Notes on Using DPP4 and PSE14. Part 1: DPP4 – Ian Wilson PhD(optics)

These notes are designed to enable users to retain the maximum amount of image information (fidelity) while at the same time keeping processing artefacts to a minimum. Before using the notes it is important that you are familiar with the Canon Digital Photo Professional 4 Instruction Manual that can be downloaded from Canon Professional Service hubs in various parts of the world. I assume you are shooting Canon RAW files (CR2) and download to your PC via a card reader. I download the RAW images to a date-order folder that I have prepared for the day's shoot in Libraries/My Pictures on the C: drive. The front page of DPP4 looks like Fig. 1 with, as an example, RAW images from 11 Feb 2017 shown as thumbnails. On the left you can see highlighted the 11 Feb 2017 folder.

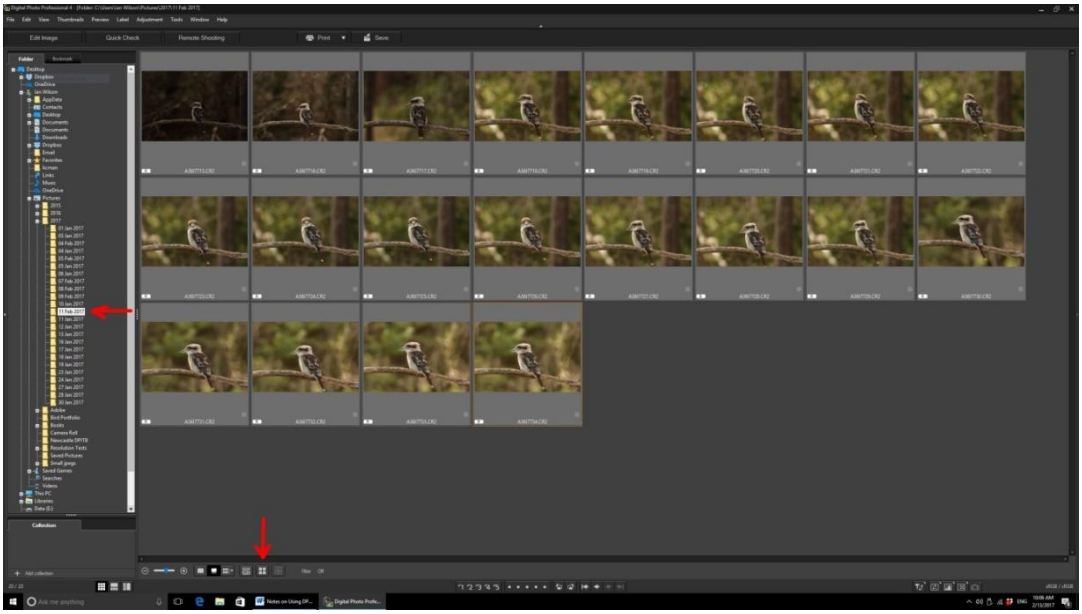

Fig. 1. Front page showing thumbnails of images in the 11 Feb 2017 folder and the Select All button.

Once in the day folder, I usually select all the thumbnails for viewing with the DPP4 **Quick Check** screen. To select all the images you use the button on the bottom tool-bar with the four white squares. I look at the images at 50% or 100% and put a Reject rating on images to be deleted (see Fig. 2). You can also grade the images with check marks from 1–5 and there are some other options as well.

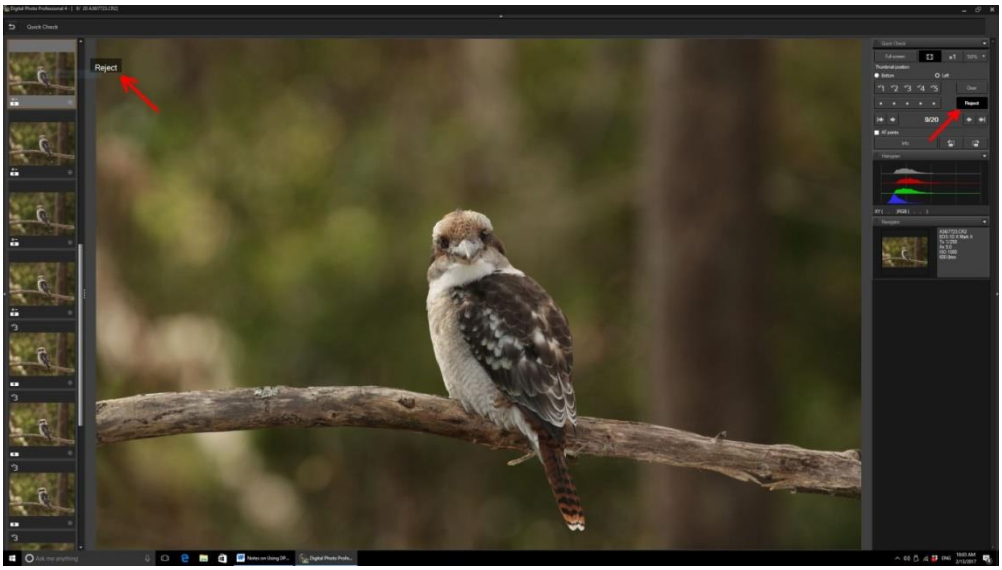

Fig. 2. Quick Check screen showing the Reject button (right) and an image with the Reject rating.

After critically viewing the images I highlight the images for deletion with the Reject rating and consign them to the recycle bin. If I have graded the images from 1–5, then I keep the top rated images and delete the rest. If you have a lot of images to delete, they can be selected by returning to the DPP4 front page top menu-bar and clicking on **Thumbnails–Sort–Rating** or **Thumbnails–Sort–Check mark**. My front page now looks like Fig. 3, with the Reject rating used to indicate images to be deleted and the image with check mark 5 is the one I am going to develop.

