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Nikon, although the pixels were 1/6 the size. The Fuji was three years newer than the Nikon, so I'm not relating this to diss Nikon. It just goes to how poorly scaling factors operate in the real world of ever-changing technology, comparing apples to oranges.

I've run the depth of field comparisons you talk about. They don't produce the results you think they do (nor does the math). Moose just posted a great comparison example of that and in my response to him I explain why.

(please excuse any word-salad. Apple Dictate's fault)
pax / Ctein
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-- Ctein's Online Gallery http://ctein.com
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Posted by: ctein | Sunday, 31 March 2024 at 06:44 PM

Thanks for helping dispelling the myth of aperture equivalence, Ctein.

Posted by: Walfredo Cirne | Sunday, 31 March 2024 at 10:29 PM

"Moose, that's a fabulous illustration (I loooooove rollovers!) "

Easy HTML. I love them too. I originally did this one just for myself, to see stuff more easily than in PS or LR.

", but it isn't showing a two-stop equivalency. It's only a little over one stop. "

Seemed to me closer to two, but now, looking again, it seems that the ratio depends, as you say, somewhat on focal distance, even within this limited range. (And the lenses really are wildly different.)

" You didn't specify what image magnification was involved for the full frame camera, but it was probably less than 1:1 (unless those are REALLY small figurines), so that's what I would expect for close-but-not-really-close photography. "

I didn't specify 'cause I didn't know. \;-)>

Most of the figurines are pens, from gift shops, etc. The two front left are, I believe, meant to be Arthur and Merlin, bought in the ticket station for Tintagel last year; couldn't resist.

Measurement indicates about 1:6.7 mag. Possibly closer than possible on the cameras it was designed for, but not much, as my adapter has extension.

Posted by: Moose | Sunday, 31 March 2024 at 11:18 PM

For regular photographers, doubling the aperture while keeping the f-number the same means doubling the focal length. So, no, the counting statistics don't get any better for extended objects.

Of course the counting statistics are better, with a full frame lens you've doubled the focal length to frame the object the same way, so at the same f-number you have four times as many photons entering your lens from that object. A factor of four is two stops in sensitivity. It is true that your imaging area at the focal plane is larger by the same factor, so the photon density is the same at image plane, but we don't show images scaled by their sensor size. We show images based on the size of the frame we pick for the wall. For the final image on the wall, a micro-four thirds camera will have the four times less photons contributing to each square-centimeter on the image *unless* you open up your aperture by two stops when you take the photo.

I've tested this with my own equipment extensively and for both SNR and depth-of-field for the range of use cases I have, the two stop rule is just about spot-on.

I actually sold my first full-frame camera and lenses after doing this test when I realized that I very rarely took a photograph at less than f/4 with that kit. My Olympus could do the same job with a few primes, so I was good to go. Then a few years later my kids joined night-time Marching Band, and I finally had a case where a bit more light helped.

Posted by: Daniel Homan | Monday, 01 April 2024 at 05:39 AM

" In fact, to a very good approximation, the depth of field has changed such that the image looks virtually identical to one taken by a full frame camera/lens with twice the focal length and the aperture stopped down two stops.

This is why people harp on 'equivalence', not because it is strictly true in the exact details, but because it is approximately true (to a very good approximation in many situations) for three things:

1) noise -- stopping down the full frame lens by two stops changes the SNR by the same factor as the smaller sensor size

2) focal length -- the subject fills the frame in the same way

3) depth of field -- stopping down the full frame lens by two stops very nearly changes the depth of field to match the smaller sensor for the same subject and distance and fraction of the frame filled."

Thank you to the astrophysicist.

Yes, exactly. And this is precisely my experience, using both cropped APS -C fuji sensors and Sony full frame sensors since 2008. Equivalence is a very useful predictor of how real world depth of field works out, no matter how vehemently Ctein claims to be right, it obviously does not convince experienced photographers.

