

PHOTOGRAPH DEVELOPMENT

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In photography, development is turning the latent image from a camera or scanner into something you can see; a print, colour slide or an image on a screen. Your digital camera develops or renders the image to present it on its LCD screen.

For you to control development of digital images, it should be performed on your personal computer using image development software, such as Lightroom, Photoshop, Elements, Gimp, Capture One, Corel PaintShop Pro, DxO PhotoLab or a number of others. There are Apps designed for mobile devices too, but I will concentrate on computer applications.

WHAT IS A PHOTOGRAPH?

Film exposed in cameras uses silver halide to record light, but requires **DEVELOPMENT** before you can see the image as a negative or slide, and to stabilise it from being fogged by light exposure.

A digital image is recorded using a regular array of individual light-sensitive pixels on the camera's or scanner's sensor. It becomes a computer **FILE**, which you can see on your monitor as an ikon using Windows Explorer or Apple Finder, when the camera card connected to your computer. You copy the file into a **FOLDER** on a **DISK** inside or attached to your computer to store and develop the image. To view a digital image, it has to be **RENDERED OR DEVELOPED** using the camera's or a computer's software, so it can be displayed on the camera's LCD screen or a computer screen.

THE CAMERA IMAGE ONLY APPROXIMATES THE SCENE PHOTOGRAPHED

Our earliest experience with images is when we looked at books with our parents. We learned to recognise shapes on paper as representations of real things. Humanity has interpreted two dimensional images depicting real things for thousands of years. Because of our lifetime association with pictures, we forget that any image (drawing, painting, photograph, movie) only illustrates three-dimensional reality on two-dimensional medium. A digital image file is just recorded data that represents the subject photographed, just like the latent image on film is just sensitised silver halide grains that has to be developed to see it.

In rendering or developing an image, the development process affects the image you see. We rely on technological developments and standardisation. To develop a film image requires chemicals, and the photographer can control the process by adjusting developer formulae, processing time and temperature. The design of rendering or development software affects how the visible digital image is displayed or printed.

Any image is only a representation of reality interpreted by the technology used to create it – the lens, sensor or film, development chemicals, computer screen, microprocessor and all the intervening software. The image is therefore a lie.

Most digital images are created automatically using a phone app. The photographer takes no control. More advanced photographers will want to develop images themselves to express their memory of the subject, and the message they want to portray.

DIGITAL IMAGE FILE

Each digital image file, is a spreadsheet-like table of rational numbers representing the tone of each pixel, along with metadata such as the camera, lens, date, exposure, GPS location and so on. A pixel can have a value of zero, to represent black (no light) to 255 to represent pure white or saturated colour in the 8-bit system. Pixels record colour information by having a filter over them. A red filter is used for pixels that record red light, and there are blue and green sensitive pixels. The image is recorded either as a standard JPEG or as a RAW file.

RAW FILES contain the unprocessed data the camera records, and are the closest representation of the original scene. RAW files are regarded as digital negatives, because they need developing to produce an image that can be shared with others. Some camera settings, such as exposure, white balance and picture styles can be changed during later development. The RAW file is usually specific to the camera, so it can only be read by software that can interpret that camera's RAW files.

JPEG FILES are RAW files developed by the camera's inbuilt processor to a format that can be displayed nicely on computer and LCD screens. Because of this, much of the original tone and colour information the sensor recorded is not used. The colours have been squashed into the relatively small sRGB colour space, the edges will have been sharpened by a standard amount, and the file has been compressed. For most photographs this processing is done automatically by your camera or phone, you have no control over it, and once done, it cannot be undone. The image displayed on the camera's LCD screen is a JPEG rendered by the camera's software.

You can create your own JPEG images by developing RAW files so as to include what you want to show.