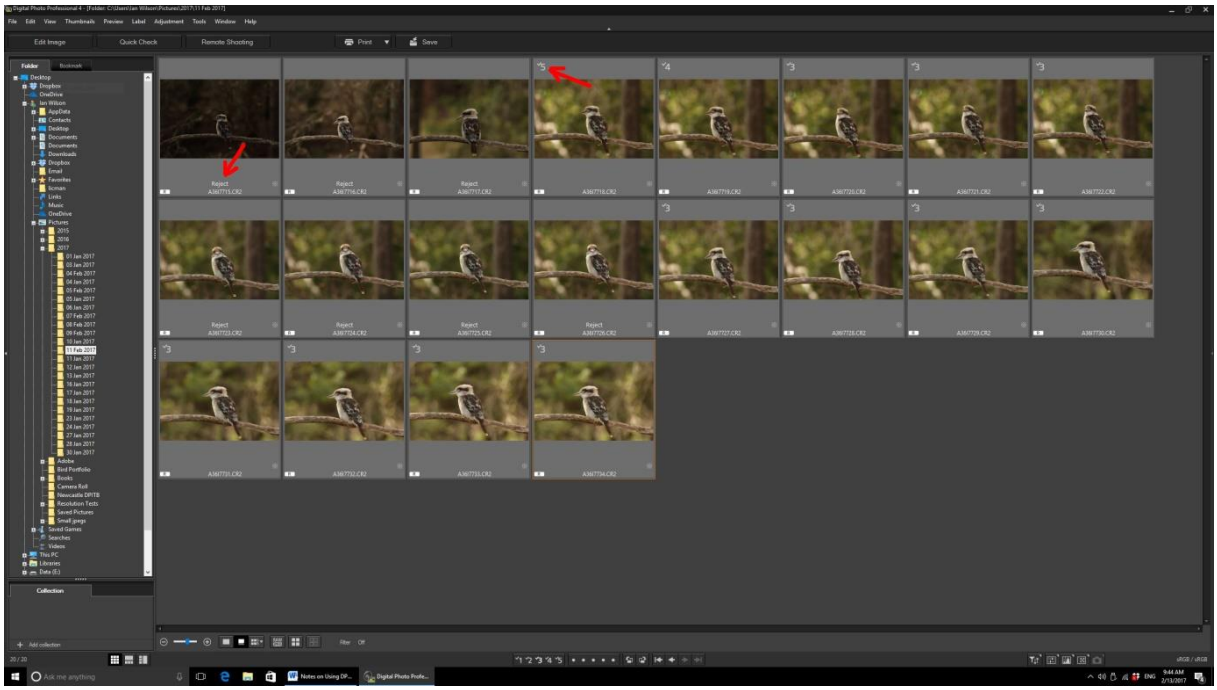

Fig. 3. Front page showing images identified for deletion and those graded using the check marks.

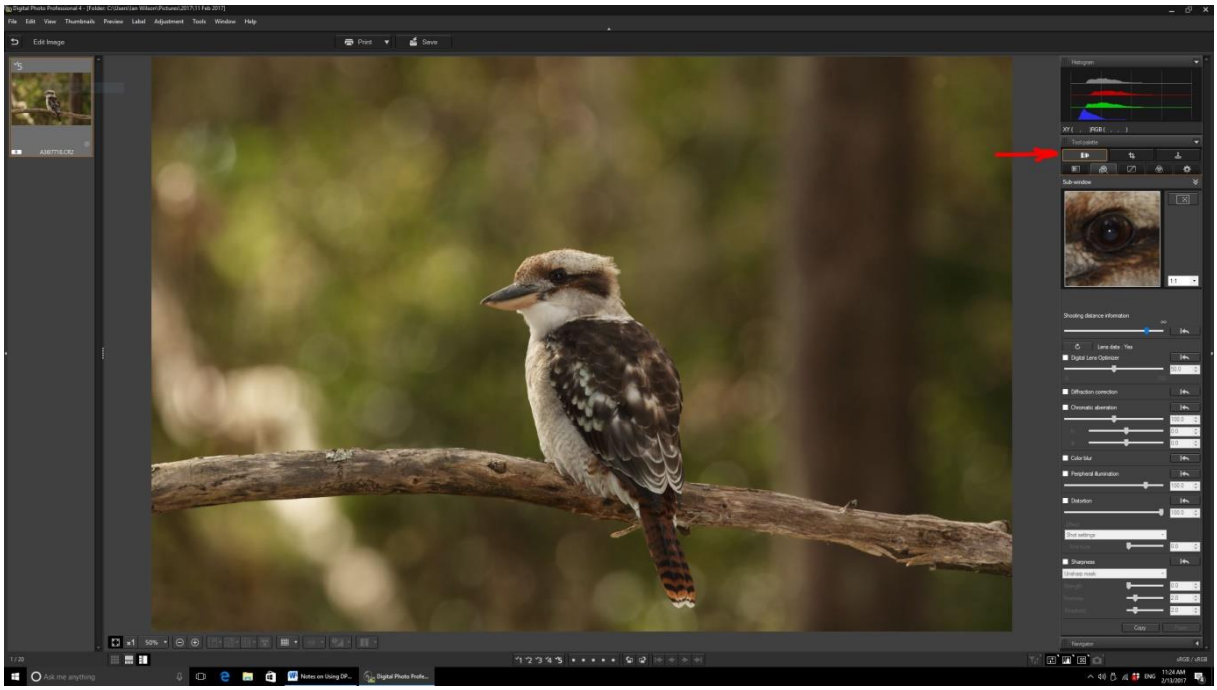

Fig. 4. Edit Image screen showing the editing Tool Palette on the right of screen with the Lens Correction button turned on.

Canon make it easy to edit an image using the optimal workflow if one follows the layout of the buttons, tabs and tick-boxes on the tool palette of the Edit Image screen shown in Fig. 4. On the right is the editing Tool Palette with two rows of buttons under the histograms. The first button with the lens symbol is Lens Correction (turned on in Fig. 4). The next button to the right is Crop

and Rotate Image, then Dust Removal (with limited ability to clone stamp). The latter you will not need unless you have dust on your sensor. There is another row of buttons below Lens Correction, Crop and Dust Removal that we will get to later. ***The workflow should proceed along the buttons from left to right and within the tool palette window from top to bottom***.

