

# Digital photo sizes and file formats

- What the size means – pixels, bytes & dpi
- How colour affects size
- File formats and sizes - compression
- Why you might need to change the size
- How to change size

For Tynemouth Photographic Society – [www.tynemouthps.org](http://www.tynemouthps.org)

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In addition to these slides the meeting included many demonstrations of how to do things which cannot of course be shown here.

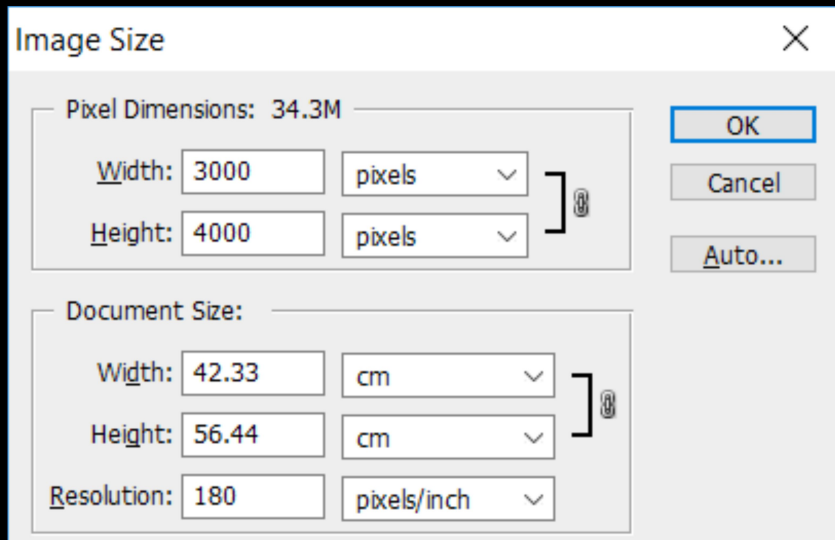
Importantly the following were shown.

- The program Paint3D, a basic component of Windows 10, enables the opening, resizing and saving of images (in various formats). This provides a way to resize images completely FREE. More details of how to use Paint3D for resizing will be put on the Tips page of [tynemouthps.org](http://tynemouthps.org) soon.
- Adobe Photoshop Elements 2019 was demonstrated. Our members should ignore the main screen and go into the Photo Editor which can do everything that was demonstrated in the full version of Photoshop (CS4 was shown) except that the “Save for web” dialogue does not have an option to include no metadata in the saved file (if you want to be sure that competition judges cannot see your name).

This image is 3000 pixels wide and 4000 pixels high

Pixels correspond to tiny squares of silicon in the back of the camera which detect light

Photoshop displays image size like this:







Highly magnified,  
the pixels look like this:

A single colour on each



So this image comprises  
 $3,000 \times 4,000 = 12,000,000$  pixels

In other words, 12 MegaPixels

That is sometimes written 12Mpx

Held in a computer for display,  
how much memory does that take?

# Computer memory

- Measured in BYTEs
- 1 byte = 8 bits
- A bit can hold 2 values: 0 or 1
- A byte can have 256 different values: 0 to 255  
(8 bits can hold  $2^8$  values,  $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 2$ )
- The values might represent brightness – so perhaps assign 1 byte per pixel?  
That only works if there is no colour information - fine for black & white (monochrome) images
- But also we may want more than 256 shades of grey
- 2 bytes can hold  $256 \times 256 = 65,356$  values



So this monochrome version of our 12 Megapixel photo can be held in 12 Megabytes of computer memory if we use only 1 byte to represent the brightness of each pixel

Many cameras now detect 14 bits, needing 2 bytes of storage for each pixel if you want to keep all the data



# RGB (Red, Green, Blue) colour

- Our eyes use 3 coloured pigments so that some cells detect red light, some green and some blue (but in a common form of colour blindness only 2 pigments are present)
- Digital cameras do the same: a regular pattern of coloured filters in front of the pixels cause some to detect red, some green and some blue
- Software in the camera works out what the R, G & B values should be for every pixel, by interpolation
- We then have 3 brightness values at every pixel and that specifies the colour
- So 3 bytes of memory are needed per pixel (more if we want more than 256 shades for each colour)