BIT DEPTH

By default, JPEG images are 8 bit and contain 256 levels of intensity (2 to the power of 8), whereas RAW images are either 12 bit (4,096 levels of intensity) or 14 bit (16,384 levels of intensity). Bit depth can only be recorded in whole numbers and not fractions or decimal places. The more levels of intensity the image is created with, the smoother is the gradation of colour and tone. When you process an image in Photoshop or similar applications, you should choose a higher bit depth – 16 bit is commonly used (65,536 levels of intensity) to avoid posterization – steps in colour and tone that can sometimes appear.

FILE COMPRESSION

JPEG image files are compressed so as to make the file size small. They had to be when JPEG was first defined back in the 1990's, because home computers were limited in storage and processing capacity. When you look back, RAM and disk storage space were 1000 times smaller than on today's home computers.

JPEG compression is done by comparing each pixel to the surrounding ones. If the intensity is the same as all the surrounding ones, the file only records equal, instead of the individual intensities. In doing this a lot of information is discarded.

ONLY DEVELOP AND SAVE JPEG IMAGES ONCE OR TWICE BECAUSE EACH TIME YOU DO THIS, THEY WILL BE DEGRADED.

The following images show the effect of re-saving JPEG images several times; sharpening and compressing the image each time. As you can see, there is severe irreversible damage.



JPEG saved once directly from RAW image - 400%



JPEG produced from JPEG and repeated five times, at 400% - notice the JPEG artefacts wrecking fine detail and exaggerating pixelation.

DO I TAKE RAW OR JPEG PHOTOS?

RAW images contain as much image information that your camera can capture, but have to be developed to see the image. The file size is large, which means that capture and transfer to the camera card is slow. It also means you have to pay for storage to keep these large files. RAW is best for your best images, those you want to develop to their full potential, and eventually want to enter in competitions. RAW images contain a much wider tonal range than can be shown on a screen or printed, but this gives far more flexibility during development. They have wide latitude to change exposure and white balance during development, and work best in difficult lighting situations, such as high contrast scenes and night time.

JPEG capture is best for many applications. For sports and wildlife images, your motor wind will operate faster, enabling the Spray and Pray photographer a better chance of capturing that decisive moment. It is great for images that you want to sell, that you don't want to spend hours processing. JPEG is best for events like the Riding for the Disabled Games. Similarly, family snaps are great if taken as JPEGs. However, you have to set the camera precisely. Exposure, white balance and other settings have to be spot on, because you have limited adjustment during development.

STORING YOUR IMAGE FILES

The best way to keep all your digital image files is in a single folder, with subfolders. You will end up with a lot of images, and a separate drive of 3 terabytes or more should be sufficient for a keen photographer's lifetime's images even if 90% of them are RAW capture, provided you throw out all the bad or repetitive ones.

A magnetic hard disc drive really is the best option currently. They are reasonably robust, and files on the drive can be copied to other drives in the future. Solid State Drives (SSD) are being used increasingly, and may eventually take over from magnetic hard disc drives. They are more robust because they don't rely on moving parts.

Ten years ago, we would store on CD and DVD disks. The writable ones of these do deteriorate, and they are no longer recommended for long-term storage, or even backups. It won't be long before these are more useless than faded minilab prints. I have heard of some photographers storing images on thumb drives. While the cost of a thumb drive is low, its capacity means you will need several of them to store your images. A single large hard drive is better than a number of thumb drives in the bottom of a drawer.

While you are purchasing one 3 terabyte hard drive, consider that you need at least one other as a backup drive. If a drive fails, what you had on it can be regarded as lost.

There are only two sorts of computer users: those that have had a hard disk failure, and those that are going to have one!

WHICH FILES DO YOU KEEP?

As you develop images you will change the original file. There are two versions of each image you need to keep: The **ORIGINAL IMAGE** produced by the camera, and a developed **MASTER FILE**. You should produce everything else directly from your master file. The output can be prints, or digital files submitted into competitions, posted on social media or shared with your friends. Each of these should be produced directly from your master file.

