File Formats and Image Processing

(File formats and the handling and processing of digital images)

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File formats and the handling and processing of digital images.

Introduction 5 minutes

File types you need to know about as a photographer. 15 minutes

1. Jpeg.
2. RAW
3. Tiff - tagged image file format.
4. psd or other propriety formats.

What format should you use to acquire the image? 30 minutes

1. The Raw v jpg debate.
2. Are there actual real life differences?
3. Does your subject/end use matter?
4. Storage requirements/considerations.
5. Setting up your camera for your chosen file type.

20 minute supper break.

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Summary 5 minutes

Introduction

The intent of this workshop is to give an overview of the processes involved in dealing with digital imaging.

The purpose of this workshop is not to detail the finer points of image manipulation per se but rather to draw a road map of the areas of relevance, the key factors needed to make informed choices and the steps involved after having made those choices.

The majority of the topics covered are specialist areas that do require a great deal of time and effort to expand on fully but for the sake of brevity have been condensed into the main points of concern for us as photographers.

We will look at the different file types involved in photography, examine the RAW versus Jpeg debate and what to consider in setting up your camera to shoot in your chosen file type. We will then consider how you deal with your images in terms of managing them and the software and hardware requirements to help you achieve this.

File types you need to know about as a photographer.

There are a large number of file formats around today but only a handful are relevant to photographers. Digital cameras as a general rule only use two main file types, these are, Jpeg and/or Raw, some do use Tiff files. Image processing software, in the main, uses jpeg, RAW, Tiff and propriety files. So what are the main features of these files?

1. Jpeg

Jpeg stands for *'joint photographic experts gr*oup' and was standardised in about 1986, but has had several revisions since that time.

Jpeg is optimized for photographs and similar continuous tone images that contain many, many colours. JPG works by analysing images and discarding kinds of information that the eye is least likely to notice, this is called *compression*. The degree of compression of a JPG is adjustable. At moderate compression levels of photographic images, say 10:1, it is very difficult for the eye to discern any difference from the original.

Jpegs are 8 bit. An 8-bit image has 256 tones per channel. 256 is a magic number worth remembering. It is the number used through out Photoshop for example to represent colours, even when the image has a greater bit-depth. Further more, the histogram on the back of your camera is a scale of 0-256 (the screen on the back of your camera only shows JPG data and preview, NOT RAW!) At 256 colours per channel and 3 channels in the image, an 8-bit JPG has a possibility of 16.7 million colours (256x256x256).

It is the most common file type used in digital cameras plus all image editing software can read and process jpegs.

JPGs have the advantage of being much smaller and are already processed for viewing, posting to the web and even printing. To achieve this reduction in size, the camera's processor reduces the bit-depth of the image from its native resolution to 8-bit and then compresses the file. Cameras sensors differ in bit-depth as they do in resolution. However, most of the DSLR cameras produced today are 14-bit. Some point and shoot cameras are 12-bit and the highest-end professional cameras can be 16-bit. So what is bit-depth?

Bit-depth is the number of unique colours available within the image file.

The higher the bit-depth, the more colours available. The more colours we have available, the better the transitions are between colours, highlights, shadows and edges of contrast. More colours also means better results from noise reduction and tools such as the Photoshop healing brush and cloning stamp.

In the JPEG format, your in-camera computer is programmed to convert the raw data captured by the sensor into an image based on the settings (exposure, contrast, sharpening, saturation, white balance, etc.) existing when the picture is made. During this process the in-camera computer, not the photographer, applies a tone curve to the data in an attempt to create an image with acceptable brightness and contrast levels. The original raw data captured by the sensor is altered, and is no longer available.

Jpeg files are known as lossy files because they discard a considerable amount of the original recorded data.

JPG compression analyses images in blocks of 8X8 pixels in size and selectively reduces the detail within each block. At higher compression rations, the block pattern becomes more visible and there may be noticeable loss of detail, especially when you attempt to make prints larger than recommended. The subject and pattern in the image is also a factor. For example, a picture of the blue sky can be compressed quite a bit without any noticeable effects but a picture of a colourful bird would "pixelate" quite quickly.