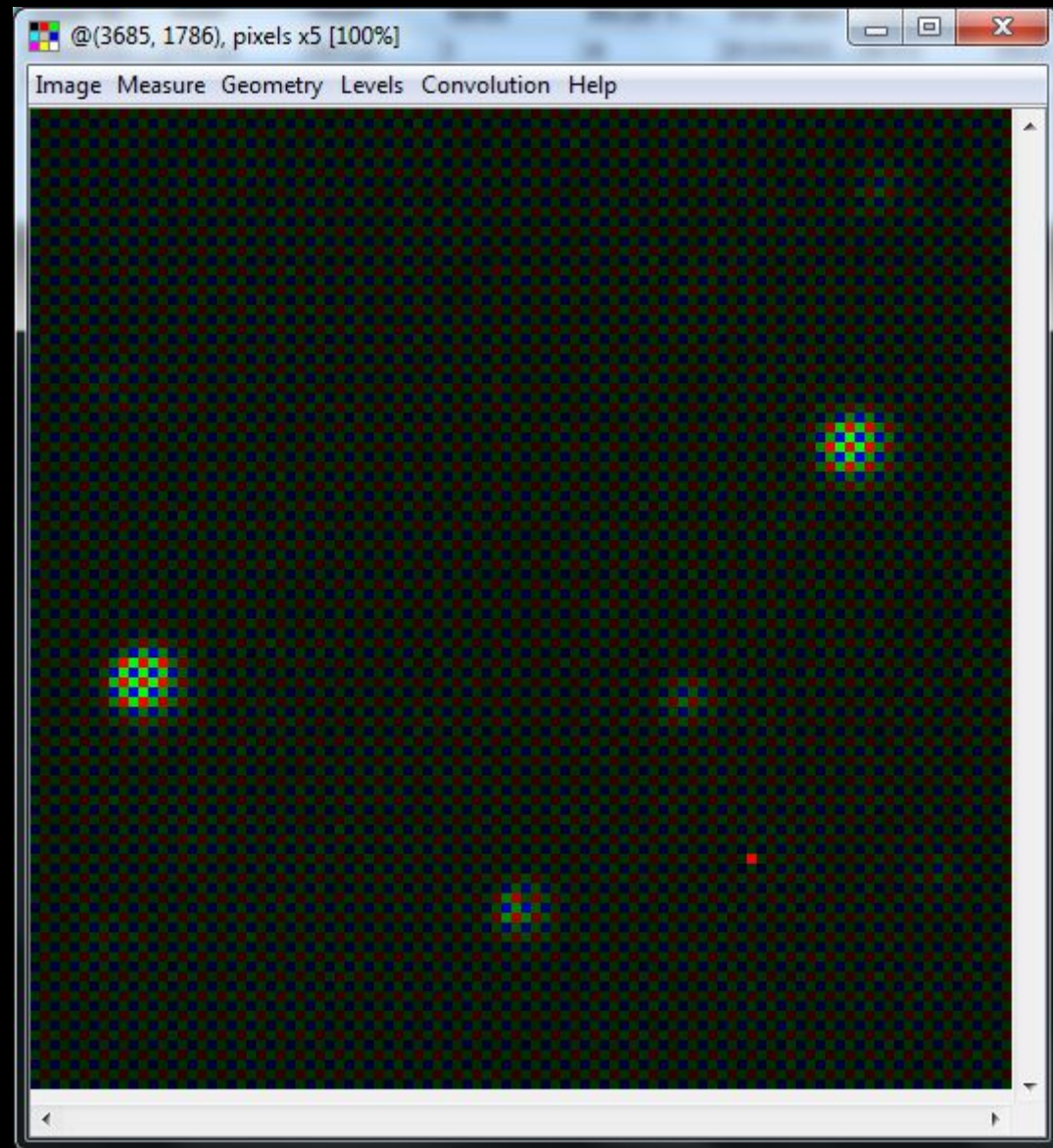
# RGB filters in digital cameras

Colour cameras have an array of red, green & blue (RGB) filters in front of the pixels in the detector

So the raw data of an image of stars really looks like this ----->

Missing colours at each pixel are interpolated from neighbours

Also there is an infra-red blocking filter in DSLRs



The single red pixel here is defective – another story – see my web site, [www.grelf.net](http://www.grelf.net)



