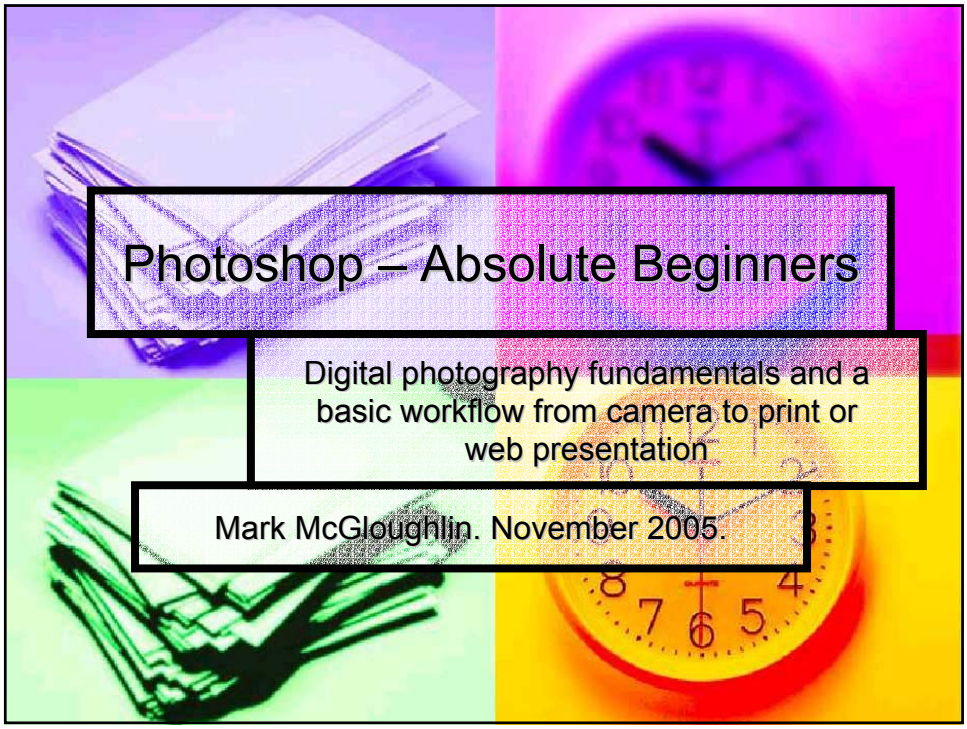
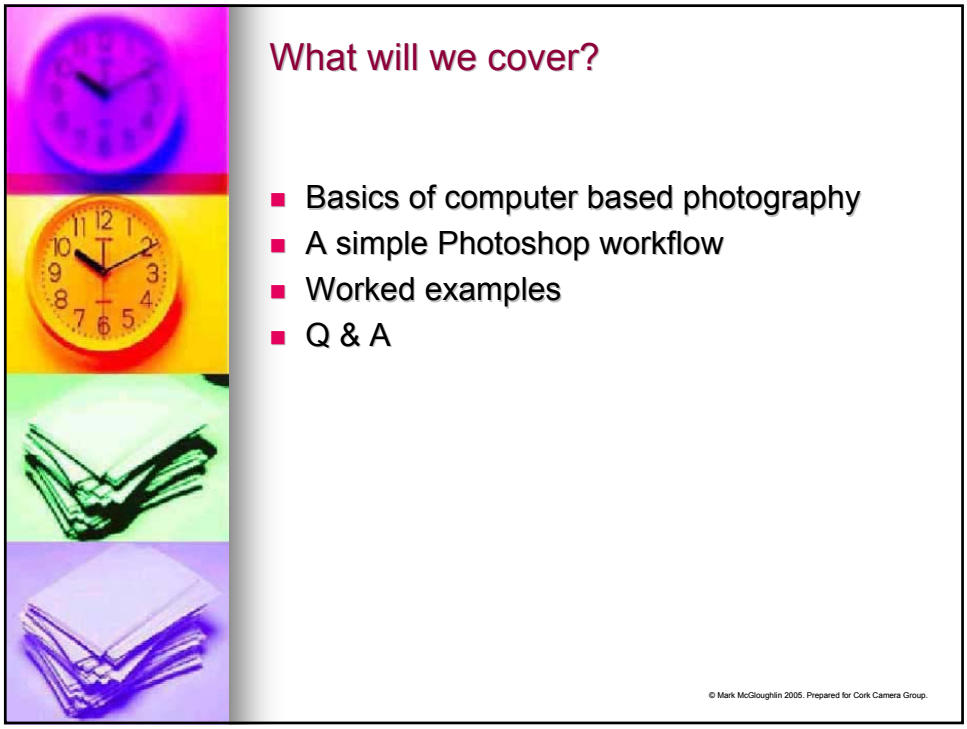

Photoshop – Absolute Beginners
Digital photography fundamentals and a basic workflow from camera to print or web presentation
Mark McGloughlin. November 2005.


