WILLIAM EMERSON
A FOOTNOTE TO HECHT

DEAC ROSSELL

In his magnificent *Pre-Cinema History, an Encyclopedia and Annotated Bibliography of the Moving Image Before 1896*, the late Hermann Hecht gave no annotation to his entry No. 77E:

> Emerson, William
> *The elements of optics in four books.*
> London: J. Nourse, 1768, 351pp
> (from 679, no. 14)

The entry was taken from a typewritten list of books and periodicals published before 1914 (No. 679) held by the members of the International Federation of Film Archives. Hecht characterised this as 'an extremely valuable source on pre-cinema and cinema history and has been very helpful to me', notwithstanding the 'number of typing errors... and no indication whatsoever of the contents of books'. If Hecht ever saw a copy he did not make an annotation; nor is the book summarised by later writers, from whom Hecht often drew information about books not easily to hand. Author John H. Hammond, for example, takes no notice of Emerson's book in his extensive bibliography to *The Camera Obscura. A Chronicle*, published in 1981.

A copy of Emerson's book has now turned up, however, and we are able at last to fill in the missing entry. It turns out to be a book that Hermann Hecht might well have enjoyed writing about, for while it has no startling revelations about the projected image, it seems to be one of the fullest and most comprehensive summaries of information on the magic lantern, solar telescope and microscope, and camera obscura to have been published in the English language by the middle of the 18th century. A new No. 77E might look like this:

> Emerson, William
> *The elements of optics in four books.*
> London: J. Nourse, 1768, pp xii, 244, 15 folding plates (136 ill.), 8°. bound with: Emerson, William: *Perspective: or, the Art of drawing the Representations of all Objects upon a Plane. In Two Sections.* London: J. Nourse, n.d., pp viii, 111, 15 folding plates (76 ill.).

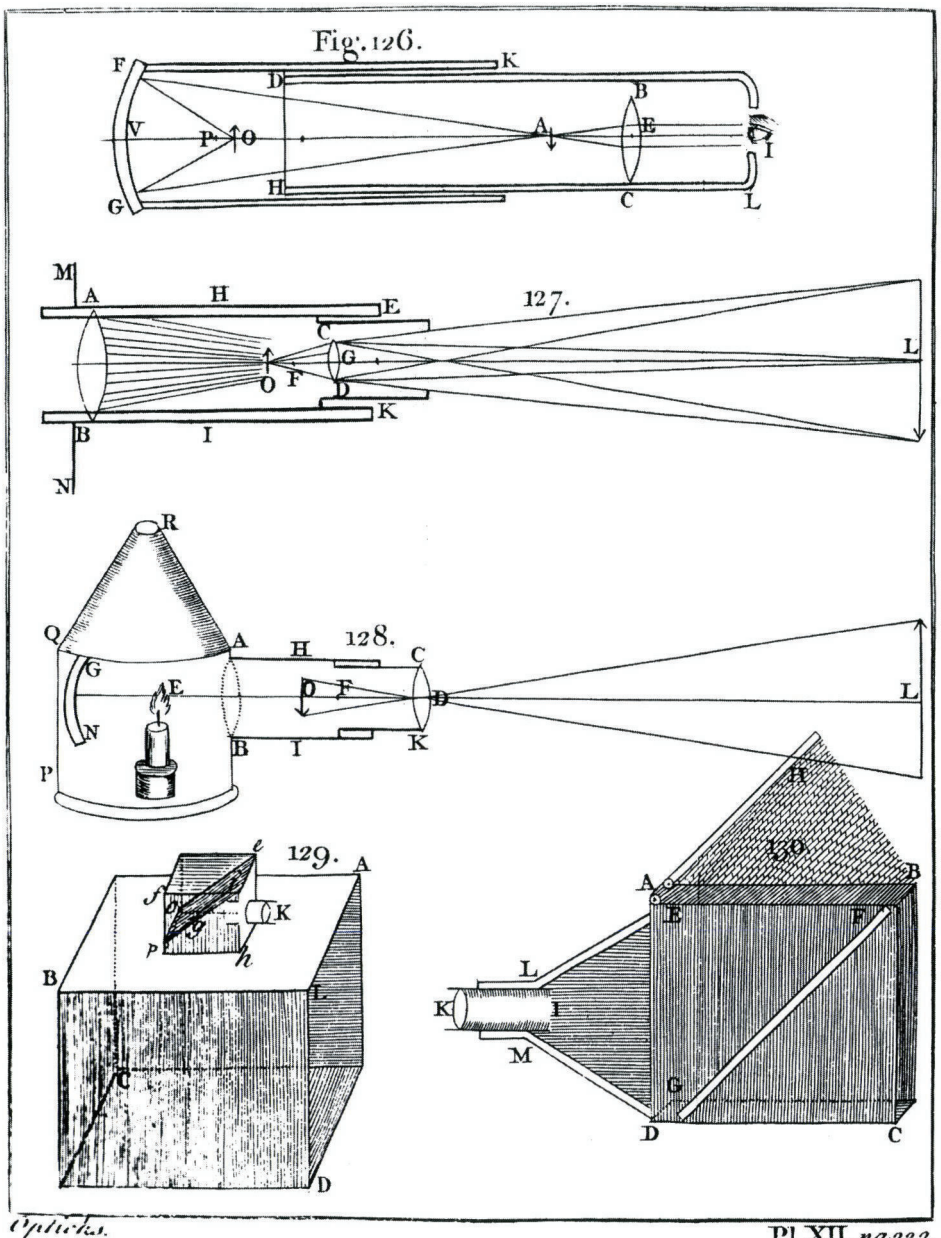
The elements of optics in four books is a textbook for the student of the science of optics, very much based on Sir Isaac Newton's 1704 work. Emerson reprints several of Newton's tables and refers to him frequently as 'our great Newton, the Prince of Philosophers'. For J. Nourse, 'Bookseller in ordinary to his Majesty', located in the Strand, William Emerson was a prolific writer. As well as texts on Trigonometry (1764), Geometry (1763), Arithmetick (1763), Algebra (1764), and Navigation (two editions, both 1764), he was the author of *The Arithmetick of Infinites, Conic Sections, and the Nature and Properties of Curve Lines* (1767).

