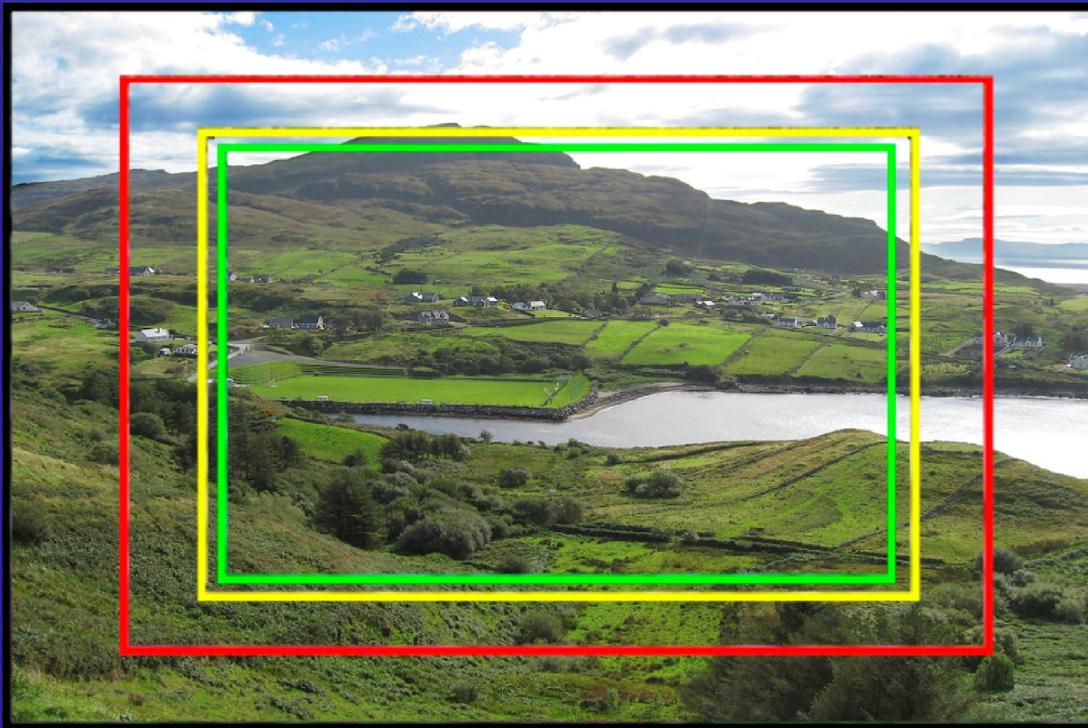


Angle of View Example (1)

Angle of View varies with sensor size

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 ($50 + (.6 \times 50)$) = 80



