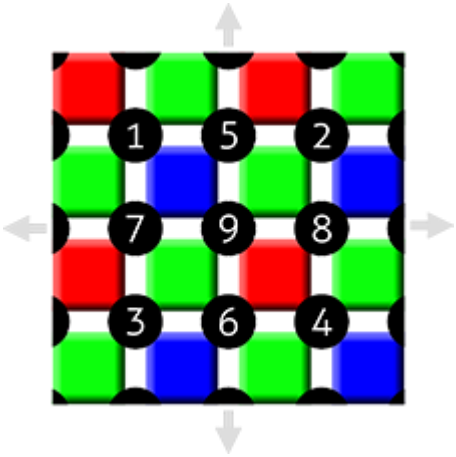
Is it worth it to remove the Bayer array?

If you like B&W photography it may be worth considering.

My A7 II was functioning perfectly but it was being used primarily for capturing raw images to be converted to B&W. The resolution was fine at 24 MP but the demosaicing process was introducing some occasional degradation.

During the B&W conversion of a raw file from a camera with a color filter array (CFA) it takes information from four adjacent pixels to create a single RGB pixel (for more information see DIGITAL CAMERA SENSORS at Cambridge in Colour). Information from each raw photosite is used in the creation of four RGB pixels at the corners of each photosite.



This can cause a loss of sharpness. The same thing happens when you convert raw information from RGB to B&W.

If we skip the demosaicing step, each photosite is used to create only one pixel. The image will be sharper but the color will be off unless we remove the CFA and treat the values as having only luminance where the red, green and blue values are equal.

Sharpness vs. Resolution

Sharpness is a linear measurement but megapixel is an area measurement. So a 2x gain in linear sharpness translates into a 4x increase in resolution. That would make a 24MP sensor as good as a 96 MP color sensor. But lenses are not that sharp. The lens will limit that improvement.

No matter how much we increase the sensor's effective resolution and sharpness, the end result will be a combination of the sensor and the lens. Either the lens or the sensor will be the weakest link. So there is no way to achieve a really dramatic increase in sharpness or resolution without also getting a sharper (and significantly more expensive) lens.

In a 24 MP Bayer sensor there are 12 green MP, and 6 MP each of red and blue. The effective resolution should be somewhere between 12 and 24 MP but likely on the low end of that range.

But all of this is theoretical. The only way to know for sure is to actually compare a camera without the Bayer array to one that still has it. Better yet, compare the sharpness of a B&W image from a monochrome camera without using the demosaicing process to the same image that is demosaiced.

The Monochrome Conversion

Why invest about $4000 to get a used Leica Monochrom Typ 246 since some of the features in the A7 II were not in the Leica? For about $1000 plus some filters the Sony could get converted to B&W only. It would also be cheaper than replacing the A7 II with an A7R II. That may be all we need to answer our question.

The conversion was done by Monochrome Imaging Services who specialize in Sony full frame and APS-C sensor cameras. It took about 2 weeks to get the camera back.

The resulting raw file needs to be converted to a DNG in order to get the computer's raw converter to skip the demosaicing process. This is done with software from Monochrome2DNG which is free.

Results

The differences are not dramatic and you really need to look very closely to see the difference.

The image was taken with a 1965 50mm Leica Summicron Rigid 50mm at f/8 at the camera's base ISO 100. The camera was on a tripod and the shutter was tripped by hand. The Sony IBIS was turned on. No color filter was used on the lens.

The Sony raw image (ARW) was developed in Capture One Pro using demosaicing It initially shows up with a strong magenta-red cast because demosaicing assumed it was a color image. Its grayscale rendition was produced by clicking the Auto WB eyedropper on a mid-tone area of the image. That could have been anywhere since every photosite is neutral and the RGB pixels all have the same value for red, green and blue.

(Click image to download at full resolution)

The DNG file simply took the ARW information and added a notation to tell the raw conversion to skip the demosaicing step. It also converted the uncompressed Sony raw data and converted it to lossless compression.

(Click image to download at full resolution)

You need to look closely to see the difference in sharpness. The highlights in the water and on the leaves are smaller in the DNG image. The grass and some of the branches are slightly sharper. If you look closer than 100% you will see that many of the point sources (highlights in the water drops) cover only one pixel in the DNG image but more than that in the ARW image. The tree branches and the grass also look sharper in the A7 II version. Pixilation becomes visible in the D610 sooner than with the A7 II.

What you can't see is that the shutter speed for the A7 II was 1/500s. If the Bayer array had still been present it would have been about 1/250s because the Bayer array blocks almost a full stop of light.

So what do you lose with the conversion? You can no longer tailor your B&W conversion by applying color adjustments. Glass filters are less effective and not as convenient.

Whether you need the extra sharpness and resolution is also questionable. If you are printing up to 13x19 inches, 24 MP is already more than enough. Besides, if you are not capturing landscape or astronomical images, sharpness may be low on your list of priorities.

So you can take this information and consider yourself fortunate to have saved the expense.

On the other hand, you may find some additional benefits as I have.