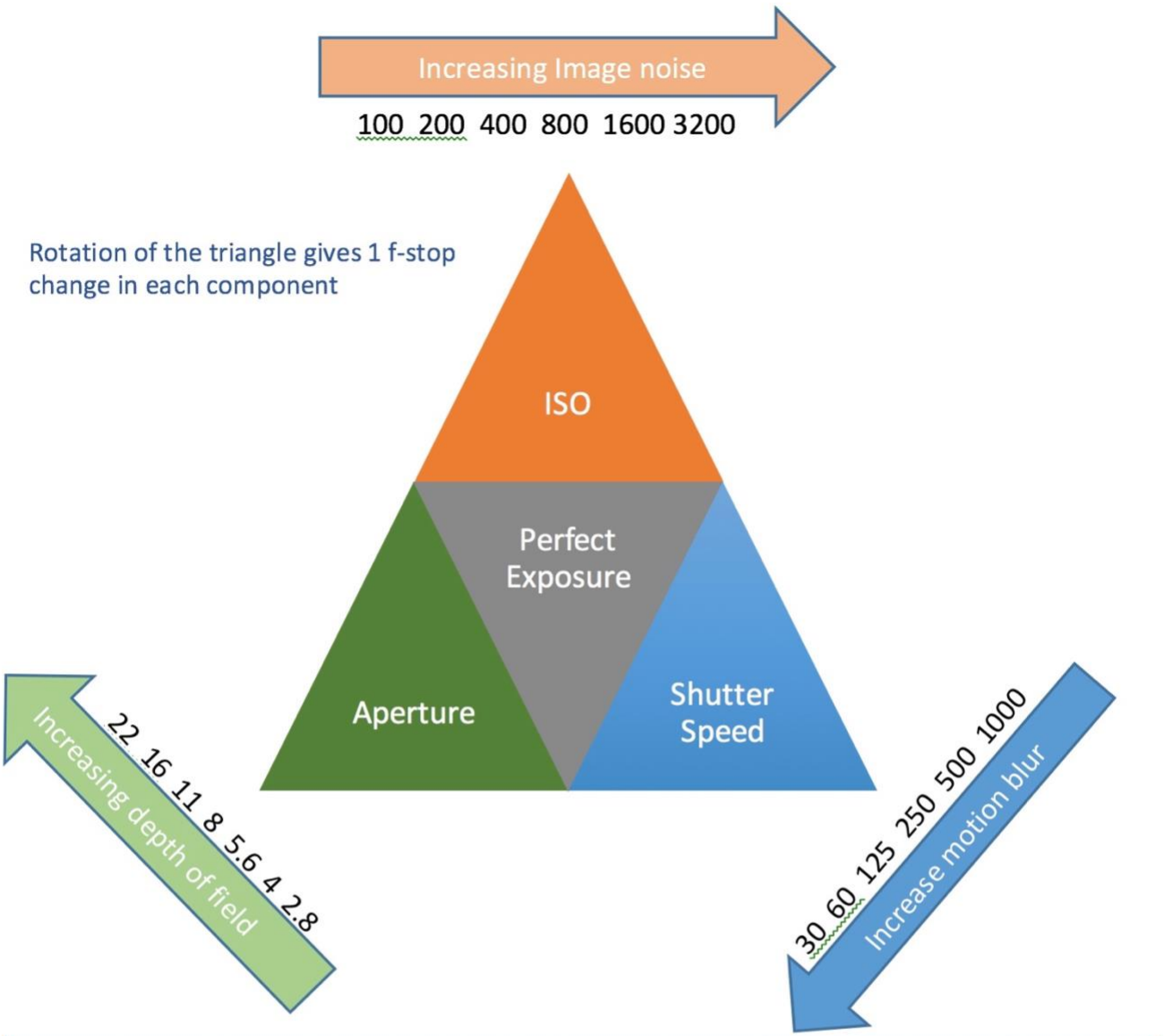
Newsletter for week ending the 24th March 2018

Exposure and the fourth dimension.

We traditionally think of the exposure triangle when thinking about exposure. It is illustrated below.



