PHOTO CLUB MAY 5, 2015

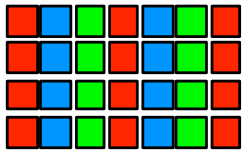
DOTS, PIXELS AND BITS

SENSOR SIZE

- Sensor Size determines the number of Megapixels the camera has. In other words it defines the pixel width and height of the image saved.
- The actual size of the sensor affects the amount of light the pixel can sense.
- The larger the area for the pixel to sense light the better dynamic range, low light performance and less noise can be provided by he sensor

SENSOR SIZE

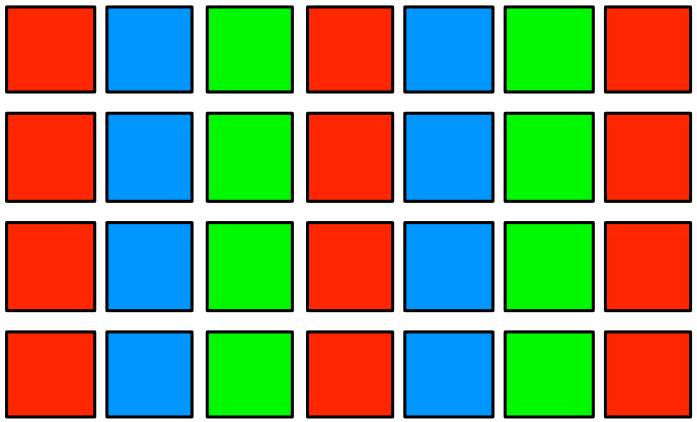
6 pixels



4 PIxels

Compact Camera Sensor

6 pixels



4 PIxels

SLR Sensor

THE RESOLUTION QUESTION

- Camera - measured in MegaPixels
- Monitor - measured in pixels width by pixels height
  - Computer
  - Television
- Scanner - measured in dots per inch
- Printer - measured in dots per inch

THE PHOTOGRAPHERS WORKFLOW

- Step 1 - Take pictures or Scan pictures
- Step 2 - Edit the pictures on the computer
- Step 3 - Print the edited picture
- With three different measurements from the devices, how can one know the effect of changes to the resolution of the pictures

