MACRO PHOTOGRAPHY

Ballarat Camera Club 2012

DENIS CRAWFORD

GRAPHIC SCIENCE

www.graphicscience.com.au
denis@graphicscience.com.au

EQUIPMENT BASICS

Which camera??

A camera body is merely a box that holds film or a digital sensor. Which camera brand is best??

As Ernst Haas says: *The camera doesn't make a bit of difference. All of them can record what you are seeing. But, you have to SEE.*

What he means is **composition** is more important than hardware.

Website: http://www.kenrockwell.com/tech/composition.htm

When buying compact digital cameras look at the size of the sensor rather than the number of megapixels. Sensors listed as 1/2.5" have a physical size of 5.76 x 4.29 mm! The 1/2.5" harks back to the way image sizes of early video cameras were expressed in terms of the outside diameter of the glass envelope of the video camera tube. Who knows why they still use this arcane method.

Why is physical size important? Think about cramming 12 megapixels into an area of 5.76 x 4.9 mm compared to the same number of megapixels in an area of 36 x 24 mm (the physical size of a full frame DSLR sensor). This is why a full frame DSLR is infinitely superior dealing with noise at high ISO values.

Websites: http://en.wikipedia.org/wiki/Image_sensor_format

http://photo.net/equipment/digital/sensorsize/

The lens

The lens is the most important part of your camera, because this is what sees the world. When purchasing a lens for a DSLR a good rule-of-thumb would be to choose the highest-quality modern lens you can afford. It must suit the subject you most commonly shoot.

There is really no such thing as an all-purpose lens.

When buying a second hand lens it would be a good idea to test before you buy, most second hand dealers will allow this. There is no such thing as a "good" cheap lens. You get what you pay for.

The dodgy "Digital zoom" dodgy feature of compact cameras:
Website: http://www.digitalcamerareviews.org.uk/article/optical-zoom-verses-digital-zoom/

Flash
Most compact digital cameras and DSLRs have a built-in flash. This workshop will show that off-camera flash is a better way to go, but in some cases the built-in flash is useful as a trigger. Flash is nothing to be afraid of and can easily be controlled with simple techniques such as diffusion and reflection. These range from quite expensive *photographic* products to cheap things like tracing paper and white cardboard.

Websites: http://www.stofen.com/

http://www.photoflex.com

http://strobist.blogspot.com/ for all you need to know about lighting. Start with his Lighting 101. Massive blog, highly recommended.

HDR
Extreme conditions may be corrected by combining several exposures with HDR software. I use Photomatix (www.hdrsoft.com).

Tripods
Some sort of camera support is essential. I showed a few options from fairly expensive tripods like my magical Manfrotto 190XPROB to cheaper bean bag camera supports like the Cam-pod. The table clamp was a Manfrotto 3424 column clamp. The flexible arm holding the flash was a Manfrotto 237HD Heavy-Duty Flex Arm which attached to the table via a Manfrotto 035 super clamp.

Websites: http://www.manfrotto.com/Jahia/site/manfrotto/pid/86

http://www.cam-pod.com/

Most of these are available through http://www.bhphotovideo.com (highly recommended).

BASIC EXPOSURE INFO

All the equipment in the world won't help you if you can't expose for a subject correctly. The four essential quantities involved in camera exposure are subject luminance, ISO, lens aperture and shutter speed.

Digital cameras make it easy to see if we have exposed a subject correctly via the **histogram**, not by looking at the image on the screen. The screen may be a poor one, you may be in bright sunshine or it may not be calibrated correctly.

Websites: http://www.kenrockwell.com/tech/histograms.htm

http://www.luminous-landscape.com/tutorials/understanding-series/understanding-histograms.shtml

http://www.shortcourses.com/use/using3-7.html

COLOUR BALANCE

The colour of light can change - even natural light. This can be a problem if you wish to take several shots of the same subject over a period of weeks or even months using natural light e.g. to illustrate how a particular flower opens. Light can vary greatly in intensity and colour temperature with season, time of day and atmospheric conditions.

The colour of light as the sun rises and sets is much warmer than at other times of the day and the shadows are longer and softer. As the sun rises higher the light is whiter and the sky is bluer. The sky then acts as a giant blue reflector causing shadows, and neutral tones such as snow and sand, to record as blue. At its zenith the sun casts the sharpest and deepest shadows, and the contrast range is at its greatest. As a rule of thumb, it is a good idea to avoid shooting in the middle of the day if you want to use natural light and don't like deep shadows.

