Digital Infra Red

November 2004

After 25 years in the Southern hemisphere I am still not used to spending Christmas at the beach. Not that I miss the cold, but it just doesn't feel right. Christmas brings pictures of sitting round a warm fire, of snow-covered trees and hills in soft light (nor do I think that Santa Claus feels much at home, with his heavy fur coat).

After last month' excursion into photo graphics I thought that B&W infrared photography would be a good topic for the Christmas season. It is certainly the closest we can get to snow-covered palm trees.

It is quite a while since I last played around with infrared Ektachrome and various B&W films. The outcome was disappointing - grainy and rather unpredictable colours and tonalities. What about digital? CCDs are sensitive to IR and we can expect good results. In this article we will look at B&W infrared photography with a digital camera, as well as simulating the effect in Photoshop. Let's start with a bit of theory.

IR and the Visible Spectrum

The visible light spectrum extends from about 380 to 700 nm (nanometers), a small window in the electromagnetic spectrum. Natural as well as artificial light extend well beyond both ends. At the shorter wavelengths we have the transition to ultraviolet radiation, which we try to block out with UV filters. At the other end, the spectrum leads into the photographically interesting near infrared region of 700-1000 nm, just beyond visible red.

Normal film is not sensitive to IR and there is no need for an IR block filter. When working with infrared sensitive film, we use an 'IR filter' to eliminate most of the visible spectrum. These filters are visually opaque, quite expensive and rather difficult to locate. Kodak's Wratten 87 has a sharp cut-off at 750 nm and is *the* standard IR filter. The Wratten 88A has an effective cut-off at 700 nm and therefore a slightly wider window. Hoya has a wide range of filters with the peak sensitivity indicated by the name: the R70 at 700 nm, the R72 at 720 nm etc. Other manufacturers include Heliopan, Schott and Tiffen.

What is so special about IR photography? The most striking effects are the nearly white vegetation and the very dark skies. Chlorophyll in living plants almost totally reflects IR and this part of the spectrum is less scattered and penetrates haze better than visible light, giving us the dark skies.

Digital IR Photography

CCDs are very sensitive to infrared radiation. They were used in security cameras long before they appeared in consumer digital cameras. In fact, IR needs to be blocked out for normal photography. The early generations of digital consumer cameras did a poor job with filtering IR out. This resulted in images that were too red under tungsten lighting, but it also made them good little infrared cameras! In particular the Nikon 950 is still seen as one of the best (with the only drawback of having only 2 MP resolution).

Later generation models have more effective IR block filters built into their light pass, also called 'hot mirrors'. With the absolute certainty of loosing one's guarantee, the more courageous enthusiast can try and replace the hot mirror in front of the CCD with a piece of glass with similar optical qualities. There are even companies who offer this as a service.

But you don't need to despair as the owner of one of the newer cameras. Even today, most of the IR block filters are not very efficient. The amount of IR radiation reaching the sensor is reduced, but good results are possible by simply increasing the exposure time. A tripod is essential, which is not a problem with landscape photography.

There is a quick test to see whether your camera can capture infrared light: Aim your TV remote control at the front lens, making sure that the LCD screen at the back is activated. Any button on the remote control will trigger infrared emission. If there is a bright flash on the LCD, then the camera can be used for IR photography.

Early generation cameras will work well with pure infrared filters, such as the #87, #87C and R72 (87B) filters. Later models will need filters with a broader spectral transmission, like the #88A and #89B filters.

My practical experience in digital IR is very limited. I am still trying to find the optimum filter for my Canon G2, but Peter Mc Mahon, an expert in digital IR photography, kindly allowed me to use one of his images from the Japanese Garden in Toowoomba, Queensland. He used a Nikon 950 with an exposure of 1sec at f8 and a Heliopan #780 filter. The colour picture serves as a comparison. The two images were taken from a slightly different angle, only a few minutes apart.