DEFINITION

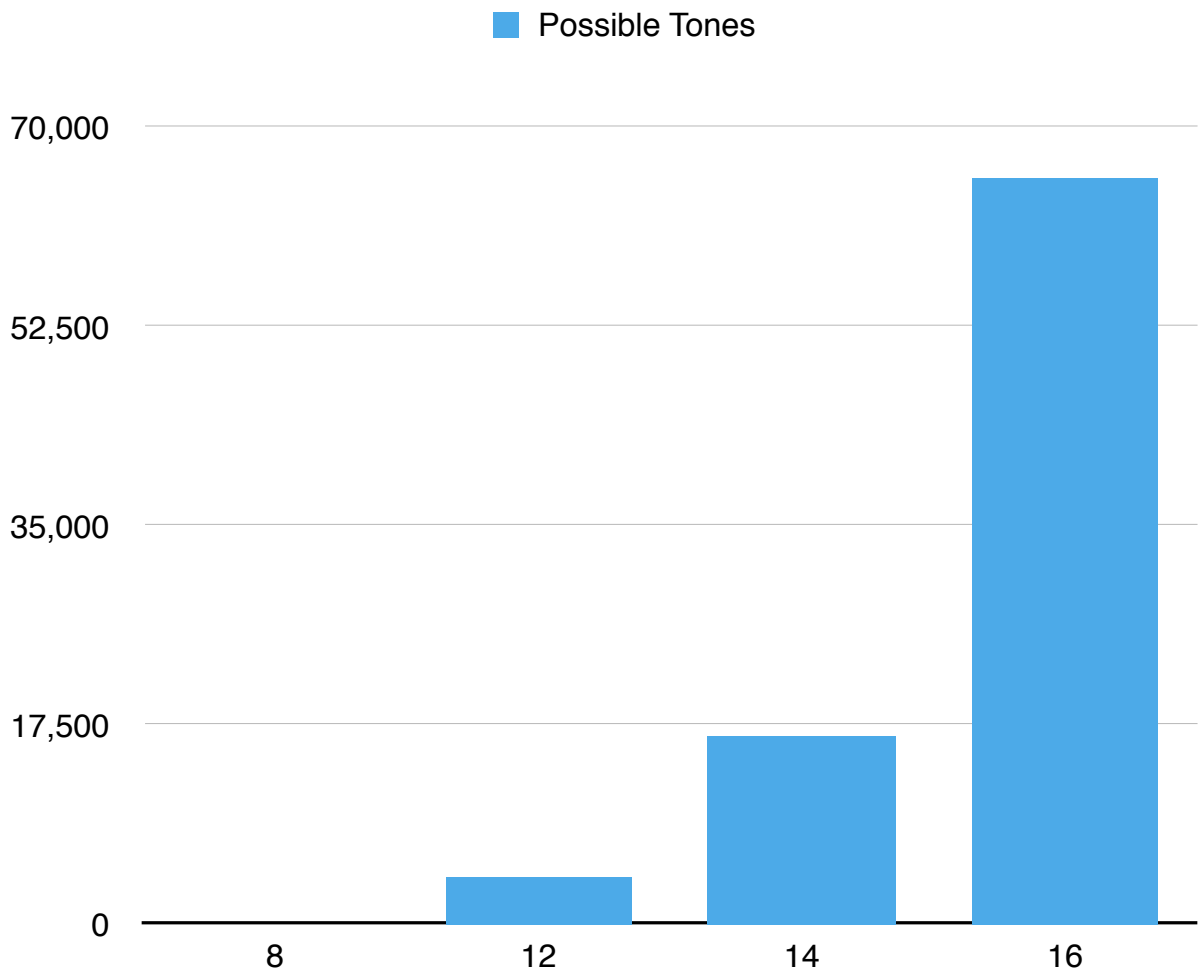
- Pixels per Inch (PPI)
  - The word “Pixel” is derived from the term “PICture ELement"
  - The number of pixels in an image per inch
  - Describes the resolution of an image regardless of device
  - Is the result of a devices input such as a camera sensor or scanned image

DEFINITION

- Bit Depth
  - This represents the colour intensity for each pixel
  - Think of shades of gray that can be captured or shades of different colours
  - Common Bit Depths are 8,12,14,16. HDR is 32
  - Bit Depth is for each colour Red, Blue, Green (RGB)
  - 2^Bit Depth is the number of tonal values possible

BIT DEPTH

Bit Depth	Possible Tones
8	256
12	4,096
14	16,384
16	65,536



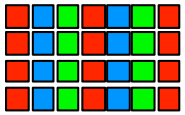
MEGAPIXELS

- Is the result of multiplying the images width in pixels by the height in pixels
- Nikon D7100 DX 24.1 million pixels or 6000 x 4000
- Nikon D810 FX 36.3 million pixels or 7360 x 4912
- 27 in iMac 3.69 million pixels or 2560 x 1440
- HD TV 2.07 million pixels or 1920 x 1080
- 5K TV 14.75 million pixels or 5120 x 2880