**Helps
Some shots**

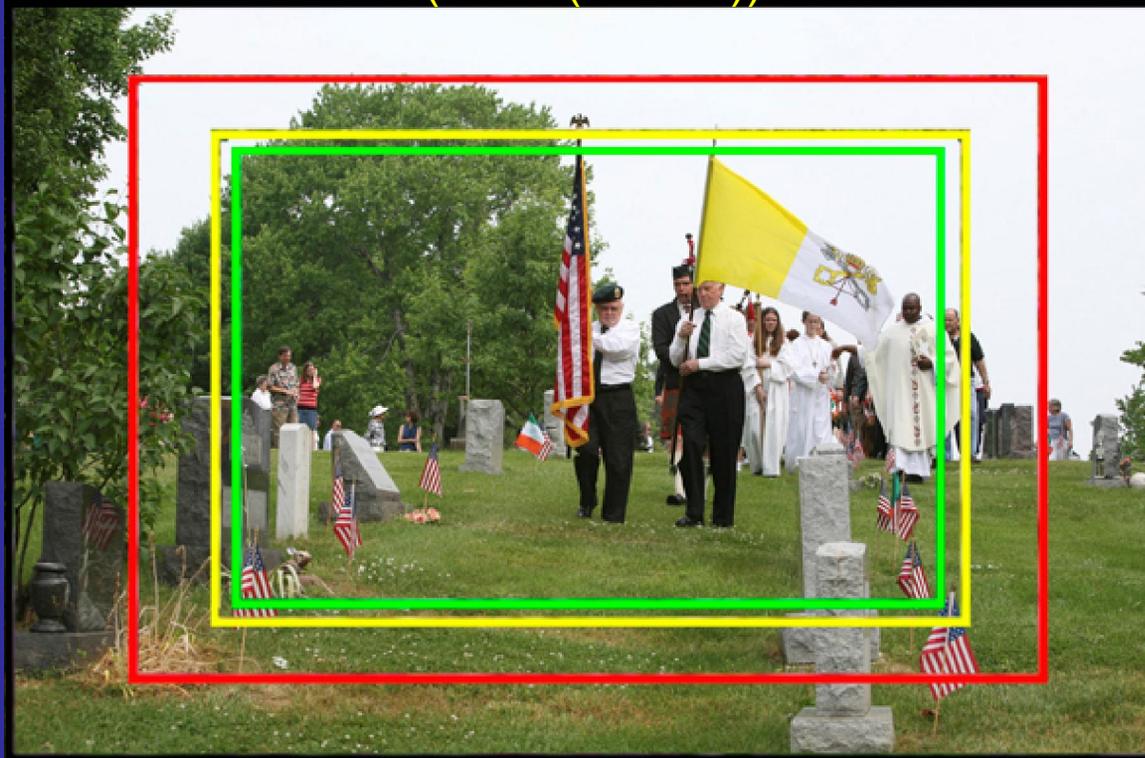
Canon D1-series=1.3, Nikon DX=1.5, Canon Consumer Series 1.6

Angle of View Example (2)

Angle of View varies with sensor size

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 ($50 + (.6 \times 50)$) = 80



**Hurts
Some shots**

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

Zoom Ratio

Zoom ratio is simply the longest focal length divided by the shortest
It says nothing about picture quality

- **Nikon Coolpix 8200** (\$329.00)
 - http://www.bhphotovideo.com/c/product/818665-REG/Nikon_26288_COOLPIX_S8200_Digital_Camera.html
 - focal length ranges from 25-350mm* (14x)
- **Canon Powershot SX 230 HS** (\$189.00)
 - http://www.bhphotovideo.com/c/product/753782-REG/Canon_5043B001_Powershot_SX230_HS_Digital.html
 - Focal Length range 28-392mm* (14x)
- **Canon Powershot A1200** (\$84.00)
 - http://www.bhphotovideo.com/c/product/750177-REG/Canon_Powershot_A1200_Digital_Camera.html
 - focal Length 28 - 112mm*. (4x)

* Focal Length is 35mm equivalent

Examine Lens Focus (1)

- Tape paper to a wall - try different lens / settings
- Shoot the newspaper



- 28-75mm zoom lens at 50mm, F2.8 1/400sec
- Note: Most lenses are sharpest around F8 (mid Range)

Examine Lens Focus (2)

- If you have several lenses redo for each



Canon 180mm f2.8 Macro



Leica 35mm f2 Summicron M

Examine Lens Focus (3)

- Series of shots changing aperture between shots
 - Lens is Not equally sharp at all focal points



Exposure Triangle

Aperture, Shutter Speed, Chip Sensitivity

Definitions

- **Aperture** - circular hole in the front of the camera lens which controls the amount of light allowed to pass on to the sensor.
 - Aperture settings are given as F-stops
 - Example f2.8, f4.5, f5.6, f8, f11, f16, f22, f32
- **Shutter Speed**: The action of the shutter that controls the duration of an exposure. The faster the speed the shorter the time the sensor is exposed to light.
 - Shutter speed settings are given in seconds or fraction of a second
 - Example 15"=15sec "3=0.3 sec, 20=1/20sec. 60=1/60 sec. 1/125 sec.
- **ISO setting**: A measure of the sensor sensitivity to light. Higher ISO settings amplify the signal making the sensor seem more sensitive to lower light leveles
 - But higher ISOs may result in lower quality photos.
 - More Grain