# RGB components

Every pixel has 3 values to fix colour, so  
12 Mpx image takes 36 Mbytes memory



Red hull  
bright

Green grass  
bright

Blue boats  
bright



Red component

**R**



Green component

**G**



Blue component

**B**

# Image file formats

- There are several different formats for saving images as files on disc (or on USB stick, etc)
- The most standardised for photos are TIFF & JPEG
- TIFF retains the full information in the image but files can be large
- JPEG uses compression to make much smaller files but it does this by throwing some information away!
- Many cameras can save their data in RAW format but this is not standard between camera makers
- There are other image file formats but these are the most useful for photography

# JPEG files

- Big advantage: very small file size
- Disadvantage: small size is achieved by discarding details that the processing method deems unimportant
- This works well in most cases
- No good if you may want to process the file again: every time the data are resaved more will be lost
- The file extension is usually **.jpg**
- All photo software (apps) can use JPEG files
- JPEG can only save 1 byte (8 bits) per colour
- JPEG stands for Joint Photographic Experts Group who defined the standard around 1990
- A revised standard in 2000 did not catch on (not all software recognises it)



# JPEG file sizes

JPEG has a quality factor trade-off: detail loss vs file size  
When you save a JPEG file you can choose a quality factor



Highest quality: 3.7 Mbytes



Medium quality: 1.4 Mbytes



Lowest quality: 0.4 Mbytes

Remember the full RGB image required 36 Mbytes memory

# TIFF files

- Standard format which saves all the image data so it can be loaded back into memory unchanged
- If you are likely to want to process the image again later, save as TIFF
- There can be compression but in such a way that nothing is lost. In practice not much file size reduction
- Disadvantage: files are large (similar to full memory size of image)
- 1 or 2 bytes per colour can be saved (8 or 16 bits)
- The file extension is usually **.tif**
- Most software (apps) recognise TIFF
- TIFF stands for Tagged Image File Format

# RAW files

- Not standard – every camera maker has its own layout for the data in the file (and its own file extension, such as **.cr2** or **.nef**)
- Saves the brightness values originally detected on each pixel – before interpolation or other processing
- File size is about 1/3 of the full memory size of the image because RGB interpolation has not been done
- You are likely to need the camera maker's own software to read the RAW files but Adobe's programs and some others attempt to keep up with all the various RAW formats
- RAW is not intended to be resaved – after processing an image save it as TIFF (or JPEG)

# Metadata

- Image files also contain information about the image, such as:
  - date and time when the photo was taken
  - camera settings (aperture, ISO, exposure time)
  - camera and lens make and model
  - photographer's name and copyright notice, if these have been set in the camera (helps prevent theft)
- You will sometimes see these referred to as EXIF data.  
EXIF is another standard for data layout in the file, which most imaging software recognises



