

Resolution & Bit Depth

Power to the pixel!

Ask this question . . . always.

- ✓ How is the image to be reproduced?
- ✓ What technology will be used to output it?
- ✓ Could there be more than one answer to this question?

PRINT?

- ✓ Wrong Answer!!
- ✓ No such thing as a print . . .
. . . but there are different sorts of prints
- ✓ So, what kind of print?



Possible prints

- ✓ Ink jet print
- ✓ Poster printer
- ✓ Laser print
- ✓ C-type print
- ✓ Lambda print
- ✓ Fuji Pictography
- ✓ Half tone printing



. . . then again?



- ✓ The web?
- ✓ Multimedia?
- ✓ Digital video?
- ✓ Film writer?
- ✓ The tee shirt?
- ✓ Tattoo?

So which one?

- ✓ If you can't answer the question, then how can you make and process a digital image with any certainty?



What do we need to know?



- ✓ How is the file to be reproduced?
- ✓ What are the requirements of that particular technology?
- ✓ How big will the image be reproduced?

A BIG therefore . . .

How many pixels do you need?



It's all about the pixel, stupid!



The Pixel

Pixels

- ✓ Pixels can represent the tonality (greyscale) of a subject
- ✓ Pixels in channels can represent the colour of a subject
- ✓ Pixels, as resolution, can show the detail of a subject relative to size

Pixel Image



The pixel detail



Bits & Bytes

- ✓ A Bit = the numbers 0 or 1
- ✓ One Byte = 8 bits, eg 00000111
- ✓ 1 Kb = 1024 bytes
- ✓ 1 Mb = 1024 Kb
- ✓ 1 Gb = 1024 Mb
- ✓ 1 Tb = 1024 Gb

Bit Depth: 1 Bit Image - 2^1

- ✓ Only two tonal choices: Black or white



Bit Depth: 2 Bit Image - 2^2

- ✓ Four tonal choices: Black, dark grey, light grey or white



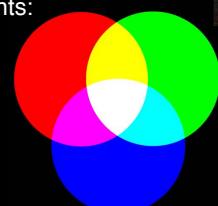
Bit Depth: 8 Bit Greyscale - 2^8

- ✓ 256 choices of tone
- ✓ White > Grey > Black
- ✓ Minimum acceptable choice for photography
- ✓ More than the human eye can resolve



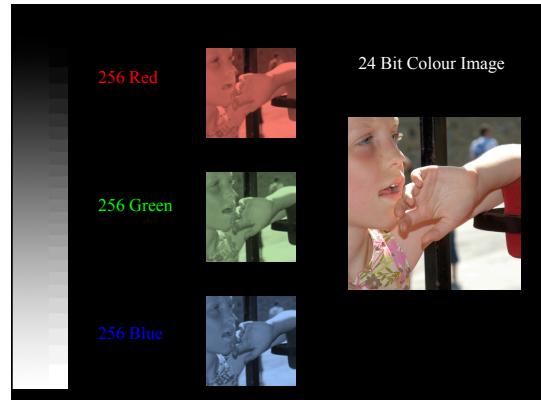
RGB Colour Mode

- ✓ Additive Colour Synthesis
- ✓ Components:
 - ✓ Red
 - ✓ Green
 - ✓ Blue



Bit Depth: 24 Bit Colour Image

- ✓ 8 bits per channel
 - ✓ 256 tones per channel
- ✓ Three channels
 - ✓ Red – 2^8 tones
 - ✓ Green – 2^8 tones
 - ✓ Blue – 2^8 tones
- ✓ $2^{8 \times 3} = 16,777,216$ Colours



256 Red



24 Bit Colour Image



256 Green



256 Blue



48 Bit Colour Image

- ✓ 16 bits per channel
- ✓ Three channels
 - ✓ Red – 2^{16} tones = 65,536 = 64Kb
 - ✓ Green – 2^{16} tones = 65,536 = 64Kb
 - ✓ Blue – 2^{16} tones = 65,536 = 64Kb
- ✓ 281,474,976,710,656 possible colours!!!

Pixels dimensions

- ✓ Example
 - ✓ Height = 750px
 - ✓ Width = 1000px
- ✓ Height X Width
 - = Total number of Pixels
 - ✓ $1000\text{px} \times 750\text{px} = 750,000$
- ✓ 732Kb approx



Resolution - what's it for?

- ✓ How is it relevant?
 - ✓ Pixels are invisible!
 - ✓ Pixels are only made *visible* through an output device, e.g. screen or printer
 - ✓ Devices *require* pixels at defined rates
 - ✓ Screens at 72 or 96 pixels per inch
 - ✓ Epson printers 240/300 pixels per inch

Resolution - Input and Output

- ✓ PPI = Pixels per Inch
 - ✓ The number of pixels per linear inch (or centimetre)
 - ✓ Relevant to scanners and monitors
 - ✓ Used in calculating Input and Output dimensions in pixels
- ✓ DPI = Dots per Inch
 - ✓ Only relevant to printers
 - ✓ Not interchangeable with PPI
 - ✓ Dots are not pixels!

Dimensions (h)

- ✓ Number of Pixels = Dimension x Resolution PPI
- ✓ Height = 7.5"
- ✓ PPI = 100
- ✓ No. of pixels (height) = 750



Dimensions (w)

Number of Pixels = Dimension x Resolution (PPI)

- ✓ Width = 10"
- ✓ PPI = 100

- ✓ No. of pixels (width) = 1000



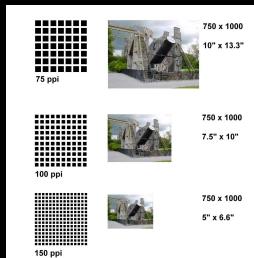
Number of Pixels

- ✓ Height X Width = Total number of Pixels
- ✓ 1000px X 750px = 750,000px
- ✓ 732Kb approx



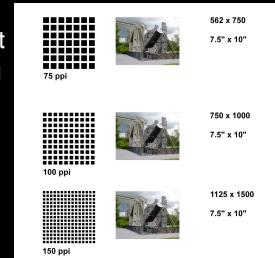
Changing the Resolution Only

- ✓ Pixel dimensions remain the same 750px X 1000px
- ✓ Output dimension (inches and centimetres) change
- ✓ File size will also remain the same (Kb/Mb) since there is no change



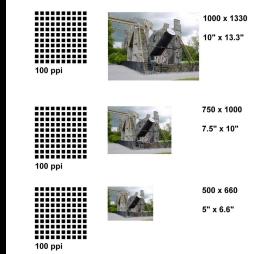
Maintaining Size Only

- ✓ Maintaining output size and changing the resolution
- ✓ The number of pixels will change



Changing the Output Size Only

- ✓ Changing output size and maintaining the same resolution
- ✓ The number of pixels will change



File Sizes in Pixels

- ✓ 8 bit files = (height X width)
- ✓ 24 bit files = (height X width) X 3
 - ✓ contains three 8 bit channels (RGB)
 - ✓ three items of information (RGB) per pixel
- ✓ 48 bit files = ((height X width) X 3) X2
 - ✓ contains three 16 bit channels (RGB)
 - ✓ each 16 bit channel is twice the size of one 8 bit channel

Note - Saved File Sizes

- ✓ Saved file sizes will vary according to file format used
 - e.g. TIF and PSD are larger than JPEG
- ✓ This does not effect the pixel dimensions or the resolution
- ✓ It may effect other image/file components especially, Jpeg and Gif images
- ✓ Different file types for photographic images have specific uses and characteristics

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