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Optical vs. Digital Zoom

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Zoom on a camera can add to the pleasure of digital photography. However, many consumers are confused between optical and digital zoom. An understanding of the difference between the two zooms will help you choose the digital camera that is right for you.

Most people who have used a 35mm camera or an APS camera are aware of only optical zoom. Optical zoom uses the optics (lens) of the camera to bring the subject closer. Digital zoom is an invention of digital video cameras. It is not uncommon to see digital videocams with 300x digital zoom.

For our purpose, digital zoom is not really zoom, in the strictest definition of the term. What digital zoom does is enlarge a portion of the image, thus 'simulating' optical zoom. In other words, the camera crops a portion of the image and then enlarges it back to size. In so doing, you lose image quality. If you've been regularly using digital zoom and wondered why your pictures did not look that great, now you know.

Is digital zoom therefore all bad? No, not at all. It's a feature that you might want in your digital camera (in fact, all digital cameras include some digital zoom, so you can't really avoid it), especially if you don't care about using (or don't know how to use) an image editing software. So, as far as digital zoom is concerned, you can do it in camera or you can do it afterwards in an image editing software. Any cropping and enlarging can be done in an image editing software, such as Photoshop.

So, when a digital camera is advertised with 3x digital zoom, no big deal. You can achieve the same 3x (and in fact as much as you want) digital zoom effect in an image editing software. The advantage of doing it later is that you can then decide exactly which portion to crop and how much to enlarge (3x, 4x, ...). If you do it in camera, image quality is irreversibly lost.

Someone in a digital camera forum once mentioned that he uses digital zoom because it might mean the difference between capturing a great shot or not at all. Umm, let's think about this a bit. True, if by zooming digitally in camera you get to see what your subject is doing and thus can capture the shot at the right moment. Not quite true, if it's something like a landscape shot, and the mountains ain't going nowhere fast, because you can achieve the same cropping and enlarging effect after the fact in your image editing software. So, it's really up to you, if you know what you're doing.

What, therefore is the rule of thumb, when it comes to using zoom? Here it is: Always use optical zoom. When buying a camera, choose one that warns you that you are about to use digital zoom or that allows you to disable digital zoom (most do). If you do use digital zoom, use it only if it does not appreciably impact your image quality. If you rarely print past 4x6 in. photos, digital zoom may not adversely affect you.

When comparing cameras, you should always use optical zoom. There is no point in comparing digital zoom with digital zoom or optical zoom with total zoom. Always compare optical zoom with optical zoom.

Optical Zoom vs. Resolution

What about optical zoom vs. resolution? Sigh! Now y'all know that we cannot and should not be comparing apples 'n oranges, but we still try. The question I often read about goes something like this: "Which is better: 2 megapixels resolution with 3x optical zoom or 3 megapixels resolution with 2x optical zoom?"

The megapixels resolution of a digital camera can be thought of as the number of pixels available to capture an image. With a 2 megapixels camera, you have 2 million pixels to record an image. With a 3 megapixels camera, you have 1 million extra pixels to record the same image — in other words, you are able to capture the image in more detail.

Whether you zoom or not does not affect how many pixels are used to capture the image. So, zoomed at its maximum, a 2 megapixels 3x optical zoom digital camera will still have captured a 2 million pixels image. Likewise, a 3 megapixels 2x optical zoom digital camera will always capture a 3 million pixels image.

The real question behind the question is, "So now if I use digital zoom to zoom in with the 3 megapixels camera and simulate a total zoom of 3x, will the resultant image quality be less, the same, or still better than the one I captured with the 2 megapixels 3x optical zoom camera?" You follow so far?

With a 2 megapixels digital camera, you can make good 4×6 in. prints, and maybe even 5×7 in. prints. With a 3 megapixels digital camera, you can make good 8×10 in. prints. So, as far as image quality is concerned, the 3 megapixels camera is better. Unless you are always going to take pictures at max. zoom, the 3MP camera is better because at 2x optical zoom and less, it is always capturing images with more detail than the 2MP camera.

Of course, since we first wrote this article, digital cameras now have 5x, 10x, even 20x optical zoom, and resolution has reached 14MP and going upwards. You would think that with all of that MP and optical zoom, this question would at last be laid to rest, but you'd be wrong. People still write in and ask whether 12Mp with 5x optical zoom is better or worse than 6MP with 10x optical zoom.