Book I of *The elements of optics* explains the 'Simple Optics' of direct vision and the nature of light and colour. Book II, 'Catoptrics', discusses the reflection of light from plane and spherical surfaces. Book III, 'Dioptrics', is an extended treatment of the refraction of light through one or more surfaces. Book IV, 'Optical Instruments', deals not only with the structure of the eye, but also that of telescopes, microscopes, the magic lantern, the camera obscura and 'several machines for shewing perspective views'. It ends with an explanation of the colours of the rainbow.

In Book IV, Chapter XXIII, 'To make a magic Lanthorn', Emerson describes a magic lantern made of tin about a foot in diameter, or alternatively a square box made of wood, illuminated by a candle or lamp, with a concave reflector and a concave lens of 3-inch focal length (Ill. 128, Pl. XII). His lens is placed in a tube 4 inches long which slides inside another tube about 8 inches long, fixed to the side of the lantern, as first described by Deschales in 1674 (Hecht, No. 27). Emerson also suggests that a deep convex lens mounted at the inside end of the tube can act as a condenser instead of the concave reflector, as first described by William Molyneux in 1692 (Hecht, No. 39), focusing the rays of the lamp upon the projected slide. He also describes further variants in building a lantern, particularly the use of two lenses in the tube 'to make the rays converge sooner', recognising as well that in this case 'there must be placed a stop between them with a hole to let the light thro', and cut off the superfluous rays'.

The slides to be projected are placed, inverted, in the tube just beyond the focus of the lens, so that the distances between the slide and the focus point, the lens, and the image on a wall are continuously proportional. After the images have been painted on thin glass in dilute and transparent colours ('best done with oil of spike, mixt with several sorts of colours; they penetrate the glass and dry presently'), Emerson suggests that the glass then 'be put into sliders, three of them in one slider', and placed in a line between the flame of the lamp or candle and the lens.

Emerson repeats William Molyneux's 1692 observations, in *Dioptrica Nova* (Hecht, No. 39), that the projected image is 'generally some ludicrous or frightful figure, on purpose to divert the spectators', and he comments that 'small living animals may also be used; and some of them make a most terrible appearance.' In use, the magic lantern is carried into a dark room, set on one side, the lamp lit, the box closed, and, a slide being properly inserted, the image will be given erect on

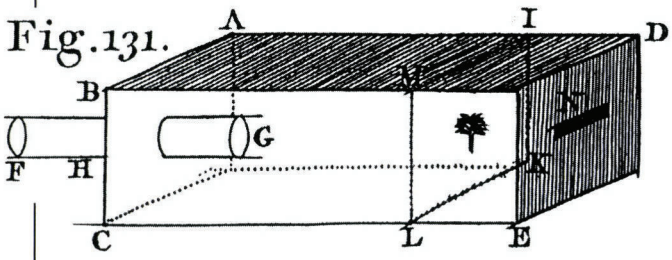


the opposite wall. The slide is illuminated in part by the direct light of the candle or lamp, but more so by the reflection from the convex mirror at the rear of the case. Moving the inner sliding tube with its fixed lens will make the image distinct on the wall.