Light Gathering of Aperture

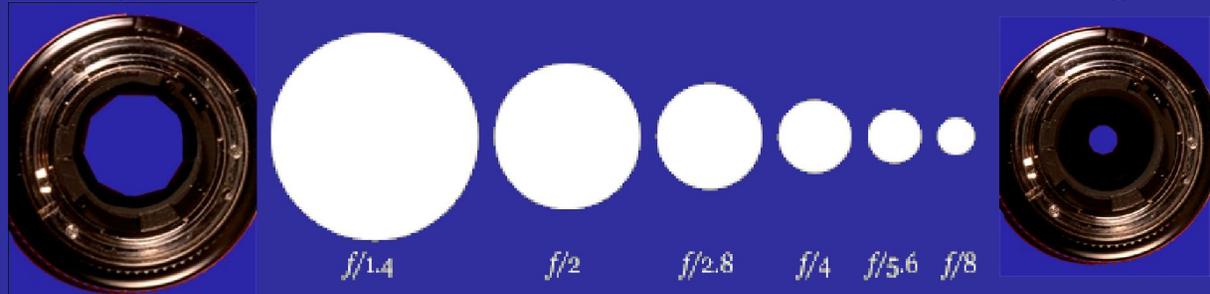
Typical Maximum Apertures	Relative Light-Gathering Ability	Typical Lens Types
<i>f/1.0</i>	32X	Fastest Available Prime Lenses (for Consumer Use)
<i>f/1.4</i>	16X	Fast Prime Lenses
<i>f/2.0</i>	8X	
<i>f/2.8</i>	4X	Fastest Zoom Lenses (for Constant Aperture)
<i>f/4.0</i>	2X	Light Weight Zoom Lenses or Extreme Telephoto Primes
<i>f/5.6</i>	1X	

How Much Light (*Volume*)

How Much Light (*Volume*) passes through lens

- Determined by the size of the opening

- F stop



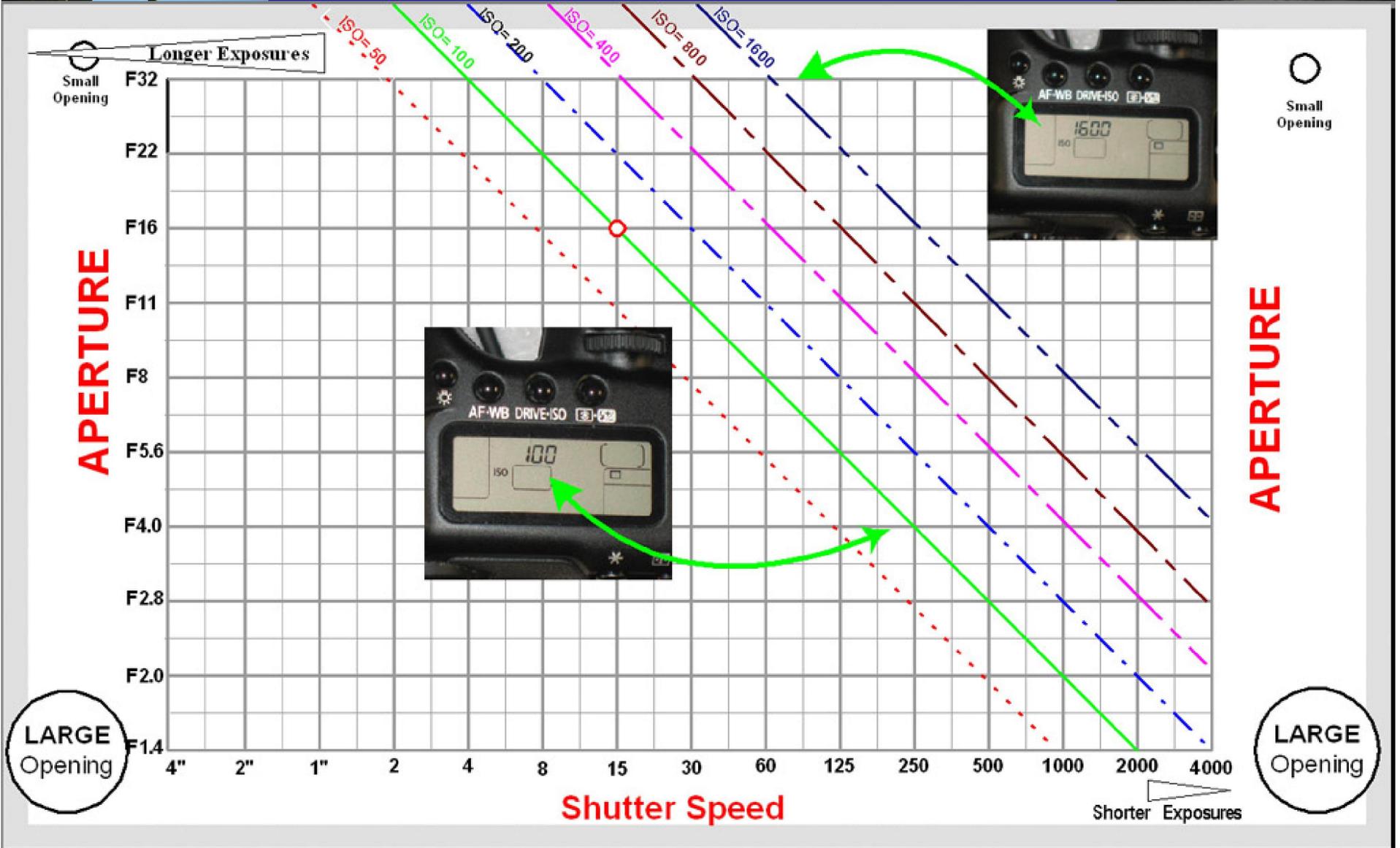
Standard full stop numbers = F # 1.0, 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22, 32, 45, 64,

