Getting Unlimited Digital Resolution

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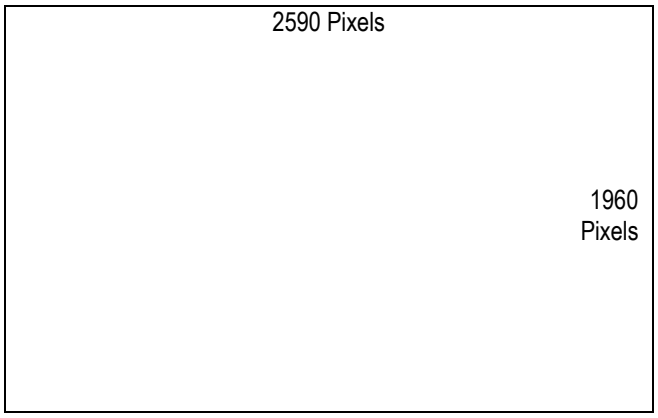
Wow, now here's a goal: how would you like to be able to create nearly any amount of resolution you want with a digital camera. Since the higher the resolution the finer the detail that can be recorded, high resolution has become the Holy Grail of digital photography.

Unfortunately, if the chip size remains more or less constant, there is a point of diminishing returns with finer resolution. If you are still shooting with a lens designed for film use, it is easy to reach a point where not only do the light angles fail to properly enter the recessed photo cells, the circles of confusion the lenses can resolve are smaller than the cells on the chips. Combined, this unfortunate optical situation leads to increasingly poor quality in the images.

The answer, ultimately, is to use larger imaging chips. But larger chips have a dreadful habit of costing noticeably more as the size increases. But what if there was a way to effectively increase the size of the chip and with it, the number of photo cells so that you got larger chips AND higher resolution, all out of your current 5 or 6 megapixel camera.

Well, if the subject will sit still for you, such as for a landscape or product shot, you can do exactly that using a technique borrowed from the Romans: creating a mosaic. When you think about it, the solution is pretty obvious and based on something digital shooters already commonly do. When photographers make a panorama, they stitch together multiple images in order to increase the view. Some digital backs designed for use with a 4x5 allow stitching two views in order to increase effective resolution. Using the two ideas as a starting point, the idea of creating a mosaic becomes feasible if you can move the camera BOTH vertically and horizontally around the nodal point of the lens.

So how does it work? If you take a single frame of a subject — any subject — then it contains the maximum number of pixels that chip is capable of recording. If you have a frame of 2590 by 1960 pixels then you have about 5 million pixels… 5 megapixels.



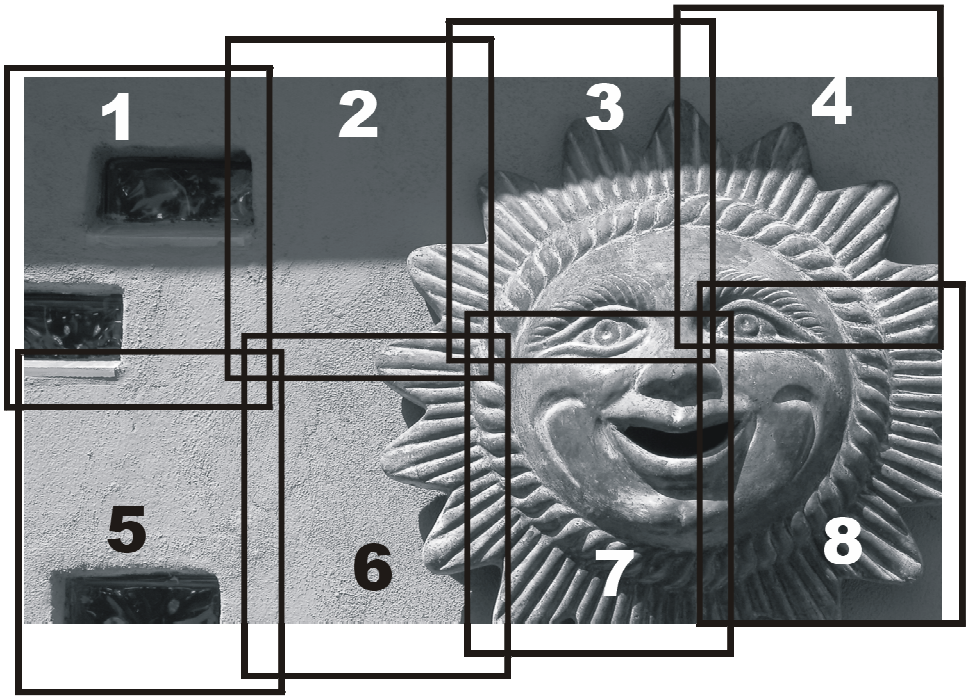
Now think of a table made up of rows and columns of cells. But in which each cell is a 5 Megapixel frame.