2. Raw

A digital RAW file is simply what its name implies, a file containing the unprocessed raw data captured by the sensor in the digital camera at the time of exposure. The RAW file standing alone does not contain a finished photograph. To acquire that, the RAW file must first be converted. Camera settings for colour space, sharpness, saturation, and white balance also are not in the RAW file; they are tags which accompany the RAW file through the conversion process.

Each camera manufacturer created its own unique RAW format: Nikon .NEF, Canon .CRW, Minolta .MRW, Olympus .ORF, Fuji .RAF, and the list goes on. As noted above, before exposed raw data in these formats is transformed into an image, it must first undergo conversion. And, conversion can only be accomplished using the proprietary software supplied by the specific camera manufacturer, or purchased from a third party like Adobe, Breeze Systems, Bibble Labs, or Phase One.

RAW file conversion allows the photographer to process all of the original data on a desktop or laptop computer which has considerably more speed and power than the in-camera version. The photographer is able to change the camera settings for colour space, contrast, sharpening, saturation, white balance, and, to a limited degree, exposure, just as though making or adjusting these settings before taking the picture. And, since the raw data is converted on the photographer's computer, the effect of these adjustments can be observed in real time on screen.

Plus, the photographer is always free to return to the RAW file to change settings and process the image differently whenever necessary, because RAW conversion does not alter the underlying data. The original RAW file is preserved. As conversion software improves you will be able to re-process your RAW files to take

advantage of any new improvements the software brings.

In summery, the RAW file contains mere data which must be processed with special software in order to become a finished image. To draw an analogy, the RAW file is similar to a frame of exposed film waiting to be developed. Raw files are *lossless* because they retain all the original recorded data. Most RAW data files are in *14 bit* and contain a possible 549 billion colours.

There are a further two file types photographers need to know about and possibly use. These are Tiff files and psd or other propriety file formats.

3. Tiff

Tiff stands for: *tagged image file format.*

TIFF is the format of choice for archiving important images. TIFF is THE leading commercial and professional image standard. TIFF is the most universal and most widely supported format across all platforms, Mac, Windows, Unix. Data up to 48 bits is supported.

TIFF supports most colour spaces, RGB, CMYK, LAB, etc. TIFF is a flexible format with many options. The data contains tags to declare what type of data follows. Some digital cameras can shoot tiff files. Tiff files by nature are large files and can be in *8, 16, 32 or 48 bit.*

Tiff is a *lossless* file format and is often preferred when doing conversions from the RAW image.

The Tiff file format is owned by Adobe since 1992.

4. PSD and other proprietary files.

The better image editing software programmes have file formats specific to their software. Both Adobe Photoshop and Adobe Elements use psd (Adobe Photoshop Document) files, while Paint Shop Pro use PSP files (Paint Shop Pro).

These are the preferred working formats as you edit images in the software, because only the proprietary formats retain all the editing power of the programs. These packages use layers, for example, to build complex images, and layer information will be lost in the non proprietary formats such as TIFF and specially JPG. The overall file sizes can be very large though. These files can be in 8, 16 or 32 bit.

These files are lossless.

Given the various file types and their characteristics which should you use as you go about your craft?

1. The Raw versus jpeg debate.

There is a lot of emotional debate on shooting Raw or jpeg. There are several factors that can determine which file format you use, camera options, the type of images you are shooting, the intended use for those images and the amount of storage both on and off the camera you have at your disposal. However a good understanding of the inherent differences between RAW and jpegs is fundamental to an informed choice.

A sound way forward is to stick to the actual facts that both formats embody. To recap on the main points for each file type I have made the following table.

File type	Bit Depth Per Channel	Lossy	Lossless	Total Bits Per Channel	Total Colours 3 Channels
Jpegs	8	Yes	No	256	16.7 mill.
RAW	14	No	Yes	8192	549 bill.

Comparing 8-bit to the 14-bit native resolution of most digital camera sensors starts to reveal some really large numbers. First, an 8-bit image contains only 3.125% of the colours per channel as a 14-bit file. In other words, the camera to process the 14-bit file RAW data to an 8-bit JPG throws **96.875%** of the file away. A 14-bit per channel file contains a possible 549 billion colours. Does this mean that EACH file contains that many colours? No. The camera is sensitive enough to define that broad spectrum but each file does not contain that many colours. Even if it did, computer monitors can not display anywhere near that many colours nor can the human eye detect that many colours (this is where colour science gets really fascinating and much beyond the scope of this tutorial.) However the ability to capture that many colours has some great mathematical advantages in a digital system– particularly for noise reduction and tonal transitions – that enable a better visual representation when the image is displayed on a monitor screen or printed on paper.

