Not seeing eye to eye

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In the Eye's Mind: Vision and the Helmholtz–Hering Controversy. By R. Steven Turner. *Princeton University Press: 1994. Pp. 338. $49.50, £37.50.*

MODERN science is increasingly done by committee: credit and blame are spread over many authors, whose publications are a bland lowest-common-denominator of their opinions. In the nineteenth century, single authors were the norm and the level of their polemic can seem strange to modern eyes. This personal quality had other consequences: even the most eminent scientists tended to make their own observations; and the higher one's standing, the more credence the results received. In the hands of a careful, shrewd observer this could be beneficial, but it could also be disastrous, as when Blondlot deluded himself, the French Academy of Sciences and many respected scientists into believing in the existence of N-rays; when shown to be in error, he went mad.

Steven Turner gives a scholarly account of two of the most famous antagonists of that era: Hermann von Helmholtz and Ewald Hering. Of the two, Helmholtz is better known today, largely because of his remarkable ability to ride the crest of the wave of contemporary science. Hering was in comparison an outsider, but also more of a visionary: at a time when the very existence of single neurons was disputed, he proposed what are today called Hebbian synapses, whose strength is modified by use.

Although Hering is largely forgotten, a century ago he was more nearly Helmholtz's equal: in the edition of Poggendorff's biographical dictionary that covers the period 1904–22, it is Hering who is given more space (although this must have reflected his then recent death). Hering's entry in 1958 is similar to that in the earlier edition, whereas Helmholtz's has grown by an astonishing 50-fold.

Hering tends to sound irascible in his writings, but his modern characterization as a solitary misanthrope cannot be accurate. He was clearly capable of negotiation and persuasion, since he was a leading force in establishing, and was the founding rector of, the German University in Prague, which was for half-a-century a centre of academic excellence in central Europe. Further, he gathered around him a group of devoted followers, which Helmholtz never achieved.

Although they disagreed on many topics, colour vision is perhaps the most accessible and certainly the best-known. Helmholtz followed Thomas Young in holding that there are three types of receptor, each responding to a limited portion of the visible spectrum such as red, green or blue, and that all other colour sensations arise when these receptors are stimulated in various ratios. Hering also believed in three types of receptor (although these were not necessarily the retinal cones), but postulated that activity in each type is increased by light of one colour and decreased by its complementary colour. This resulted in three opponent processes, one sensitive to variation along a red–green dimension, one along yellow–blue and one along black–white. This proposal, which was fundamentally qualitative and supported by such observations as the fact that one can see reddish yellows or greenish blues, but not reddish greens or yellowish blues, found disfavour among the chemists, who could find no photochemical reactions with this property, and among the physiologists, who held that stimulation could increase, but not reduce, nervous activity.

Interestingly, neither scheme originated with the person with whom it is usually associated. Twenty years before Young, a London merchant named George Palmer proposed a theory of colour vision that is essentially identical to Young's. Palmer's ideas were described in Lichtenberg's *Magazin*, a periodical that had much the same function as the News section of *Nature* today and with which Young was familiar. Curiously, although Turner acknowledges the advice of J. D. Mollon, who has written on Palmer, he follows tradition in attributing the trichromatic theory to Young. Hering was anticipated by Arthur Schopenhauer, who in his youth was much influenced by Goethe and who in 1816 proposed an explicit opponent-process model. His book went into two further editions, the last published in 1870, when Hering was formulating his ideas on vision. Although the opponent colours that Schopenhauer proposed (red–green, orange–blue and yellow–violet) differ from Hering's, the principle is similar; and considering Schopenhauer's prominence, Hering must have been aware of his theory.

In the course of time, the balance tipped firmly in favour of Helmholtz, as colour science became increasingly identified with colorimetry, the branch of applied physics that deals with specifying colours in terms of mixtures of certain real (or better, ideal) primary colours. Because

The Magic Lantern **by Charles-Amédéé-Philippe van Loo (1764). Taken from Barbara Maria Stafford's *Artful Science: Enlightenment Entertainment and the Eclipse of Visual Education*. MIT Press, $35, £24.95.**