Reading Glasses

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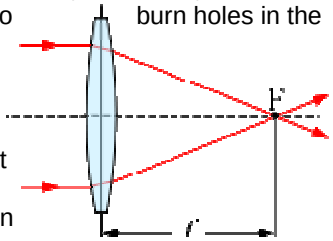
As you pass the age of fifty, amongst the things that life throws at you, you start noticing how much small print there is around. Must the product labels on food be printed so small?

I have presbyopia, which is a fancy name for not being able focus your eyes close up anymore. As we age, the lenses in our eyes stiffen up, so that the muscles in the eye are unable to change shape enough for us to focus close up. So for those of us with normal vision, we need reading glasses. Talking to people about this, most only have a vague idea of how to select which glasses to use. Here is an explanation of how the eye works, so you can understand enough to select the right reading glasses for the task in hand.

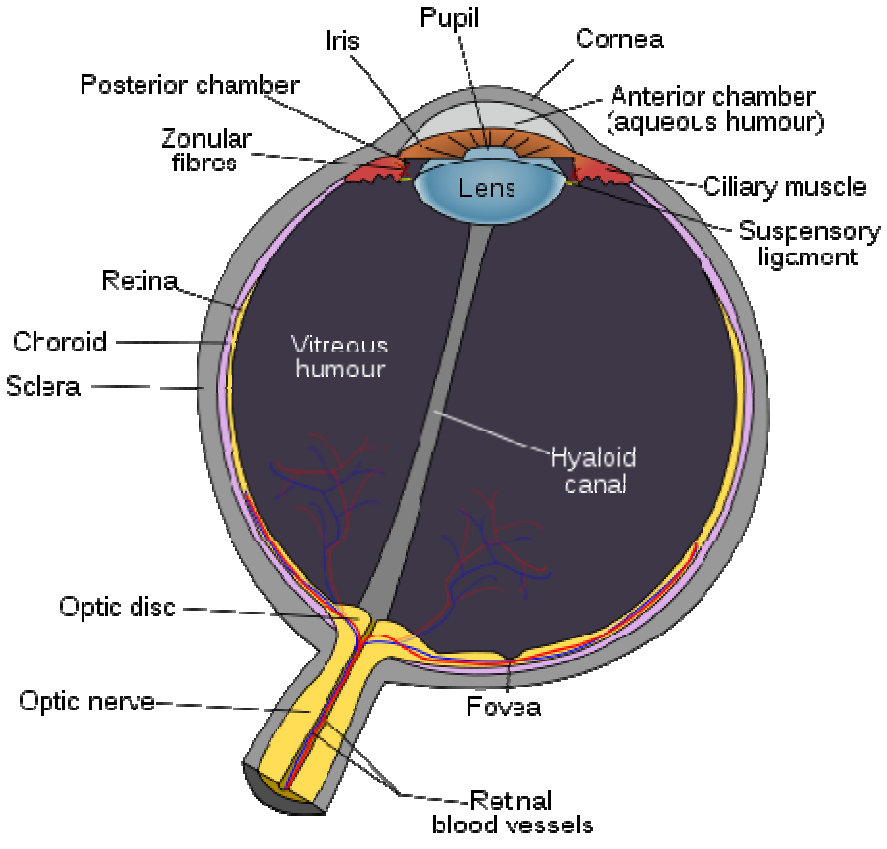
If you don't mind a bit of theory, read on, otherwise skip to the end.

Flat glass doesn't bend light, so light rays that pass through it are not concentrated or spread, whereas a lens concentrates or spreads the light in a controlled way. A lens is made with a carefully controlled curvature that either concentrates or spreads the light by an exact amount. The more curved a lens, the more it bends the light. A convex lens concentrates light. When you hold a magnifying glass (a convex lens) in the sun and focus the light onto a point (F), the distance from the lens to the point is the focal length (f). As any small boy knows, if you want maximum effect, then you need to focus the sun onto the smallest area, all the better to burn holes in the carpet or make ants explode.



The power of lenses used in eye glasses is measured in diopters which is a measurement of the optical power of lenses. A diopter is defined as being equal to the reciprocal of the focal length measured in metres (that is, 1/metres). It is thus a unit of reciprocal length. For example, a 3-diopter lens brings parallel rays of light to focus at ⅓ metre. The usage was proposed by French ophthalmologist Ferdinand Monoyer in 1872.
One benefit of quantifying a lens in terms of its optical power rather than its focal length is that when relatively thin lenses are placed close together their powers approximately add. Thus a thin 2-dioptre lens placed close to a thin 0.5-dioptre lens yields almost the same focal length as a 2.5-dioptre lens would have.

This diagram from Wikipedia shows the lens in the eye. The eye contains a concentrating lens that focuses the image of what you are looking at onto the light sensitive part of the eye at the back, called the retina. To accommodate objects at different distances, the eye focuses the lens to suit – this is called accommodation and is done by the ciliary muscle. The eye has a built in mechanism that does edge detection to adjust the lens so that the edge is in focus – this happens automatically over a wide range from infinity to close up, so you are not aware of it happening.



Until you approach fifty, when it stops working as well as it did – welcome to the world of glasses!

In the human eye, the total optical power of the relaxed eye is approximately 60 diopters. The cornea and anterior chamber provides for approximately two-thirds of this refractive power and the crystalline lens (in conjunction

with the aqueous and vitreous humors) contributes the remaining third. In the very young, the range of accommodation of the lens is approximately 15 to 20 diopters. It reduces to about 10 diopters at age 25, right down to around 1 diopter at 50 and over. The balance has to be made up with reading glasses.

What strength reading glasses do I need?
Well it depends on what you are looking at. Reading glasses are offered over the counter in a range from +1.0 to +3.5. Each person's eyes are slightly different, and each eye may also differ.

In my case +1.0 will let me focus comfortably at arm's length. +1.5 is suitable for general office work – reading and writing and computer work. For finer work in the workshop, I find +2.0 is about right. +1.5 leaves me squinting to see the divisions on a millimeter ruler, whereas +2.0 is comfortable for that. I have some +3.5 glasses for really fine work, but they can only be used really close up. There is a big gap between the really close up work and even arm's length objects, so they are frustrating to use.

To determine what you need, go to the reading glasses display in a shop and test the different strengths on what you typically work on at the right distance. Make a note of the strength, and then you can select the style you like. Reading glasses are relatively cheap (R60- upwards) which is just as well, as I have several pairs and they do get damaged or are lost.

You may have noticed that you can read close up better in bright light – why is that?
Photographers will know the answer. In bright light, your iris closes down to admit less light into your eye, effectively reducing the aperture which increases the depth of the field, so you can focus closer.

One note of caution – reading glasses are not safety glasses – they don't cover enough of your eye and they are not impact rated. For work on machinery, I use plain safety glasses with a reading insert. These are not readily available, so I order them from the local supplier of Elvex. They are available with inserts from +1.0 to +3.0.

Obviously, if you don't have normal vision, you may want to consult an optometrist, because the standard readers may not help. There may also be differences between your eyes, which will require different strengths. Also if you notice rapid changes to your eyes, there may be an underlying cause which must be investigated!

Sources:
en.wikipedia.org
www.elvex.com/safety-readers.htm