Photo: Peter Mahon - True IR (Japanese Garden, Queensland)

Photo: Peter Mahon – Colour Image (from slightly different angle)

Some people recommend using the highest ISO setting. Since tripod and cable release are in effect essential for IR photography, I rather suggest choosing the lowest ISO setting to keep camera noise at a minimum. We can always add noise later in Photoshop to get the more traditional grainy look.

It is probably best to set the camera to fully manual mode and to run a number of test shots. I've also heard of people who stay in automatic mode and let the camera do its thing, with good results. One of the beauties of digital photography is that we get instant feedback! In any case, make sure to disable any autoflash capability.

Post-exposure Image Adjustments

Straight out of the camera, the image will probably look red-pink, flat and too dark. Some cameras give images with a definite blue cast. First, turn it into a B&W image simply by desaturating the file, then brighten the image with curves or levels and finally adjust the contrast to your liking. That's all!

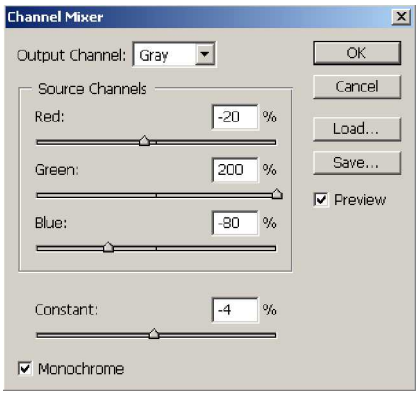
Of course, there is no end to the creative effects you can add to your images. Traditional infrared films are grainy and you might want to add noise (filter>noise>add noise or filter>texture>grain) to emulate the film look. Also, try the diffuse glow filter to simulate the glowing highlights commonly seen in infrared film images.

It is a good idea to take a normal colour shot, as well as the IR shot (with the IR filter in place) from the same tripod position. These two can then be combined in Photoshop to create a 'hand-coloured' effect.

IR Simulation with Photoshop

If your camera is not suitable for IR photography, or while you wait for your new IR filter to arrive, why not try to simulate the effect in Photoshop? Do keep in mind that infrared photography registers radiation that is not captured in a normal photograph. No amount of digital editing can retrieve this information, but we can certainly get a good approximation to the real thing.

The key factor for transforming a colour photo into an infrared B&W simulation is the Channel Mixer. The idea is to take the green channel to the maximum 200% and reduce both the red and blue channel to compensate.



- The first step is to make a new adjustment layer. Select the Channel Mixer from the pop-up menu. Set the slider for the green channel to 200%. The red and blue channels are set to –20 and –80%, respectively. The optimal settings will depend on your particular image, but the percentages should add up to around 100%. With the 'Constant' slider we can make adjustments to the overall tonality. The Monochrome box must be checked.
- We then make the image layer active again by clicking on it. Then select the green channel in the Channel palette and add Gaussian Blur (radius around 5 pixels).
- Go straight to Edit>Fade, reduce the opacity to 30% and set the blending mode to Overlay. Also try blending in Screen mode. This will give the green channel the typical luminous glow.
- Noise can be added to simulate film grain. I like to insert a Hue/Saturation adjustment layer between the Channel Mixer and the image layer to have more control over the tonalities of the various colours, e.g. blue often needs to come out darker.

This is a simple recipe which can be made into an action. One can go a step further and prepare separate selections, e.g. a selection for plants and another one for the sky and then work on them individually. This will give you superior results, but it is time consuming and does not lend itself for a simple action.

The third image of Peter's Japanese Garden gives you my Photoshop IR simulation. Certainly not the real thing, but it could be further improved by working with individual selections.

Photo: Peter Mahon (IR Simulation from colour original)

I hope that this brief introduction into digital IR will give you hours of fun for the holiday season. We need plenty of sunshine for IR photography - summer is the best time. Next year I want to kick off with the hot topic of up-sampling of small digital files. Until then best wishes for happy and safe holidays and a prosperous 2005!

Many thanks to Peter Mc Mahon for allowing me to use one of his superb IR images.