Flash lighting is a fully controllable way of lighting most subjects. Flash units whether portable or studio units are (supposed to be) balanced to daylight (5500K).

This is where the white balance function of our cameras can really help us.

Website: http://www.pcreview.co.uk/articles/Digital-Photography/White_Balance/

I like to use a “white balance card”, sometimes called a “digital grey card”. It doesn't matter if they are grey or white, what is important is they are *neutral*. Note that these are not the same as the old Kodak grey cards which are used for *exposure* not white balance. With some cameras you can use white balance cards to record custom white balance presets for particular lighting conditions.

Websites: http://www.digitalartsphotography.com/instructions.htm

http://store.rmimaging.com/digitalgraycard-100.aspx

You need to shoot in RAW to get maximum benefit of white balance cards. You can simply place the white balance card somewhere in your first shot, and take other shots without it under the same lighting conditions. Open the first image in a Raw Converter such as Adobe Camera Raw (ACR) and click on the image of the white balance card with the white balance tool. Then apply that white balance to all the other images you shot (as long as the light was the same of course). You can always fine tune the images later using the Temperature and Tint controls if you think the image is looking *too* neutral.

ACR can be calibrated: http://fors.net/chromoholics/

Other Websites: http://www.photoshop-tutorials-plus.com/grey-card.html

http://www.russellbrown.com/tips_tech.html

MACRO PHOTOGRAPHY

Photomacrography is the scientific term for extreme close-up photography giving magnifications of 1X or larger, without the use of a microscope. But these days most people call it macro photography.

Magnification explained

Magnification is the ratio between the size of the subject on the sensor/film and its actual size.

So-called macro zoom lenses do not achieve magnifications better than 1:4. If you *really* want to shoot macro buy a macro lens or learn how to use reversed lenses and/or bellows.

Compact cameras? Most compact cameras have **very poor** magnification compared to DSLR's even though they may focus as close as 4 cm.

A 1X magnification (or 1:1 ratio) means that the lens takes in a view equivalent to the dimensions of the sensor size. A full-frame DSLR has an area of coverage at 1:1 measuring 36 mm x 24 mm, allowing for a subject of 36 mm in length to fill the frame.

A simple way to express the magnification formula is: $m = {}^{I}/_{O}$
where m = magnification, I = image size and O = object size.

Magnification can be determined by placing a ruler across the plane of focus and reading the distance across the field of view as seen through your viewfinder or on your LCD screen (assuming your viewfinder is close to 100%). That measurement is the object size. The image size is the sensor width of your camera. Simple division then results in the magnification figure.

A standard 50 mm lens on a DSLR will only focus as closely as about 45 cm, resulting in a magnification of about 0.15. *Why won't a lens focus closer?* The closest focusing distance of a lens is limited by the focus travel of the lens. If we could move the lens further away from the film (and closer to the subject), magnification would increase.

Macro lenses have an extending helical tube which allows just that - closer focusing. Macro lenses are designed to function better in the macro ranges (from 1:10 to 10:1) than conventional lenses of the same focal length. Macro lenses come in several focal lengths such as 55mm, 105mm and 200mm. Longer focal length lenses have greater working distances (lens to subject distance) - allowing more space for lighting. Modern macro lenses will achieve a magnification of 1:1 straight out of the box.

Exposure Increase Factor (EIF)

Greater magnification can be achieved with a macro lens by using extension tubes or bellows positioned between the lens and camera body, which allows the camera to focus even closer. This means a greater lens-sensor distance, thus a reduction in the amount of light which reaches the sensor.

Exposure has to be *increased* to correctly expose a subject. I won't bore you with the formula here but 1X magnification needs 2 extra stops of light, and 2X magnification needs 3 extra stops of light.

This information was essential back in the film days because we couldn't simply look at the screen on the back of the camera to determine if our exposure was correct.

Stacking lenses
Supplementary lenses which attach to a lens the way a filter does, is one way to increase magnification for a camera system. Adding a supplementary or “dioptre” in front of a lens does not increase extension and so there is no change in the amount of light coming through the lens, and on to the film. However, a loss of optical quality does result due to the addition of optical elements in front of the lens. I will point out other limitations during the workshop.

Regular camera lenses can be used instead. The lenses can be reversed (stacked) onto the front of a primary lens with a lens coupling ring. The ring has male filter threads on both sides. The magnification obtained with stacked lenses is given by the following very simple formula:

$$\text{Magnification} = \frac{\text{focal length of primary lens}}{\text{focal length of reversed lens}}$$

Vignetting may occur with some lenses.