Many cameras also give 1/2 or 1/3 stop increments

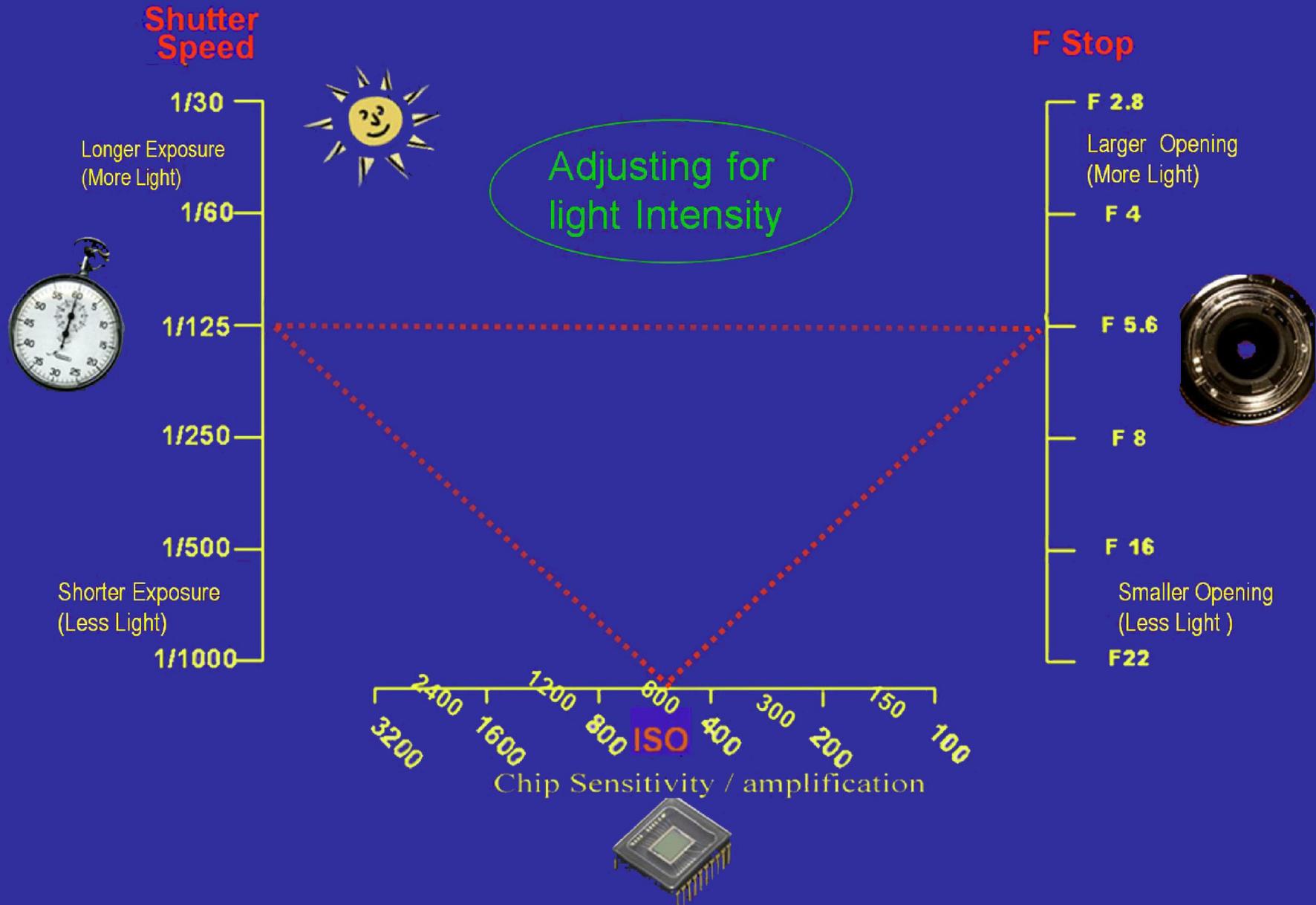