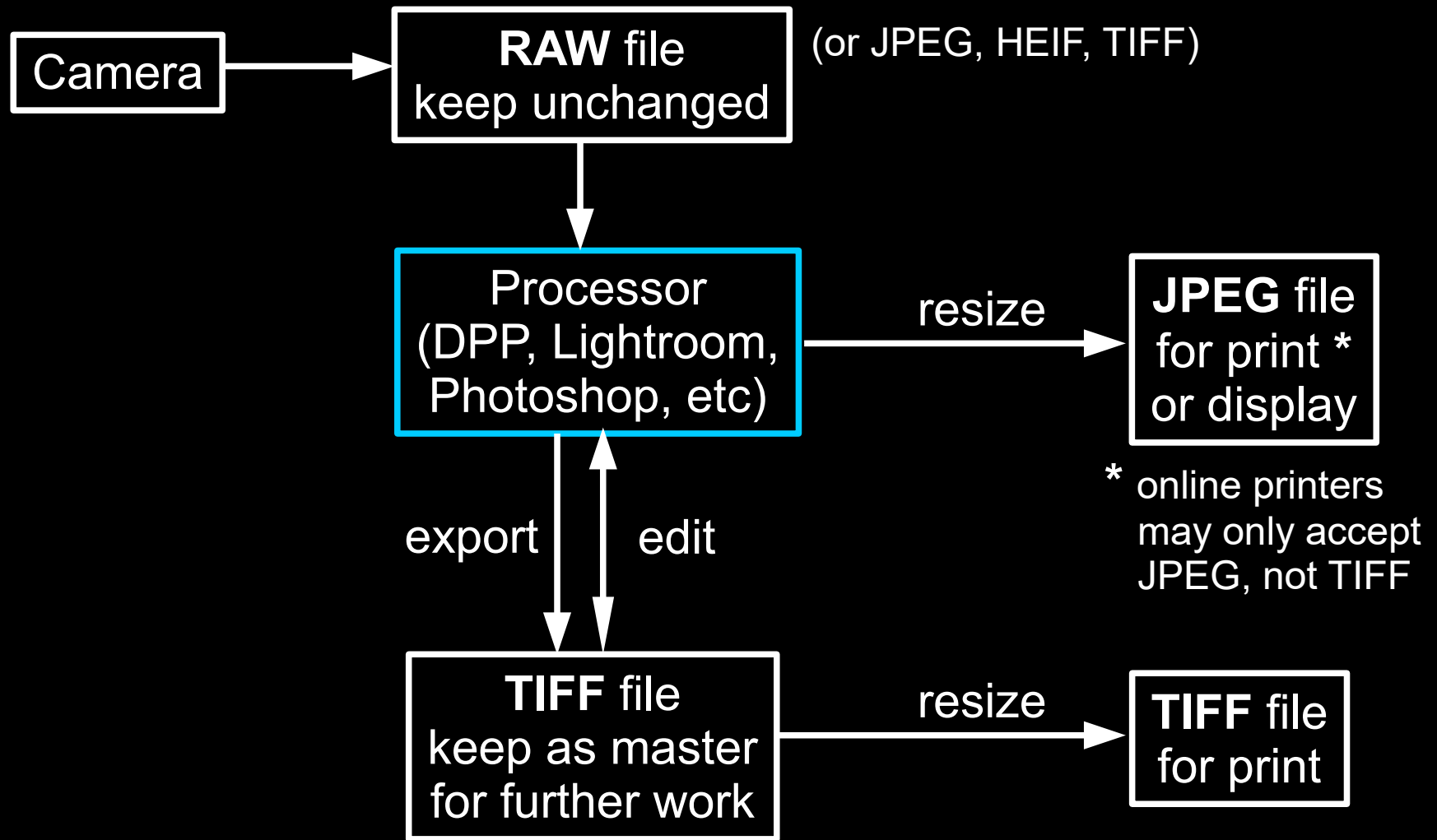
# “Save to RAW”

- If your photo software appears to let you save as RAW, what it really does is change or add to metadata in the original RAW file (or sometimes in an accompanying .xmp file). It should not change the raw pixel values
- Adobe Lightroom (and its forerunner, Canon DPP) save “recipes” in the RAW file – a series of instructions for processing the file after opening it, to get back to where you were
  - In this case you may want to “export as TIFF” (or JPEG) instead and leave the RAW file as it was

# Other file formats you may see

- GIF = Graphics Interchange Format  
for graphics. Only allows 256 colours  
Can hold animated sequences
- PNG = Portable Network Graphics – in 2 flavours:  
PNG-8 is like GIF in only allowing 256 colours  
PNG-24 has 8-bit RGB so can hold photos
  - Both GIF and PNG are meant for use on web sites
- HEIF = High Efficiency Image Format  
new (as of 2015) improvement on JPEG  
May catch on – wait and see (JPEG2000 did not)  
Some phones already use it but need their  
own software to open it