The Exposure Triangle

Is the key to understanding exposure and the interaction of the three principal components of ISO (camera sensitivity to light), Aperture (which governs the amount of light entering the camera and the depth of field) and Shutter Speed (which governs the amount of light entering the camera and the amount of motion blur in the image).

We can adjust any one element in the exposure however to keep the exposure the same we need to make a corresponding and opposite change to one of the other (or a combination of each of the other two – as long as it adds up to the same EV).

For example: If our exposure is 1/250 sec, F8 and ISO 800 (as shown above) and we want more depth of field we could set the aperture to F11 (1 full F-stop or 1 EV unit) and then either change the shutter speed by the same 1 f-stop to a longer time to compensate for the reduction in light or we could increase the camera sensitivity by changing the ISO to a higher value by the equivalent of 1 f-stop or 1 EV unit. The effect on the image quality will be increased subject motion blur if we make the shutter speed longer, or higher image noise if we increase the ISO setting

With the exposure triangle, we can immediately and see the effect of changing any one of the variables. For example, if we want to increase our depth of field we need to close the lens aperture down, making it smaller.
If we close the lens aperture then, by looking at the exposure triangle, we need to make an equal and opposite change to any one of the other two components.
So, for example we could increase the ISO by the equivalent change made to the aperture or we could make changes to the shutter speed by the same amount.
If we made a change in the Aperture of 1 F-stop from say F8 to F11 and then we would have to make the corresponding change in ISO sensitivity from say from 100 to 200 or make a change in the shutter speed of $1/250^{th}$ to $1/1\ 25^{th}$ of a second.
When making these changes, we must realise there is a consequence to this action. For example, increasingly ISO will also increase the amount of noise in the image.

Likewise, reducing the shutter speed may result in subject motion blur.
In my opinion for best image quality it is always best to keep the ISO to the very minimum value you can use, depending upon the ambient light level.

By keeping the camera sensitivity, or ISO, to the minimum value we reduce the amount of noise in the image and increase the dynamic range of the tones captured in that image.
When I say that there is a fourth dimension in exposure I am referring to the whole reason the photography can exist and that is the light which creates the exposure.

Without light that can be no exposure.
Both the quality and the quantity of light which falls upon our subject can greatly affect the way in which the image results.

In terms of Quality we can consider the colour temperature (measured in degrees Kelvin) the colour spectrum and the shadow forming property of that light (soft or harsh light).

In terms of Quantity we can consider the light intensity measured in foot-candles or in Lux.
When looking at the quality of the light, the colour temperature and more specifically the spread of wavelengths within its spectrum can greatly affect the way in which the image colour is captured.

Any light which is either containing more, or is deficient in, a specific wavelength will result in the image being recorded incorrectly as that colour will be brighter or lower in contrast depending whether its intensity is higher or lower than the rest of the spectrum.

Think of CFL (compact fluorescent lights).
These normally have a slight green cast and with film based emulsions it was common to use a magenta (rose) filter to suppress this spectral peak.
Other light sources, such as LED lights are notorious for having portions of the visible light spectrum missing - notably green.

As with the other three components of exposure, light can be considered in the same way.
Halving the light intensity is the same as changing the aperture by 1 F-stop smaller, halving the shutter speed or doubling the ISO.

Sharpness or Depth of Field – You Can't Have Both!

When we think about sharpness in an image we would like to think that we have some control over it.
Depth of field (DOF) is probably how you would understand this front to back zone of acceptable sharpness.
Of course, the DOF at any focal length is dependent upon the size of the aperture.
The smaller the aperture the more DOF there will be in the image formed on the sensor.
The DOF is a term given to the two limits of acceptable sharpness, one in front and the other behind the point at which the lens is focussed.

The measure of sharpness is determined by the size of the circle of confusion. This is the largest point recorded by the lens-all lenses record points as circles- it still looks like a point to the naked eye.
Stopping down the aperture means that the angle at which the light waves converge on the sensor become shallower.
Consequently, the circles of confusion on either side of the sensor plane are smaller, with the result that more of the subject, in terms of image depth, becomes sharp.

