

An Introduction to Digital Imaging for Artists

What is Digital Imagery ?	1
1. The digital image – it's not obvious	1
2. Importance of good digital imagery:	2
Producing the Image.....	2
3. Lighting for accurate colour reproduction and minimizing reflections.	2
4. Minimizing post-processing and quality deterioration by eliminating distortions.	2
Viewing and Manipulating Digital Images.....	3
5. Adjusting the computer monitor color, contrast and saturation	3
6. Computer processing to crop and remove distortions.....	3
7. Adjusting digital images to increase the fidelity of colour reproduction.....	3
Saving Images	3
8. File formats	3
Printing Images.....	5
9. Suitable Resolution and Size For Images Sent To The Printer.....	5
10. Maximum Print Size From Your Camera	5
Other Issues.....	5
11. Colour Space.....	5
12. Monitor Colour Depth or Quality.....	5
13. Producing CD's for submissions or to store images	6
14. Image Sources	6
15. Using Your Camera.....	6
16. Choosing a Camera	6
17. Resources on the web.....	7
About me:.....	7

Presentation: Maximizing the quality of images in a manner appropriate to their use.

I will attempt to minimize the technical aspects and deal with the concepts. An understanding of the concepts should facilitate the subsequent use of manuals and the absorption of the details. It is presumed that you are able to take satisfactory photos with your digital camera and understand computer use enough to use a word processor program and find computer files. Essential advice to ensure sharp images: always use an f stop of f 8 or greater. All the procedures used in the demonstrations are named here. You will not remember all of them but will be able to look them up in your software help file.

What is Digital Imagery ?

1. The digital image – it's not obvious

Digital images are made up of pixels. Each pixel in the imaging device contains three sensors: red, green, and blue (RGB) that correspond to light emitting cells in each pixel of the monitor.

Reflected colours of light behave differently than emitted colours. Mix reflective red, green and blue paint on your palette and you get mud. Yet, on your television or computer monitor the mixture of red, green and blue light appears to the eye as white.

For colour printing, the RGB composition of each digital image pixel is converted by the computer into intensities of cyan, yellow, magenta and black. These are mixed appropriately on the page as you would on your palette to reproduce the original image. The manner in which the colours mix depends on the dyes or pigments, and the surface on which it is printed.

A lot of magic goes on inside the computer.

2. Importance of good digital imagery:

a) **Juried exhibitions and other competitions**

The accurate rendition of the original image should appear as similar as possible to both the artist and the jurors.

b) **Reproductions**

Successful sales require that the fidelity of the reproduction is maximized.

c) **Web sales**

Reproductions of satisfactory quality are necessary but excess quality increases download time. Potential clients lose patience, artists lose sales.

Producing the Image

3. Lighting for accurate colour reproduction and minimizing reflections.

With both digital and film cameras, diffuse, indirect sunlight is best for accurate colour reproduction. A bright but overcast day with indirect lighting will minimize reflections. Avoid having the light fall directly on the work. To avoid lens flare, do not have the camera face in the direction of a window. Hold a glossy piece of work in your hands directly in front of you. Move around until you find a location where reflections are reduced to a minimum.

A well adjusted polarizing filter on your camera lens is always necessary to remove reflections, particularly on glossy surfaces. Never photograph an image that is behind glass or other highly reflective surface. Oil paintings on canvas are very difficult but not impossible to photograph without reflection. Ideally they should be coated with a matte varnish. Oil paint has a sheen which can wash out colour and texture in photos.

4. Minimizing post-processing and quality deterioration by eliminating distortions.

It is possible to correct distortions using the computer after the image has been photographed. However, in doing so, some pixels are lost and others are artificially mathematically generated which reduces the fidelity of the images.

The two main techniques to eliminate distortion when the photo is taken are:

- i) To eliminate perspective stretch, ensure the camera is aligned with the perpendicular to the centre of the image.
- ii) To eliminate "barreling" or "pin cushioning", use a standard lens. If the camera has a zoom lens, adjust to no telescopic or wide angle, or match the focal length of the zoom lens to the diagonal of your image sensor.