If you shoot RAW images, they can never be written over and degraded. Your original file will always be preserved. If you shoot JPEGs, it is possible to change the original irrecoverably. You can't go back to it unless you have a backup.

IMAGE DEVELOPMENT SOFTWARE

As you have learned how to use a computer you will have become familiar with the process that most software (Word, Excel) uses to create and modify documents. When you start up Word, you create a new document, and then type into it to add your written text. When the document is saved, a new file is created which you can see in Explorer or Finder. You can also open an existing file, and modify it by adding or deleting from it. When you save, your original file is updated with the changes. You can if you like keep a copy of the document before it was revised by using Save-as.

Photography software can work in different ways, which most of us find difficulty getting their heads around. Adobe produces four applications that are used for photography, and each works in a different way. Applications produced by others, including those provided with your camera, can be considered to follow similar principles.

There are a large number of applications that can be used to develop digital photographs. Just look up Raster Graphics Editors in Wikipedia to see the range and a comparison. Most of us choose one and stick to it. Generally, edits performed in one supplier's suite of software is incompatible with a rival supplier's. Although the Adobe Creative Cloud suite of Lightroom, Bridge, ACR and Photoshop is the most expensive, and annoyingly the licence is only available on subscription now rather than outright purchase, it is the best.

DEVELOPMENT SOFTWARE PROVIDED WITH YOUR CAMERA

Unless you purchase a Phase One camera, which provides Capture One software with the camera, or a Leica, which provides Lightroom, the software provided with your camera is limited in use. Canon's is poor. Most experienced photographers only use the camera maker's software for converting RAW images when they have bought a new model camera, and Adobe has not yet created the RAW converter for this camera's images.

APPLE PHOTOS

Apple PHOTOS is provided free with the purchase of Macintosh computers. It does not keep individual files of your images. They are all placed in one image file called a Library. You can't find individual images using Finder (Explorer on a PC), you can only find the library. Email applications work the same way. Normally you don't save individual email messages as single files. Just as you can only open your mail with a Mail application, you can only view your images in the Photos application. A limited amount of editing can be done in Photos: the edits are stored in the library. The range of adjustment of RAW files in Photos is far less than is available in the professional development software described below.

ADOBE BRIDGE

Adobe Bridge is used for viewing and cataloguing photographic images and other graphics files produced by Adobe's Creative Suite software. This application reads the file structure you created with Apple's Finder or Windows Explorer, but in addition can be used to view images.

You can't develop an image file with Bridge, but you can change its metadata by adding Keywords, flags, colour coding and other changes. You can use Bridge to change your file structure, in the same way as with Finder or Explorer by creating new folders, moving image files from one folder or disk to another. It is acting as an

alternative way of doing this to Finder or Explorer, so changes you make in Bridge are reflected in Finder/Explorer. What Bridge will do is open an image file in Camera Raw.

ADOBE CAMERA RAW (ACR) – A RAW IMAGE EDITOR

If you open an original camera image in Bridge, (MENU: File > Open or double click the image's icon) it will take you to the Camera Raw window, rather than the Photoshop window. ACR was originally designed for RAW images only, but now opens all camera images, RAW or JPEG capture.

You can develop images using the sliders on the right-hand side. Click Save Image... when you have finished. However, all the changes you make are not saved to the original file, but to a Sidecar .xmp File, which will have the same name as the image file, and be in the same folder. These sidecar files open in nerdy text if you try to open one in Explorer or Finder.

This preserves the original file, so that it is exactly as it came out of the camera. You can always go back to it and develop it again. RAW capture images cannot be revised by any application, which is why ACR was designed with this behaviour. However, JPEG's can be altered by some applications, and when this is done the file is degraded. The Bridge > ACR way of working safely protects your original camera image files.

An ACR image can only be read by ACR or Lightroom, and requires the sidecar file to see your edits. You have to create a new developed image file using Photoshop if you want something to share with others.