A large aperture opening, on the other hand, reduces this depth of field considerably.
There is only one plane of focus and it is the circles of confusion that provide the perception of sharpness in the image. As we stop down the lens this increases the perceived sharpness.
However, as the lens is stopped own there is another phenomenon, diffraction, that works in opposition to sharpness.
The smaller the aperture the more that the light waves are scattered at the sharp edge of the aperture.
Therefore, as the DOF increases the overall image sharpness decreases.

Thus, as photographers we have a compromise - especially for landscape photographers.
To some extent this can be overcome by focus stacking multiple images shot at differing focus points.
Additionally, as the focal plane formed by the lens is on a spherical surface, not a flat one as we have with the sensor, consequently the edges of the image will have a different focus point than at the middle of the sensor plane.
To some degree this can be reduced again by stopping down the lens to about 2 F-stops smaller than the maximum aperture. This is usually referred to as the optimum aperture or lens sweet spot.

Product Review - The TurnsPro Time lapse Camera Mount

The UK made TurnsPro is a motorised rotating camera mount for smartphones, GoPro, action cameras, compact cameras and DLSRs (under 1 kg)

Key features

- **Rotation speed** - Specify 360° rotation time from 20 seconds to 10 hours in 1 second increments.
- Rotation direction - Rotate clockwise or anticlockwise or pan back and forwards over a set angle from 15 to 360 degrees in 15 degree increments.
- **Batteries** - 4 x standard AA batteries gives approximately 10 hours battery time.
- **Screen** - 50 x 20mm Back-lit LCD display for night use.
- **Tripod Thread** - 1/4" - 20 female thread on the base and 1/4" -20 thread on the top.
- **Maximum camera weight** - up to 1kg in upright position or 0.25kg with the TurnsPro on its side.
- **Weight** - 241g excluding batteries. Light and easy to carry, easily fits in a coat pocket or camera bag.
- **Size** - Approximately 80 x 80 x 80mm
- **Package contents** - 1 x TurnsPro Time Lapse Camera Mount, 1 x TurnsPro Smartphone Clip and 1 x Instructions Box.
- **Compatible cameras** - Use with a GoPro (GoPro Tripod Adapter Mount required), Action Cameras, small Bridge/CSC/DSLRs (under 1kg), compact cameras and smartphones.

Many people start out creating panning time-lapse videos using a standard egg timer – (Ikea make the best ones for customisation – the Ordning just £7.45 on Amazon). Just stick the Go Pro camera on the top with its standard mount and off you go.
This is a great start, but you are limited to one direction and one speed. Typically it is clockwise and 360 degrees in an hour.
Usually you are using between 90 and 180 degrees of its rotation for your video so that limits you again to 15 or 30 minutes of travel

The TurnsPro allows you to have much greater customisation to these shots, allowing you to find the optimum speed, direction and angle for the shot you need.

Now I had dual use in mind when I bought the Turnspro unit.
Yes, I wanted to do the standard rotational time lapse sequences – especially next month when I go to Niece and Monte-Carlo and hope to get some panoramic shots of the marina and gardens but also I wanted this to act as a motor driver for my linear camera slider.
I thought that it would be quicker to use this “off the shelf” unit rather than sit and develop some stepper motor and Arduino driver unit as I would still have to make some form of enclosure for the electronics and the display etc.
If I had a 3D printer that would help (maybe later!) to produce something that would look the part as well as being functional.

Update:

As I started to build the "proof of concept" for this slider motor unit it became obvious that the rotational speed of the unit (20 seconds per revolution) was far too slow for a video slider.

Additionally, I soon discovered that although the TurnsPro unit was, on the surface, a great idea I found that the implementation of the software was particularly bad.

If you made a mistake in entering any of the values, there is no way to correct that entry, you must switch off the unit and start again!

When doing a back and forth sweeping action of say 90 degrees the starting position for the panorama or video clip unit rotates from the current head position and you are left guessing where the end position will be.

If you want a specific start position, then you must turn the whole body around which may mean the display is now facing away from you.