Most of the information a sensor captures (exactly ½ of the information in the file in fact) is in the last stop of exposure. If a digital image is underexposed by even 1 stop, fully ½ of the file is lost. An 8-bit JPG file will lose 128 possible tones per channel and a 14-bit RAW will lose 4096 tones per channel. Even so, that underexposed 14-bit RAW file starts with 32 times more information per channel than the JPG which allows a RAW processing program to “recover” information to make a great print where as a JPG would never be able to obtain the same results.

The following table illustrates the above points and shows the true value of shooting in RAW as it provides a breakdown of the actual data recorded relative to the capture exposure of the camera. A thorough understanding of this table will give you the insight to capture the best quality data possible.

Exposure Zone*	Fraction of Tones	8 Bit	12 Bit	14 Bit	16 Bit
1	1/2048			4	16
2	1/1024		2	8	32
3	1/512		4	16	64
4	1/256		8	32	128
5	1/128	2	16	64	256
6	1/64	4	32	128	512
7	1/32	8	64	256	1024
8	1/16	16	128	512	2048
9	1/8	32	256	1024	4096
10	1/4	64	512	2948	8192
11	1/2	128	1024	4096	16448
	1/1	256	2048	8192	32896

*Based on chart published by Norman Koren at:

http://www.normankoren.com/digital_tonality.html

The zones correspond to the Ansel Adams zone system of black (zone 1) to white (zone 11)

As can been seen from the table jpegs contain no details in the first four zones, 14 bit RAW files do capture shadow details in these four zones. Jpegs only start to show data in zone five.

Looking at the highlight end (9,10,11) you can see that over 3/4 or 87.5% of the data is captured in the last three zones for jpegs, 224 bits in total. 90% of the data for RAW files is captured, 8068 bits in total. This clearly shows the importance of exposing to the right on the histogram in either RAW or jpegs and the cost of under exposing.

When shooting in jpeg mode remember that the in-camera computer discards a large amount of data as it compresses the 14 bit raw file to the jpeg so that underexposed jpegs will have little image detail left. Plus all the camera settings you used are ‘baked’ in.

Raw files on the other hand retain ALL the data recorded. Plus you can adjust many of the settings you selected and see the results in real time on your computer screen.

2. Are there actual real life differences?

The RAW file format looks good on paper, but does it actually produce? Can one see a meaningful difference between a processed RAW file and a processed JPEG file of the same image? Here are two images taken on my Nikon D700 with the 105 macro lens using the same subject and settings, the RAW file was processed with Nikon Capture. Both images were resized using Photoshop CS5. A tripod and a electronic shutter release where used to capture the images.

The RAW image.

The camera was set up with the electronic shutter release and locked down on a tripod. The light was sunlight to get a fast shutter speed at base ISO of 200. The RAW file was converted to a TIFF file in Nikon Capture with no settings altered then saved as a jpeg with a small amount of sharpening applied after resizing. The jpeg was resized exactly the same and a identical amount of sharpening applied. You can see from careful examination of the two images that the RAW file has more detail, the tonal range is slightly more extended and is less 'muddied/smeared' than the jpeg image. The details in the cloth background and the pearls are more noticeable in the RAW file too. This is a good test as most cameras have difficulty recording the red channel without overwhelming the red photosites on the sensor array. You can adjust for this on a RAW image to some extent but here it was left as shot to get a fair comparison with the jpeg. As you can see from this simple test there is real life differences that offer worthwhile rewards to those shooting in the RAW format.

The jpeg image.

3. Does Subject/end use matter?

There are occasions and indeed field requirements that will determine the file type you shoot in.

Professional sports shooters for example often shoot jpegs or have cameras with two card slots so that they shoot one for RAW and the second for jpegs. This gives them access to smaller files to get back to their media outlet quickly and the flexibility of Raw files if the shooting conditions are tricky or they need high resolution files for high end printing. Most DSLR's have the ability to shoot both RAW and Jpeg at the very least.

