

## Focal Length Multiplier

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You couldn't pay me enough [NPN Gift Shoppe Dollars](#) to write a column about Windows versus Macintosh. That's just begging for trouble. And yet, here I am, writing a column about another controversial topic, the focal length multiplier factor on digital SLR cameras (though this topic is admittedly not up there with religion, politics, or operating system debates).

This is a topic that has periodically come up in the [NPN Digital Imaging Forum](#).

### Free Tele-Extender

When digital 35mm SLR cameras were first coming onto the market, it seemed that manufacturers would boast about the fact that you were getting a "free" tele-extender by virtue of the focal length multiplier. While many photographers accepted it at face value, many others were less trusting. There must be a catch.

Of course, there isn't a built-in tele-extender or magnifier in these digital cameras. The effective extension of focal length is a simple by-product of the size of the imaging sensor. Because it is smaller than a single frame of the 35mm film it replaces, it captures a smaller portion of the image circle than 35mm film would. The result is that you capture a scene that is the same as what you would have captured with a film camera using a longer lens. Sure sounds like you've gotten a free extension of your lens, doesn't it?

Well, it isn't that simple. You'll also notice that digital camera manufacturers don't talk about focal length multipliers anymore. When the issue is addressed, it usually gets referred to as producing a different angle of view rather than an extended effective focal length.

### In This Corner...

There are two sides to the debate, and both of them are correct in most respects.

On one side are those who refer to the digital SLR cameras as featuring a focal length multiplier. They tout the "free" tele-extender they get when you use a digital camera that has a sensor smaller than the film it replaces. They have a valid point, because the field of view is the same as if you had used a longer lens. Furthermore, with the focal length multiplier offered by a digital SLR camera, you don't have the loss of quality you get when using a tele-extender on a film camera.

On the other side are those who call the concept of a focal length multiplier dishonest. They point out, quite correctly, that the image is simply being cropped in the camera.

It really comes down to semantics. Understanding what is going on inside the camera can help shed some light on the situation and clarify both sides of the debate.

Think about standing before a scene you want to photograph. You put a 100mm lens on the camera and look through the viewfinder. You decide you want to tighten up the composition, so you put a 300mm lens on the camera and look through the viewfinder again. What has happened to the scene? If you compare the view at 100mm and 300mm to the original scene before you, it becomes clear that increasing focal length simply crops the scene. We think of it as magnification, and that is what happens inside the lens. The lens



magnifies the scene so that the film sees a smaller portion of the scene in front of the lens. The bottom line, though, is that the scene itself is being cropped.

With a digital camera, effectively the same thing is happening. The difference is that instead of using magnification in a lens to crop the scene, the image circle projected by the lens is being cropped by the sensor. This happens because the sensor is physically smaller than the film that it replaces. Because a smaller piece of the scene is being recorded, the net effect is the same as though a longer lens had been used. Just how much it effectively multiplies the focal length of the lens depends upon how much smaller the imaging sensor is compared to the film it is being compared to.

Most digital SLR cameras in the 35mm format have a focal length multiplier factor of 1.5X or 1.6X, with a few variations from that.

### Quality Benefits

There are actually some benefits to the cropping that occurs in the camera, although they are slight. Because the smaller sensor is effectively cropping the final image out of the image circle projected by the lens, it is actually capturing from the sharpest part of the image circle. That means you are getting an image of potentially higher quality than if the sensor was full size. This is more theoretical than anything, but there is the potential for improved quality, particularly with lenses that lose a lot of sharpness toward the edges.

Another benefit is that you're getting the full resolution of the camera at the cropped image area. If the same number of megapixels was used at the normal focal length with a full-sized sensor and you then cropped to get the same image, you'd have fewer pixels covering that area.

In other words, you aren't giving up any quality when the camera includes a focal length multiplier factor, so there shouldn't be any concerns about the final image.

### So Long, Wide Angle

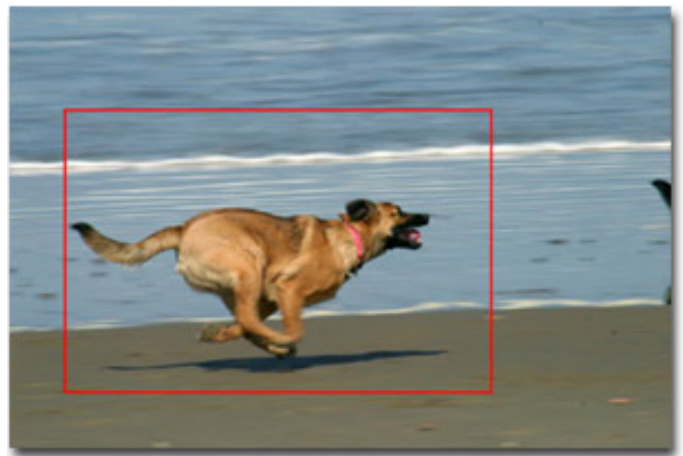
Of course, it isn't all positive, which is part of why the focal length multiplier has gotten a bad rap with many photographers. One of the biggest drawbacks of the focal length multiplier factor is the fact that wide-angle lenses are no longer wide angle. A 15mm fisheye lens becomes a 24mm wide-angle lens. A 24mm wide angle lens becomes an almost-normal 38mm. To get the same field of view of a 50mm lens you could employ a 28mm lens. But how are you going to replace a 15mm fisheye? You'd need about a 9mm lens, and I don't see one of those in the lens lineup from Canon or Nikon!

Part of the frustration is that lenses aren't behaving the way we have learned to expect. In order to get the same results you are accustomed to from the lenses in your bag, you may need to buy new lenses. No wonder this has become a controversial issue.

### The Bottom Line

The final image is what really counts. You can argue all day long about whether digital SLR cameras crop the image or provide a focal length multiplier. The simple fact is that a lens on a digital camera with a sensor smaller than the film it replaces isn't going to provide the same image. However, what you see in the viewfinder reflects what the sensor will capture, so this doesn't need to change the way you work.

Dealing with lenses giving slightly different results than you have come to expect can be frustrating, but you can learn to adapt. Eventually we may see sensors that match the size of the film they replace. Camera manufacturers are also coming out with shorter focal length lenses to help compensate for the focal length multiplier factor in existing cameras, and I expect we'll continue to see more cameras in the near future that still include a focal length multiplier factor.



It really isn't critical that digital cameras perform exactly the same as the film cameras they are replacing. However, we tend to expect that to be the case, so making the transition can be a challenge. Trust what you see in the viewfinder, and continue taking great pictures, regardless of what's happening inside the camera.

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#### About Tim Grey...

Tim enjoys sharing information about digital imaging as much as he enjoys learning it in the first place. Tim publishes an almost-daily [Digital Darkroom Questions](#) (DDQ) e-mail service that provides a forum for photographers to have their questions related to the digital darkroom answered. He is editor of *The Digital Image*, a quarterly journal published by [George Lepp](#). He also teaches courses to help photographers master the digital darkroom at the [Lepp Institute of Digital Imaging](#).

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