What will we cover?
Basics of computer based photography
A simple Photoshop workflow
Worked examples
Q & A
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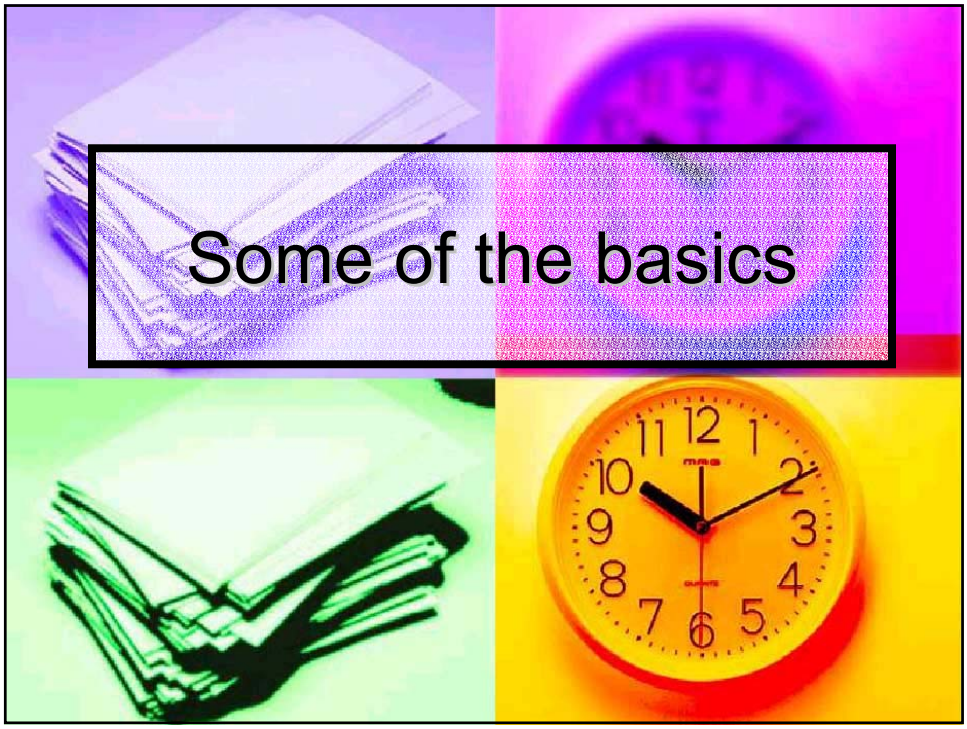


Basics of computer based photography

- How is a photograph stored on a computer? What is a pixel?
- Why is image resolution important?
- Understanding magnification factor.

What is a pixel?

- A *pixel* on your computer monitor is a point of light. A pixel in your camera is a single light sensor.
- What is the maximum resolution of your monitor?
  - Probably 1024 x 768 pixels
- How many pixels is this?
  - 786,432 pixels or 0.7 MP
- Assuming a 3:2 aspect ratio, how many pixels has a 6 MP camera?
  - 6 MP ≈ 6,000,000 pixels = 3000 x 2000 pixels
- Your average computer monitor is approximately 72-96 ppi, depending on size

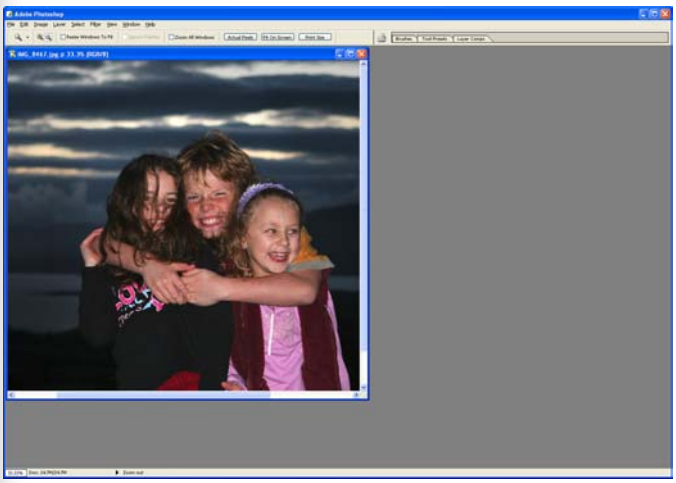
What is a pixel?