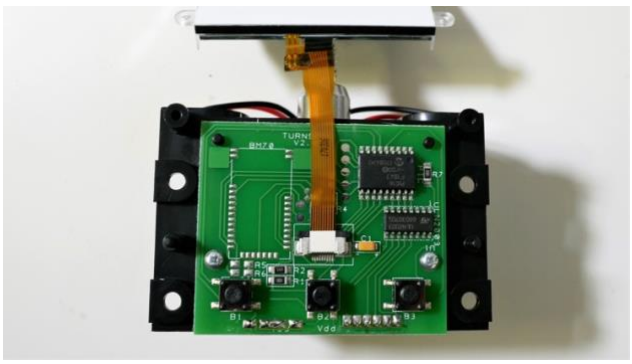
There is no provision to move the head to where you want it to commence the operation some sort of rotating scale on the top of the unit would have helped here.

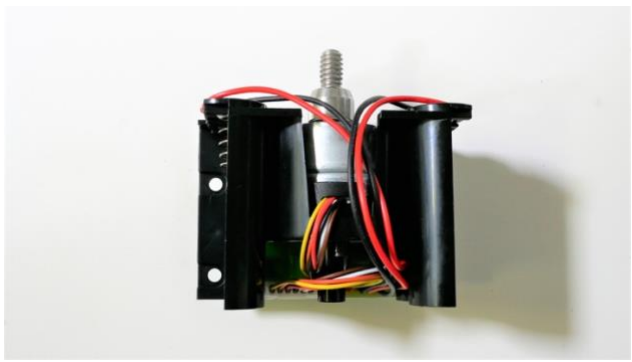
With the vertical angle of the display quite often I found myself having to crouch down to read the upper lines of the display.

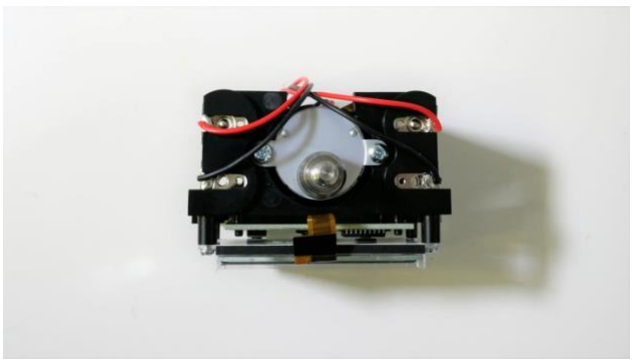
Had the display been set at an angle it would have been far easier to read.

When I tore down the unit for review it was very simplistic and based upon a PIC 16F1847 microprocessor.

There is an extra pad on the PCB which looks like it is for maybe a blue tooth module which would obviously enhance the operational modes of the unit and improve on some of the misgivings that I currently have on this unit. £85 for this does seem a little excessive.







So, I decided to abandon the TurnsPro for this and build my own stepper motor driven slider unit based upon an Arduino UNO board with two-line display.

Initially it won't have any features like remote control or provision to stop the motor at either end of the slider however I'm sure I can add these facilities in to this unit if I find that I begin to use the slider more often for my video production.

I'm hoping to have a prototype control unit ready for the next issue and have some sample video shot using the 18-inch slider rail.

