FOCUS

Taking Note(s)

*By Lorraine Daston**

ABSTRACT

Because reading was and remains a central aspect of doing science, reading practices may provide insights into cognitive practices—such as observation, economies of attention, arts of memory, and the solidification and erosion of belief—in the context of science. Reading has since ancient times been the model for all forms of understanding and possibly also the template upon which other ways of making the world intelligible were formed. Reading practices may also provide keys to the formation of the specifically scientific self, as they have more generally for that of the learned habitus. Finally, collectivities of readers served as the prototype of all such virtual communities of savants, including the scientific community.

1543, 1632, 1687, 1753, 1859, 1905—this litany of publication dates (add your favorites) is emblematic of a whole historiography of science grounded in texts. In the past two decades, the older historiography of scientific texts has been all but buried by a historiography of scientific practices. The stimulating articles by Ann Blair and Jonathan Topham call for a new look at texts from the standpoint of practices, combining an analysis of what texts contain with consideration of how, when, where, why, and by whom they were read. As Blair and Topham explain, the aims of this new historiography of scientific texts are multiple: to reconstruct how an individual "acquires new knowledge and critical understanding through reading" (Blair); to discover how material form (octavo versus folio, luxurious vellum-bound volume versus cheap paper edition), physical setting (library, field, whizzing train), and bodily habitus (seated or standing, in concentrated silence or in the midst of laboratory hubbub) affect the assimilation of content; to ferret out collective modes of reading and the ways in which they are instilled and exploited (whether by early modern humanists or nineteenth-century Cambridge Tripos coaches); to explore the interactions between the ways in which texts are read and written (note-taking, marginal annotations, and the alarming habit of cutting out extracts or tearing out whole pages); and to track the reception of science in both learned and popular culture, in which the meaning of a text is in part generated through "an unequal struggle for hermeneutic control" (Topham). At least as diverse are the forms of evidence ingeniously deployed in the service of these inquiries: the various editions of a work, including their format, print runs, and distribution; the physical traces of reading left in books, from Newton's dog-earing to

* Max Planck Institute for History of Science, Wilhelmstrasse 44, Berlin 10117, Germany.

Isis, 2004, 95:443–448

0021-1753/2004/9503-0005$10.00

Darwin's ripped pages; the apparatus of notebooks, marginal annotations, commonplace books, indices, and other ways to organize and distill reading; the architectural plans and diaries that show how special spaces and times came to be dedicated to reading. After reading these two articles, historians of science will look at books with fresh (and avid) eyes.

In this brief commentary I would like to explore, in a tentative vein, the implications of the history of scientific reading for other, more familiar forms of scientific practice, such as observation, but also for what might be called cognitive practices: economies of attention, arts of memory, the solidification and erosion of belief. Reading is and has been for millennia so central and seminal an intellectual practice that it has long served as the principal metaphor for understanding *tout court*. More concretely, ways of reading, absorbed at a young age and constantly practiced, may supply the templates for other ways of making sense of objects quite distinct from the manuscript or printed page—the morphology of a plant, the trajectory of a comet, the slide under the microscope, the "reading" of an instrument. This would especially have been the case for those who—for reasons of class, gender, and the cultural status of literacy—would have learned bookish skills before or to the exclusion of manual ones. Reading practices may also mold the self of the reader, at least among those who devote many of their waking hours to intercourse with books. Despite the bibliophobic rhetoric that since the seventeenth century has upheld the study of things over that of words, portraits of scientists even in the nineteenth and twentieth centuries still depict their subjects with books as well as with test tubes, skulls, chemical models, and other tools of empirical inquiry. The norms of scientific publication ensure that scientists continue to read for much the same reasons they continue to write—and both incessantly. The library remains as essential to most sciences as the laboratory. What imprint do these ingrained habits leave upon the scientific reader?