DxO PhotoLab is similar to ACR. It has no catalogue file and sees your Explorer/Finder file structure. It produces sidecar files containing any edits you do with it. This application comes with the latest upgrade of the Nik suite software. This package is a great alternative to the Adobe Creative cloud applications at a reasonable one-off price currently 129 Euros. Although both use sidecar files, ACR and PhotoLab sidecar files are incompatible.

LIGHTROOM – CATALOGING AND RAW IMAGE PROCESSING

Lightroom is a development from Bridge and ACR. The application itself does not store anything within it. Instead it stores everything you do with it in a single catalogue file. By default, the catalogue file is on the hard disk of the computer used to create it. Be sure to back-up this file to another disk as it contains everything you do in Lightroom.

Unlike Bridge, Lightroom can only see files that have been imported into the catalogue. The first thing you have to do is import your existing files so it can see them – it does not change these files. After that, when you import files from your camera, it transfers the files where you want them and adds the information to the catalogue. You can find the imported images using Finder or Explorer if you like. Lightroom will only see image and video files.

You can use Lightroom to organise your images by moving them from one folder to another, and by creating new folders. The changes you make to the file structure in Lightroom are reflected in Finder or Explorer. However, if you these changes in Finder/Explorer, Lightroom does not know what you have done. It can lose track of where your files are.

Lightroom is used for cataloguing in a similar way to Bridge, but better. For example, you can see the contents of the Lightroom catalogue even if the drive containing the images is disconnected. By creating Smart Previews of images, you can even develop them without the drive they are on being connected.

Development using Lightroom is identical to development using ACR, except that all the changes are made to the catalogue file. You can set up for Lightroom to create a Sidecar file that can be read by ACR by setting preferences.

ACR and Lightroom can fully develop many images ready for printing or export as JPEGs.

The developed image file cannot be directly shared with others. Images developed with Lightroom can only be seen by the computer with Lightroom and your catalogue file installed. They have to be EXPORTED from Lightroom to make a single file with all your edits, in a format that is universal, such as TIFF or JPEG.

Lightroom and Bridge sort and catalogue your image files, so you can quickly find a particular image in your ever-growing number.

CAPTURE ONE is similar to Lightroom with some advantages and disadvantages. Its cataloguing features are considered inferior to Lightroom. When an image is opened in Capture One a Preset is applied that duplicates the image seen on the camera's LCD. Lightroom's standard start position is a little flatter in colour rendition, but is improved on development. Capture One can apply local adjustments as layers. Its pricing is similar to the Adobe Creative Cloud suite of Lightroom and Photoshop. It is provided with Phase One cameras and is liked by many professionals. But development in Photoshop is far more powerful.

PHOTOSHOP AND OTHER PIXEL EDITING APPLICATIONS

Photoshop, Elements and other pixel editing applications are easy to get your head around. They work just like most other applications. You start the application and either Open a document or create a New document. As you work on your document you change the file, and you Save your work before Exiting or Quitting the application.

The problem with this is that edits change the original file permanently. Photoshop has several features such as layers and masks that delay the application of a change, and through the use of adjustment layers, confine changes to a layer which can be revised or deleted. But when the image is flattened, resized, or saved as a JPEG, any changes are permanent. The only option is to undo changes, which cannot be done once the image file is closed.

RAW images have to be saved in another format, Photoshop (.psd), TIFF or JPEG for example, but if you work on a JPEG camera image you risk losing your original. You have to remember to Save-as to a different filename or file type when you first open the image, to protect your original. Better still, only open images using ACR and then transfer to Photoshop.

Pixel editors like Photoshop give the photographer the most creative freedom.

Photoshop is able to do far more than Lightroom or ACR, such as combining multiple images (compositing), working with graphics (drawings and paintings), and text. It can make sophisticated changes to tones and colours in the image by using selections, layers and masks. Objects can be removed or have their shape transformed.