Correcting the Lens Nodal Point for Panoramic Images

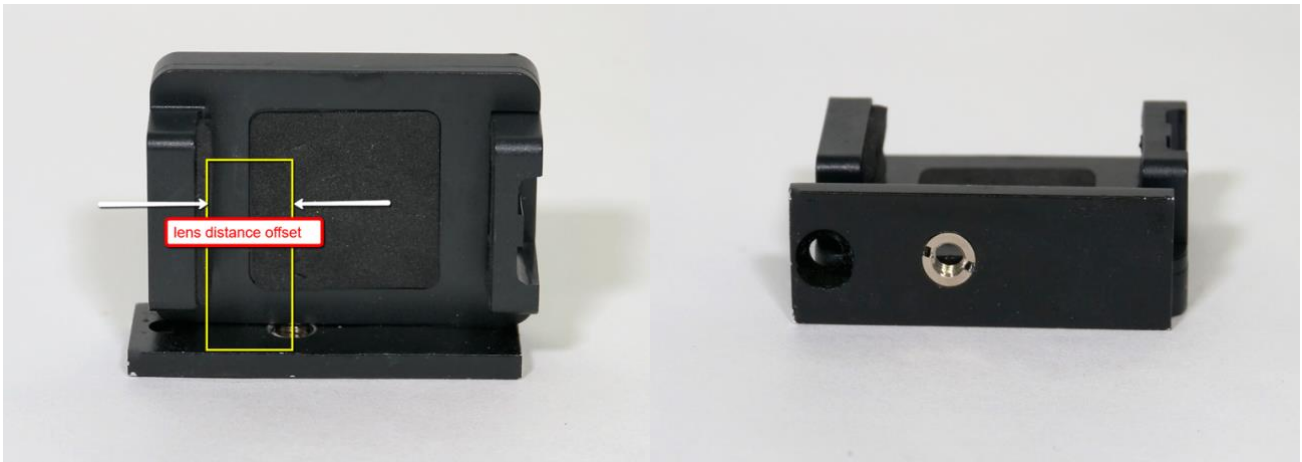
When I was looking at the Turnspro and the included smartphone clip I realised that the design did not make any consideration to the fact that the lens axis would shift for each of the images captured in a panoramic shot or video sequence.
Whilst this may not make a tremendous difference when it comes to stitching the images, either automatically in camera or in post processing, it is generally accepted that the best results are made when the lens axis (nodal point) stays in the same place as the camera is rotated. In this way, there is no change of parallax as the camera pivots around the rotational axis.

So, I designed a new mount which would set the iPhone 8 cameras on the correct axis for rotation.

As the iPhone 8 plus has two cameras, and the 50mm EFL of the second lens would be useful, I had to compromise the axis between the two lenses.

The mount was made from a piece of 25mm wide x 6mm aluminium bar that I had for making the FZ200 mount to allow the camera to be used on tripod and still have access to the battery compartment.

It has ¼-20 tripod mount which is set to allow the correct offset to the fixed side of the adaptor.
The sprung side moves to accommodate the phone.



The new mount bracket for mounting iPhone 8 Plus at the correct nodal point for panoramic images/videos.
Thinking about this nodal position I then made an adaptor to mount my GX80 with 14mm lens at the correct nodal point when using it on the TurnsPro unit.

Again, the idea is to set the lens axis to be on the same rotational axis as the TurnsPro unit.
I hope to do some field tests of both the iPhone and the GX80 soon.

Update:

I did some video tests with the iPhone 8 Plus and the GX80 using the 14mm lens.
I got so frustrated with the programming of this unit to be able to set and repeat a video sequence that I decided that the unit would have to go back as I think it very much only a proof of concept to a more feature rich product and this unit is being used to fund the development of a second issue (the pcb would suggest that it will be Bluetooth controlled).
The actual video was OK from both units using a sweep speed of 40 seconds over a 105 degree arc of movement.

Optimising the JPEG Processing Engine by Using the In Camera RAW Converter (FZ300/330/1000)

The image above was captured with the Panasonic Lumix FZ330(300) and I think it demonstrates the tremendous ability of this camera in overcast grey skies to produce superb images.

By keeping within the dynamic range that the camera can handle it produces images which have good tonal gradation and highlights that are well under control.
This is an out of camera jpeg image and I have produced a tutorial that shows how the in camera RAW file processing option can be used to establish optimum operating parameters for each of the JPEG engine parameters.
These are the Photostyle and its parameters of contrast, sharpening, noise reduction, saturation.
You can also adjust the i.dynamic and i.resolution settings and the highlights and shadows adjustment curves.
It is also possible to set the white balance presets and fine control of the actual white balance point.
You will find the video on Youtube here.

….. or this half way down on this blog page.

Aperture or Shutter Priority - Which is the best choice and a BONUS for FZ330(300) and FZ1000 users.