For all but the blind, to read means also to see. The eye is as engaged as the mind, as the scholar's spectacles bear rueful witness. The Latin verb *legere* means "to read," "to select," but also "to survey" or "to observe." There are ready analogies between the kind of cognitive and sensory calibration required to develop collective ways of seeing and that represented by shared ways of reading, as described by Blair and Topham. Novices are taught to heed some details and ignore others, to parse the object under investigation—be it an anatomical preparation or a treatise—into units of analysis, and to connect what is being seen now with what has been seen before. In the case of illustrated texts, the shuttling back and forth between text and image, a process modified by medium (e.g., woodcuts can be integrated onto the same page as text; engravings require a different quality of paper and must therefore be bound separately from text), approximates observation still more closely. There are many examples from the sixteenth century onward of anatomists and naturalists conducting observations with books in hand, triangulating between word, image, and thing. In these cases, reading and observing are so tightly integrated as to form a single practice.[1]

Taking notes also binds together the practices of observing and reading. There seems to be an unbroken tradition of mingling notes taken on (or in) books read and on nature

[1] Gianna Pomata and Nancy G. Siraisi, "Introduction," in *Historia: Empiricism and Erudition in Early Modern Europe,* ed. Pomata and Siraisi (Cambridge, Mass.: MIT Press, in press). On the long-standing association of seeing and reading see Michael Camille, "Seeing and Reading: Some Visual Implications of Medieval Literacy and Illiteracy," *Art History,* 1985, *8:*26–49. On collective ways of seeing see, e.g., L. S. Jacyna, "'A Host of

observed from the sixteenth through at least the nineteenth centuries. Some sixteenth-century herbals had blank pages bound into them for the botanist to jot down field observations on the spot; the commonplace book of John Locke, the *Sudelbücher* of Georg Christoph Lichtenberg, and the notebooks of Charles Darwin are simply among the best-known examples of interspersed reading and observation notes.[2] More fine-grained analogies might be drawn between reading and observation. For example, the Renaissance humanist practice of excerpting short, pithy quotations from long texts for florilegia and commonplace books bears a close resemblance to the excerpting of short, pithy facts from the continuum of experience. Both practices were radically anti-contextual and anti-systematic, ripping out morsels of eloquence and information for use elsewhere and quite possibly to very different ends. Hence both tended to produce numbered lists, as in Francis Bacon's *Sylva sylvarum,* another potpourri of items culled from reading and observation.[3]

Taking notes entails taking note—that is, riveting the attention on this or that particular. All scientific and scholarly training imparts a distinctive economy of attention to practitioners, sharpening their senses and whetting their curiosity for certain domains of phenomena at the expense of others. From the seventeenth through at least the mid-nineteenth centuries, moralists attacked these specialized economies of attention as injurious to civic, religious, and familial duties. An obsession with butterflies or chemistry or some other branch of natural knowledge could, it was claimed, ruin family fortunes and preoccupy savants to the point where they no longer attended to the demands of their own health. Yet such criticisms also testified to the reality and power of such economies, while Enlightenment treatises on scientific observation underscored their importance, as well as the link between attentive reading and observing: "The *Observer* is a man who regards Nature like a book; whose characters he must seek to read rigorously, without concern to imagine the meaning they must have."[4] Essential to the management of scientific attention was the practice of taking notes, which entailed fixing the object under scrutiny firmly in one's gaze, "cropping" it to exclude its surroundings, describing it in words and sometimes also sketching it, and later reading and re-reading it in juxtaposition with the published observations of others and one's own further notes.[5] In both reading and observing, note-taking fortified the selective and focused exercise of attention—and closed the circle connecting

Experienced Microscopists': The Establishment of Histology in Nineteenth-Century Edinburgh," *Bulletin of the History of Medicine,* 2001, *75:*225–253; and Helen Macdonald, " 'What Makes You a Scientist Is the Way You Look at Things': Ornithology and the Observer, 1930–1955," *Studies in History and Philosophy of Science,* 2002, *33:*53–77. On the interaction of texts and images see Sachiko Kusukawa, "Leonhart Fuchs on the Importance of Pictures," *Journal of the History of Ideas,* 1997, *58:*403–427.