Photojournalists often shoot in jpeg as the files are quick to transfer and the print media do not require high resolution images.

Event shooters often shoot in jpeg for size and delivery convenience.

The difference here is most of the photographers are experienced in their chosen field and are very competent at nailing the exposure of the images to record the most data. Fast processing and delivery time requirements can dictate the need to shoot jpegs.

If you are shooting for competition and camera club print nights or once in a life time occasions then capturing files that contain the maximum data makes the most sense. Time restraints and file size should not be the driving factor here.

4. Storage requirements/considerations

In the late nineties and up to about 2006-7 storage was a much more costly exercise and many found shooting jpegs was a necessity. The size of memory card capacity was limited too, as was the size of hard drives.

Today memory cards come in very large sizes and the cost is affordable to most photographers. Hard drives are very cheap as are external hard drives and they have large storage capacities of 1 terabyte or more now.

5. Setting up your camera for your chosen file type.

It is difficult to give precise guidelines to cover all makes and models of digital cameras. Rather I will make a few suggestions relevant to each file format based on the assumption you will be doing some post processing.

For those that choose to shoot jpegs through necessity or those that do not want the slight extra effort that shooting in RAW entails then you need to consider that the default settings or the camera setting you chose may need to be tweaked to achieve the best quality jpeg files.

- Make sure you are shooting in the highest quality jpeg setting with the least compression your camera has. This is usually *jpeg fine*.
- Set the in-camera sharpening to LOW or NONE. This helps to reduce amplifying noise and reduces the white lines and artifacting so often seen in jpeg files. Sharpening can be more effectively applied on your computer after capture. *Note that images will look soft until you apply sharpening later.*
- Avoid extreme settings if your camera gives the option to adjust for saturation, hue, contrast and brightness. Set these to neutral as a preference. Pay particular attention to white balance.
- Try to limit the ISO to the base or lower range on your camera and check before each shoot.
- Consider shooting in RAW plus jpeg if your camera has that feature or just RAW when shooting in tricky light or if the subject matter is a once in a life time opportunity. You can learn how to process Raw files or have them processed, if necessary, but you can not capture the shots again if they turned out poorly and beyond recovery.

- Above all learn to achieve a good exposure, biased to the right on the histogram, when shooting jpegs to retain as much data as possible but avoid over exposing.
- Remember that the settings you choose will be permanent for any given file and that the in-camera computer will be doing all the processing for you.

For those of you shooting in RAW the options are much greater.

- ISO is the one key setting that can not be altered after the fact in RAW. So choose your ISO settings wisely and learn to check ISO before each shoot.
- Some camera makes allow you to choose some compression of RAW files (12 bit rather than 14 bit), check that you have your camera set to the highest quality 14 bit RAW files.
- You can set the sharpening level to medium - high so that you can check critical sharpness in the field. This is very useful when shooting macro subjects. All sharpening can be removed during conversion.
- Correct exposure is still important when shooting raw as it determines how much quality data the file contains and how much recovery is possible during conversion. Shoot to the right on the histogram as much as possible without blowing highlights.
- Raw files have not had while balance or other key modes set. They are tagged with whatever the camera's setting was but the actual data has not been changed. This allows you to set any colour temperature and white balance or contrast, hue, saturation etc. one wishes after the fact with no image degradation.
- You get to select the majority of settings in real time processed by your computer, not the camera, plus all the data is retained unless you choose otherwise.
- Consider shooting Raw and Jpeg files if your camera has this setting if at family events for ease of viewing/emailing with the safety of RAW files if required.

The bottom line for us as photographers is that it is better to have the bit-depth and the data it contains than to need it and not have it. While it does take more time to process the files and more space to save them, we should strive to consistently create the best images possible under all conditions. RAW files are by far the best way to capture images under those conditions.

Dealing with your images.

1. A brief overview of image management.

Managing your digital files is one of the most neglected and least understood areas of shooting digital for beginners and amateurs alike. At first the number of images seems small and finding them is easy. After a few months you begin to realise you have a large number of images in various states and keeping track of them all is becoming harder and more frustrating. Even finding them on your computer may be daunting. Many mistakes are made during this period and at the very least are time consuming or worse yet impossible to correct. There are three main steps to get you started for a good outcome.

