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Chapter 3

Big Rhetoric, Little Rhetoric: Gaonkar on the Rhetoric of Science

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Dilip Gaonkar notes that the rhetoric of science is an argument a fortiori: "If science is not free of rhetoric, nothing is." Yes. The rhetorical studies of biology, economics, and mathematics over the past twenty years have used just this tactic, reading even scientific texts rhetorically. Gaonkar does not like it, not one bit. He wants to keep Science distinct from the rest of the culture. He wants rhetoric to stay in its cage. He is a Little Rhetoric guy.

The arguments he marshals to support his distaste for Big Rhetoric are unconvincing, though conveyed in a lively and authoritative style. They are not—as would appear from the surface rhetoric—based on the evidence of the works being criticized. By the length of his respectful summaries, in fact, Gaonkar admits that the writers he surveys do good work. A posteriori, therefore, the rhetoric of science is possible and good, even in Gaonkar's opinion. He depends for making his case against the rhetoric of science on the a priori: a rule of method says that the definition of rhetoric must be narrow, therefore rhetoric could not possibly apply to science, and so anyone who says otherwise must be an anything-goes, touchie-feelie relativist. But these arguments are specious. They are supported mainly by bluster.

In a long paper, Gaonkar manages to cover a surprisingly small number of works. For all the self-conscious elaboration, he treats a small selection of pieces by some of the people in speech communication and English/Rhetoric departments who have written on the rhetoric of science. Gaonkar admits when he gets down to business that he "concentrates on work produced within the discipline of

speech communication" (37). He narrows it further, to exclude for example John Lyne's or Henry Krips's work. His claim that "the rhetoric-of-science literature is not extensive" (39) is made true therefore by construction, by overlooking much of the work (as an embarrassing footnote admits). And in wider focus Gaonkar excludes the literature on the sociology and history of science, much of it rhetorical in character. This he does by labeling it "implicitly" rhetorical, and therefore not *echt* rhetoric. He gives no argument for ignoring the implicitly as against the explicitly rhetorical. This device for excluding most of the rhetoric of science would apply also to the literature by scientists themselves reflecting on their rhetorical practices, such as Fleck (1935), Polya (1954), Polanyi (1962), Chandrasekhar (1987), Gould (1993), and to all else beyond a tiny group of incoherently selected texts. Little wonder that he finds the field "not extensive."

The new sociologists and historians and rhetoricians of science call themselves "the children of Thomas Kuhn." Science studies have thrived since Kuhn spoke out in 1962, and the change can be summarized in one word: rhetoric. Gaonkar, by contrast, is the son of Edwin Black. He adopts Black's pre-Kuhnian view of how to treat the religion of Science in our culture. Gaonkar admires some of the children of Kuhn, especially the "Social Studies of Knowledge" undertaken by British sociologists such as Harry Collins, Trevor Pinch, Michael Mulkay, Barry Barnes, Malcolm Ashmore, Steve Woolgar—rhetoric of science by another name. But characteristically Gaonkar turns the success in Britain into an attack on his own department: "In the study of scientific controversies, a topic eminently suited for rhetorical analysis, the work of Harry Collins at the University of Bath exceeds anything the rhetoric of science has to offer both in terms of conceptualization and empirical work" (41).

I agree with the favorable assessment of Collins (Gaonkar does not seem to be aware of Michael Mulkay's work, which is still more rhetorical). We had a conference at the Project on Rhetoric of Inquiry some years ago that brought the British sociologists and the American rhetoricians of science together. We concluded that the two groups were doing essentially the same thing. Collins and I worked fitfully on a long paper drawing the analogy between Social Studies of Knowledge and the Rhetoric of Inquiry. Kuhn himself participated enthusiastically in the 1984 conference that initiated the rhetoric of inquiry. These people are rhetoricians, if sometimes ignorant of their own tradition.

Listen to how the SSK people talk. Collins:

> Scientists do not act dishonourably when they engage in the debates . . . ; there is nothing else for them to do if a debate is ever to be settled and if new knowledge is ever to emerge from the dispute. (1985:143)

And Mulkay:

> My chapters . . . investigate and describe certain recurrent forms of scientific discourse which occur in connection with technical debate. . . . They examine the relationship between participants' and analysts' discourse; between participants' and analysts' interpretative practices. . . . They explore the difference between monologue and dialogue. (1985:7)

More rhetorical one could not get. So hurrah for British sociology of science, and welcome to a late development in the 2500-year-old tradition of rhetoric.

What I do not agree with is Gaonkar's self-deprecating bluster against Speech Communication and its accomplishments in the rhetoric of science. Gaonkar uses social studies of knowledge against the rhetoric of science, making the best the enemy of the good. At seminars or conferences on rhetoric, someone from Speech Comm can be relied on to stand up and make the case against rhetoric. I have never understood this impulse. You would think the self-deprecator would be embarrassed to be caught making the bush-league point that speech, you know, is sometimes insincere. These are hard times for Speech Comm, and perhaps it is in such terms that one can understand the impulse to self-deprecation. Antirhetorical coastie deans full of zeal for science (as understood ca. 1965) view the Department of Speech Communication with suspicion—I need hardly remind the present readers that it is a midwestern field; or that in universities from Columbus to Seattle it is under administrative attack. You will find chemists trained at Cal Tech and turned administrators running around asking, "But what is speech communication?" and not staying for the answer. In the face of such an onslaught on her dignity, reinforced by the low place of persuasion in Western culture since Francis Bacon, rhetoric borrows prestige from her more respectable sisters. She dons philosophical white gloves and a pretty scientific pillbox hat, in the intellectual and sartorial style of 1965, and commences sneering at the lowly place from which she came.

