First description of aniseikonia

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The first mention of inequality of retinal image size has been traced back from 1864 to 1669

The clinical syndrome of aniseikonia, where the retinal images differ in size in the right and left eyes, was prominent during the middle of the last century. Precise methods were developed for its measurement, sophisticated optical devices were designed for its correction and the topic gave a substantial impetus to the analysis of the geometry of visual space.

The history of aniseikonia is covered in his usual thorough and scholarly manner by Duke-Elder.¹ Ophthalmologists had wrestled with the problem in the late 19th century, but according to Duke-Elder, its first treatment was by Donders² in his seminal *On the anomalies of accommodation and refraction of the eye* published in 1864. In connection with the difficulties experienced by patients on the first correction of anisometropia, Donders wrote:

The cause of this is principally that when the distance of distinct vision is made equal, the image of the two eyes are not equal, but different, particularly in magnitude. (p 565)

It is therefore of interest that a reference to unequal image sizes predates Donders' citation by almost two centuries. The clue is contained in a single paragraph of the treatise *De la recherche de la verité (In search of truth)* by Nicolas Malebranche, published in various versions between 1674 and 1712. The paragraph reads as follows³:

Since it is not certain that there are two men who view the same object as having the same size, and since sometimes even the same man sees things larger with the left eye than

with the right [one of my friends always sees the letters of a book larger with the right eye than the left], according to observations reported in the *Giornale de letterati*, January 1669, it is clear that we must not rely on the testimony of our eyes to make judgment about size.³

Malebranche, 1638–1715, a French priest, taught mathematics in Paris for the Order of the Oratory from 1674, and became a member of the Academie des Sciences in 1699. His book contains discussion of many optical and visual phenomena. In vision research, he achieved lasting fame for a meticulous explanation of the moon illusion and for being the first, by 150 years, to lay out a geometrical-optical illusion: a vertical line looks longer than a horizontal one of equal length.⁴

The 400-word entry on pages 11–12 of the 29 January 1669 issue of *Giornale de letterati* that Malebranche referred to is what we would now call a letter to the editor, by Sig Giovanni Alfonso Borelli, titled "Alla virtù ineguale degli occhi". Borelli reports that while viewing distinct and conspicuous objects, he sees them of different size through his two eyes. He made comparisons between the two eyes viewing a round hole in a window of a dark room. In addition, he hung a black ball in the middle of an open window, viewing it first with the right and then with the left eye, and found a difference in the images. This effect was observed

The passage in question is not in the original 1674 edition to which I was kindly given access by the Bancroft Library at the University of California, Berkeley. It must, therefore, have been inserted some time before the 6th and final edition, on which the English translation is based

not only in his own eyes but "anche à molto amici"—also in many friends.

It is not accidental that the contribution contains not just a casual observation but also experiments, for the author, Giovanni Alfonso Borelli (1608–79), was a famous physiologist, still remembered for his demonstration that muscular contraction was not caused by the expansion of gases.⁵

In most modern studies, direct comparison of the image size of the two eyes has been replaced by the more sensitive procedure of using three-dimensional spatial distortions caused by the binocular disparity that aniseikonia induces. However, the stereoscope and the differences in the images in the two eyes in stereoscopy were not discovered until the 1830s, and this analytical procedure was unavailable to the earlier investigators.

As Donders explained, aniseikonia is most commonly encountered with spectacle corrections in anisometropia. The closer to the eye's principal point an optical correction is located, the less is its effect on the retinal image size. Hence, the introduction of intraocular lenses after cataract extraction, the use of contact lenses and the prevalence of refractive surgery, all are nowadays serving to mitigate the incidence of aniseikonia. But placing its first mention back from 1864 to 1669 has considerably extended the time span during which inequality of the retinal image size in the two eyes has attracted the interest of vision researchers.

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