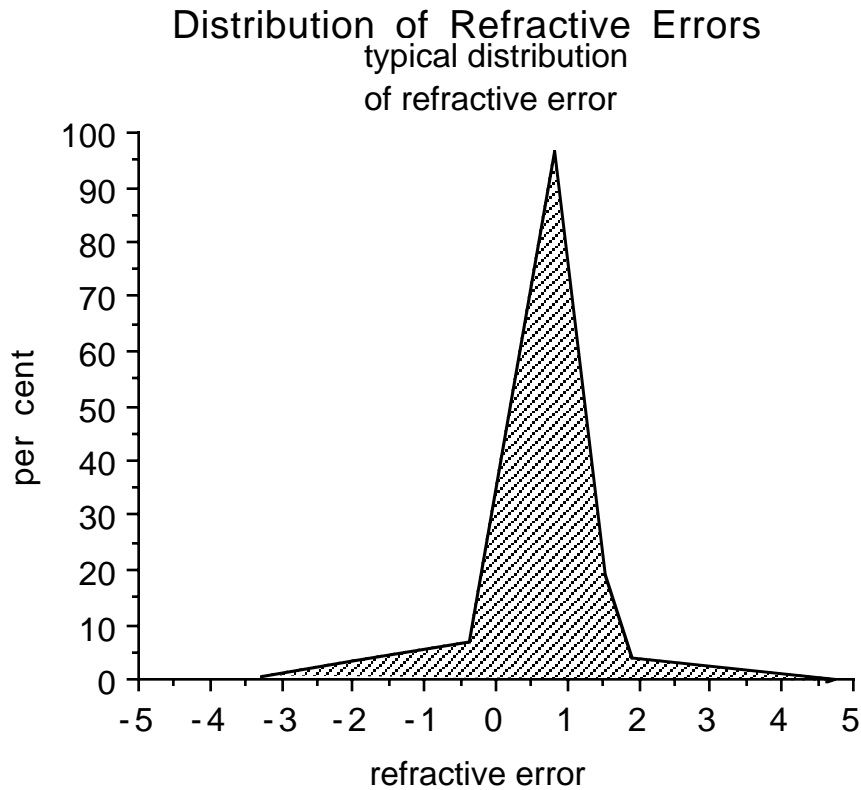


Epidemiology of Refractive Error

A great many studies have been made of the incidence of refractive error in the population. While it is often difficult to compare studies and there are points of contradiction among them, there are some generally accepted facts about the distribution of refractive errors.



The figure above gives a distribution of refractive error typical of several studies. It shows that most people are a bit hyperopic, with very few people lying outside the range of $\pm 4.00D$. It turns out that the distribution of refractive errors is leptokurtotic, that is it is not a normal bell shaped curve. The distribution is also skewed toward myopia. Of all the parameters of the eye, refraction correlates strongly only with axial length.

Since most biological traits are normally distributed, the leptokurtosis of the refractive error distribution has prompted the suggestion that some process is at work to prevent the eye from developing refractive error. That process has been named emmetropization.

Changes in Refractive Error with Age

Most infants are hyperopic. Children entering school also have considerable hyperopia but lose it gradually as they approach their teens. The rate of loss is around 0.25D per year. A child who is not hyperopic in kindergarten will surely become so by the time he enters high school. Generally refractive error stabilizes in the mid-teens although late-onset myopia has been observed. Through the twenties and thirties refraction is relatively stable. Thereafter increased hyperopia develops along with an increase in against-the-rule astigmatism.

Causes of Refractive Error

There has been much discussion as to whether refractive error is inherited or caused by environmental factors. Twin studies have shown high correlations between the refractive errors of siblings, greater among fraternal twins than other siblings, and greater still for identical twins. On the other hand, several studies have shown that the entrance of literacy into a culture is accompanied by a generation with much less hyperopia and more myopia than its parents. And it's clear that scholars are more myopic than those outside the learned professions, but it isn't always sure whether the scholarship led to myopia or vice versa.

Emmetropization itself suggests a feedback loop of some sort which regulates growth of the eye. Various authors have suggested that accommodation can influence myopia development as well, perhaps through an increase in the pressure of the eye which causes it to distend.

Prevention of Refractive Error

Speculation on the etiology of myopia is important because if myopia is caused then maybe it can be prevented. A variety of techniques have been tried with children at risk of myopia including visual training of various sorts, bifocals, and rigid contact lenses. No method has yet proved effective.