1. Learn to apply 'key wording' and other information to your images. Cataloguing your images is a vast topic that involves Digital Asset Management (DAM) - basically how are you going to manage all of these digital files that are filling up hard drive after hard drive? A key part of any cataloguing system is entering keywords and metadata* into every image. That is the first BIG step. Learning to do this at the downloading or reviewing stage will save hours of work and heartache later. You will need software to allow you to do this.
2. Devise a folder system on your computer that works for you. A simple but effective method is to create a main folder for the year. 2012 for example. Then for each month create a separate folder. January etc. Within that month create a folder for each days shooting by date or subject matter, Horses for example. Within that folder create a Processed/Reworked folder.
3. Back up your images - create a back up system that works for you and use it.

**Metadata describes other data. It provides information about a certain item's content. For example, an image may include metadata that describes how large the picture is, the colour depth, the image resolution, when the image was created, and other data.*

This simple and basic approach will get you started on the road to sound digital image management. When and if you evolve to a more sophisticated system you have the basics in place to make the transition as pain free as possible. The new 'cloud storage' systems may be an option in the near future as we get faster internet speeds and you should be prepared to migrate there if you choose to.

2. Downloading the images.

There are two main methods of downloading your images from the camera to your computer.

- Plug the camera into the computer via the cord supplied with your camera. This is slow and is not a method most favour.
- Use a card reader. This is faster, cleaner and gives more control. Card readers are built into most laptops and computers nowadays. If yours does not have card slots then card readers that plug in to USB2 ports are readily available and inexpensive. The newer USB 3 ports offer even faster download times if your computer has these.
- You can download the files direct to a folder on your computer or you can use software to help with downloading, sorting and keywording. It is important that you learn to cull images that are beyond saving at this stage.

Which ever method you use make sure you are in control of the process and can apply basic image management practices that allow you to view and find your images readily. The key requirement here is for you to be in control only keeping sound images and to know where your images are downloading to.

3. Software considerations and use.

Software falls into three main categories, *image organization, Raw file conversion and image processing/ manipulation.* There are many stand alone software applications in each area plus software that combines all three areas. We will look at the main options.

Most camera manufactures supply basic software in the box with your camera with updates available for download from their web site, that will help with downloading your files, organising them, at least basic conversion from RAW files and some post processing options. This is a good place to start for most.

- Nikon for example offer ViewNX2 free. This includes a downloading/transfer facility that lets you apply keywords and other metadata to the files as you download. You can then further refine the metadata, do basic conversions from RAW files and do some further processing of the images. It has a batching facility too to enable easy conversions of a folder of files. It even has a movie editor. It uses the MS Windows convention of Folder structures.
- Nikon does have more powerful conversion software, Capture NX2 (not free) that does an excellent job of converting files with precise control over camera settings and recovery options. It has 'Upoint' controls for easy masking and adjustments.
- Canon has similar software, Digital Photo Professional (DPP). It too offers very good control over conversion settings of RAW files. It is free.
- Most other makes have similar software.

- There are several third party software options for converting your files from RAW - Adobe, Breeze Systems, Bibble Labs, or Phase One, all are expensive, all are good. Adobe has three versions, the more expensive and comprehensive Photoshop CS5 or Elements 10 at less than $150.00 and Lightroom. All allow you to organise your images, apply keywording and metadata, do conversions from RAW (via a plug-in) and do other image manipulations. Elements has a proprietary Folder structure that tends to take over the image folders as it catalogues the images. Many find Elements to be all they need. Raw conversions are somewhat limited in Elements compared to Photoshop CS5, Lightroom and other software though.
- The plug-ins that handle RAW conversions in Adobe (Adobe Camera Raw) do have some drawbacks as do may of the other third party software options, in that you have to wait for updates if you buy a new release camera as the codec required to read the new camera needs to be read and processed by Adobe and others before being included in the plug-ins. This can sometimes take a few months. **Adobe only offer so many free updates to the plug-ins before you need to purchase a new version of the entire software programme or at least an upgrade.**
- Adobe Lightroom is stand alone software that offers organisation, conversion and manipulation of images. It uses the Adobe Camera Raw plugin as do the other two Adobe software options and carries the same warnings. It is preferred by many professionals and amateurs alike.
- There are some freeware options that can offer organisation, straight conversions of the 'as shot' settings from Raw to jpegs and some image manipulation. The best of these would be Gimp, Irfanview, Picasa and Zoner Photo Studio.
- Paint Shop Pro is software that allows image manipulation only and is best used after conversion from Raw or for jpeg files. (not free)