Posted by: Robert | Monday, 01 April 2024 at 06:40 AM

I had forgotten all about those m4/3 lens comparisons you did way back in the day! I would love to see how the Oly 75 mm (which, in my use, seems to actually be superior to my dearly loved 45 mm, with better microcontrast) stacks up to those zooms in your mind, and how some of the more modern zooms (like the 12-40 mm f/2.8) fare as well.

Posted by: Nick | Monday, 01 April 2024 at 10:45 AM

Dear Daniel & Robert,

I'm glad the two-stop rule works for your equipment and conditions. It does not work in the general case. Really. Math says it doesn't and experimental evidence says it doesn't.

If it's a good rule of thumb for you, great. I have no problem with that! But keep it as your personal rule of thumb and not an objective pronouncement, please?

(And, Daniel, no, we do not agree on the meaning nor significance of the counting statistics, but this is so far down in the weeds and off topic that if you want to continue the conversation, please email me.)

pax / Ctein

Posted by: ctein | Monday, 01 April 2024 at 05:19 PM

Dear Nick,

Oh, I don't even need to run those tests. The Olympus 75mm is spectacularly good in every respect, over its entire field of view. Yes, it's better than the 45mm Olympus, better than the 42.5mm Lumix (which is better than the 45mm). Its one of those utterly outstanding lenses that belong on anyone's list of "best lenses ever made."

It'll beat out the zooms because it'll beat out almost anything in that focal length.

pax / Ctein

Posted by: ctein | Tuesday, 02 April 2024 at 01:42 AM

Follow- up: actually the DOF math was remarkably simple and fits on one whiteboard, with explanations. The essential idea is to use the point where the circle of confusion first becomes unacceptably large. The diameter of that circle, d = the diameter of the aperture * the focal length of the lens * constant (for a fixed object and distance). I assume the object distance is >> focal length, but the definition of >> is really only a factor of a few to a good approximation, so were talking about most non-macro lenses behaving this way.

Because d depends on aperture diameter * focal length, and focal length depends on sensor size, s, to get the same framing, d/s which is the size of the confusion circle relative to your framing (which is what we care about) depends only the diameter of the aperture, not the f-stop! It was fun to see this work out.

I can share an image of my whiteboard with the math and result, but I don't see an easy way to attach an image.

Posted by: Daniel Homan | Tuesday, 02 April 2024 at 08:28 AM

Regarding equivalence, Ctein is right in highlighting that from a point of view of photometry the aperture of a lens doesn't change with sensor size. E.g. an f/1.7 lens needing 1/50 exposure at ISO 100 on FX sensor would need exactly the same parameters of exposure for m43 as it would on a larger 645 sensor (assuming all other lens characteristics are the same)

However, while there is no equivalence in exposure parameters, there is absolutely undeniably an equivalence in visual parameters, i.e. framing and depth of field. It's trivially verifiable and has been demonstrated thousands of time online.

And it is useful.

Since Mike talked about DoF equivalence being used by FX owners to show off, let's take an example from Weegee, who shot with a Kodak 127mm Ektar on a massive 127mm x 101mm (5" x 4") film "sensor". His favourite shooting apertures... f/11 (longer distance) through f/22 (close-ups).
[https://archive.org/details/wgPhotoflash]

It's impractical for me to acquire a 5x4 camera today, so I must make do with my puny little 35mm sensor. Applying the equivalence math, I ought to be using a 35mm lens set to f/3 through f/6 or thereabouts. Seems plausible, looking at his published photos, I reckon those settings would fit.

If I were to ignore DoF and FoV equivalence and shoot with 127mm at f/22, I don't think I'd be doing close-ups anymore.

And, oh, getting Weegee's f/22 DoF on my humble iPhone... impossible! But somehow the iPhone gets everything in focus even at its f/1.8 aperture.

There is such a thing as DoF equivalence, and it shouldn't be denied. What's needed is clarity around where to apply aperture invariance (exposure calculations) and where to apply aperture equivalence (visual approximation).

Posted by: Tahir Hashmi | Tuesday, 02 April 2024 at 09:09 PM

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