Ask 100 photographers this question and the majority would say they use Aperture Priority. However, what about Shutter priority for wildlife shooting? After all, as wildlife photographers, shutter speed is the key to suppressing subject motion blur, right? So why not just set in the ideal shutter speed and run with it?
Well the biggest problem with Shutter Priority is that it uses F-Stops to maintain your shutter speed and exposure. This comes with some heavy trade offs.
For example there isn't much range in F-Stops compared to shutter speeds - especially when you need more light. In reality you have only 4 stops of variance with the FZ200/300/330 (F/2.8, 4, 5.6 and 8). Compare that a whole range of shutter speeds from 30 seconds on up to 1/2000th (or more on the FZ300/330.
If we just look at the "useable" shutter speed range of 1/30th - 1/2000th we have 6 F-stops in Aperture Priority versus just 4 in Shutter Priority.
Additionally as the light levels begin to fall If we have our shutter speed set to 1/500th, we "bottom out" pretty quick, even with an F2.8 lens - Shutter Priority simply can't open the lens up to let more light in, so now beginning to get into underexposure. This can be the most common source of blurred images if you don't realise the light levels are falling and the camera has maxed out on aperture.
Conversely on a really bright sunny day if you have set 1/125th of a second set as your shutter speed then in order to maintain that speed, the lens needs to stop down to at least F11 or F16.
This isn't possible on the FZ200/330/330 so we run the risk of overexposure as the camera only can set F8 as the minimum aperture at the lowest ISO of 100 (based on the sunny F16 rule!).

The trouble with the smaller apertures is the problem of diffraction causing the image to become less sharp and it becomes harder to isolate the subject from the background!

So what is the bonus feature for the FZ330(300) & FZ1000 shooters?
Well it lies in the fact that these cameras support a new AUT0 ISO mode in the MANUAL Mode.
This unfortunately does not exist on the FZ200 so you cannot adopt this shooting method.
As we should know Exposure depends upon three things Aperture Value, Shutter Speed and ISO.
Change any one of them and the exposure can be maintained by changing equal and opposite to one of the other components.
Thus, we can have the best of Aperture Priority where we can set our optimum Aperture and Shutter Priority where we can set the optimum Shutter Speed and let the Auto ISO maintain the Exposure for us. Cool feature or what!
Additionally we can set an upper ISO limit (using the side control wheel on the FZ330(300) and via the REC setup menu of the FZ1000) so that we don't begin to lose image quality through excessive noise.
The camera will warn you when you have reached the ISO limit that you have set by flashing the indicated exposure aperture and shutter speed in red.

Below are some sample images shot at 1/50 sec, f3.2 Auto ISO in the Manual Mode.

RAW versus JPEG - Some thoughts!

Let's begin by looking at some JPEG advantages
JPEGS are much smaller files. Typically around 4 to 6 times smaller so more room on your memory card.
These smaller files also don't take up as much buffer space and so you get far more shots before your camera buffer fills up and shooting slows down and you start missing vital shots!
Normally JPEGs require minimal post processing as the JPEG engine in the camera has done most of the work.
If you have hundreds of images, you can see how this could be an advantage.
JPEGS work pretty much with all image editing programs, right out of your camera.

And what about those camera RAW files?
Well, you need special software to convert them into something more useful (like a JPEG, TIFF or DNG) before you can use the images.
So why shoot RAW at all?
A lot of photographers (amateur and pro alike), and I classify myself in this camp, simply don't shoot RAW. Too much of a hassle for the benefits achieved!
However, a lot of photographers do shoot in RAW exclusively as it allows them to process the file to their exact requirements, correct minor colour balance problems and recover highlight and shadow detail.
I suspect that they do not process every image, only the very best shots will see publication. With some editing programs, like Lightroom, files can be batch processed to give JPEG image for evaluation before opening the RAW image for full development.
So why not shoot RAW + JPEG in the camera? Well this is an option I sometimes take if I know I have a tricky lighting situation such as backlight where edge lit highlights are often too easily blown out. However, there is a downside of this technique inasmuch that it really does slow down the camera in burst mode shooting as the buffer fills up very quickly.
Also with JPEG underexposure is harder to correct in post processing due to the fact the file is only 8 bits colour depth thus only 65535 individual colours exist. So, colour fidelity is not as accurate and noise is more likely to be seen when the shadows are lightened to reveal any hidden detail.
Now, this isn't to say that you shouldn't manipulate a JPEG image – it's surprising how much you can pull out of a JPEG. In fact, most of the time, I can get a JPEG to look almost identical to a RAW file if the exposure and such isn't too far off. So, it pays dividend to spend some time learning about exposure control, exposure compensation and photostyle adjustments.