To avoid wasting pixels, move the camera towards or away from the original to fill the viewfinder with your image. **Do not use the zoom.** If your camera has built-in a close-up feature, use that as it will also probably disable the zoom.

Viewing and Manipulating Digital Images

5. Adjusting the computer monitor color, contrast and saturation

so what you see best approximates what the juror observes.

This can be done using PhotoShop Adobe Gamma which has been demonstrated, or using relatively inexpensive but more effective automatic hardware/software combination such as Pantone's Colorvision Spyder. This system can also provide quite accurate printer profiles which allow your printer output to approximately match your computer screen. (Producing printer profiles is not for the "computer faint at heart".)

"Approximately" is the operative word. Quite apart from differences in the eye of the beholder, no two computer displays are exactly the same.

Printing is even more problematic. Computer displays are light emitting devices whereas printed pages reflect light. Very close matches are possible, but absolutely identical images are not.

6. Computer processing to crop and remove distortions.

- i) Removing distortions
- ii) Cropping

These procedures destroy or artificially generate pixels in the original image. The methods used are software dependent and are detailed in your software manual. Those demonstrated were using Adobe PhotoShop. Corel Paint, for example, offers similar functionality.

7. Adjusting digital images to increase the fidelity of colour reproduction.

These changes do not destroy or artificially generate pixels. They can generally be reversed without loss in quality. Colour tone, brightness, contrast, and saturation; a multi-step process. Again the methods are software dependent.

Note the adjustments of brightness and contrast often need to be adjusted in the opposite directions to avoid losing highlighted or lightly defined parts of the original image.

Some other effects using filters to simulate brush patterns, selecting and modifying parts of images, fixing blemishes, red eye, etc. may have been demonstrated. These effects are difficult to reverse once the image is saved. **Work with a copy of your image file** in case you wish to revert back to the original.

Saving Images

8. File formats

- a) There are many digital image file formats available and this can be confusing. For example: jpg, giff, psd, raw, tiff, wmf, eps, png, pct, pcz, bmp, pcx, etc.

For the internet, use only jpg and giff formats to ensure compatibility with web browsers and all operating systems. jpg files are most often used because they allow for compression with a minimal loss in quality and faster download times. giff files are also universal and provide other features such as transparent backgrounds, animations, etc, but they are larger in file size.

For storing your images on your computer use the work files native to your computer image software such as psd files used in Adobe Photoshop. These often preserve resolution, quality, and reversible changes you may make to your images and other features but are very large in size. The native file formats that your camera uses such as jpg, tiff or raw (depending on your camera) are also useful for storage in that they preserve the maximum quality of your camera images.

Resolution for internet, jurying and print use

Again, always save your originals and **manipulate a copy** of your original image. If you change the number of pixels or dots per inch in the original, **where possible use factors by which the size and resolution are changed that are the mathematical inverse of each other**. In this way no pixels are lost or generated artificially. Size or pixels per inch changes cannot be reversed once the image is saved if this procedure is not followed.

For internet use, a typical computer monitor has a resolution of 96 **dpi (dots or pixels per inch)**. The copy of the original image should be set to that of the expected viewing dimensions. This will decrease the amount of reformatting that occurs on the viewer's computer and the time to open the page. Thus, for example, for web page images of an onscreen size of 3" x 4" the basic file size should not exceed 110 kb. Using a medium jpg compression of about 5 gives good fidelity and should reduce this down to about 12 kb which should load very quickly into an internet browser window. Note that jpg compressions cannot be reversed when the saved image is subsequently opened. Again it is important to work with a copy of the original image.

jpg compression is on a scale of 1 to 10. 1 gives the maximum compression, 8 gives no compression and 10 gives larger file sizes with less compression but no new pixels. Once you have saved a file then subsequently changed it, use the same value for the jpg compression to maintain the same file size. There is no point in increasing the file size from its original value. This file size for various compression indices is displayed in PhotoShop in the <Save As> dialogue box.