In summery most camera makers offer software that allow you to organise, do conversions from RAW and manipulate your images for end use requirements. There are a plethora of software options available and funding the right one for you can be costly and confusing. Your software should allow you to organise your images, do conversions from RAW and to process/manipulate your images as required. This can be with a single software package such as Elements or a combination of two or more software programs.

4. Computer Hardware Requirements

Computing options are many and varied nowadays with an array of laptops and computers on offer but photographic computing requirements are fairly specific. Below are the key factors to look for when upgrading your system or buying /building a new system for those of you serious about your photography.

Computers

- Operating Systems - For PC systems it is best to use Windows 64 bit, either Home Premium or Pro. 64 bit as it gives access to more usable RAM (memory) that most image processing software requires.
- Processor - Most of the better software programmes require a good level of processing power and it is best to have at least 2 Ghz or more processor speed to work on layered files or to do batch runs or when working with large RAW files. An Intel Core i5 or greater is desired on PC's.
- RAM or Memory - A minimum of 4 Gigs of RAM but 8 Gigs gives better results.
- Video Card - A good quality 1 Gig video card is more than adequate for most systems.
- Hard Drives - Go for the fastest quality hard drive you can afford, Sata drives are great as they allow the processor to work more efficiently. Try to have two or more internal hard drives. One for the operating system and software and one for your images. Slow hard drives are often the bottleneck in computing systems and can really slow the computer down. An additional external hard drive for backing up your files is required (not eSata).
- Monitors - You need a screen that is comfortable on the eye for glare, viewing angle and that can be colour calibrated plus big enough for images and tool pallets to be accommodated while you work. An IPS panel is recommended.
- For Apple Mac use the more recent releases as they can now operate in 64 bitt, and some 64 bit software is now available.

Laptops

Laptops are best used for field trips, holiday sessions and the like to download your images and for quick processing for emailing etc. rather than processing and managing your images. There are very few PC laptop screens that can render images accurately enough for effective image adjustments unless paying top prices. Processing power is less of a problem if you are willing to spend enough money.

If you have no option other than to use a laptop then you could consider one of the Apple Mac's, even a latter refurbished model would be good.

5. Backing Up

Backing up you images is vital. Sooner or later you will experience a hard drive failure and the potential loss of most or all of your images. You should make duplicate copies on a second drive or on other storage media (a process that is called backing up). While this seems like a difficult task, it can be quite simple. Backing up involves keeping your pictures in clearly named folders, copying them to clearly named backup folders, and using *software* that simplifies your task.

Hardware

- Hard drives. You can either install a second or third hard drive into your computer, or attach an external hard drive through a USB port. External hard drives are available in hundreds of gigabytes, as are internal hard drives.

- The best storage for quick and easy backups is the external hard drive. This is true for three reasons: it can be quite large and it can be quite fast. Once you have set up the backup software, it takes only a couple of minutes each night to back up your latest data. With large external USB hard drives costing about $100, it is also cost effective. The third benefit is they are kept separate to your computer and even off site if required.
- Additional internal hard drives for storage are easy to use and access but if you computer is stolen all you images are gone for good.
- Removable media such as DVDs and magnetic disks take longer and fill up quickly. You then must organize and catalogue the disks, which adds another chore to your photo storage.
- Cloud computing options.

Software

While backing up pictures might seem a difficult chore, it is really quite simple with the right software. There are a number of ways to back up, but the simplest and easiest is to back up your data every day in a form that can be read by any computer.

Both PC's and Macs come with back up software built in, plus there is a vast array of software, some free, to choose from on line.