IMAGE SIZE

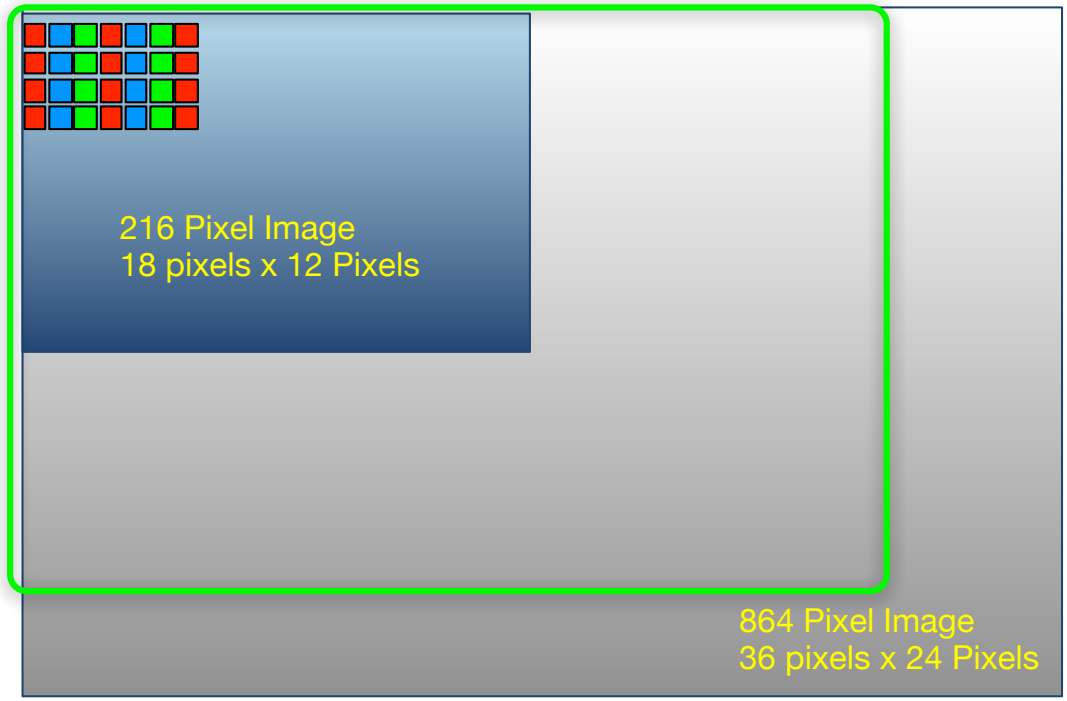
24 Pixel Image

6 pixels



4 PIxels

Monitor 30 pixels x 20 pixels - 600 pixel image



PIXELS PER INCH (PPI)

- PPI is a key factor in determining the size of a print.
- 180 PPI provides good quality prints
- 240 PPI provides better quality prints
- 300 PPI provides best quality prints (considered photographic quality)

DETERMINING PPI

- The calculations are based on a camera image size of 6000 x 4000.
- To calculate the PPI for an 8 x 10 picture

  6000 pixels / 8 inches = 750 PPI

  4000 pixels / 10 inches = 400 PPI
- As one can see the PPI is based on size of print

PPI - 300PPI FOR A 12 X 9 PRINT

PPI - 25PPI FOR A 12 X 9 PRINT

PPI - 10PPI FOR A 12 X 9 PRINT

DEFINITION

- Dots per Inch (DPI) for a scanner
  - Used for defining input such as a scanner
  - Is equivalent to pixels per inch
  - Defines the resolution of the image resulting from the scan

DEFINITION

- Dots per Inch (DPI) for printing
  - Printing multiple dots may be needed to produce one pixel
  - It varies from device to device
  - Does not result in the same resolution
  - DPI should not be used to refer to images, it is a printing attribute to produce an image
  - This is the resolution of the printer

DETERMINING MAX. PRINT SIZE

- Continuing from last slide. The maximum print size for our example to create a Best quality print would be -
- 6000 pixels / 300 PPI = 20 inches
- 4000 pixels / 300 PPI = 13.3 inches
- 24.1 megapixel image
- DPI is equivalent to about half the PPI

DETERMINING MIN. PIXELS

- To determine the minimum number of pixels needed to print a specific size print at Best quality would be
- 8 inches * 300 PPI = 2400 pixels
- 10 inches * 300 PPI = 3000 pixels
- 7 megapixel image