F Stop Determines Depth of Field

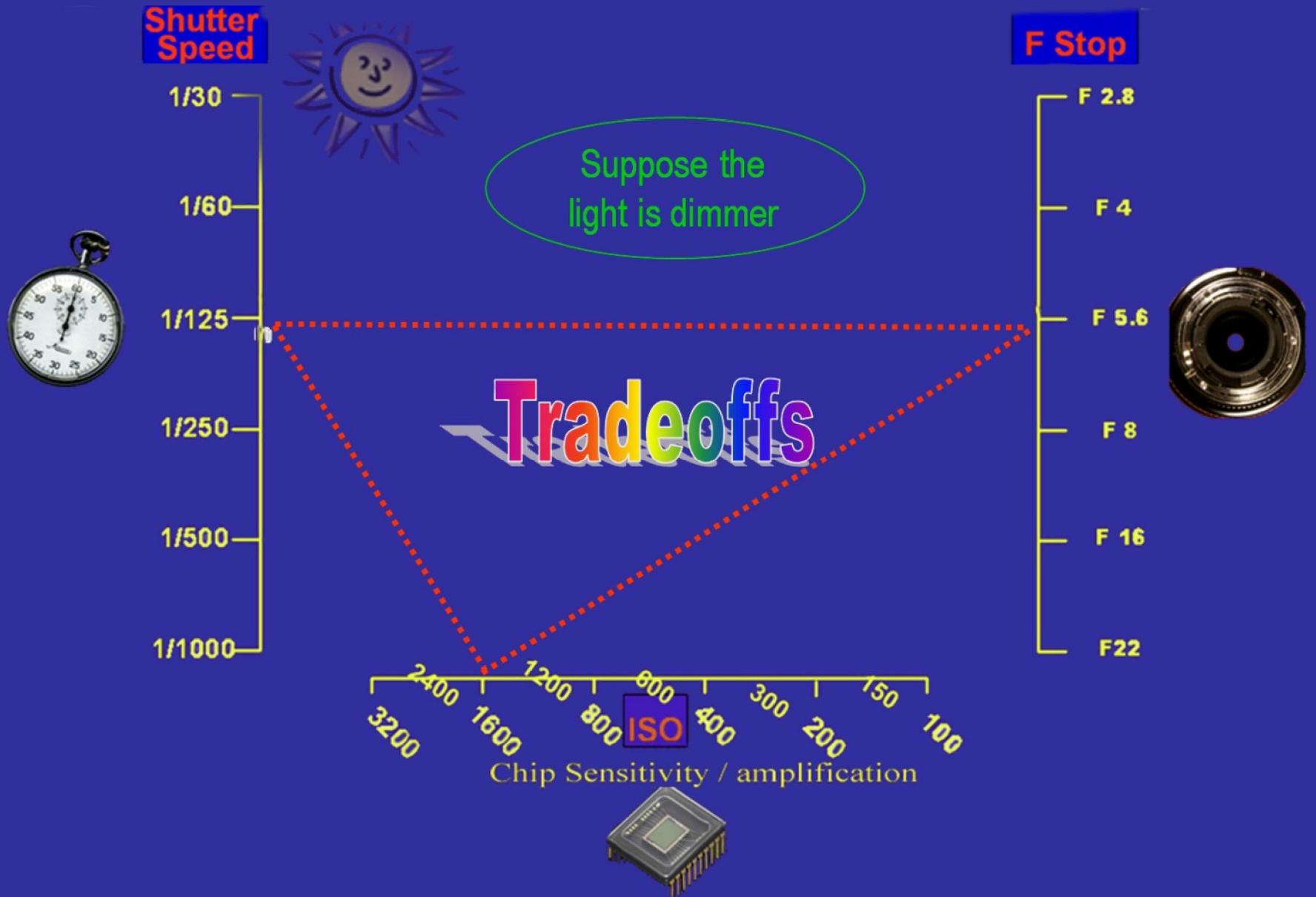
Adjusting ISO