For jurying be careful to check the file size, format, and resolution expected.

A resolution of 300 dpi always seems to be requested with no image size specified. This is strange because 300 dpi is not a multiple of the typical screen resolution of 96 dpi, nor is it a multiple of the typical printer basic resolution of 72 dpi. I suspect it was to conform to the standard of laser printers which nobody uses to reproduce art work. If the image size is not specified, the file size could be so small that the image is useless, or so large that the broadband download time would require more than a coffee break.

I recommend a new standard of the maximum number of image pixels that can fit the dimensions 860 pixels high and 900 pixels wide, saved as a jpg file at a compression standard of 5. This should, depending on the image, bring the file size down to about 90 KB. With a non-broadband connection of 56.6 Kbps this image would take about 15 seconds to upload or download. With broadband this would be a snap. This is manageable for a jurying system where some of the artists and jurors may not have broadband internet connections. It should not produce any perceptible reduction in image quality when viewed on a computer screen or projector. This was the resolution that was used in the last successful jurying.

In some cases photographic slides are requested. Slides can be produced from your digital images using very specialized commercial equipment. One source of photo slide production service in the United States can be accessed at <http://www.iprintfromhome.com> who charge about 2.50 \$US per slide for the service. They specify a jpg image size preference of 2732 x 4096 pixels, but do not suggest jpg compression index. I would suggest 8 (no compression) if none is stipulated and a whole number multiple of your original image resolution as close as possible and up to their specified maximum. (Their maximum is not a whole multiple of 72. Thus the suggested maximum would be 2664 x 4032 pixels.)

For giclée or ink jet prints on most printers, use multiples of 72 dpi which is probably also the resolution of the files that your camera produces and an image size equal to the expected print size. The choices of print resolution in your printer such as 360, 720, 1440, 2880, etc. dpi will indicate if it uses multiples of 72 dpi. If you do not use a multiple of the basic resolution of the printer, the printer driver will mathematically generate artificial pixels. See **Suitable Resolution and Size For Images Sent To The Printer** below.

Printing Images

9. Suitable Resolution and Size For Images Sent To The Printer

Even if your printer prints at a resolution of 2880 dpi to eliminate “jaggies”, etc., using an image resolution in excess of 360 dpi will probably not make any difference to the final print. It will only unnecessarily slow the process. Experiment with your printer using various image resolutions and different printer resolutions to find what is acceptable to you and your equipment. 360 dpi will probably be quite satisfactory for your image resolution.

As near as possible, change the image size by a whole multiple of the original image to the desired size of the final print. This is to avoid having the printer mathematically generate artificial pixels.

If you are sending your images to a commercial printer, they will specify the preferred format, size, pixels per inch, maximum print size available to you, etc.

10. Maximum Print Size From Your Camera

(This is somewhat technical ☺)

A rule of thumb for a **very good quality camera** and a full frame, not excessively compressed image is:

The **maximum** length in inches $\approx \sqrt{300r}$

Where r is the maximum effective resolution in mega Pixels of a good quality camera.

The width should not exceed $\frac{2}{3}$ of this.

For example, a good quality 6 mega pixel camera is capable of producing printed images of up to $\approx \sqrt{300 \times 6} = 42$ inches long by $\frac{2}{3} \times 42 = 28$ inches wide. Note that the maximum dimension of a square printed image is that of the maximum width.

For very large images (in excess of 36” long) with a top quality camera and printer, it is possible to increase the size slightly as such images are viewed at a distance. Printer driver computer software will also smooth out the “jaggies”.

This rule of thumb should be subject to experimentation on your system as it is **very dependent on the quality of your camera**. See **Choosing a Camera** below.

Other Issues

11. Colour Space

For most cameras and printers use the sRGB colour space. With high end cameras and printers it is possible to use the Adobe RGB (1998) colour space. Verify this with your camera and printer documentation. The Adobe RGB (1998) colour space contains a more suitable array of colours for accurate colour reproduction. This is the colour space used in commercial reproductions.