Step 1. Lens Correction

The first step in editing a RAW image is Lens Correction as shown in Fig. 4. Within the Lens Correction tool palette you will find at the top an enlarged thumbnail of part of the image; you can drag this around to show any part of the image and change magnification. Then there is **Shooting Distance** which you must not touch; this is the distance to the bird determined by your camera AF system. Below this is the **Digital Lens Optimizer** (DLO), a unique feature that enables one to remove blur caused by the residual lens aberrations (spherical aberration, coma and astigmatism), diffraction, and the optical low-pass filter. Apply the DLO to the full frame image before cropping. The DLO needs proprietary lens correction data which is downloaded from Canon. To get this data, you need to be connected to the Internet and press the Lens Data button just above the DLO tick-box. It will recognize your lens (you must confirm with a tick), take about 30 seconds to download the data, and when it's done will show Lens Data: Yes meaning all is OK for you to continue. The lens data is not available on any other platform, like LR, and this is one of the important advantages of using DPP4. The optimum value for DLO operation is 50 as shown in Fig. 4. The DLO is computationally intensive and may take up to about 30 seconds on an older computer. When it is done you should be able to see a slight improvement in the sharpness of the image if you are using a good lens. You will see a more obvious improvement if you are using a lesser quality lens.

Continuing down the Lens Correction tool palette, you can tick **Peripheral Illumination** and **Color Blur** but not Distortion. Distortion correction may cause the image to be resampled and introduce an undesirable mild blur. You should already have lens data for Peripheral Illumination correction, Chromatic Aberration, Color Blur and Distortion loaded on your camera for the lens you are using and this data will appear by default in the Lens Correction tool palette. Note that Diffraction correction and Chromatic Aberration will be greyed out as they are taken care of when you run the DLO. If default values are not showing, then you can download the latest version of EOS Utility from an official Canon website and then follow the instructions to transfer the lens correction data for your lens to your camera. *Note that we are talking about two sets of lens correction data; the first is used in the DLO and corrects spherical aberration, coma, astigmatism, chromatic aberration, diffraction and blur due to the optical low-pass filter. It is downloaded from Canon using the Lens Data button associated with the DLO. The second set of lens data is peripheral illumination, chromatic aberration, color blur and distortion which are pre-loaded on your camera for about 30 different Canon lenses or, if your particular lens or lens + extender combination is not pre-loaded, you will need to load it onto your camera using the EOS Utility*.

At the bottom of the tool palette is the **Sharpness** tick-box. You should tick this and choose Sharpness but not UnSharp Mask (USM). Set the sharpness Strength to 3, the optimum value recommended by the Canon engineers for removing the blur from the demosaic operation used to estimate the missing colour values under the Bayer colour filter array (see Fig. 5). Do not use a higher Strength as this can cause over-sharpening and undesirable artefacts. USM sharpening is not recommended as it gives the perception of sharpness but also causes artefacts.

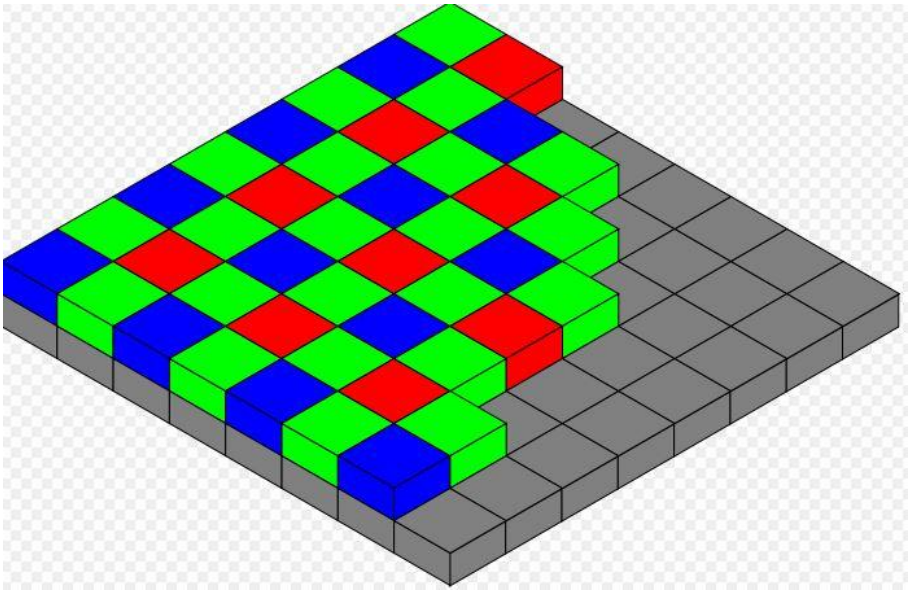

Fig. 5. Bayer colour filter array in front of the sensor detector array (grey). There are twice as many green filters as there are red and blue. The demosaic algorithm estimates the missing colour data at each pixel site based on the colour values detected at surrounding pixel positions.

The demosaic algorithm is at the heart of all RAW conversion and adjustment software. Because it makes a mathematical estimate of the missing colour data at each pixel position, there can be errors. The number and magnitude of the errors increases with the noise in the image. In the worst case, the colour estimate at a pixel position can be wildly in error and we notice a point of false colour in the image. This is chrominance noise and can be effectively dealt with using the chrominance noise reduction slider. There may also be a grainy appearance due to random errors in the estimate of the strength of the colour at each pixel position; this is luminance noise and can be ameliorated using the luminance noise reduction slider. There will also be a mild blur over the entire image that is due to the nature of the 'under-sampling' inherent in the use of a Bayer filter array. The lower spatial resolution of the Bayer filter sampling, even after the demosiac, cannot match the monochrome resolution of the underlying detector array. We can go some way to making up the difference using the Sharpness slider with Sharpness = 3.

Step 2. Crop and Rotate Image

The next step is to crop the image. Cropping at this stage has the advantage of reducing the file size but if you are unsure about the final crop, you can skip this step and crop later or you can do a generous crop and later on trim to final size. I usually crop to final size at this stage using the **Aspect ratio** set to Free and position the bird in the frame guided by the Grid tool. I usually use the 'Rule of Thirds' for subject placement which can be set up using **Show Grid** and the **Grid pitch** slider. Unfortunately, a 3 x 3 grid is not automatically generated and you will need to adjust the Grid Pitch slider to get 6 or 12 squares on a side. Fig. 6 shows a screen grab of the Crop and Rotate Image screen.