OTHER PIXEL EDITING APPLICATIONS

Photoshop is the application by which all other pixel editing applications are compared, but there are lower cost alternatives. Adobe **PHOTOSHOP ELEMENTS** is a cut-down form of Photoshop that is a one-off cost, that is used a lot by beginners. It has built-in effects. You will eventually want to move to Lightroom and Photoshop for much more creative control.

GIMP (GNU Image Manipulation Program) is a free and open-sourced application. One reviewer stated that for “those that have never used Photoshop, GIMP is simply a very powerful raster graphics application”.

Corel **PAINTSHOP PRO** is another Pixel editor, but it is only available for Windows (not Apple or Linux). It has a lot of features similar to Photoshop, such as layers, curves and levels. Many features are considered inferior to Photoshop by reviewers, such as the ability to correct lens aberrations.

AFFINITY Photo is a newer photo editor described as “Professional”. Originally developed for Apple Mac computers, and rated very highly, this is now available for Windows and Linux computers.

NIK SOFTWARE SUITE

Nik Silver Efex Pro is probably the best software for creating monochrome images. It is part of the Nik suite of applications, which originated in Hamburg, and was further developed in San Diego before the licence was purchased by Google, who did nothing with it. This suite of software has now been acquired by DxO, a French company, who are continuing to develop the software.

The Nik suite can be operated as Photoshop plug-ins, but do not need Photoshop for their use. They are Pixel editing applications. The Nik suite includes the following:

- Dfine – an excellent noise reduction application
- Viveza – an excellent application for colour and texture adjustments.
- Silver Efex Pro – to my mind the best tool for creating monochrome images
- HDR Efex Pro – an application for processing images of high dynamic range (high contrast)
- Sharpener Pro RAW Pre-sharpener
- Sharpener Pro Output sharpening – Excellent tool for sharpening files sized for printing
- Analog Efex Pro – creates film-like effects
- Color Efex Pro – different colour filters and Presets can be added

The key to the Nik suite of software is their use of U-Point technology, which is Nik’s alternative way of working to Photoshop’s Selections, Layers and Masks. Once you see how U-Point Technology works, it intuitively allows development of separate parts of your image. You can control brightness, contrast, sharpness, texture, tone and colour of different parts of your image, visualising and understanding what you do as you go. It is much easier to understand than Layers and Masks. The reason DxO took over the Nik suite is so they can use U-Point technology in their DxO applications, including PhotoLab 2.

Normally when you develop your image using a Nik application, the changes are permanent. However, applying the software on a Smart layer in Photoshop makes the changes editable.

DEVELOPED IMAGE FORMATS

You can choose which format to use for your developed image depending on what you want to do with it. I recommend only the following formats are used.

PHOTOSHOP (.PSD)

Adobe format for Photoshopped images. May not be recognised by non-Adobe software. Capable of storing layers.

TIFF (.TIF)

Much more widely used than .PSD. Capable of storing layers. My preference.

DNG (.DNG)

Adobe's raw image format (digital negative) that is more universally accepted than camera RAW. Some cameras (Leica and Pentax) have adopted this as their standard, but Nikon and Canon still produce a different format RAW file for each camera model. Some photographers convert their camera RAW files to DNG, just in case their original camera's RAW converter in Adobe products is deleted. Some scanning software can produce DNG files.

JPEG (.JPG)

Although widely used for screen images and for prints, not a good choice for your master developed images. In producing a JPEG file, much information is lost.