- If you use an external USB hard drive, for example, you can back up your data every session. In the event that your principal hard drive fails, you can simply plug your external USB drive into another computer, which will then have access to all your pictures. As with most software, you might need to spend an hour or so at the beginning learning how to set it up. But after that, all you need to do is press a button or two and your principal hard drive will be backed up in a couple of minutes.
- You select folders on your principal drive that need to be copied on a regular basis. They can be entire folders or subfolders or sub-subfolders, and you can select a number of different folders at a time. Your principal drive is often called the source drive by the backup software.
- You create a folder on the external drive or removable medium or internal hard drive. This is often called the target drive or the destination drive by the backup software. Once you have made a few more choices, you can then simply press a couple of keys and the backup software will quickly scan your source folders and your target folders and make a backup. This can be done rapidly because the software is looking for only those files that have been changed since the last backup. This ability to quickly locate the recently altered files speeds the backup process considerably.
- Backing up is often best done as a two stage process. Backing up your images on download or just after culling reject images, then making a backup of any additional versions of the images you have created at the close of a session. Most software will do this automatically if set up correctly.

Manual Backups

Once you have organized your folders into a simple system, you can make an exact copy of your source (primary) folders. A manual backup is often easier than an automatic one and gives you more control. Simply do it at the end of each session to an external hard drive. The onus is on you to do the backup rather than relying on automated software though.

Processing your images

1. Do you need to process your images?

In the days of film when you dropped the film off at the lab the technicians did the processing for you. They didn't print those complete disaster shots, they applied basic colour corrections and sharpened the images before you picked them up. Your digital images will need some degree of processing too, particularly if you shoot in RAW mode plus your jpegs will benefit from some basic adjustments. The degree of processing will be determined by the intended use of your image/s and your level of ability. If emailing to friends/relatives for example, then the images will need downsizing, a crop maybe and saving to a file size acceptable for emailing. There is a large range of creative options ranging from the simple to the very complex that will depend on your ability, the software you have , the intended use for the images and the time you have to devote to the images. The art of processing your images encompasses a range of options and levels of ability beyond this paper. We will look at the basic steps you need to undertake and things you need to be aware of.

2. Culling your Images.

Learning to evaluate your images and to cull the rejects is something you should develop early on as you come to grips with the digital world of imaging. After downloading your images the first step is to view the images and delete the obvious failures. After that stage many photographers make a backup copy of the files to an external hard drive before deleting/formatting the card.

Best practice is to download all images after each shooting session, cull the rejects, backup, then format your memory card in camera. Formatting serves a similar function to 'defragging' your computer and keeps the card in good order.

3. Using your software.

The majority of software available has a range of features to aid in the job of managing and processing your images. You are advised to spend some time studying the tutorials or help pages supplied with the software to gain a good understanding of the features and applications available. Depending on the type of software (image organization, or Raw file conversion and image processing/manipulation) then things to consider are:

- The software should let you apply ratings or tags to the images to narrow down the keepers. It is good practice to do this at a second viewing. Anything not in focus should be marked for deletion at this stage and then deleted.
- Apply key wording or refine the key wording, if you applied them at the downloading stage, at this time too. This is a very valuable tool and you should learn all you can on key wording.
- If you shot in raw then tag the files you want to convert to jpegs or tiffs and do a batch conversion for these non critical files. Batch conversions can save a lot of time and effort and it is worth learning the procedure. If for example you shot your child's birthday party, then doing a batch conversion to jpeg for emailing of all the files, is quick and easy.

- Any special files, competition files for example or one off moments, can be converted individually with more care and precision as required.
- *Learn how to make a copy of any image before attempting any modifications and work on the copy.* There is nothing worse that realising you have made a bad mistake and have ruined the best image of 'grandma or little Billy' you had, especially if you have not backed up your files.
- *Resaving jpeg files several times leads to degraded images.* Better to use the software propriety file format or tiff files as these do not degrade as they are lossless file formats. You can make a new copy of this file as a jpeg when you are finished working on it. Remember jpegs are lossy files, every time you save a jpeg file some image data is discarded by the compression algorithm and it is an accumulative loss with each save.
- When saving jpeg files make sure you are saving at a file quality that will give the best results now and in the future. Quality refers to the degree of compression the jpeg has undergone. So make sure you are not saving the image you intend to print at a highly compressed rate (low kilobyte size) as the result will be poor. If you are emailing then you will need a big degree of compression to achieve the smaller file size required.