# Outline workflow



# Why resize an image?

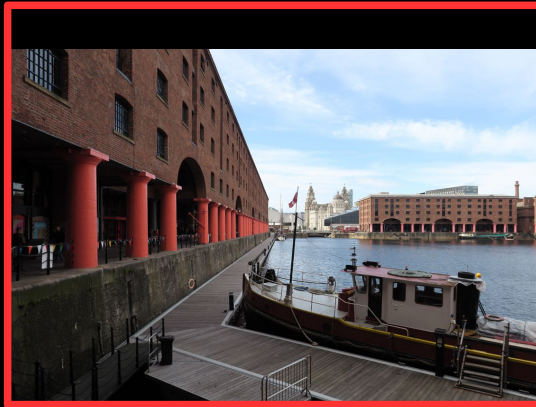
- If you want to send it to someone as an email attachment it is not very friendly to send many megabytes. So use software (app) to scale it down to (say) 800 pixels maximum dimension and then resave as a medium JPEG file for sending
- To put the image on a web page, again scale it down. Otherwise it can take a long time to download and appear in a browser
  - Also if you put the full size image, anyone can copy it at a size suitable for printing – and maybe sell it!
- Photo competitions usually have rules about acceptable image sizes. A typical maximum is 1400 x 1050 pixels in JPEG file of at most 0.8 Mbytes



# Aspect ratio

- A full frame 35mm camera has aspect ratio 3 : 2 (36mm x 24mm)
- Competitions often want image fitting in 4 : 3 (TPS: 1400px x 1050px)

Scale width  
to 1400  
gives  
1400 x 933



Scale height  
to 1050  
gives  
1400 x 1577  
then crop

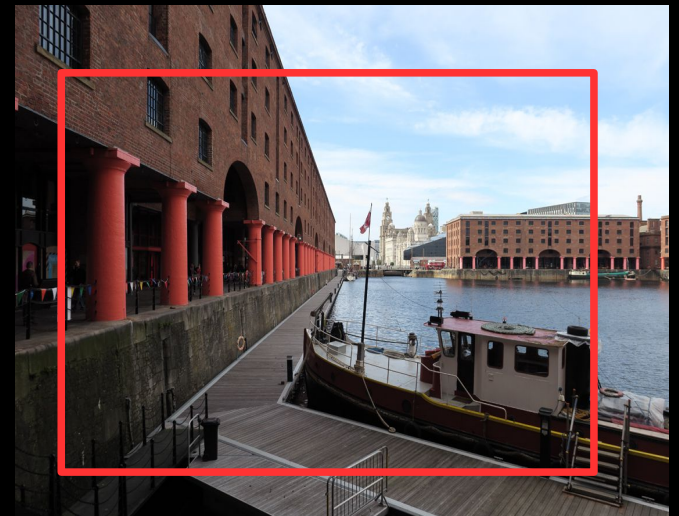


Scale both,  
distorting  
slightly to  
1400 x 1050  
(not if circles)



Sometimes  
useful in AV  
to keep all  
images same size

Crop the right  
size out of  
arbitrarily  
scaled image







# How do you resize an image?

- You need a program (app) which can
  - Open your image file (JPEG, TIFF, RAW)
  - Give you a dialogue for setting new sizes
  - Save the image in a new file (JPEG or TIFF)
- There are many programs available
  - Reputable ones include
    - Adobe Photoshop Elements or
    - Corel PhotoPaint
  - There are free ones available on the Internet but
    - (a) it is hard to be sure you are not downloading something undesirable and
    - (b) you may be giving away your full-size image

# dpi = dots per inch

- Also known as pixels per inch, ppi (even in metric countries)
- For computer display this is meaningless because the display screen could be any size
  - But there is a tradition of setting 72 dpi for images intended for display (Mac users? say 96 dpi)
- For printing it can determine how big the result will really be on paper
  - It is common to use 300 dpi for images for printing
- Image resizing software will usually allow you to change the dpi setting

Pixels per inch are shown as “Resolution” in the image resizing dialogue below (from Photoshop)

You can see how that converts pixel dimensions to printed size on paper

Image Size ✕

Pixel Dimensions: 34.3M

Width:	3000	pixels	⌵
Height:	4000	pixels	⌵

Document Size:

Width:	42.33	cm	⌵
Height:	56.44	cm	⌵
Resolution:	180	pixels/inch	⌵

OK Cancel Auto...





More information about how to resize images  
is available on our club's web site, on the TIPS page:

**[www.tynemouthps.org](http://www.tynemouthps.org)**

A banner image for the Tynemouth Photographic Society. It features a coastal scene with a lighthouse on the left, a small boat in the middle, and another lighthouse on the right, all set against a blue sky and sea. The text "Tynemouth Photographic Society" is overlaid in white.

# Tynemouth Photographic Society

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**Hints & tips**