DIGITAL DEVELOPMENT WORKFLOW

There is a logical sequence for working on your digital images. A batch of images is usually the output of a photographing session:

- Download the session's images from camera or camera card to a new folder on your hard disc.
- Go through the images one-by-one, viewing at full screen size in either Bridge or Lightroom. Reject any bad (poorly composed, poorly exposed, mistimed, out of focus), or repetitive images. Mark the others with one star. Delete rejected images. The images with one star have been sorted. Those with no stars are still to be looked at.
- If your camera is set to record RAW + JPEG, you can discard camera JPEG images to save space.
- Apply keywords to each of the remaining images.
- Go through the images again in groups of similar images comparing them. Choose the best one or two out of each group for further work (first development), and give them 2 stars. Again, reject any near similar images. Two star images are your **KEEPERS**.
- Use filtering so that you can see your keepers. Pick out any real heroes and give them 3 stars.
- Develop your 3 star images using Lightroom or Adobe Camera Raw. As you are working on an image and see a flaw, look to see if the one taken before and after it is better.
- These images are your **MASTER FILES**. Identify them as such with a flag. When development is complete they can be used for making prints or JPEG images for distribution.
- If further development to be done in Photoshop, open them in this application (See hint below). Photoshop workflow should be: firstly, noise reduction using proprietary software (Dfine), touch up to remove defects, adjust tones and colours as you would like overall and locally, then perform creative sharpening, which is local sharpening where it enhances the image. You may crop, but don't resize your master file. When complete, save the new master file in Photoshop (.PSD) or TIFF format. This is the master file that will be resized to create prints or JPEG images for distribution. Flag this one as your master file, and delete the flag from the RAW original.

- Produce screen-sized JPEGs and prints for competitions, or any other images you want to share, directly from the [MASTER FILE](#).
- Rename each output file to reflect its use.

See my articles [STARTING WITH LIGHTROOM](#), [LIGHTROOM LIBRARY WINDOW](#), and [IMAGE DEVELOPMENT IN LIGHTROOM](#) for more details. There are also articles [Sharpening Overview](#), [Layers and Masks Overview](#), [Touching Up Using Photoshop](#), and others.

HINT: In Lightroom, MENU: Preferences > External Editing > External Editing File Naming > Template > Custom Settings > Edit > Custom Text. Use this dialogue box to add text to the edited file name, such as Master or M. Now the new master file created by Photoshop will be distinguishable from the camera image.

PRODUCING SCREEN-SIZED JPEG IMAGES

Your master file can be used to create JPEG images for display on your computer, smartphone or tablet. JPEGs can be created of different sizes for website, social media (Instagram, Facebook etc.), and of course be submitted for club judging evenings and competitions. You should produce JPEGs of different sizes for each different use. Competition images that are too small will not attract the judge, but those too large will be disqualified.

See my article, [AUTOMATE THE PRODUCTION OF SCREEN SIZED JPEGs](#), for how to set up Lightroom and Photoshop to automatically produce JPEGs of just the right size for Club judging and competition. I also have a Lightroom Preset and two Photoshop actions that do this.

Whenever you want JPEG images of different sizes, always produce each one directly from your master file. You can use Lightroom or Photoshop to resample a JPEG, but you will degrade it further, and you will risk posterization or JPEG artefacts. I recommend naming screen-sized files by adding a suitable suffix to the original file name. For example, G7C3418_MPC Digital.jpg.

PRINTING YOUR IMAGES

Whether you are printing yourself or a commercial printer is going to print the image, the workflow for printing is as follows.

- Resize your master image to exactly match the size of the print you want.
- Resave the image as a new file name, so as to protect your master file.
- Proof the image to adjust the colours in your original match the paper and printer you will use.
- Perform output sharpening
- The image may be flattened to one layer.
- Converting to a JPEG is only necessary if your photofinisher requires it: some will print TIFFs. Converting to JPEG will reduce the tonal range to 8 bit, compress the file destructively, and apply sharpening.
- Print the image, either on your own printer, or take to your photofinisher on a thumb drive or spare camera card, or send to your photofinisher using their website instructions.

Save the print file if you think you might need to print off more copies, otherwise it can be discarded when you are happy with the print. You will need to produce a new print file from your master if the print size, printer or paper type is not the same as your first print. See the article [PRESENTATION OF PRINTS FOR JUDGING](#) for further details on how to print and matt your images. [Website > Image Judging]

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