4. Processing considerations and end use.

Beyond organising and backing up your images you will want to undertake some degree of image manipulation, either during converting from RAW to tiff or jpeg files and/or after conversion or on the jpeg files if that is what you shot in. The final out come for the images will determine how you proceed but assuming you are processing for prints or completion files then the first stage of processing may include the following depending on your software options.

Raw File Conversions.

- Remove all sharpening.
- Do dust spot removal if software has this option.
- Set White and Black points.
- Check exposure for under or over exposure and adjust if required.
- Check white balance and adjust if required.
- Correct colour balance if needed.
- Adjust Levels or Curves as needed.
- Do lens correction for distortion/vignetting as required.
- Leave Noise reduction for later.
- Do not crop or straighten at this time.

Save the file as an 8 or 16 bit Tiff file as these are a lossless format or as a jpeg if you must. You can save it as a RAW file for conversion later too as an alternate option as all the alterations are carried as a separate small appended file.

As a general rule it is far better to do as many of the edits you can during the RAW conversion stage as these edits are far less destructive and have more options.

Jp*e*g Files.

With jpeg files the settings are pretty much' baked in' but it is possible to do image manipulations to correct for some problems with out too much file degradation.

Before proceeding make sure you are working on a copy of the original file, even if you made a backup.

- Do dust spot removal.
- Set Black and White points.
- Adjust exposure via Shadow and Highlights/Curves or Levels.
- Adjust Colour Balance as required.
- Do Lens correction.

After this process both the Tiff files and the Jpeg files are now ready for final image manipulation. It is of real benefit if you can learn how to use Layers if your software has this option as this is where the real power of image editing is enabling you to preserve each edit for adjustment at a later stage as required. If you can use layers then the above jpeg adjustments are best done as layer adjustments as they are far less destructive.

During the next stage of processing some of the things you may do include:

- Do noise reduction as required via built-in software or via a plug-in.
- Do levelling/rotation as required.
- Do any cloning needed.
- Apply Capture sharpening if the file has no in camera sharpening applied.
- Apply any special effects or techniques for the look you are after.

This file would then be saved as the 'master file' from which you derive all the end use images as needed. Cropping and final output sharpening are applied to copies made from the master file depending on end use, for example an 8 x 10 print, an emailed copy, Web upload or club EDPI or Print at 16 x 20 inches.

Colour Management, ICC Profiles and Working Spaces.

There is one further area of dealing with images to consider and that is the issue of Colour Management and Colour Profiles.

Colour management is the controlled conversion between the colour representations of various devices, such as digital cameras, monitors, TV screens, film printers, computer printers, offset presses, and corresponding media.

The primary goal of colour management is to obtain a good match across colour devices; for example, the colours of one frame of a video should appear the same on a computer LCD monitor, on a plasma TV screen, and as a printed poster. Colour management helps to achieve the same appearance on all of these devices, provided the devices are capable of delivering the needed colour intensities.

As photographers you need a monitor that is capable of Colour calibration and software/hardware that enables one to calibrate the monitor in order to achieve good colour management. A full explanation of colour management is beyond the scope of this workshop but you should attempt to learn to calibrate your computer monitor for best results of prints and web images alike.

International Colour Consortium (ICC) and Colour Profiles.

The ICC is an organisation that has introduced a set of criteria where by colour can be standardised across the variety of platforms.

ICC profiles are a set of standardised data that defines the format precisely but does not define algorithms or processing details, that is left to individual manufactures. Digital cameras, computers, printers all have a set of pre-defined ICC profiles at your disposal. Many others can be downloaded or created for specific devices.

Our main concern here is your camera and the colour working space of your software.

Your camera may only have a single ICC profile, that is sRGB or it may have additional profiles such as Adobe RGB (1998). These are known as shooting profiles. For most beginners it is best to stick with sRGB as most devises default to sRGB. If you are shooting in RAW then the setting is not important as you can change it during conversion.

Colour Work Spaces

Most good software, all the Adobe software, has the ability to set Colour Work Spaces. This is a colour space you set up in order to better process your images within the software so results are consistent across devises, for example when printing. The colour space is based on the same ICC Profiles as above. Until you fully understand the implications of Colour Management it is advisable to set the working space to sRGB. This will give you a good match, providing you have your monitor calibrated, between the camera, monitor and printer or web display.