ASPECT RATIO

- ratio = pixels width / pixels height
- A value of 1.5 refers to a 3:2 aspect ratio
- A value of 1.33 refers to a 4:3 aspect ratio
- A value of 1.78 refers to a 16:9 aspect ratio

PRINT SIZE VS PPI

IMAGE MEGAPIXELS BASED ON 3:2 RATIO	300 PPI	200 PPI
2	5.8 X 3.8	8.7 X 5.8
3	7.1 X 4.7	10.6 X 7.1
4	8.2 X 5.4	12.2 X 8.2
5	9.1 X 6.1	13.7 X 9.1
6	10.0 X 6.7	15.0 X 10.0
8	11.5 X 7.7	17.3 X 11.5
12	14.1 X 9.4	21.2 X 14.1
16	16.3 X 10.9	24.5 X 16.3
22	19.1 X 12.8	28.7 X 19.1

SCANNING

- Input is measured in DPI
- This DPI should really be PPI because the result is an image of a specific pixel width and height based on the picture or slide being scanned
- The higher the DPI the more detail that is captured from the picture
- Paper prints can only provide up to 300 DPI on average

SCANNING

- If you have the negatives or slides of a print that is a better medium to scan to capture the highest detail
- Keep in mind that he higher the DPI the more storage space will be needed
- Only use the optical resolution of the scanner since it is the real PPI of the output
- Keep in mind when scanning what size of print you may actually later want to print - this drives the DPI choice

SCANNING

- A 2.5 x 3.5 print at best quality would be 300 DPI
  - 2.5 * 300 = 750 pixels by 3.5 * 300 = 1050 pixels
- To scan the 2.5 x 3.5 print and be able to print a 300 PPI 8x10 print would require a DPI of 1000
  - 8 * 300 = 2400 pixels by 10 * 300 = 3000 pixels
  - Factor of 3.2 is required to achieve 300 PPI from the original photo 2400/750 = 3.2 and 3000/1050 = 2.9
  - Take largest factor 3.2 * 300 = 960 rounded up to 1000 DPI

SCANNING

- Minimum DPI Setting for some common print sizes

PRINT SIZE	DPI
2.5 X 3.5	1000
3.5 X 3.5	900
4 X 4.5	600
3.5 X 5	600
4 X 5	600
4 X 6	600
4 X 7	600
5 X 7	600
8 X 10	600

MEGAPIXELS VS MEGABYTES

- Megapixels have no direct relationship to storage megabytes
- The following affect storage
  - Megapixels
  - Bit Depth
  - File Format - RAW, TIFF, JPEG
  - Compression (may be referred to as Quality Setting)

MEGABYTES

- To calculate an estimate of storage space a picture takes uncompressed and a bit depth of 8 with a 10MP camera.
  - 8 bits = 1 Byte - there is 1 byte per Red, Green and Blue. So 1 pixel will take 3 bytes
  - 3bytes * 10 Megapixels = 30,000,000 bytes
  - 30,000,000 bytes / 1,000,000 = 30 Megabytes

COMPRESSION

- Different file formats have different compressions
- The image’s pixel count does not change

COMPRESSION

- TIFF format has no compression - good for post processing storage and can be the destination of RAW processing

- File sizes are huge

COMPRESSION

- RAW format - differs per vendor, as the name says it is the unprocessed information captured by the sensor. Requires processing before it can be displayed.
- Supports various Bit Depth
- Processing a RAW image does not change the original information
- All the information the digital image captured is available for tweaking
- Uses visually lossless compression

COMPRESSION

- Joint Photographic Experts Group (JPEG) is an industry standard
- Uses compression which varies by the quality chosen for the image (Fine, Normal and Basic)
- Uses lossy type compression (loses information), so the image is not the same as the original image when uncompressed
- Editing a JPEG image multiple times causes a cumlative loss of image data
- JPEG does not capture all the information like RAW
- Provides up to 8 Bit Depth (2014/01/22 - 12 Bit and Lossless compression)