LET'S TALK PROPORTIONS

First let us look at television, everyone is familiar with that.

Nothing stays the same for long, and that applies to cameras and pictures as much as anything. It was determined back in the middle ages, or before, that the relationship of three units high and four units wide was ideal for presenting a picture or object for viewing. This protocal was followed when 35mm movie film was developed, with the frame 18mm by 24mm. For some reason, when the same film was adapted for still cameras, the movie frame was doubled to 24mm by 36mm. The three by four relationship gives us a ratio of 1:1.33. The 24 by 36 relationship results in a ratio of 1:1.5. Then widescreen came into fashion, starting with cinerama with it's triple wide format, requiring three projectors to show it, and three cameras to record it. This had a slightly less than 1:4 relationship with some loss from the overlap between the adjoining frames.

Cinemascope and several similar widescreen formats were developed with ratios from 1:1.65 to 1:2.55 and used fancy lenses (anamorphoscopic) to accomplish this with one camera and one projector. Anamorphoscopic lenses compress the picture in the horizontal direction but not the vertical as the film is shot. Showing the film through the same lens returns the picture to it's original proportions. The accepted widescreen standard, which is ignored more often than not, is 16 by nine, this is four squared by three squared, which means nothing I am aware of, with the larger number given first in the current vogue (just go into a lumber yard and ask for some four by twos if you want to see a laugh). This translates to a ratio of 1:1.78. In most advertising and such, this is given as 1.78, with the 1: proportion understood to be there. Any ratio from 1.78 to 1.85 is considered close enough viewers will not notice. On video tape, any divergence from the 1.33 ratio is corrected by using the full width of the frame and filling in the space above and below the picture information with blank bands of a neutral color, called letterboxing, or by using "pan and scan" techniques to select the major focus of each scene, presented in the 1.33 ratio. This also applies to DVDs, BDs and HDTV with the addition of anamorphic compression, that word itself compressed down from anamorphoscopic. This allows full use of the height of the medium with the desired ratio and is less deleterious to the resolution than letterboxing which literally wastes that portion of the capability of the equipment. Pan and scan loses some of the side information, but this I find preferable if you are going to use the 1.33 ratio, since directors still have trouble with the widescreen bit and include distracting material off to the sides while concentrating on the centered subject. Of more importance is the diagonal measurement. Again, trying to get numbers as big as possiblewithout actually lying, all TV screen sizes are given in this measurement so that a screen approximately 19" by 25" is advertised as a 32" screen. In widescreen format for instance, a screen approximately 20" by 36" is advertised as 42" diagonal.

Now apply this to our cameras.

This relates to cameras that we use in several ways, the most important being the relationship between the size of the sensor and distance from the focal point of the lens to the sensor. the sensor can be film, a.CCD (Charge Coupled Device) the standard for many years, a CMOS sensor or other options. When 35mm film came into fashion, it was determined that for this size format a 58mm focal length lens best approximated the human eye. The"normal" lenses now vary from about 50mm to 52mm or 55mm from a very few that were 58mm. Most of these are actually mild wideangle lenses, if the 58mm lens is accepted as normal, but close enough that most people will accept them. You have noticed that wideangle lenses make nearby objects appear much larger in proportion than objects farther away, and that this effect is exaggerated as the focal length shortens. Telephoto lenses do the opposite, objects far away look larger than expected compared to closer things. It is this shift in perspective that determines the actual "normal" lens.

A 35mm frame has a diagonal measurement of 43mm, and a normal lens has a center of focus (focal length) between 50 and 58mm away from the film. As this proportion is maintained for other sensors, you can see that a smaller sensor can have a normal lens with a shorter focal length without introducing distortion. This is the case with digital cameras. Most digital sensors until recently were one third of an inch diagonal in "consumer" (I hate that word) cameras. This means that a 35mm camera normal lens is almost five times as large as the comparable digital camera. In metric terms, an 8.8mm diagonal sensor will see a 10.3mm focal length lens as a normal lens. It aso means that a 55mm focal length lens adapted to a digital camera with a one-third inch sensor, would become a five times telephoto lens. Newer digital cameras have a sensor with a one tenth inch diagonal, and a correspondingly smaller lens. This is good in terms of cost, but less so in most other respects.

One of the few absolutes in photography is that the smaller the lens opening (aperature), the greater the depth of field. The depth of field is the region in front of and in back of where the lens is focused that also appears to be reasonably in focus. A large lens opening gives a shallow depth of field. This is useful when you want to emphasize the subject by causing the background, or even foreground objects to be out of focus. You have all seen portrait style pictures framed by a misty curtain or flowering branch. And I know you have seen pictures using the opposite effect, a nearby subject and the distant building or mountain, all kept in focus by the extreme depth of field of a very small aperature.

The f-stop measurement used for lenses is a fractional number relating to the diameter of the lens opening at it's most restrictive. An adjustable diaphram is placed at the focal point, where it causes little distortion to the picture, but limits the ammount of light allowed to pass A 50mm f2 lens has an opening 25mm in diameter. At f4, the same lens has an opening of 12.5mm. Long standing practice with 35mm cameras was to use a sequence of f-stops marked on the housing: f2, f2.8, f4, f6.3, f8, f11, f16, f22 and f32, that each halved the light gathering ability of the previous number. Since virtually all diaphrams operate continuously over their range, all intermediate values can be achieved. Accepted half stops of f2.5, f3.5, f4.5 and f5.8 were often marked on the lens housing. Compromises in lens design usually means that the best picture is probably achieved about halfway between the limits of the lens. In the lens described above, ranging from f2 to f32, this would be around f8.

The minimum size of a lens opening is determined by a distortion called edge effect. Light passing very close to a surface, or the edge of the diaphram in the camera, is affected by this, while light a few angstroms away is not. When this distortion becomes noticable, a smaller lens opening offers no improvement in focus or depth of field, but instead results in a less acceptable picture. Since the f-stop is a factor of the focal length of the lens, and therefore of the size of the sensor, the old cameras that used a sensitized plate measured in inches could achieve an f-stop of 100 or more. A 35mm camera is limited to about f32. A 1/3" sensor is apparently limited to about f8, since I don't see any offered with smaller than that. The cameras with 1/10" sensors may not even change the lens opening. The minute lens opening gives great depth of field, and the relationship between the sensor and the lens opening sizes gives the camera good light gathering ability.

In summary, the function of the lens is to gather and focus the light. The diaphram controls the amount of light. All the numbers tell us what is going on so we can tell the lens what we want it to do. The longer the focal length of the lens, the more it magnifies the image (telephoto), the shorter the focal length, the wider the angle. The controlling factor in this is the relationship between the focal length of the lens and the size of the sensor.