2590 1960	2590 1960	2590 1960
2590 1960	2590 1960	2590 1960

If that table covered the same field of view as the single frame, you'd now have almost 30 megapixels to record the same image as the original 5 megapixel chip. Actually, due to the necessary overlapping needed for stitching, you'd not get the full equivalent of all 30 million pixels, but it would be close. And the results can be amazing. Lets take a look at an example and then see how it goes together.

Below is the shot; a view of a backyard wall with a ceramic sculpture on it. It has a couple of textural issues of value for this topic. One is the fine texture of the stucco work and the other is the smooth tones in the glazing on the pottery sun face. Ready to print from a single frame this shot is cropped from the original 2560x1920 frame to 2035 x 1213 pixels at 360 ppi.

After shooting this as a single frame image I then divided the view into eight sections and took it again, this time devoting a 2560x1920 shot to each section. The sections/frames were then stitched back together as shown in the following illustration.



I turned the camera vertically in order to make the plot of tiles work out to roughly the same dimensions as the cropped version of the single frame. The stitched file of eight images, when cropped, ended up being roughly 6574 x 4140 pixels at 360 ppi.

As you can see from the plot of shots above, the tripod was not level when I made the shots resulting in a slant to the tiles. I had leveled it when I first started the test but decided on a slightly different view and the uneven ground threw it a few degrees out of level. This meant that my final mosaic was not as efficient in terms of pixel usage as it might have been and much of the picture area had to be cropped off in order to cut a clean rectangle and still keep the horizontal lines in the glass blocks to be more or less horizontal. To gain the maximum value of all this effort you really need to pay attention to such details.

Seen at the small size on these pages (approximately 5 inches wide) and printed on this non-photo paper the two versions are virtually indistinguishable which shows that for some purposes this technique is massive overkill for little or no practical gain: like shooting raw images for use as web illustrations. But when it comes to making enlargements, the story changes dramatically.

Once made, I then took both files and enlarged them to fill a 13 x 19 sheet of paper. I chose this size since it is a typical large print for most desktop art printers other than expensive wider printers such as the Epson 7600 and 9600. It is the standard paper I use for large prints.

This was a minimal enlargement for the stitched image, but the original single frame had to come up from an approximate 7x9 inch size to the 18.5 inch width (which would leave ¼ inch borders) on the Super B paper.

To illustrate the difference in quality of these two files, I cropped a segment of each enlarged file showing some of the stucco texture and some of the smooth tones on the ceramic face. Here you can see the difference clearly.

White rectangle indicates area taken from an enlargement of the image to fill a sheet of 13" x 19" paper.

Section enlarged from single frame version

Same section enlarged From stitched mosaic of eight frames

It is like looking at the difference between small and large format film images. Not only is there more subtle detail (compare especially the cracks on the outer edge of the sun's rays in mid

frame), there is far more mid-range tonality to the larger file. The lower picture made from the mosaic has far more mid tones and at first blush is "flatter" in contrast just as large format prints look at first to be flatter — and for the same reasons.

The actual 13x19 print is astonishing compared to even ones made before that I thought were pretty good. When the subject holds still, this is a technique I'll be using over and over. There is no reason I could not have zoomed in even tighter and used more "tiles" in the mosaic for even greater resolution.

The down side is that the technique won't work with moving subjects. Nor is there any point in doing it when all you need is an 8x10 from a 5 megapixel or larger file. But for larger prints, this is an incredibly easy and cheap way to gain image quality when the subject allows.

The key however, is the ability to use longer lenses or focal lengths allowing for narrower views with each tile, and to pivot the camera for both the rows and columns along the optical axis of the lens. I jerry rigged a set-up to perform this test, but a good VR rig from Kaidan or Bogen would make it a piece of cake.

NDK