- A *pixel* in an image file, whether on a digital camera or in a computer file is a piece of data.
- It could be represented in 1 bit, 1 byte, or 3 bytes
- How many colors can you represent if a pixel is
  - 1 bit
    - $2^1 = 2$ (black or white)
  - 1 byte
    - $2^8 = 256$ (grey scale or limited colour)
  - 3 bytes
    - $2^{24} = \sim 16$ million (colour)

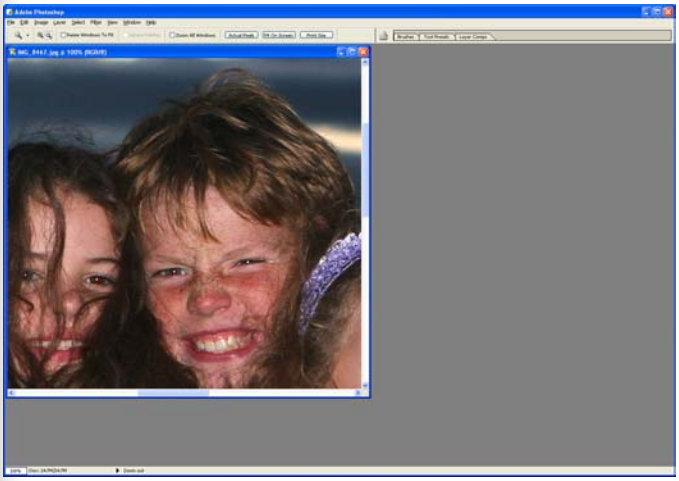
Relationship pixel to pixel (image to screen)

- None really, except that the only time you see all the image pixels is when your image is at or greater that 100% scale on screen.

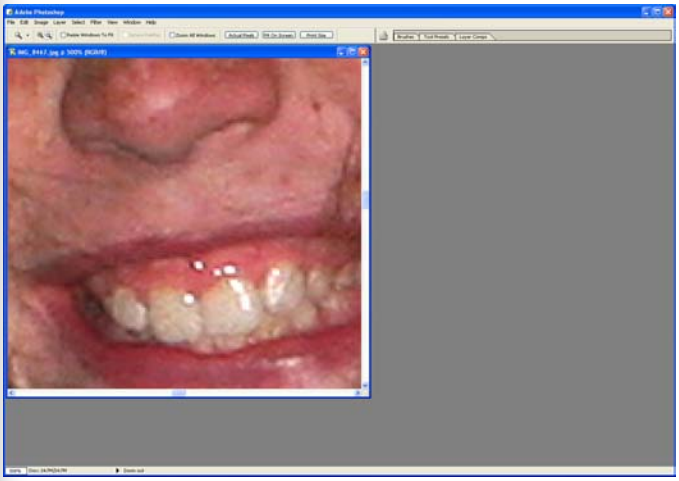
Photograph at 33.3%. Only 33.3% of image pixels are shown on screen. 3.33 image pixels are compressed into one screen pixel.



Photograph at 100%. All of image pixels are shown on screen; each image pixel takes up one screen pixel.



Photograph at 500%. All of image pixels are shown on screen; each image pixel takes up 25 screen pixels (5x5). Image pixels are clearly visible.



What is a dot?

- Resolution of a scanner is measured in *dots per inch* (dpi). This is essentially the same as pixels per inch (ppi) in the sense that it is pieces of information per inch.
- If you scan at a resolution of 72 dpi (or ppi) you're getting 72 pixels of information about the picture in each direction for each inch of the picture. (5184 pixels per inch^2)

What is a dot?

- The resolution of a printer is measured in *dots per inch* (dpi).
- Each dot is a spot of color output by the printer.
- The dot is the smallest dot of color the printer creates.
- Your printer output is probably 300 dpi.

My first law of computer images.