12. Monitor Colour Depth or Quality

Your monitor preferences should be set to 32 bits per pixel; but if necessary, to a minimum of 24 bits per pixel.

13. Producing CD's for submissions or to store images

In the PC world there are two recommended brands of software: Roxio and Nero media management software. This software not only allows you to change the file formats of images, it also allows you to manage sound and video files. Their real convenience is files may be dragged and dropped onto a CD icon or between directories in your usual file manager. They produce CD labels and a host of other functions.

14. Image Sources

Digital images may be produced using a digital camera or by scanning a photographic transparency (slide), a transparent negative or a positive print. Scanning of 35 mm slides at a scanner resolution of 3200 dpi will yield an image of 11 Mega pixels. 1600 dpi will produce an image of about 3 Mega pixels. Most scanners can only produce digital images from reflective surfaces such as printed or original images. Only scanners so equipped can produce digital images from transparencies. Scanners that can handle both transparent and reflective image sources are very useful and are often a better value.

15. Using Your Camera

As cameras vary extensively, again it is beyond the scope of this introduction to digital imaging to deal with specific camera use. Studying the manual that came with your camera is a good, but for some a painful, start. General workshops or courses on photography are also useful in this regard.

16. Choosing a Camera

At the time of this writing a typical digital camera has an imaging chip capable of 5 Mega Pixels, each with 3 colour sensors (Red, Green and Blue) for a total of 15 million light sensors. For less expensive cameras, these 15 million light sensors are crammed into a space of about $\frac{3}{8}$ " x $\frac{1}{2}$ ". LCD

computer and television monitors are produced with much the same method as a camera imaging chip. New LCD monitors often have a couple of pixels that do not function and the manufacturers inform you that it is normal. It is also normal in the manufacture of camera imaging chips with all these sensors crammed into such a small space to also have a number of faulty pixels. When such errors occur in the camera imaging chip, the camera is programmed in manufacture to substitute faulty pixels with the average value of the pixels surrounding the faulty pixels when an image is taken. This undoubtedly slows the camera down, and decreases the quality of the digital image.

Imaging chips are a commodity item sold to many different camera manufacturers, the most reputable producing their own. You get what you pay for and it is wise to invest in a camera from a reputable manufacturer.

The size of the imaging chip is also an important consideration. The larger chips result in less faulty pixels to be corrected, improved imaging speed (time between images), larger resolutions, and less noise on long exposures due to extraneous radiation. The chip size is available to you in the specifications before you purchase. A good source for reviews, specifications and buying guides is <http://www.cnet.com>.

17. Resources on the web

The following are useful sources of information about digital imaging. They are quite technical. Good results may be obtained without opening the hood and adjusting the engine; however, sometimes you don't have a choice, or curiosity gets the better of you.

The Luminous Landscape

This is one of the best resources I have found on digital imaging. This has an extensive collection of resources as well as related product reviews.

<http://luminous-landscape.com/>

Digital Dog

This site contains tutorials about many aspects of digital photography. It is Mac based but all also applies to the Windows operating system.

<http://www.digitaldog.net/tips/index.shtml>

Computer Darkroom

Although this site does not have as an extensive selection of reviews and tutorial as the others, however the information appears a little easier for the neophyte to absorb.

<http://www.computer-darkroom.com/home.htm>

About me:

I am Linda Hobley's (SCA) computer guy. I photo scan and adjust images to be as faithful as possible to the originals and produce quality archival giclée prints of her paintings. The reproductions are on canvas, water colour paper, etc, and are up to 44" wide and any length. Because of their quality and fidelity these images have sold very successfully. I also produce gift cards, brochures, catalogs and other publicity documents. I built her web site at <http://kenlinda.com/linda>

As of July, 2006, I will offer economical, quality image and web site services to other artists. Please refer to our website at <http://kenlinda.com> for details. The information should be available in September.

Ken Tannahill