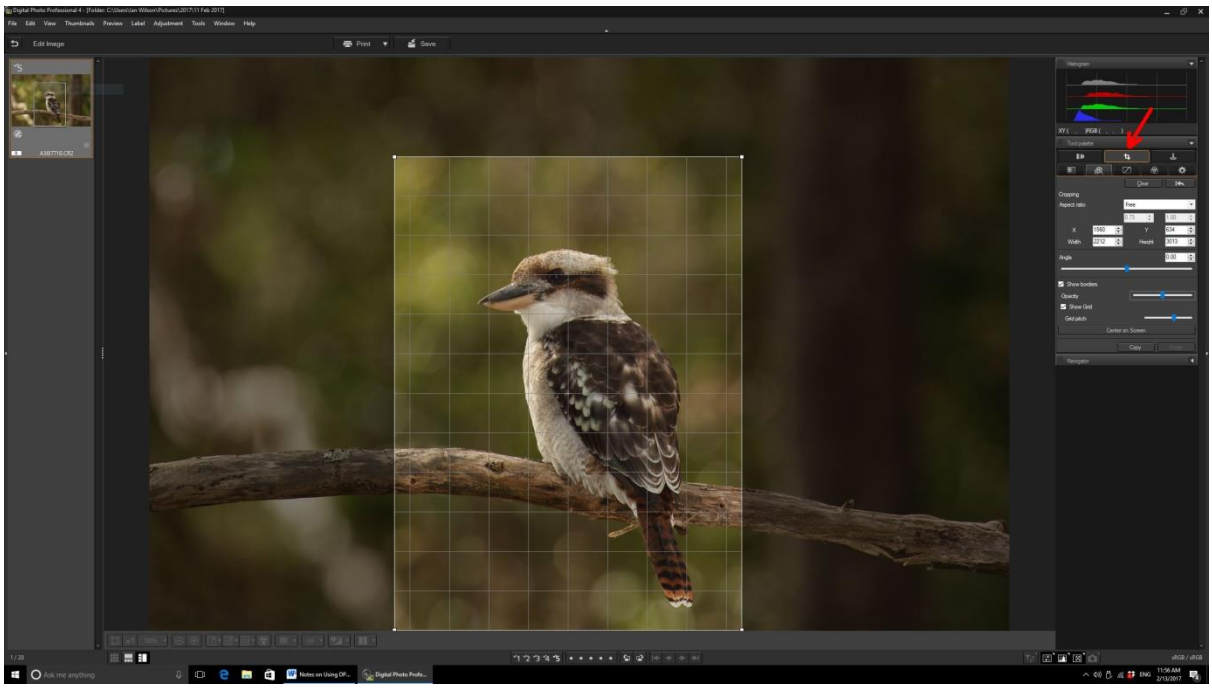

Fig. 6 Crop and Rotate Image screen showing the adjustable grid that can be used to aid in subject placement.

Notice that you can turn down the brightness of the screen outside the cropped area using the **Opacity** slider. I have not mentioned Rotate Image because, if possible, try not to rotate the cropped area. This is because rotation involves resampling the image and this can introduce an undesirable mild blur for all angles except 90° rotation. Sometimes the camera angle is all wonky and there is no other option but to rotate the image, for example, to get a level horizon. Then you can grab the corner of the crop box and rotate, use the Angle slider, or numerically type in the number of degrees of rotation in the tool palette window.

The next button to the right of Crop and Rotate Image is for Dust Removal with limited clone stamp capability. You should not need to use this button so I will skip it and move on to the next row of buttons, the first of which is Perform Basic Image Adjustment.

Step 3. Basic Image Adjustments

This is where the magic happens but it is far from 'basic', that's just Japanese wry humour. Before getting started I recommend you turn on the **shadow and highlight warnings** using the appropriate on/off button on the tool-bar below the image. You can customize the warnings by opening up the warnings threshold adjustment window using the down-arrow associated with the on/off button. Most people set the limits for shadows (blacks) to 0 and highlights (whites) to 255 digital numbers (DN) but I like to have a little leeway and in any case, 255 DN is too bright on the screen to see much detail (unless you have your screen brightness turned way down). I set the shadow warning to 5 DN (blue) and the highlight warning to 245 DN (red). Note that the warnings only turn on when all colour channels are over the threshold. To see what is happening in individual colour channels you need to run your cursor over critical parts of the image and watch the RGB numbers that appear under the colour histograms. I have the warnings turned on most of the time although they are not showing in the Fig. 7 image because the tonal range does not exceed the warning thresholds. **Brightness adjustment** will not be needed if your exposure is spot on but usually one needs to tweak it by up to $\pm$ 0.67 stop, perhaps more if you have deliberately overexposed the image.

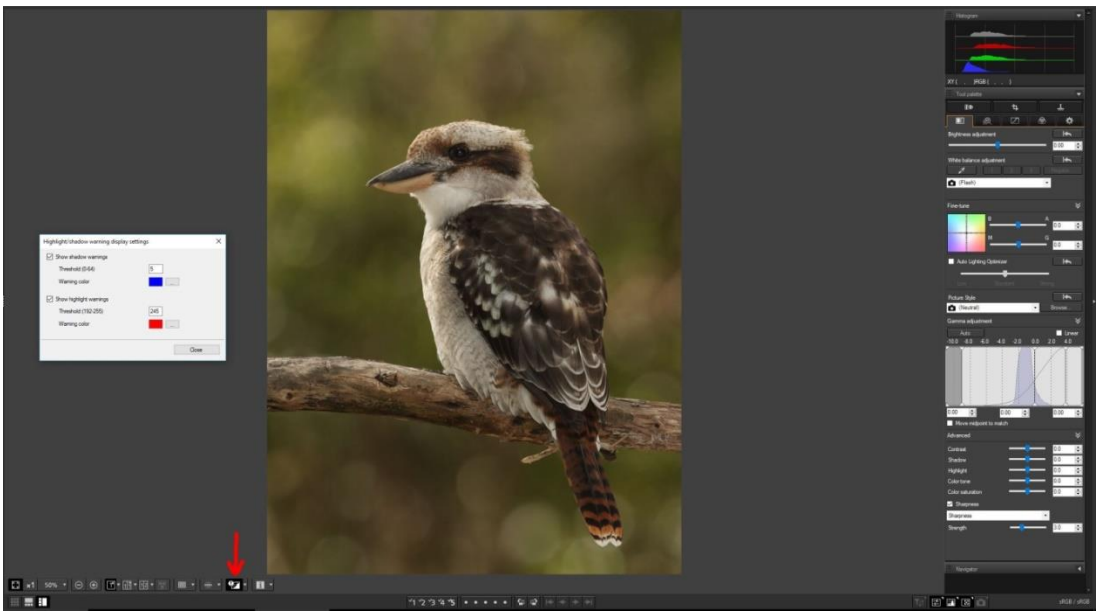

Fig. 7. Basic Image Adjustment screen with the highlight/shadows warnings turned on and showing the threshold warnings adjustment window.