[2] Brian W. Ogilvie, *The Science of Describing: Natural History in Renaissance Europe, 1490–1620* (Chicago: Univ. Chicago Press, forthcoming), Ch. 4 (herbals); John Locke, "Adversaria physica," MS Locke d.9, Bodleian Library, Oxford University; Georg Christoph Lichtenberg, *Schriften und Briefe,* ed. Wolfgang Promies, 4 vols., Vol. 2: *Sudelbücher II: Materialhefte, Tagebücher* (Munich: Hanser, 1971); and Charles Darwin, *Charles Darwin's Notebooks, 1836–1844: Geology, Transmutation of the Species, Metaphysical Enquiries,* ed. Paul H. Barrett *et al.* (Ithaca, N.Y.: Cornell Univ. Press, 1987).

[3] On excerpting see Ann Blair, "Humanist Methods in Natural Philosophy: The Commonplace Book," *J. Hist. Ideas,* 1992, *53:*541–551; and Lorraine Daston, "Perché i fatti sono brevi?" *Quaderni Storici,* 2001, *108:*745–770. On Bacon's text see Graham Rees, "An Unpublished Manuscript by Francis Bacon: *Sylva Sylvarum* Drafts and Other Working Notes," *Annals of Science,* 1981, *38:*377–412.

[4] Jean Senebier, *L'art d'observer,* 2 vols. (Geneva: Chez Cl. Philibert & Bart Chirol, 1775), Vol. 1, p. 5. On the dangers of obsessive attention see Lorraine Daston, "Attention and the Values of Nature in the Enlightenment," in *The Moral Authority of Nature,* ed. Daston and Fernando Vidal (Chicago: Univ. Chicago Press, 2003), pp. 100–126.

[5] I know of no comprehensive work on scientific note-taking, but see Anke te Heesen, "Boxes in Nature,"

reading to observing to reading again. In addition to the fact that note-taking in the lab and in the field derived from note-taking on books, the processes by which attention was channeled and held, and by which seeing was converted first into writing (and drawing) and then into reading, are suggestive of how nature was made intelligible by being made legible.

Cognitive practices like the form of attention recorded and reinforced by note-taking correspond to very specific ways of reading, which have their own histories. The medievalist Mary Carruthers has written evocatively about how reading was, throughout the Latin Middle Ages, an act of memory but not necessarily one of memorization. Reading was less an act of interpretation, substantiated by appeals to exact textual citations, than one of rumination: "Reading is to be digested, to be ruminated, like a cow chewing her cud, or like a bee making honey from the nectar of flowers. . . . The process familiarizes a text to a medieval scholar, in a way like that by which human beings may be said to 'familiarize' their food. It is both physiological and psychological, and it changes both the food and the consumer." The reading practices associated with meditative reading, such as murmuring the words half aloud and recalling multiple texts as a chorus of internalized voices, would not have fostered note-taking based on pinpoint attention and faithful citation or description, whether directed toward a text or a natural phenomenon. The latter originates with humanist reading, "pen in hand, writing as he moved through text," an activity that required line-by-line, "continual attentiveness."[6]

Cognitive practices like memory and attention are to be distinguished from, on the one hand, explicit intellectual practices (e.g., the presentation of evidence and arguments in a journal article) and, on the other, the murky realms of individual creativity. Nor are they tacit knowledge, which can be transmitted but not explained; cognitive practices can be made both explicit and explicable. Rather, they are part of a learned (and learnèd) habitus, which has bodily, mental, and ethical components. One of the several services a history of scientific reading practices might render would be to unlock an as yet largely unwritten history of cognitive practices, which, like reading practices themselves, are at once collective but deeply internalized.

