# Informed by nature's light

*Arthur Zajonc*

**Color and Light in Nature**. By David K. Lynch and William Livingston. *Cambridge University Press: 1995. Pp. 254. £40, $69.95 (hbk); £17.95, $29.95 (pbk).*
**Optics in the Age of Euler: Conceptions of the Nature of Light, 1700–1795**. By Casper Hakfoort. *Cambridge University Press: 1995. Pp. 243. £35, $64.95.*

THE subject of light warrants a wide range of treatments, and these two books exemplify the extremes between which such treatments can fall. At one end of the spectrum is *Color and Light in Nature*, a beautifully illustrated popular account of atmospheric phenomena written by David Lynch and William Livingston, both of whom are US astronomers with a fine eye for colour in the sky. At the other end lies Casper Hakfoort's meticulous research monograph on the conceptions of light between 1700 and 1795. Both volumes are worthy additions to the corpus of works on light.

Lynch and Livingston pick up where Minnaert left off in his classic *The Nature of Light and Colour in the Open Air*. They take the reader through hundreds of light and colour phenomena visible in the sky overhead, ranging from the straightforward to the exotic. Each account is succinct and lucid, illustrated by both diagrams and photographs, some stunning in their beauty. A distinguishing feature of their account is a systematic attempt to give clear scientific explanations for each effect, including appropriate graphs and tables, while avoiding the underlying mathematics. Often the treatment is straightforward, but in a surprising number of cases one can make reasoned assertions only, which the authors are careful to frame as such. The balance of description and physical explanation is excellent. Many teachers as well as a good many naturalists will find the book to be a highly useful and comprehensive treatment of a beautiful subject, one that can be used to enliven dry classroom discussions of optics, light and colour.

My one complaint is that the authors do not give enough emphasis to the role of the human visual system in producing some of the effects. For example, in their treatment of coloured shadows, they include in the analysis the role of the incident light and the object but neglect the psychological dimension. It is well known that coloured shadows are largely due to a psychological effect sometimes termed chromatic adaptation. The entire book is concerned with seen colours, and these arise not only through the physical interaction of light with air and water, but also depend on the complex action of the eye and mind of the observer.

In *Optics in the Age of Euler*, Casper Hakfoort provides us with a careful, one might even say cautious, study of the various conceptions of light prevalent during the Enlightenment. This is a forthright historical presentation of the major (and not so major) theories of light, proceeding chronologically from Newton and Descartes through to Euler and the subsequent reception of his wave theory. Hakfoort strives throughout to avoid historical condensation by giving detailed, nuanced treatments of specific ideas held by specific individuals. One will find no sweeping generalizations here, but only the measured voice of careful textual analysis (often in the original language). The author summarizes clearly the ideas of each person, noting differences and commonalties before moving on to the next one.

For example, the usual simplification of 'wave versus particle' is avoided. At the beginning of the eighteenth century the debate was, rather, between mechanistic accounts of light, whether Newton's or Descartes', and those derived from Aristotle that held that qualities are not derivative but have ontological status in themselves. The antagonism between emission theories and 'medium' theories arose only gradually, coming into clarity in Euler's important work *Nova theoria* (1746) which presented the first serious medium theory of light. Surprisingly, Hakfoort shows that many in Germany persisted in holding to a wave theory until photochemical experiments came onto the scene. Until this point, little originality is apparent in the book, but in his epilogue Hakfoort advances, again cautiously, a historiographical suggestion that I find convincing. Science from 1700 on is usually divided (following T. S. Kuhn) into mathematical and empirical branches. Hakfoort argues that this twofold division misses the important stream of natural philosophy still active in the eighteenth century. For Descartes, Euler and others, the issue is not only one of mathematical formalism, nor of data alone, but what light really is. One might go even further than Hakfoort and ask whether science even today has given up the longing to know the true nature of things. □

*Arthur Zajonc is in the Department of Physics, Amherst College, Amherst, Massachusetts 01002, USA.*