The next adjustment is **White Balance** (WB). DPP4 has good tools for adjusting WB but it can be complicated. I will not discuss all the options but give you an idea of my most commonly used approach to WB adjustment. The first thing I do is choose the appropriate scenario; daylight, cloudy, shade or flash, but when I captured the Kookaburra image it was overcast and the light was tricky so I used some fill flash. This complicates the issue because I have a dual illuminant, that is, a cloudy sky and flash. There is no pre-set WB for this scenario. By carefully looking at the image I concluded that natural light was the main light so in this case I decided to use the cloudy WB pre-set while being aware that it will result in an image that is slightly 'warm' due to the contribution from the flash and may have a slight green tint from light scattered off the surrounding trees.

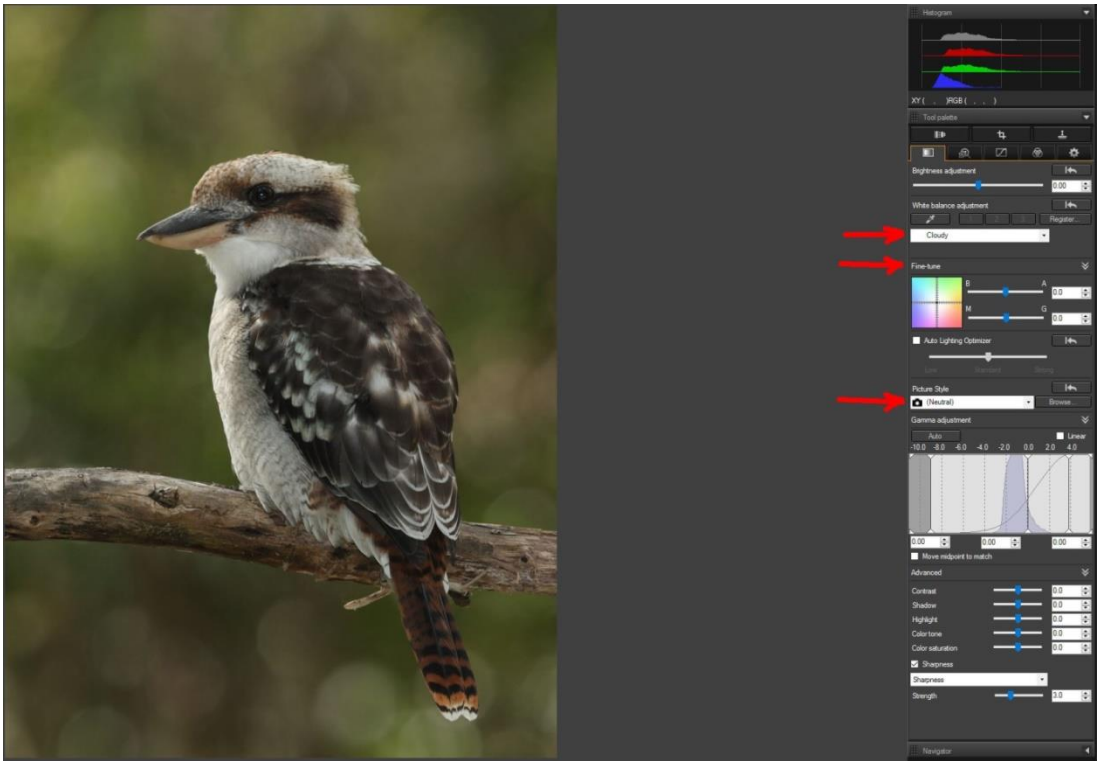

Fig. 8. White Balance adjustment using the pre-set WB and the Fine Tune tools. The Picture Style for this capture was set to Neutral.

If the bird has a neutral white patch, I will use this to fine-tune the WB. A neutral white has the RGB numbers all the same value, that is R = G = B. There are a number of ways to make this adjustment but the one I like best is the **Fine Tune** option prominently shown in the tool palette window. To use this you first need to discover whether the whites are too 'warm' (red) or too 'cold' (blue) and the best way to do this is to run your cursor over the white patch and look at the RGB numbers under the colour histograms. I was unable to do this with the Kookaburra because it does not have any neutral white parts. If you do have a bird with a suitable neutral white part then you can adjust for 'warm' or 'cold' using the blue (B) – amber (A) slider. Moving the slider towards blue will increase the blue and reduce the amber, thereby 'cooling' down the white and vice versa. The slider below is magenta (M) – green (G) and can be used if, for example, you find you have a slight green tint, and you can use both sliders together in more complicated lighting situations.

The next adjustment below WB is the Auto Lighting Optimizer; you should have this turned off as it is of little use in bird photography and is mainly used by novices.

Picture Style is next (see Fig. 8). You will have this set in camera to Standard or Neutral and it will appear in DPP4 with that default setting. Use the Neutral setting for accurate colours; Standard gives brighter, more vivid colours that are slightly more saturated and with a little sharpening applied.

That brings us to **Gamma Adjustment** which is the least understood adjustment and the most difficult to get right. Before going too far I will try to explain what the gamma curve is and what it does. A good camera can capture images with exposure ranging over 12–14 stops, which when digitized is a dynamic range of 12–14 bits per colour channel, but we usually display images on monitors and other output devices with a dynamic range of 8-bits per colour channel. In order to achieve this, black and white brightness values are compressed resulting in less contrast in the dark and light parts of the image. The gamma curve shows how much compression has been applied to the blacks and whites relative to the mid-tones. The Gamma Adjustment palette in DPP4 shows a graph of the default gamma curve superimposed on the image luminosity histogram on a scale at the top running from –9 to +6 stops. For bird images we usually want a special kind of look that is a bit different to what most photographers want for their landscape and portrait pictures so the default gamma curve in DPP4 is not usually ideal. We want to bring out the detail in the dark and light parts of the bird, in other words, we want good contrast in the blacks and whites whereas other photographers want maximum contrast in the mid-tones. We want good mid-tone contrast too but there is a trade-off; to get good contrast in the blacks and whites we must sacrifice some mid-tone contrast. This is the conservation of contrast principle; there is only a finite amount of contrast available and by manipulating the gamma curve we distribute the available contrast adjustment between the blacks, whites and mid-tones to get the look we want. The local slope (gradient) of the gamma curve is proportional to contrast so the flatter parts of the curve indicate lower contrast. The default gamma curve rolls over to a flat shoulder (whites) and flat heel (blacks) indicating that the standard curve will produce an image with less contrast in the blacks and whites and maximum contrast in the mid-tones (the steepest part of the curve).

