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of Saturn Run. :]

Posted by: Rosser Bradburn | Saturday, 26 December 2015 at 08:44 PM

"I can tell you for a fact that the 42mm and 75mm Olympus lenses will hold up just fine, corner-to-corner, when a 32-megapixel camera comes along."

It's already come along, with the High Res Mode of the E-M5 II. While not ready for prime time with subjects that aren't static, it certainly is higher than 32 MB resolution, and useful for many subjects.

From tests, it's clear that the 64 MB Raw files aren't quite the overall equivalent in actual resolution of detail to the Pentax 645Z 50 MB Bayer array sensor. It does nicely out resolve the 645Z on small, fine, repetitive detail.

OTOH, the HR Mode is far superior to the 36 MP Nikon D800 for small and/or repetitive detail, as the D800 has terrible moire effects, and the Oly in HR Mode does not.

The test shots on Imaging Resource appear to have been shot with the older, 4/3 50/2 macro lens. While it seems up to the job, we can't really know if a sharper lens might make the sensor look a little better.

While I imagine that at least the 45/1.8, 75/1.8 and 60/2.8 Macro are fully ready for at least 32 MB, how may one be sure? I have all three lenses and the E-M5 II, but wouldn't know what to compare them to.

Posted by: Mouse | Saturday, 26 December 2015 at 04:17 PM

Well put. I feel that a higher resolution micro 4/3 sensor is inevitable, the technology has been maturing and the advantages of higher resolutions are obvious even if the final image will be downsampled.

However, I've been for a while bothered that the discussion about cameras is still largely about resolution, which I feel is something that is increasingly reaching a point of sufficiency for the vast majority of users. I would like to see more focus on the ability to reproduce color and capture demanding exposure ranges; when using a small sensor camera, the limitations in those areas are the ones that bother me most.

Posted by: Oskar Ojala | Saturday, 26 December 2015 at 04:24 PM

I'm not sure if dangav356pils wanted further explanation of the paragraph or the idiom. "Further down the pike" can mean 'further down the road' - pike being short for turnpike (a toll toad). Merry Christmas!

Posted by: Mike G | Saturday, 26 December 2015 at 06:23 PM

Hey! I shoot with Foveon sensors and drive a Mazda RX-8. What are you saying? A happy X to you.

[***Chris*** *replies: Michael - That you are a member of an extraordinarily select group.*]

Posted by: Michael Bearman | Saturday, 26 December 2015 at 08:08 PM

Dear Chris (happy to continue offline if needed, because this subject is very interesting...)

FERGODSAKES, PEOPLE, DON'T SAY "DYNAMIC RANGE" IF YOU'RE TALKING ABOUT EXPOSURE RANGE!

I'm not sure where I did.

I accept that exposure range is not the same thing as DR for all the reasons you explained, but what you describe seems to relate to tonal range as much as dynamic range (both as defined by DxO)

Ie. the ability to detect tonal changes at signal levels less than the noise level given more than 1 pixel to look at. It's an interesting perspective, and I would like to know how it relates to DxO's definition of tonal range at much higher signal and noise levels.

For my part I was just trying to gauge roughly what the potential improvement could be in terms of engineering DR, SNR etc. since this is what Fuji (and DxO et al.) keep talking about, right or wrong.

20EV capacity with a noise floor of 12 electrons (read and thermal noise) yields around 16.4 EV of DR, so a 16 bit ADC would cause very little quantisation. Of course, 20 e of downstream noise may make the improvement even less noticeable, around 15.4 EV, but this is still higher than the results obtained for a Nikon D4 (for instance).

The other issue is tonal range (as defined by DxO as the number of noise limited tonal gradiations between noise floor and saturation). This is mainly shot/PRNU noise limited and likely to be much less than 16 bits. Probably slightly less than 10 bits, although that is still usefully more than the 8 bits or so that is quoted for a D4 (for instance) given the prevalence of 16bit editors and high bit depth printers (even if you may still see issues on an 8bit display).

However, you have made me wonder if this definition of tonal range is also a nonsense, in the sense that if you can distinguish tones at separations less than noise, then tonal range is also less useful as a measurement.

Nevertheless, as a yardstick, I would assume that improved DR and tonal range would nevertheless yield a likely improvement in exposure range.

Please feel free to set me straight (by email) if I made an incorrect implication or if this assumption is wrong.

PS. I have read Emil Martinec's excellent paper many times and it is indeed very useful. The maths is happily not too strenuous.

[***Chris*** *replies: Steve- I think we can leave this be, because we're in substantial technical agreement. One minor note and one correction. The minor note– when you talk about dynamic range in "EV," you are conflating dynamic range and exposure range even if you don't mean to be, because EV is a measure of exposure. It perpetuates the confusion.*

The minor correction– if "tonal range," as used by DxO is as you say (I haven't looked into it), then it's another way of measuring of how many stairs there are in the staircase; whereas exposure range is about the total height of the staircase. So, they'd be different things.

Fun, as always. Steve!]

Posted by: Steve Jacob | Saturday, 26 December 2015 at 09:37 PM

The minor note– when you talk about dynamic range in "EV," you are conflating dynamic range and exposure range even if you don't mean to be, because EV is a measure of exposure. It perpetuates the confusion.

OK, I can give you that one ;-)

Unfortunately this has been more or less fixed in people's minds by DxOMark. Nevertheless, it's useful in the sense that DR in EV can never exceed the bit-depth, both being Log2(signal).

Thanks for the reply, and still interested in your assessment of DxO 'tonal range' if you ever take a look at it at some point.

