Joseph Priestley (1733–1804)

“In order to facilitate the advancement of all the branches of useful science, two things seem to be principally requisite. The first is, an historical account of their rise, progress, and present state; and the second, an easy channel of communication for all new discoveries. Without the former of these helps, a person every way qualified for extending the bounds of science, labours under great disadvantages; wanting the lights which have been struck out by others, and perpetually running the risk of losing his labour, and finding himself anticipated in the discoveries he makes, which is a great mortification and discouragement. In other respects, also, the progress of natural knowledge is retarded on this account; so that, in the present state of science, such histories as these are, in a manner, absolutely necessary.” (Priestley 1772, page i)

Joseph Priestley (figure 1) died two hundred years ago in Northumberland, Pennsylvania. In 1791 he was driven out of Birmingham because of intolerance for his political and religious views. He moved initially to London, then to the New World where he hoped to find a less hostile atmosphere for his ideas. His bicentenary has been marked by many groups, not least, by chemists. His experiments isolated “different kinds of air”, including oxygen, but he did not integrate his results with emerging contemporary chemical theory. After his death, it was said that he was the father of modern chemistry but he failed to acknowledge his child!

His range of interests was wide and he wrote extensively on science, language, philosophy, and religion. His circle of scientific friends was similarly broad, extending...
from Benjamin Franklin to the worthies of the Lunar Society (see Uglow 2002). He was a successful teacher and communicator of ideas and was encouraged by his friends to convey the concepts of natural philosophy to a wider audience. He commenced with an account of electricity (Priestley 1767) which proved both popular and introduced him to many of Europe's leading researchers in this area. The book ran to five editions during his lifetime and was translated into French, German, and Dutch. Its success fuelled his desire to continue with such compendia. In 1770 he published an introduction to perspective and two years later his history of optics. Indeed, as is evident from the quotation at the head of this editorial, he was a champion of using history as a vehicle of scientific communication. He had so applied it with success to electricity, and the same strategy was employed for his analysis of vision. Priestley’s History and Present State of Discoveries relating to Vision, Light, and Colours commenced with a frontispiece biographical time chart, in which Alhazen was the first name. His history of optics was divided into six periods. The first was concerned with the revival of learning in Europe. Here he presented the views of the ‘antients’ with regard to light and the rainbow and the transmission of these ideas in the writings of Alhazen and Roger Bacon. The second period extends to Descartes and Kepler, and introduces telescopes and microscopes. The third addresses the advances made by Descartes and his contemporaries. The fourth period travels from Descartes to Newton, and the fifth is concerned with Newton's discoveries. The final period, which takes up half the book, covers the discoveries made after the time of Newton. Priestley provided some ‘Additions’ which related to books that had been published during the preparation of his history; it also included an explanation of the technical terms used, an index, and a list of books consulted.

Priestley’s history was avowedly derivative both with regard to the text and to the figures he reproduced; he copied large sections from earlier books on vision, notably those by Smith (1738/2004) and Porterfield (1759). Priestley did, however, sample the field broadly and he was up-to-date. He also made a point of restricting reference to books he had consulted: “Neither in this volume, nor in the history of electricity, shall I be found to have made a parade of quoting any author that I have not actually consulted” (1772, page ix, original italics). This restriction did leave some gaps in his accounts of vision, particularly binocular vision, but they were filled by subsequent works such as those by Harris (1775) and Wells (1792). The book was translated into German but it was not a publishing success; Priestley did not recoup the costs of the books he had purchased in order to compile his history.

Priestley was a master of many tongues and he often included translations of works published in languages other than English. For example, he provided an account of the experiments conducted by Patrice D’Arcy (1765) on measurements of visual persistence:

“For this purpose he contrived a machine, which consisted of a cross, turning horizontally upon its center, by means of a wheel and a weight, the velocity of which he could vary at pleasure, and ascertain to the utmost exactness. To view this machine, he placed an observer at 28 toises [about 55 m] from it, in a room in which no light was admitted but what came from the object (which was a live coal fastened upon the cross) and the experiments were made in the night time. In these circumstances, using every precaution that he could think of, he found that the coal seemed to make an uninterrupted circle, when it revolved in 8 thirds of a minute [8/60 s]; and that no velocity less than this would answer the purpose. It made no difference at whatever distance from the center of the cross the coal was placed, or whether the machine was viewed through a telescope, or in any other manner he could think of applying. The result was also the same, at whatever distance the machine was viewed.” (Priestley 1772, pages 634–635)
One of the topics Priestley considered in several parts of his book was the seat of vision. This related to the interpretation of Mariotte's (1668) experiment concerning the insensibility to light falling on the insertion of the optic nerve. Priestley described and illustrated (figure 2) a simple way of demonstrating the phenomenon. His preference was for assigning the retina as the seat of vision rather than the choroid, but he was not totally convinced of this.

Priestley also provided a platform from which novel ideas could be communicated to the scientific public. One of the earliest accounts of the hereditary basis of anomalies of colour vision was channelled through Priestley. A Reverend Whisson reported a case to Priestley, noting the links across three generations: the father was colour defective, unlike the mother, but her brother had abnormal colour vision; one daughter was normal, a son and a second daughter were colour defective; the second daughter bore two colour defective sons and a colour normal daughter, while the son had a boy and girl who were colour normal:

“I am willing to inform you ... of my inability concerning colours, as far as I am able from my own common observation. It is a family failing: my father has exactly the same impediment: my mother and one of my sisters were perfect in all colours: my other sister and myself are alike imperfect: my last mentioned sister has two sons both imperfect: but she has a daughter who is very perfect: I have a son and a daughter, who both know all colours without exception: my mother’s own brother had the like impediment with me.” (Whisson 1778, page 612)

Thus, the essential clues to the hereditary nature of certain colour deficiencies were available at this early stage. The remarkable aspect of this report is that the brother of the mother was colour defective, too, rendering the occurrence of a defective daughter comprehensible. Despite Whisson's description of a colour defective female, John Dalton (1798) said that he had never heard of such a case.
A short history of perspective was presented in the second period of Priestley’s optics. Two years earlier he had published a monograph on the subject. In the book he described the practicalities of drawing in perspective and he clearly revelled in its virtues:

“The art of drawing in perspective has so many, and such obvious uses, that there can be no occasion to enumerate them. Those who want to communicate their ideas to others often feel the imperfection of sounds, or of characters that represent sounds, for this purpose; and those who are desirous of receiving information find, that it is, in many cases, conveyed with unspeakably more ease and certainty, by the eye, than by the ear.” (Priestley 1780, page 3, original italics)

It is clear that Priestley was an intensely visual individual. Vision is prominent in his survey of light and colours, and he found visual representations a powerful form of communication. He surveyed the major problems of his day, like colour vision, accommodation, distinct vision, illusions, and the perception of direction and distance. He did not add greatly to any of these areas, but he did provide an analysis that was useful to others.

Since this tribute to Priestley started with a quotation extolling an appreciation of the precursors of present-day perception, we will end with one, too:

“I have adopted the historical method because it appears to me to have many obvious advantages over any other for my purpose, being particularly calculated to engage the attention, and to communicate knowledge with the greatest ease, certainty, and pleasure. Moreover, the recital of the labours of philosophers in an historical method gives a writer a better opportunity than a systematical method would do, of transmitting them to posterity in such a manner as will operate most powerfully on the minds of the readers, and be a motive with them to exert and distinguish themselves in philosophical pursuits. To such considerations as these the mind of man is never wholly insensible.” (Priestley 1772, page vii, original italics)

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