Exposure Triangle (1)



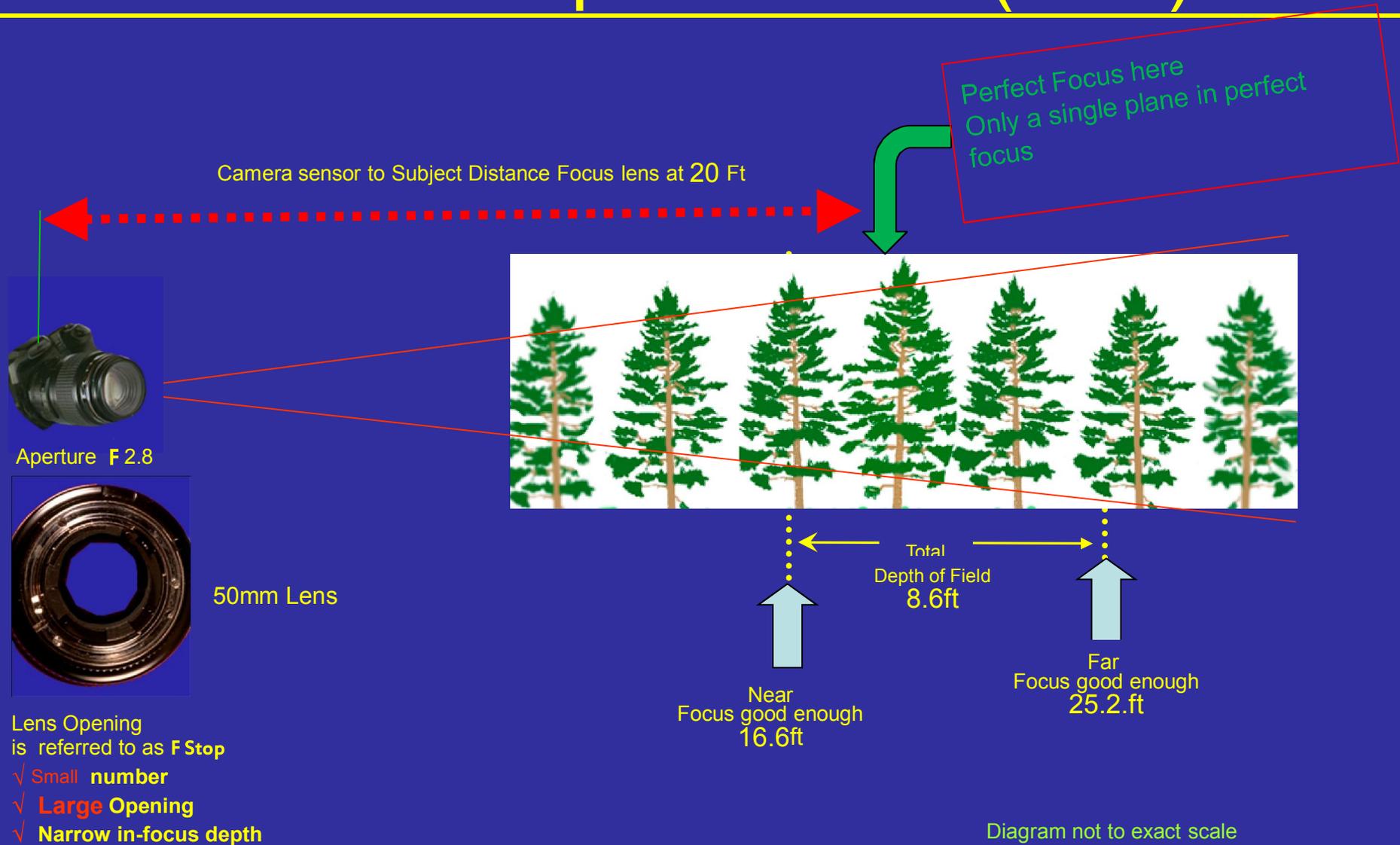
Exposure Triangle (2)