Prob. XXII gives a precise optical definition of a solar microscope (Ill. 127, Pl. XII), with its collecting lens placed in a scioptric ball in 'a hole in the window shut'. Alternatively, Emerson describes briefly, but does not illustrate, a mirror-glass which can be adjusted 'by turning some screws or pins' and set at an angle to reflect the sun's rays horizontally through a fixed microscope tube.

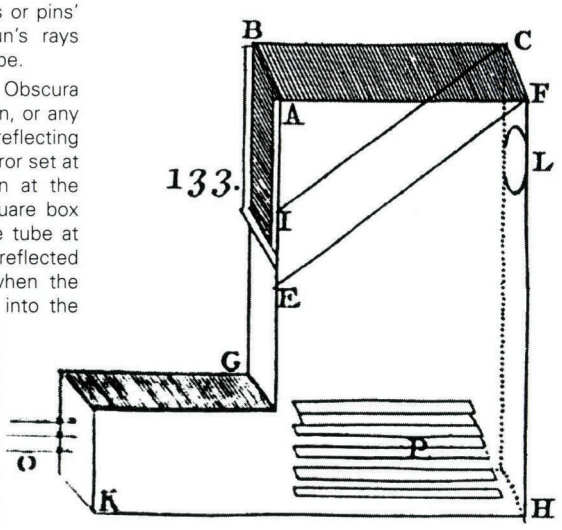
In Book IV, Prob. XXIV, 'To make a Camera Obscura for taking the draught of a country, a town, or any building, &c.', Emerson describes a reflecting camera obscura (Ill. 129, Pl. XII) with a mirror set at 45 degrees in a small 6-inch box, open at the bottom and set on top of an 18-inch-square box open at the side. A lens in an adjustable tube at the side of the small box produces a reflected image on the floor of the larger box when the draughtsman inserts his head and hand into the lower box and draws a curtain around him to block off exterior light. He also describes variants where the lens is fixed perpendicularly under the mirror, requiring 'a greater height of box', so that the image is first reflected and then subsequently refracted by the lens. Another version has the lower box completely closed except for a hole through which the draughtsman's hand can reach his paper in the bottom of the box, and a second hole near the top which he can look through. Emerson comments: 'and there the side of the box should be slanted off'.

Several kinds of portable camera obscura for viewing distant objects are considered in Prob. XXV. The first is a reflecting camera obscura (Ill. 130, Pl. XII) with an adjustable lens and a wooden hood that swings up to shade the viewing glass on three sides. The viewing plane is of glass with the 'upper side unpolished', making a kind of 'ground glass' surface on which the image may be seen or traced clearly.



The second proposal is for a peep-box camera obscura (Ill. 131, Pl. XIII), 2 feet long and 9 inches wide, with two lenses in its adjustable tube. The user looks through a slit cut at one end to see the upright image captured on a sheet of oiled paper or plane glass fitted parallel to the viewing slit. The use of three lenses, for further magnification, is also possible with this apparatus, although strong sunshine is then necessary to compensate for the loss of image brightness.

Emerson's next three devices (Prob. XXVI) are all used to magnify perspective drawings. The first (Ill. 132, Pl. XIII), shows how binocular vision through a 4-inch-diameter lens captures the mirror reflection of a drawing placed in the opening underneath the raised box of the instrument. The other two devices are perhaps more interesting as they describe optical systems useful not only to the artist or draughtsman but also to the showman of the early 18th century. In the simpler of the two (Ill. 134, Pl. XIII), a drawing is inserted at a precise angle into the top corner of a box. The image is then reflected in a large concave mirror, up to 12 inches in diameter, which is set at a corresponding angle at the other end of the enclosure. The image is viewed through a slit on the opposite side of the box just below the picture. Light enters the apparatus from the wholly or partially open top. If this device was in reasonably common use by mid-century, then very close examination must be undertaken in seeking out early representations of optical shows and peep-boxes, for no lens or other optical device shows on the outside of the wooden enclosure.