There are a number of gamma adjustment strategies depending upon the amount of dynamic range one wishes to use in rendering the bird. For example, if it is a black and white bird in direct sunshine, you will probably need all the dynamic range recorded and the default gamma curve will be a good starting point. However, if it is a drab bird in shade, the full tonal range of the bird may be recorded over as little as 6 stops of exposure. Then there is the background; is it important to render the background with a wide tonal range or do you want to reduce the background contrast

so that the bird will 'pop'? I usually use the latter strategy and focus my attention on adjusting the tonal range and contrast of the bird and pay little attention to the background. To achieve this, the first step is to un-tick the Move Midpoint to Match box under the gamma curve graph and then press the Auto button. Unfortunately, this adjustment uses the tonal values for the full frame rather than the cropped image we have selected and is therefore a very rough adjustment and will need to be fine-tuned. Before doing that let us take a moment to look at what happened when we pressed the Auto button (see Fig. 9).

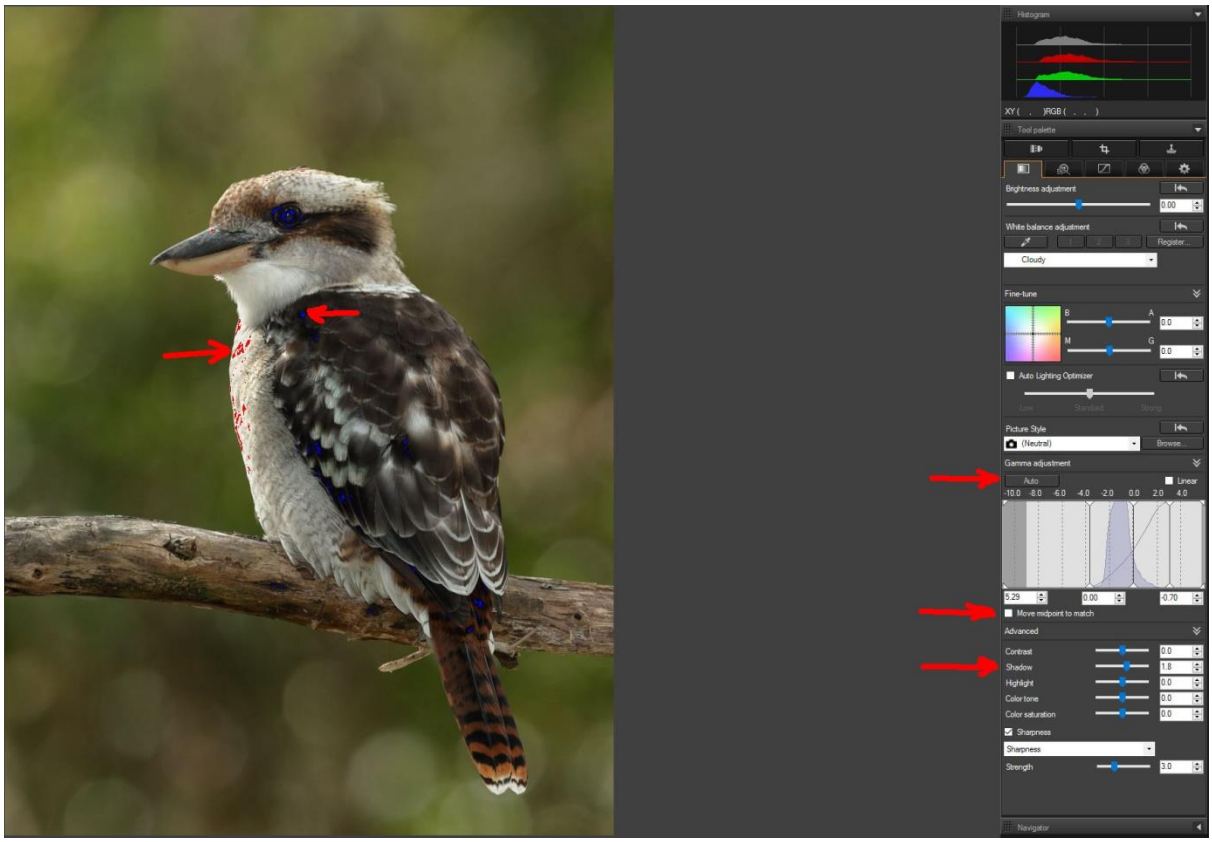

Fig. 9. Gamma Adjustment using the Auto button. Turn off Move Midpoint to Match then press the Auto button. Highlight/shadow warning colours turned on and the Shadow slider automatically jumped to +1.8 stops.

First of all, the highlight/shadows warnings turned on. Secondly, the black point and white point vertical bars automatically moved to reduce the dynamic range to more closely match the range of the luminosity histogram. Thirdly, the heel and shoulder of the gamma curve steepened up a bit like we want. And, finally, the shadows slider in the Advanced section of the tool palette jumped to a value of +1.8 stops. Each of these adjustments is heading in the right direction but we now need to take charge and do the fine tuning. The first thing we do is get the shadow warning under control by grabbing the black point vertical bar on the gamma graph and pulling it to the left until the warning turns off. This is setting the black point for the output image to 5 DN. Next we grab the white point vertical bar and pull it to the right until the highlight warning turns off; this sets the white point output to 245 DN. The middle vertical bar adjusts the mid-tones (128 DN) and should be adjusted to 0. You can finely adjust the black point, mid-tone and white point using the up/down arrows in the number boxes under the graph. The numbers are exposure stops relative to the extreme values of the adjustment range. In the case of the black-point bar the numbers show the stops above –9 stops and at the white end the white-point numbers indicate the number of stops above or below +4 stops. The mid-point box shows the number of stops above or below 0, the proper exposure for an 18% grey card. For a closer look at the Gamma adjustment window see Fig. 10.