- The computer cannot create something from nothing
  In fact, it sometimes can, but it is best to believe that it cannot.
- Corollary of this law:
  - You need one pixel in your image file for every dot you wish to print or pixel you wish to display on screen.
  - E.g.: Assuming you print at 300 dpi and want to print a 6”x4” photograph, you need an 1800 x 1200 pixel image file.
  - E.g.: Assuming your monitor is 72 ppi and you want to take up 6”x4” with your image, you need an 432 x 288 pixel image file.

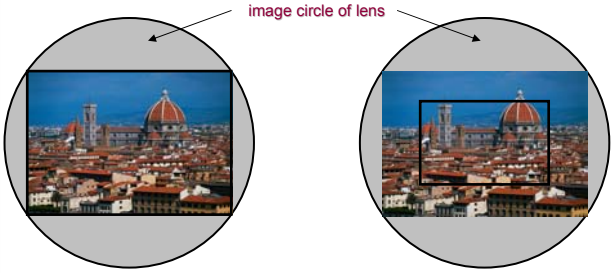
Maximum image sizes

- As we calculated earlier a 6 MP camera will provide approximately 3000 x 2000 pixels.
- At 300 dpi, that gives us maximum print size of 10” x 6⅔”.
- Reality is that the human eye is very forgiving, so we can stretch this a bit.
- Also, there are some techniques for increasing the number of pixels we have to begin with. *[for another day]*

Sidebar: Inkjet printers

- The dot of ink sprayed out by an inkjet printer is wet. One dot blends into another.
- In general, when you're scanning or working on a picture to be printed out on an inkjet printer, a resolution of no more than 1/3 the resolution of the printer is sufficient.
- Thus, for a 600 dpi inkjet printer, 200 dpi resolution should be enough.
- This is not always true for other kinds of printing.

Digital camera magnification factor



35mm frame size

digital sensor size

A reduced sensor size results in a more compressed image for the same focal length, which increases the "effective" focal length. Except for full-frame sensor models, Canon digital SLR cameras use a sensor size which gives rise to a 1.6x factor and Nikon digital SLR cameras use one that gives rise to a 1.5x factor.

Understanding Colour Representation

- The model used for color representation on a computer monitor and most digital cameras is RGB.
- Each pixel on the screen or sensor is represented as independent values for red, green and blue.
- These values are converted into intensities of light.
- By using the appropriate combination of red, green and blue light intensities, the device can reproduce many of the colors between its black level and white point.
- Typically, devices use a total of 24 bits of information for each pixel (commonly known as bits per pixel or bpp). This corresponds to 8 bits each for red, green, and blue, giving a range of 256 possible values, or intensities, for each color.
- With this system, approximately 16.7 million discrete colors can be reproduced, although the human eye can distinguish between only around 10 million discrete colors (this number varies from person to person depending upon the condition of the eye and the age of the person).

Understanding Colour Representation (cont'd)

- The intensity of the color output on computer display devices is normally not proportional to the R, G, and B values. That is, even though a value of 127 is very close to halfway between zero and 255, the light intensity of a computer display device when displaying (127, 127, 127) is normally only 18% of that when displaying (255, 255, 255), instead of at 50%.
- The amount of memory, in bytes, that a 24-bit image occupies in its raw state, can be found by multiplying the number of pixels in the image by 3. A 640 × 480 24-bit RGB color image will have 640 × 480 = 307,200 pixels. Thus, the memory space required is 307,200 × 3 = 921,600 bytes = 900 kilobytes.
- "16-bit mode" can also refer to 16 bit per component, resulting in 48 bpp. This modes makes it possible to represent 65536 tones of each color component instead of 256, which gives rise to 281,474,976,710,656 colours. Of no real use visually, this is primarily used in image editing, like Photoshop for maintaining greater precision when a sequence of more than one image filtering algorithms is used on the image. With only 8 bit per component, rounding errors tend to accumulate with each filtering algorithm that is employed, distorting the end result.

Understanding Colour Representation (cont'd)

- RGB is not absolute.
- What does this mean? A colour referenced by (231,123,054) may look different on one device to another. Neither is correct or incorrect. That is just the way those values are represented.
- In an effort to create uniformity, several absolute RGB standards exist, such as adobeRGB and sRGB. Using these standards, a colour represented by (231,123,054) would be exactly the same on any device, assuming it has been correctly calibrated.
- This is similar in concept to Pantone as used in print colour proofing.