Just because reading practices and the cognitive practices associated with them become second nature, some recent literature on the history of reading has implicated them in the formation of the self, more particularly of an individuated ego that is most itself when left by itself. Starting as early as the fifteenth century, special "closets" or "cabinets" or "studies" began to be set aside for solitary reading, forging a strong association between reading and privacy, even secretiveness. By the eighteenth century the solitude of savants, interred alone with their books and instruments, had become both proverbial and potentially patho-

Stud. Hist. Phil. Sci., 2000, *31:*381–403; Janet Browne, *Charles Darwin: The Power of Place* (London: Cape, 2002), pp. 174, 362, 374, and *passim*; Frederic L. Holmes, Jürgen Renn, and Hans-Jörg Rheinberger, eds., *Reworking the Bench: Research Notebooks in the History of Science* (Dordrecht: Kluwer, 2003); and Marie-Noëlle Bourguet, "Le Carnet d'Italie d'Alexander von Humboldt: Écriture du voyage et construction savante du monde," Max Planck Institute for the History of Science Preprint 266. On drawing see Martin J. S. Rudwick, "The Emergence of a Visual Language for Geological Science, 1760–1840," *History of Science,* 1976, *14:*149–195, esp. pp. 153–154; and Madeleine Pinault-Sørensen, "Dessin et archives," in *Éditer des manuscripts,* ed. Béatrice Didier and Jacques Neefs (Saint-Denis: Presses Univ. Vincennes, 1996), pp. 39–52.

[6] Mary Carruthers, *The Book of Memory: A Study of Memory in Medieval Culture* (Cambridge: Cambridge Univ. Press, 1990), p. 164; and Anthony Grafton, "The Humanist as Reader," in *A History of Reading in the West,* ed. Guglielmo Cavallo and Roger Chartier, trans. Lydia Cochrane (Cambridge: Polity, 1999), pp. 179–212, on p. 207.

logical, widely believed to foment diseases of the imagination.[7] Yet the link between solitude and reading (and between both and the forging of an autonomous, individuated self) is easy to overstate. In the case of scientific reading, copious marginal annotations and note-taking suggest a dialogue between reader and book, even if it was more virtual than real. It must be kept in mind that, in an age of prolific learned letter writing, interactions between colleagues would often have consisted largely of exchanges of written missives, only occasionally animated by face-to-face encounters. Responding point-and-counterpoint to the contents of a book in its margins or in a notebook in some ways resembled answering the epistles of a distant correspondent with whom one might not have been personally acquainted.

The habit of reading pen in hand, copying out long passages (or even the whole book) or reworking mathematical problems or repeating observations, promoted a more intimate interaction between reader and text, in which the reader re-experienced the process of writing the work. Sometimes this process of recreation was deemed essential to grasping its message, as in the case of René Descartes's six *Meditationes* (1641), whose readers were meant not only to retrace Descartes's arguments but also to participate in his radical doubt and gradual restoration of belief.[8] The apparatus of annotations, citations, and footnotes enmeshed both author and readers in a web of other works, with their respective authors and readers. This on-paper community had its own social codes and conventions, and, judging from repeated medical warnings about the dangers of addictive reading, its hold on its members was often as strong as that of the flesh-and-blood communities to which they belonged. In his 1837 essay on Francis Bacon, the British historian Thomas Babington Macaulay pointed out the advantages of communion with dead authors in the library over conversations with live colleagues: "With the dead there is no rivalry. In the dead there is no change. Plato is never sullen. Cervantes is never petulant. Demosthenes never comes unseasonably. Dante never stays too long."[9] Only in the most literal sense would scientific reading have been, for most of the seventeenth through the nineteenth centuries (and probably beyond), a solitary pursuit.