Posted by: Steve Jacob | Sunday, 27 December 2015 at 10:13 AM

"The test shots on Imaging Resource appear to have been shot with the older, 4/3 50/2 macro lens. While it seems up to the job, we can't really know if a sharper lens might make the sensor look a little better."

Ahem - there is no sharper lens.

Posted by: Adrian | Sunday, 27 December 2015 at 07:17 AM

Any digital camera developed after 2011 is capable of outperforming it's chemical counterpart 2 to 1. In resolution, speed, editability (is that a word), ISO and what not. A humble 550D with some good glass can do tricks these days, for which you would be burned for using witchcraft back in the 80th. I predict (with a trusted palantir at my side) that in the future camera's will be seen more and more as an input device (Yeah, I updated the BIOS of my brand new motherboard end of info and much rejoicing).

My camera's are used for:

1) Creating panorama's of Gopixel dimensions using Kolor AutoPano Pro.

2) Creating 3D scans of anything ranging from a 4 cm matchbox car from the 60th up to the facade of the Xanten cathedral, using Agisoft.

3) Being integrated in my SLS David Scanner

4) Creating HDR images and panorama's using Photomatics and Magic Lantern (and a 1965 Gitzo Tripod).

And about the 20 Mpixel sensor...why not, we don't have to shoot at 3200 iso when shooting landscapes!

Greets, Ed.

Posted by: Ed | Sunday, 27 December 2015 at 12:44 PM

A comment on John Camp's comment...

The big advancement in "mass/commercial/consumer computing" in the last 5 years has been in power consumption. The major manufacturers are responding to the consumer. The mass consumer doesn't want more computing power (currently) and instead wants a smaller form factor (requiring lower power consumption). Many of these tablets have more computing power than desktop computers of 10 years ago while drawing a very small fraction of the power (single Watts versus hundreds of Watts).

Another funny note...
One of the more interesting things about the consumer market (although not "mass" consumer market) has been the quest to satisfy "gamers". Gamers are hard-core computer consumers that demand very high computer graphic rendering performance. The insanity of the demands of these people have driven the performance of graphics cards into the stratosphere. Now, the research community is using the high end consumer graphics cards to study neural networks (this is a class of programming processes that have allowed for the rapid improvement in voice recognition, image identification, Google car, etc.). Interestingly, Adobe has taken note of the improved power of graphics cards as well and, if available, Photoshop will use the graphics card to perform some of its image manipulation processes.

It turns out that graphics cards fit into the "lower power consumption" paradigm. High end graphics cards typically have thousands of processing cores and yet draw only hundreds of Watts of power (as compared to hundreds of kilo Watts of power for a system with an equivalent number of CPU cores).

Posted by: Jeffrey K Hartge | Sunday, 27 December 2015 at 02:55 PM

Granting that it may be technically possible to increase MFT sensor pixel counts considerably, I think it is important to bear in mind that if you want to make use of these higher resolutions and take pictures that are uniformly sharp when viewed at the level of individual pixels, then several other factors come into play that can make this impractical or difficult.

1) Depth of field, when calculated with a circle of confusion commensurate with the inter-pixel spacing becomes very narrow. Not a problem for photographing flat objects with a macro lens, but a very real problem trying to take landscapes with sharp foregrounds and backgrounds. Focus stacking can help in some situations.

2) Images at higher resolutions are more sensitive to blurring from subject and/or camera motion. This requires a very solid tripod, avoiding shutter shock, and being very conservative about shutter speeds to stop motion.

3) Any flaws in your optics will be magnified so you need to use your best lenses.

4) Blurring due to diffraction becomes visible at the pixel level at lower f stops as you increase the sensor resolution. For the current 16MP sensors, diffraction already produces noticeable blur above f/5.6. By forcing you to shoot wider open to avoid diffraction blur, you further reduce DOF and make it hard to take sharp landscapes.

Jonathan Sachs
Digital Light & Color

[***Chris*** *replies: Jonathan- how nice to hear from you! (Jonathan and I are old friends) For folks who are new to the photography game, I'll point out that John's admonitions are the same ones given to folks trying to do really sharp film-based photography. They are neither pros nor cons, they are just the way optical photography works. I'd also like to add that there are lots of good reasons beyond resolution why you want a whole lot of pixels, considerably more than your lens' blur circle commands.*

For folks who don't know, Jonathan created Picture Window, which is my favorite non-Photoshop image processing program. People who find Photoshop's interface and design logic opaque and not particularly congruent with the way they've thought about printing should check out Picture Window at the http://www.ddl-c.com website.]

Posted by: Jonathan Sachs | Thursday, 31 December 2015 at 11:00 AM

John Camp's comments about computers miss an important point. The computer, for most people, is simply a device to perform various tasks. The power for performing those tasks has migrated increasingly to datacenters such as those owned by Google, Facebook, and Amazon. Datacenter-based computing has definitely increased in both the kinds and complexity of tasks as well as overall capacity, and continues to do so. It allows us to utilize thousands or even tens of thousands of powerful server computers for brief tasks like locating the nearest pizza restaurant. The benefits of datacenters are less obvious to photographers, perhaps, because network bandwidth limits how much image processing we can do in the cloud. For practical purposes, we need image storage to be local, with the cloud as one possible back-up destination. The analogy with computers breaks down with cameras precisely because a camera, to capture images, needs to be physically located very near the subject, at least near as compared to a datacenter that might be 10 states away or even at the antipodes. So to improve our uses of computers, we can shift much of the burden away from the device and into datacenters, whereas to improve cameras, the improvements need to be in the physical device in the hands of the photographer.

Posted by: Bill Tyler | Thursday, 31 December 2015 at 05:06 PM

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