Understanding Colour Representation (cont'd)

- RGB is a colour representation system based on the three primary colours and their behavior as light. There are several other methods of representing colour using computers
  - HSB is a model that defines a colour in terms of **H**ue, **S**aturation and **B**rightness. Hue is represented by a value between 0 and 360 and the saturation and brightness are ranged from 0 to 100%
  - CMYK is a subtractive colour model used in printing with the addition of a pure black. **C**yan, **M**agenta, **Y**ellow and **B**lack are represented by percentage saturations from 0 to 100% Not an absolute model
  - LAB or more correctly L*a*b* is based on a Luminance model. The L represents a luminance value between 1 and 100 and the a value represents the position of the colour between red and green and b represents the colours position between blue and yellow. LAB has been defined as a device independent absolute model, so it can rarely be used as the basis for a computer image. Photoshop and other similar programmes often will allow this model to be used, but it is of limited value unless referenced to an absolute colour space such as adobeRGB.

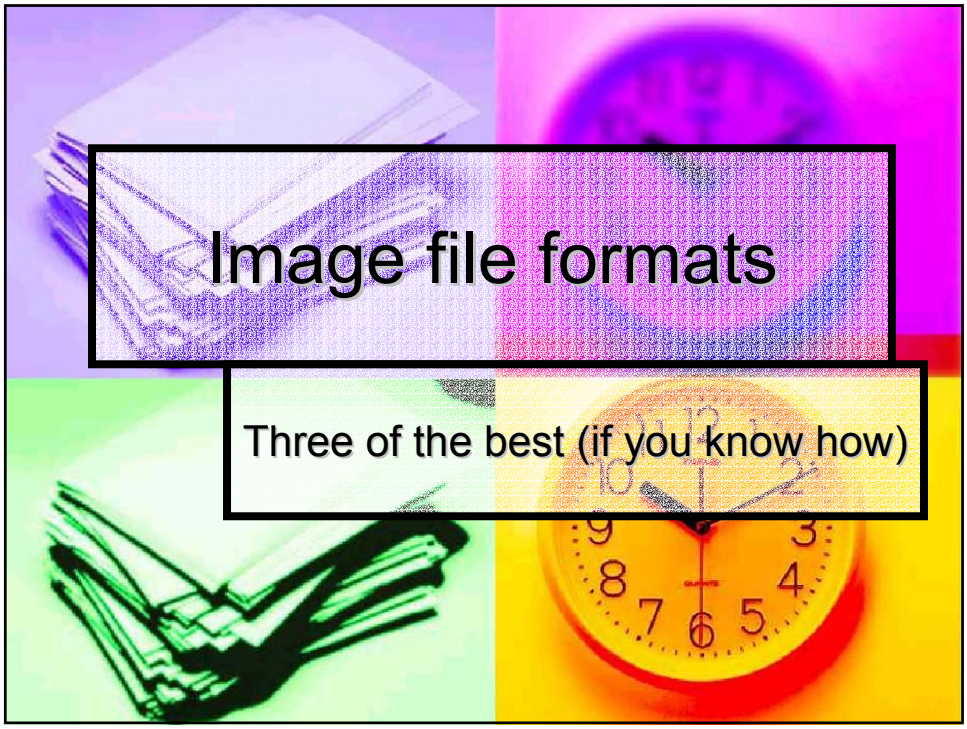


Image file formats
Three of the best (if you know how)