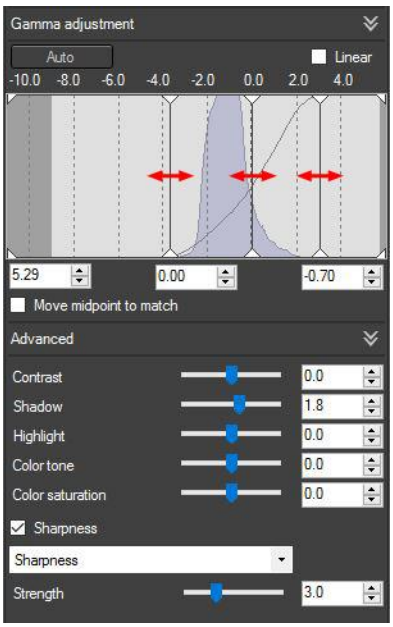

Fig. 10. A closer look at the gamma adjustment tools. The scale at the top of the graph is in stops of exposure above and below 0, the proper exposure for an 18% grey target. To set the black, mid-tone and white point, grab the vertical bars and slide them to left and right or adjust them using the number boxes below the graph.

Having made these adjustments to my Kookaburra image, I found there was still some shoulder on the gamma curve which I straightened out by moving the highlight slider to –2 stops, thereby helping to increase the contrast in the whites a bit more. I also boosted the slope of the gamma curve in the blacks by increasing the shadows slider from +1.8 to +3 stops. Be conservative in your use of the shadows and highlights sliders; it is rarely necessary to use more adjustment than Shadows +3 stops and Highlights –3 stops.

If you forget about the background and set the black and white points using the bird only, you will find that very often the exposure ranges from –5 or –4 stops for the blacks up to about +4 at the white end, that is, a range of 8 or 9 stops. If you then manually set the mid-point to 0, shadows adjustment to +2 stops and highlights to –2 stops, the gamma curve will be close to what we bird photographers want with good contrast in the blacks, whites and mid-tones. This will be a very good starting point that is often better than using the Auto button. You can fine-tune all of these parameters, including the brightness, to reach the optimum lighting adjustment for the bird.

The other sliders under Advanced adjustments are Contrast, Color Tone and Color Saturation. The contrast slider is used for mid-tone contrast adjustments which you do not need to touch because we have already optimized the gamma curve. The Color Tone should not be touched either because we have already fine-tuned the WB. You may be tempted to boost the Saturation but if it is the bird that needs more saturation, you should leave it until we get into PSE and have selected the bird. If you think the image overall needs saturation adjustment then it is OK to do it here in DPP4 but this is rarely necessary. Finally, at the bottom of the tool palette is Sharpness which we earlier set to Strength 3. After all of these so-called basic adjustments, my screen looks like the screen grab in Fig. 11.

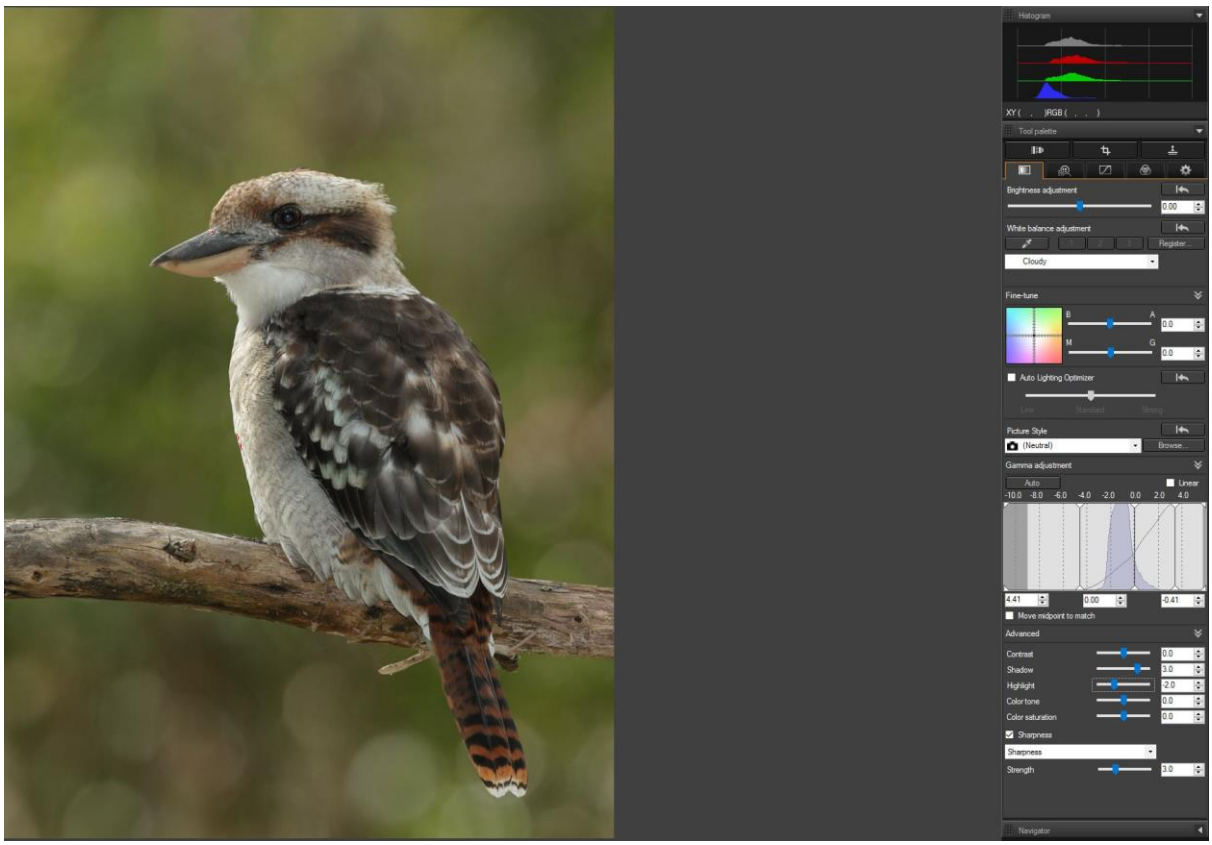

Fig. 11. The lighting adjustments are now complete with just a trace of the highlight/shadow warnings showing. The white balance and picture style have been selected for natural colour. The gamma curve has been adjusted to suit the tonal range and optimized to bring out the maximum amount of detail in the blacks, mid-tones and whites.