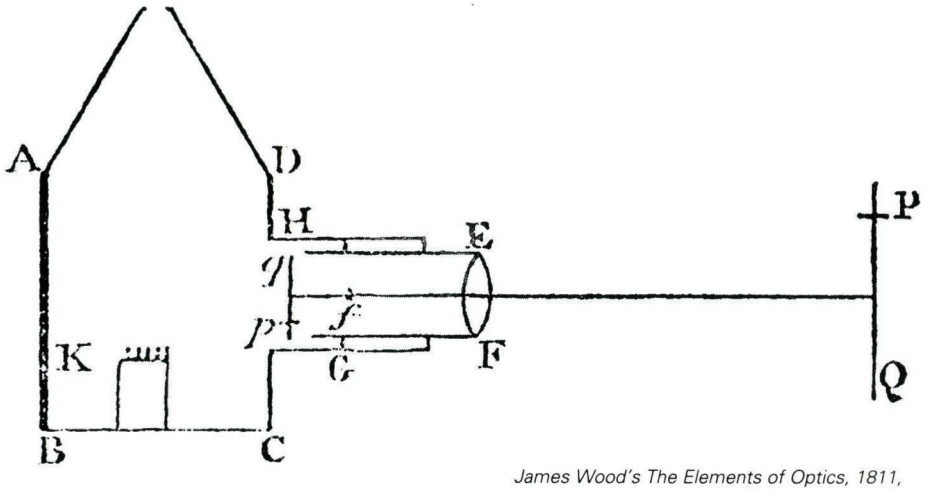
Emerson's final viewing machine (Ill. 133, Pl. XIII) is a tall closed box. Its reflecting mirror picks up the image of one of the dozen or so drawings stacked on the bottom of the box, which are manipulated by attached strings or rods. The viewer sees the images in the mirror through a large lens fixed in the side of the box, into which light enters through a thin cloth beneath the mirror. Two or three lenses will allow several people to see the magnified image at once, as the images are successively drawn aside in the bottom of the box.

In his *Perspective: or, the Art of drawing the Representations of all Objects upon a Plane*, Emerson gives a thorough treatment of every kind of issue in generating perspective drawings, including a treatment of anamorphosen in Sect. II, Prob. XXIX, titled 'To draw a deformed or monstrous picture upon a plane, which shall appear regular, from a certain point.' After a long technical description of the perspective angles involved (Ills. 80 and 81, Pl. XV), he suggests that the problem of forced deformity may also be solved mechanically, by holding a candle in the air and drawing the shadow of the object upon a plane surface, or, better, having the candle (or the sun) shine through a small hole in an opaque sheet interposed between the light and the object. In this way, he notes, 'a deformed figure may be drawn upon the surface of a cone, or any solid; which will appear regular from a certain point of view.'

If the first half of the 18th century was a time of rapid development for the magic lantern, with improvements in the technology of both lantern and slides, and an ever-expanding number of travelling Savoyard lanternists and galanty showmen entertaining in both the parlours of the rich and the streets of the working man, then it was also a period in which the lantern gradually became divorced in the mind of earnest scholars from the multiplying array of telescopes and microscopes that were finding new and useful applications in the scientific world. Emerson proposes no experimental or practical uses for the lantern, fixing it wholly within the world of frightful representations and of an incredulous and ignorant populace, 'on purpose to divert the spectators'.

In repeating Molyneux's phrase of 1692, Emerson is at one with several of his closer contemporaries. In 1756 the Abbé Nollet famously complained, in *Leçons de physique experimentale*, that the magic lantern had become almost ridiculous, 'paraded in the street' for the amusement of children and common people (Hecht, No. 72). And in 1763, Benjamin Martin, writing in London, complained that 'the tribe of Miracle-Mongers found their cause of Imposture to be... much promoted by this Instrument' (Hecht, No. 76).

One further piece of evidence for the gradual decline of interest in the magic lantern in scholarly circles is the copy of Emerson at hand. Bound with his *The elements of optics* and *Perspective* is yet another textbook on the properties of light: James Wood's *The Elements of Optics: Designed for the Use of Students in the University*, Cambridge 1811, pp. 250. This third edition of a text by a Fellow of St John's College, printed by J. Smith, Printer to the University, dispenses with the magic lantern in three brief paragraphs of simple optical description. It was not until the mid-19th century that the educational potential of the lantern was rediscovered by a growing middle class interested in visual representations of the fast-changing world around them. William Emerson, then, hovers between two worlds: he still felt obliged to collect and summarise all of the information from his scientific predecessors who were discovering the lantern's properties and writing about their original insights into its construction and operation, but as one of the last of the first wave of scholarly interpreters of the lantern, his now-forgotten treatise held little new meaning for the many later writers who developed a new literature of the science and technology of the lantern in the second half of the 19th century.



James Wood's The Elements of Optics, 1811,