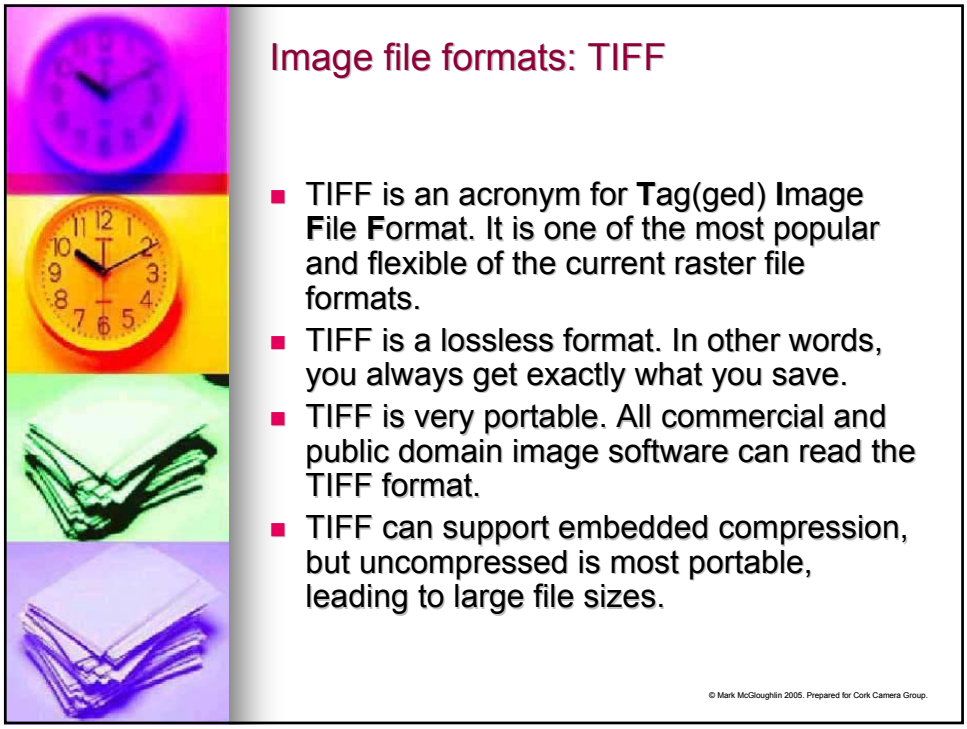


Image file formats: TIFF
TIFF is an acronym for Tag(ged) Image File Format. It is one of the most popular and flexible of the current raster file formats.
TIFF is a lossless format. In other words, you always get exactly what you save.
TIFF is very portable. All commercial and public domain image software can read the TIFF format.
TIFF can support embedded compression, but uncompressed is most portable, leading to large file sizes.
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Image file formats: PSD

- PSD is a proprietary internal file format used only by Adobe Photoshop and similar Adobe tools.
- Totally lossless format.
- Supports Photoshop layers, vector data, text and other Photoshop features as embedded data.
- Large file sizes.
- Not portable to any other programmes.

Image file formats: JPEG

- What many people call the JPEG file format, is actually called JFIF or the JPEG File Interchange Format. It is a minimal file format which enables JPEG to be exchanged between a wide variety of platforms and applications.
- JPEG is a lossy format, with embedded compression (see example).
- Should NEVER be used as in intermediate file format.
- Only use as a FINAL output for printing, distribution or web use.

JPEG file with no compression.

JPEG file with moderate compression.
Note the introduction of artifacts.

JPEG file with high compression.
Note the significant loss of detail.

Repeatedly saving a JPEG with 15% compression

Version	Start data	Compress	End Data
1	100%	15%	85.0%
2	85.0%	15%	72.3%
3	72.3%	15%	61.4%
4	61.4%	15%	52.2%
5	52.2%	15%	44.4%
6	44.4%	15%	37.7%
7	37.7%	15%	32.1%
8	32.1%	15%	27.2%
9	27.2%	15%	23.2%
10	23.2%	15%	19.7%

After only 10 saves, the file has been reduced to less than 20% of the data that it originally had.

Image file formats: GIF

- A file format created in the 1980's, expressly for computer monitor display of images. At the time, 8 bit colour (only 256 colours) was highest quality available.
- GIF is an interlaced format which made it popular when bandwidth was limited.
- GIF is a lossless format.
- GIF is restricted to 8 bits per pixel, in other words only 256 distinct colours.
- Some web browsers can only display 256 colours today
- Only *potential* use for GIF today is web, but not usually recommended.

Image file formats: Summary

- TIFF: Recommended as the standard archive format, due to it's portability and lossless encoding.
- PSD: Recommended as the format used for all photographs being edited or worked on in Photoshop, due to ability to preserve levels, colour information and other data. PSD is also a lossless file format.
- JPEG: For print output (with minimal compression) or image sharing where quality is not important, including web and email. (medium to high compression)
- GIF: Not recommended at all.

Eleven basic steps for a good workflow

Refine to suit your knowledge, skill level and personal preferences

Step 1: Prepare a folder structure to house your collection of images

- Depending on your ultimate workflow, create one folder per major step.
- Keep one folder for your “digital negatives”, one for archive copies, one for work in progress and one for any final output formats (1 each).
- Whatever you decide to do, it is best to do the same every time.

Step 2: Transfer photographs from camera (or scanner) to computer

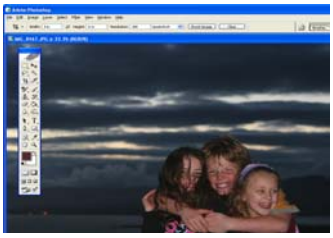
- This folder will contain your “digital negatives” and should be kept as the a permanent record of what was captured.
- This is the folder that at the very least should be burned onto CD or DVD as your “safe” copy.