Notice that I have left just a trace of the red and blue highlight/shadow warning on the bird. The objective is to get the bird properly adjusted with output tones ranging from black at 5 DN to maximum white at 245 DN and with a gamma curve that brings out maximum contrast (detail) in the blacks and whites. That has been achieved with these adjustments. You will find after processing a few images that this workflow varies little and it will become easier and quicker with practice.

Step 4. Adjust Image Detail (Noise Reduction)

The button to the right of Basic Image Adjustment is the Adjust Image Detail button. This is a bit of a misnomer because it is mostly devoted to noise reduction (NR). Under **Noise Reduction** you should see NR default values for your camera and its ISO setting. The greater the ISO used to capture the image the more noise there will be in the image and more NR will be required. You will notice there are two kinds of noise, luminance noise and chrominance (colour) noise. Luminance noise is the more troublesome because luminance NR reduces image detail (sharpness) so I recommend you do not increase it above the default value. In fact, you might try to reduce it provided the noise level does not become too bad. In some cases it is possible to reduce the luminance NR to 0 for maximum sharpness. The default value for chrominance NR does a good job and you should use the default setting.

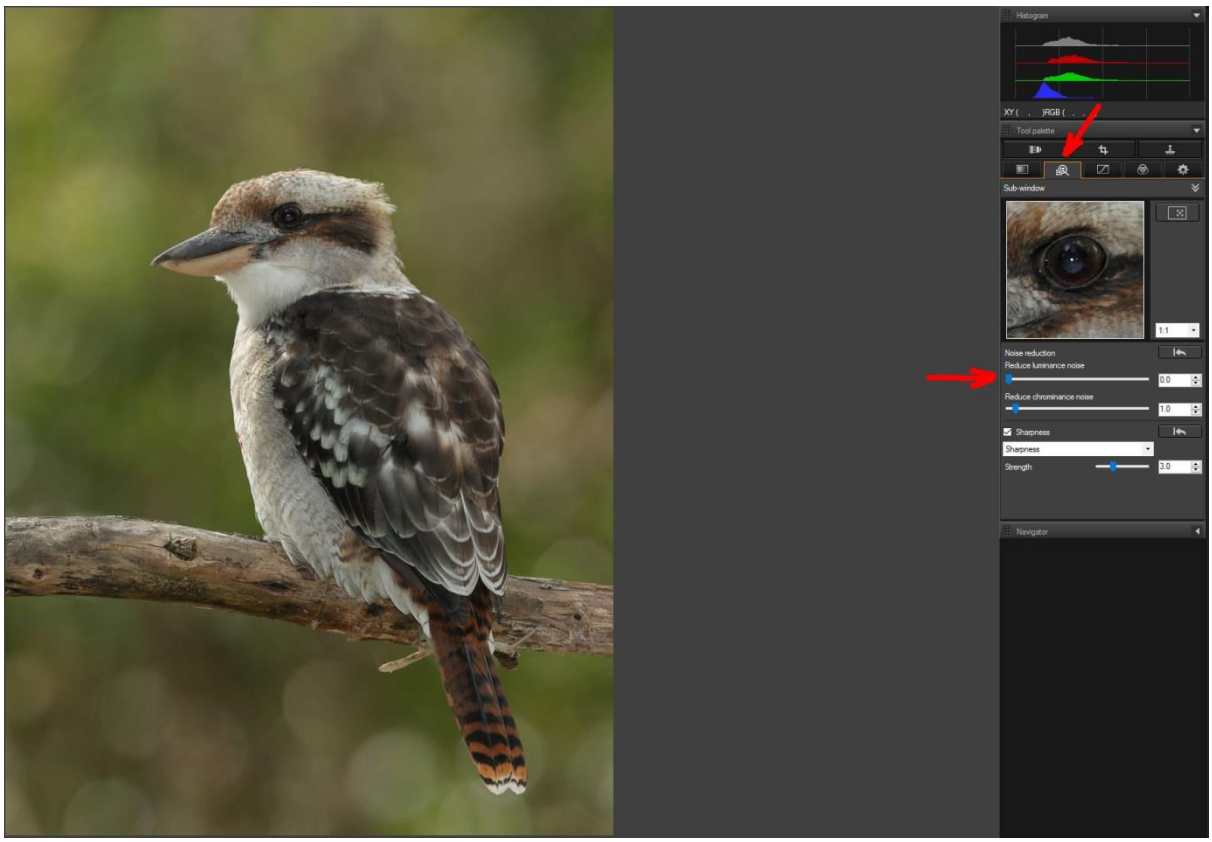

Fig. 12. Adjust Image Detail screen. There is very little noise so I have set the luminance noise reduction to 0 for maximum sharpness and accepted the default value for chrominance noise reduction.

That brings us to the end of DPP4 processing as the remaining two buttons to the right of Adjust Image Detail (Adjust Image Tone Curves and Adjust Image Colors) are only relevant for JPEG processing. The third button to the right (Settings) is used to set the working colour space which should be sRGB for posting to the BLP gallery. All we need do now is to Convert and Save the image as a 16-bit TIFF. You do this from the top menu, using **File – Convert and Save**. TIFF is a lossless, uncompressed, file format that will preserve all the information (goodness) in your original capture. Save in the same date folder as the original CR2 file and set the default Output Resolution to 300 dpi, a commonly used resolution for printing images. Below is a summary of the DPP4 workflow. Part 2 to follow will show you how to finish the image in PSE14.

Summary of DPP4 Workflow

1. Download images to day folder, grade, sort and delete.
2. Apply lens correction and remove demosaic blur with global sharpening.
3. Crop the image and rotate only if absolutely necessary.
4. Adjust brightness if required.
5. Adjust white balance if required.
6. Auto-adjust Gamma curve or manually set the starting values.
7. Fine-tune black, mid-tone and white points.
8. Adjust shadows and highlights.
9. Adjust the strength of luminance noise reduction.
10. Convert and save as a 16-bit TIFF file.