Indeed, one of the most tenacious illusions cherished by readers is that of being in conversation with a book—not necessarily with the book's author, but with the book itself. This is most famously the case for works of fiction, as in the case of the tumultuous reception of Jean-Jacques Rousseau's *La nouvelle Héloise* (1761). The French *philosophe*

[7] On reading and the formation of the individuated self see Cecile M. Jagodzinski, *Privacy and Print: Reading and Writing in Seventeenth-Century England* (Charlottesville/London: Univ. Virginia Press, 1999), pp. 2–19. On solitary venues for reading see Roger Chartier, "The Practical Impact of Writing," in *A History of Private Life: Passions of the Renaissance,* ed. Chartier, trans. Arthur Goldhammer (Cambridge, Mass.: Harvard Univ. Press, 1989), pp. 111–159, esp. pp. 116–137; and Orest Ranum, "The Refuges of Intimacy," *ibid.,* pp. 207–263, esp. pp. 225–227. On diseases of the imagination see Samuel Tissot, *De la santé des gens de lettres* (1768), ed. Christophe Calame (Paris: Éditions de la Différence, 1991), pp. 69–77 and *passim*; and Johann Georg Zimmermann, *Über die Einsamkeit,* 4 vols. (Leipzig: Weidmanns Erben & Reich, 1784), Vol. 3, pp. 26–49.

[8] Gary Hatfield, "The Senses and the Fleshless Eye: The *Meditations* as Cognitive Exercises," in *Essays on Descartes'* Meditations, ed. Amélie Oksenberg Rorty (Berkeley: Univ. California Press, 1986), pp. 45–79. On the late sixteenth-century Jesuit tradition of meditation with which Descartes would probably have been familiar from his schooling at La Flèche see François Lecercle, "Image et méditation: Sur quelques recueils de méditation illustrés de la fin du XVIe siècle," in *La méditation en prose à la Renaissance* (Cahiers V. L. Saunier, 7) (Paris: Ecole Normale Supérieure, 1990), pp. 44–57.

[9] Thomas Babington Macaulay, "Francis Bacon" (1837), in *Literary Essays Contributed to the* Edinburgh Review (London: Oxford Univ. Press, 1932), pp. 289–410, on p. 291. On the mores of the Republic of Letters see Anne Goldgar, *Impolite Learning: Conduct and Community in the Republic of Letters, 1680–1730* (New Haven, Conn.: Yale Univ. Press, 1995).

Denis Diderot was so scandalized by a woman friend who laughed rather than cried over Samuel Richardson's novel *Clarissa* (1747) that he suspected her of lacking common humanity.[10] But the scientific reader reworking mathematical proofs or vetting the steps of an argument also communes with the book in hand, realizing its contents in every sense of the word. The illusion of immediacy in reading, strong even among historians who know full well how texts are produced and consumed in highly specific and various contexts, may be an error, but it is one so broadly held and deeply entrenched that it merits an investigation in its own right.

The history of reading practices has shown, compellingly and consequentially, that texts are material objects embedded in local milieux that imbue them with sense and significance.[11] Yet the notion of the universality of texts, especially but not exclusively scientific texts, across centuries and translations persists. Universality is in turn underwritten by the experience (however deceptive) of immediacy, of direct communion with the text. The disembodiment of texts is key to this mythology, although every text must become incarnate—even if only as electronic impulses on a flickering screen—in a particular form and language in order to be read. This sort of mythology is usually branded as Platonism, but there is precious little Platonic about it: each version of the text is not simply a wan emanation of a more perfect Idea; rather, the universality of texts depends on the strict equivalence of, say, Newton's *Opticks* published in London in 1704 and its 1787 French translation by Jean Paul Marat, critic of Newton and political radical. If there is any metaphysics behind it, it is that of a universal language or currency of exchange, effortlessly crossing borders and epochs. This is a powerful myth that a history of scientific reading practices may well refute—but one it must also explain.

[10] Robert Darnton, "Readers Respond to Rousseau: The Fabrication of Romantic Sensitivity," in *The Great Cat Massacre and Other Episodes in French Cultural History* (New York: Vintage, 1985), pp. 215–256; and Roger Chartier, "Richardson, Diderot et la lectrice impatiente," *Modern Language Notes,* 1999, *114:*647–666.

[11] For a cogent refutation of the putative link between printing and the universalization of texts see Adrian Johns, *The Nature of the Book: Print and Knowledge in the Making* (Chicago: Univ. Chicago Press, 1998), pp. 6–28.