Step 3: Cull. Get rid of your obvious junk and duplicates.

- Copy a TIFF format of each photo from your “Camera” folder using an action or manually
- Using the Photoshop file browser, or the XP slide show, decide which shots are not worth keeping. Cull them!
- This will leave you with the images you want to work on for printing and/or web.

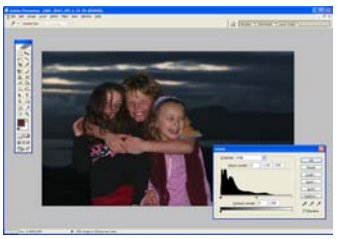
Step 4: Crop and size to desired output dimensions.

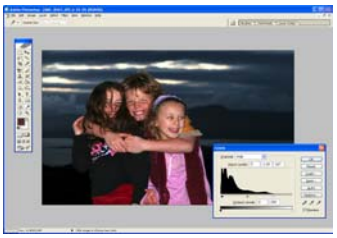
- Select the crop tool from tool bar.
- Chose your dimensions and resolution and select your crop.
- Always chose the maximum size in the desired aspect ratio.
- Immediately Save-As a PSD file, to preserve your master files.



Step 5: Adjust Contrast

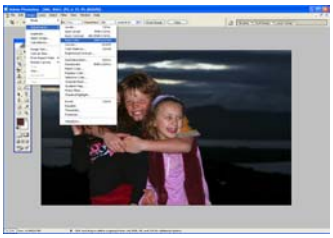
- Hit <ctrl> L to bring up the Levels dialog which can be used to adjust the contrast.
- By adjusting the black, grey and white points you can get quite good control over the image contrast.

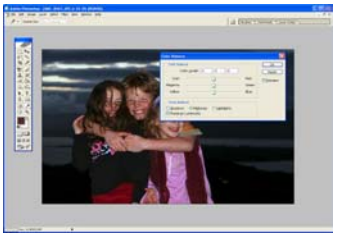




Step 6: Adjust colour

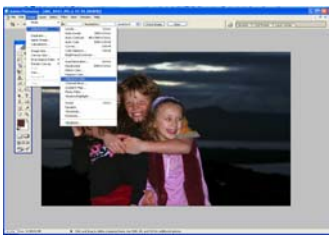
- Colour casts created by ambient lighting, whether artificial or natural can be removed by the Auto Colour option.
- If you want to have more manual control, you can use the colour balance dialogue. Experiment to see what happens…

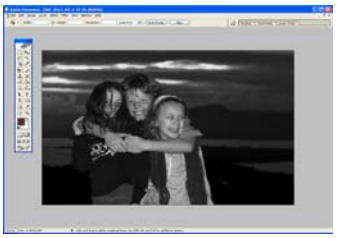




Step 7: Convert to B+W (optional)

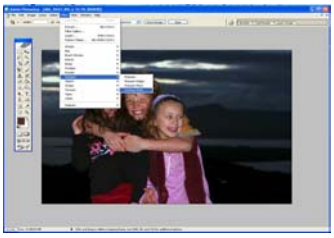
- The simplest way to convert to black and white is to select the Desaturate option on the Image Adjustment menu.
- There are SEVERAL other methods, that offer more control. These could be covered another time.
- Often a further contrast adjustment is a good idea after desaturation.

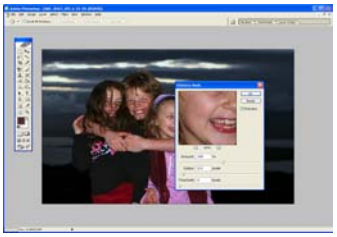




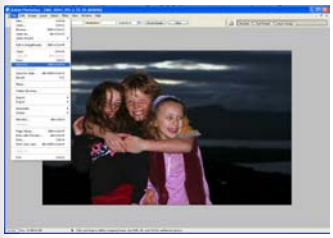
Step 8: Sharpen

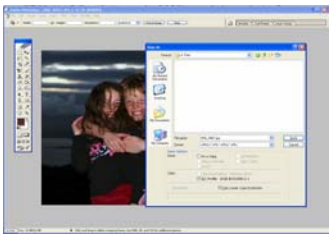
- Digital camera and scanner output is naturally a little soft.
- Most images benefit from some sharpening.
- Sharpening should ALWAYS be the last step taken in image work before saving.
- usharp mask filter offers most control.
- Recommend usually approx 100% amount with 0.9 radius and 0 threshold.