Depth of Field

Depth of Field: The distance between the nearest point and the farthest point in the subject which is perceived as acceptably sharp.

What is Depth of Field (DoF)



Changing Depth of Field

Lens Focal Length : 70mm
Aperture F32
Far Focus: 54.79Ft
Near Focus: 6.64ft.



Changing Depth of Field

Lens Focal Length : 70mm
Aperture F2.8
Far Focus: 12.88 ft.
Near Focus: 11.23 ft



Factors Affecting Depth of Field (DoF)

- Size of Image Sensor



- Small P&S cameras typically give large DoF

- Closeness to subject

- Moving closer to subject provides for less DoF

- Focal Length of Lens

- Long Telephoto lens provide for less DoF

- Wide Angle Lens result in More DoF

- Size of the Aperture

- Higher number yields more DoF

An Advantage of Adjustable Camera

Camera, film format, or circle of confusion Canon PowerShot S95	Subject distance 120 in
Focal length (mm) 5.2	Depth of field
Selected f-stop f/2	Near limit 51.1 in
Subject distance 120 inches	Far limit Infinity
<input type="button" value="Calculate"/>	Total Infinite
	In front of subject 68.9 in
	Behind subject Infinite

Compact Camera (Small lens)
tend to keep large Depth of Field

Camera, film format, or circle of confusion Canon 5D (Mark II)	Subject distance 120 in
Focal length (mm) 50	Depth of field
Selected f-stop f/2	Near limit 111.9 in
Subject distance 120 inches	Far limit 129.3 in
<input type="button" value="Calculate"/>	Total 17.4 in
	In front of subject 8.1 in (46%)
	Behind subject 9.3 in (54%)

Digital SLR (with interchangeable lens)
Allow for selective Depth of Field Control

Depth of Field Examples



F stop	Distance to subject			
		Close in focus	Far in Focus	Interval
F8	10"	6.94"	17.9"	11"
F5.6	10"	7.62"	14.5"	6.92"
F4	10"	8.19"	12.8"	4.64"
F2.8	10"	8.65"	11.2"	3.2"
F2	10"	9.1"	11.2"	2.4"



Homework Assignment

- **READ YOUR CAMERA MANUAL**

With your camera in hand

- There may be a “Magic Lantern Guide” and / or Video Disc for your camera. If so, consider them.



Camera Modes

- FULL AUTO ()
- Aperture Priority (AV)
- Shutter Priority (TV)
- Manual
- Basic (depend on camera)
 - Landscape, Portrait,
 - Sports, Macro, Night
 - Beach, Snow, etc

http://www.youtube.com/watch?v=t9FO0ZeiaMg&feature=youtu.be&cmp=February_12_news&link=image

Discussion