What we are really trying to say is this: do not compare. You've got to decide what is more important to you: resolution or optical zoom? If the answer is both, then find a digital camera that has both. It's that simple. If it's outside your pocketbook range, then choose a digital camera for what is more important to you.

One important consideration with regards to resolution is important to make here: don't be fooled by the high megapixel resolution advertised for a camera. A compact digital cameras with around 6-8 MP produces perfectly beautiful images for most point-and-shooters. Go higher and overall image quality seems to get worse instead of better. It has to do with pixel density: cram too many ever tinier pixels close together onto a tiny image sensor and all kind of image quality issues come up, including the all important noise. I am here talking about compact digicams with tiny sensors (usually sized at 1/2.3-in. to 2/3-in.). The micro Four Thirds and APS-C digital cameras have much bigger sensors and the megapixel resolution can safely go as high as 24+ MP.

To repeat, we do not compare optical zoom with megapixel resolution because optical zoom is not megapixel resolution-dependent. That is, the resolution of your final image does not change no matter how much you zoom in. If your digital camera is 5MP and has a 12x optical zoom lens with focal length of, say, 30-360mm, then at 30mm, your image is 5MP and at 360mm, it is still 5MP. With digital zoom/enlargement, the megapixel resolution decreases as you "zoom" in digitally (the premise behind Smart Zoom, Safe Zoom and the many flavors of Intelligent Zoom, see below); if you try to bring the cropped image back to the same 5MP size, then there is pixels interpolation and the resulting image suffers in quality.

We always disable digital zoom in camera, choosing to do our own cropping and enlarging in an image editing software.

Optical vs. digital zoom? There is no contest. Only optical zoom matters when selecting a digital camera.

Smart, Safe and Intelligent Zoom

Realizing that digital zoom is not really a good thing because it negatively affects image quality, camera manufacturers have introduced a new type of digital zoom variously called "Smart Zoom" (Sony), "Safe Zoom" (Canon) and "Intelligent Zoom" (Panasonic and others). Smart/Safe/Intelligent Zoom (let's collectively called them Intelligent Zoom, or iZoom for short) can be viewed as an "ethical" digital zoom which avoids interpolating the image and so avoid degrading image quality. iZoom works only if you select an image size smaller than the full available image size. So, for example, if your digital camera is capable of producing a 12MP image, Smart Zoom is available only if you select to save your images as 7MP or less. In other words, with this particular type of digital zoom, the MP resolution decreases as you 'zoom' — in other words you are just cropping the center of the image (without interpolating back to the original resolution).

Say, your digital camera is 12MP and you select to save your images as 10MP. So, in effect, you are

forfeiting 2MP of image data (extracted from all over the image area) that the digital camera's sensor has captured and now has to throw away [you hope the camera makes the right decision and does not throw away important image data]. Enter iZoom that says, "Hey, instead of throwing away 2MP of good data from all over the image area, why don't I crop out all the pixels starting from the outside perimeter? When I've cropped out 2MP of image data all around, I have 10MP left over and that's what you want, right?" Notice, the 10MP image does not have to be interpolated and enlarged back to 12MP as traditional digital zoom does (because you elected to save it as 10MP, remember?). So, in effect, you've basically more or less retained the same image quality but you have to save your resulting simulated zoomed image in a smaller image size. Of course, if now you turn around and enlarge it in post-processing, you will be limited to what a 10MP image can be enlarged up to without image degradation.

I call iZoom "ethical digital zoom" because it is not made available at full image size — this would cause image degradation. The smaller you elect to save your image, the more iZoom power you have available (folks, you're basically just cropping the image without re-enlarging, which you can also do at any time in post-processing).

So, our recommendation still holds. If you want zoom power, only optical zoom matters! iZoom is the better form of digital zoom, but what you gain in simulated zoom power (again, you're just cropping), you lose in image size. There's no free lunch.

Again, don't buy a digital camera based on digital (traditional or intelligent) zoom. Always compare optical zoom with optical zoom. If you are comparing 2 digital cameras with the same optical zoom, but one has intelligent digital zoom and the other has traditional digital zoom, then the intelligent zoom has a slight advantage. But personally, I wouldn't even look at that because there are a lot more important features to differentiate the cameras.

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