Step 9: Save and Save As
Make sure you save your PSD as well

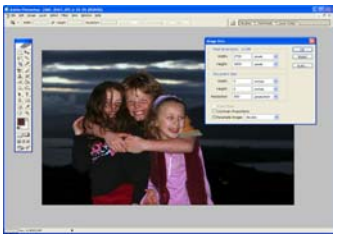




- If you are saving for print, save as a jpeg file, using the maximum image quality.
- If you are saving for email or web, select a quality/size balance that allows you email.

Step 10: Make a web copy (optional)

- Resize the image to a size suitable for web or email. 800 pixels on the longest edge is usually OK.
- Select the image by hitting <ctrl> A and select the stroke command from the Edit menu. This allows you put a simple frame around the image.

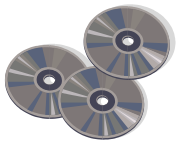


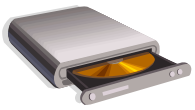
Step 10: Make a web copy (cont'd)

- Create a mat or a mount around the image by selecting canvas size from the Image menu.
- Make sure that relative is ticked. Make sure that pixels are the unit of measurement.
- Add 100 pixels in each axis. Experiment with this number.
- Result: A perfectly framed image for email or web.
- Save As – make sure you don't over-write the original!

Step 11: Make an archive offline copy.

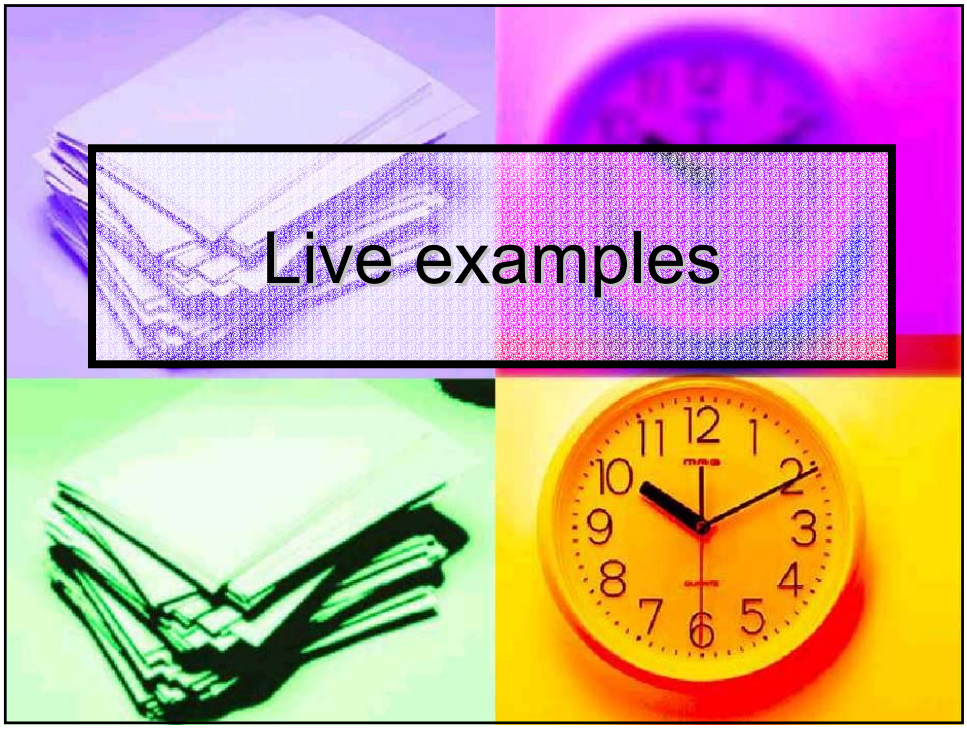
- Never trust your hard drive on your computer. The most likely component to fail.
- Burn at least 2 copies of your data to CD or DVD. At least your digital negative, but preferably eveything.





11 Steps Summary

1. Create a folder structure.
2. Transfer from camera.
3. Cull.
4. Crop for size and aspect ratio.
5. Adjust contrast.
6. Adjust colour.
7. Make black and white.
8. Sharpen.
9. Save your work and print copy.
10. Make a web copy.
11. Archive your work to offline storage.


Live examples