Websites: http://www.alanwood.net/photography/coupling-rings.html

http://www.earthboundlight.com/phototips/closeup-stacking-reversing.html

http://www.amazon.com/Adorama-Macro-Coupling-Ring-52-52/dp/B0000AB4LV

Bellows
Bellows are more flexible than extension tubes or lens stacking as they provide continuously variable extension and magnification. It is old technology but I use them all the time.

Website: http://www.alanwood.net/photography/bellows.html

Reversing lenses
A “normal” or shorter focal-length lens designed for general use does not provide its best performance when magnifications approach 1X or greater. Normal lenses are designed to be used when the distance from the rear of the lens to the film is less than the distance from the front of the lens to the subject. When enough extension is used (such as with bellows) to create magnifications greater than 1X, this relationship is reversed. A lens’s optical performance will actually improve when reverse mounted so that its rear element is facing the subject. Take care to protect the rear lens element. I will show a home-made rear lens protector during the workshop.

Website: http://www.cs.mtu.edu/~shene/DigiCam/User-Guide/A95/Close-Up/Reversal.html

Depth of field
The *depth of field* is the range from the nearest part of a subject that is in focus to the farthest point of a subject that is in focus. At close distances depth of field is minimal. Most texts acknowledge that when photographing insects at close range, the maximum possible depth of field is usually required and even then is frequently inadequate. To maximise depth of field a lens can be stopped down to the minimum aperture.

But, the use of small apertures at high magnification reduces the resolving power of the lens and may impair the image. This is caused by the light diffracting as it passes by the edges of the diaphragm of the lens.

Macro photography requires a **compromise** between achieving a useful depth of field and avoiding diffraction. The depth of field available has to be used effectively. This can be achieved by making sure the most important part of the subject is in focus. For example, an important feature of an insect is its head. If a specimen is facing the camera obliquely and the head is in sharp focus, other features can be out of focus and the image will still appear “natural”.

One way to solve the depth of field problem is by focus stacking, where several images are taken at different focal points and combined (stacked) in the computer.

Websites: http://www.luminous-landscape.com/tutorials/Helicon.shtml

http://www.dgrin.com/showthread.php?t=61316

http://combinezm.software.informer.com/

http://www.heliconsoft.com/heliconfocus.html (the one I use)

More macro websites:

http://www.edbergphoto.com/pages/Tip-macro-tools.html

http://en.wikipedia.org/wiki/Depth_of_field

http://www.profotos.com/education/promag/articles/macro/index.shtml (a bit dated but still OK)

http://www.naturephotographers.net/articles0807/ha0807-1.html

More equipment such as slave units and plamps.

Website: http://www.tripodhead.com/products/plamp-main.cfm

http://www.amazon.co.uk/Hama-Slave-Unit-Shoe-Contact/dp/B00005LLPK

or try EBay.

FURTHER READING

Angel, Heather (1988). *Nature in Focus.* Pyramid. London.

Busselle, Michael (1999). *Still Life & Close-up photography*. RotoVison, Switzerland.

Constant, Alan (2000). *Close-up Photography*. Focal Press, Boston.

Cooper, J.D. and Abbot, J.C. (1979). *Nikon Handbook Series : Close-up Photography and Copying.* Amphoto. New York.

Fraser, Bruce. *Real World Camera RAW with Adobe Photoshop*. Peachpit Press, USA

Harcourt Davies, Paul (2000). *Complete guide to Close-up & Macro Photography*. David & Cahrles, UK.

Harcourt Davies, Paul (2003). *Nature photography close up*. Amphoto Books. New York.

Hicks, R. (ed.) (1994). *Still Life and Close-up*. Cassell. London.

Martin, Giles (2003). *Macrophotography. Learning from a master*. Abrams, New York. (*This amazing book is the best of all of them, but rather expensive*)

Meehan, J. (1994). *The Art of Close-up Photography*. Fountain Press. Surrey.

Murie, R.A. (1985). Take a closer look! Equipment and techniques for close-up and macro photography. *Industrial Photography*. March: 31-34.

Papert, J. (1971). *Photomacrography: Art and Technique*. Amphoto. New York.

Shaw, J. (1987). *Close-ups in Nature.* Amphoto. New York.

White, W. (1984). *Close-up Photography*. Eastman Kodak Co. KW-22. Rochester, NY.