It's a pity, an opportunity lost. Because of intersecting idiocies in American departments of philosophy and political science, the department of speech communication has been left in charge of the rhetorical tradition. Rhetoric is the guardian of democracy, the nurse of reason, the teacher of sense. Yet rhetoric itself (thus advertising and politics) and any department studying it (thus composition and journalism, too) has low status. The further a field is from democratic persuasion, the higher its academic prestige, in Plato's style: "You attempt to refute me," Socrates says in the *Gorgias*, "in a rhetorical fashion, as they understand refuting in the law courts. . . . But this sort of refutation is quite useless for getting at the truth" (471e). Or in the *Phaedrus*: "He who is to be a competent rhetorician need have nothing at all to do . . . with truth. . . . For in the courts . . . nobody cares for truth about these matters" (272d). The Platonic disdain for how we actually persuade each other is the central absurdity of our culture. To be left in charge of remedying the absurdity, as speech communication is, bringing us back to a proper understanding of word and action, is a great honor—though it must be admitted that in practice the honor works out like the Duke's in *Huckleberry Finn*, who, after being tarred and feathered and run out of town on a rail, allowed that if it weren't for the honor of the thing, he'd just as soon have skipped it.

Gaonkar implausibly claims that the rhetoric of science has "stalled after a promising beginning" (41). The claim of "stalling" is implausible on its face because in Gaonkar's narrow definition so few works in the field have been attempted. A car does not stall if it is never started. That Gaonkar claims to discern a "low status of rhetoric of science in comparison to philosophy, history, and sociology of science" shows where he lives. The "low status" has nothing to do with the quality of work and a lot to do with ancient Platonism and modern attacks on departments of communication. It's all most unedifying, this diffidence about his field of study.

Gaonkar's technique is to put the rhetoric of science in a double bind. If rhetoric of science does something empirical (for example, examining closely the rhetoric of scientific papers), it is in Gaonkar's eyes "routine and predictable" ("routine" is his favorite word of condemnation). If it does not do something very extensive (for example, produce fifty papers a year on its subject), it is "stalled."

Gaonkar's rhetoric of proof throughout is merely assertive; he hasn't any arguments worthy of the name. He depends on bluster, a "merely rhetorical" move: if you make assertions at length, portentously, with ample throat-clearing, you can depend on fooling some of the people some of the time. Gaonkar says that classical rhetoric

is disabled from inspiring modern rhetoric because classical rhetoric was about performance and modern rhetoric about understanding. How's that? On these grounds no applied subject could be continuous with a theoretical subject: medicine would be discontinuous with anatomy and biology. The rhetoric of science has "stalled," says Gaonkar, justifying his lugubrious inquest into why, though the program is in its infancy. On these grounds any small field would be declared "stalled" and then closed down—shades of the coastie deans. Gaonkar's tropes of argument remind me of a spoof on medical diagnosis published a few years ago that identified "short stature syndrome," affecting an alarmingly high share of the population—to wit, children.

Gaonkar wants to assert against all the writings in science studies since Kuhn that science is not rhetorical. Galileo, Boyle and the air pump, DNA, and so forth "allegedly testify to the unavoidably rhetorical character of scientific enterprise." For the assertion Gaonkar has no argument, merely sneering modifiers. Thus in full his bluster against the pioneering paper by Overington:

> The key move in this translation is to substitute "audience" for [research] "community," and lo and behold, the scientists become licensed speakers. . . . Overington mechanically reads off a rhetorical view of science from a communitarian view of science. . . . The results are predictably dismal. What we get is a catalogue of rhetorical techniques and a typology of arguments . . . that are routinely present in sociological discourse. (43)

Gaonkar does not justify the diction "lo and behold," "mechanically," "dismal," "routinely." When he turns to substance he is confused. He complains for example that Overington does not "fashion a rhetorical approach that takes into consideration the distinctive features of scientific practice" (43). The complaint is bizarre, considering that it was Overington's purpose and the purpose of other science studies since Kuhn to show that scientific practice is precisely not "distinctive." The children of Thomas Kuhn repeat what the Father said, that "we have only begun to discover the benefits of seeing science and art as one" (Kuhn, 1977:343).

Gaonkar is indignant when the conventional dichotomies of art/science, persuasion/proof, rhetoric/knowledge are undermined. About Weimer he is reduced to sputtering "Thus, rhetoric goes global and science becomes *sub specie rhetoricae.*" Gaonkar can think of no argument why rhetoric should not go global or why sci-

ence should not be viewed sub specie rhetoricae, except, goodness, how frightful, to "go global." In short, Gaonkar on Overington, Weimer, and the rest is an *ignoratio elenchi*, bluster borrowing the surface rhetoric of argument without in fact giving any.

Gaonkar announces and reannounces (I count four times) the "collapse of neo-Aristotelianism." Again, no argument; mere bluster. Apparently he regards Edwin Black as the last word on the subject. But saying so doesn't make it so. The Stagirite, the World's First Graduate Student, has legs, as has been shown recently in ethical theory. For myself I see no reason in Gaonkar's bluster to revise John Stuart Mill's opinion of the *Rhetoric* (he read it in Greek as a boy), "which, as the first expressly scientific treatise on any moral or psychological subject which I had read, and containing many of the best observations of the ancients on human nature and life, my father made me study with particular care, and throw the matter of it into synoptic tables." Some collapse.

Gaonkar's main target is the "globalization of rhetoric" (30 and throughout). He is unhappy with a wide definition of the word, and wants to show by exercise of pure reason that a narrow definition is better. His distaste for Big Rhetoric borders on revulsion: he uses the word "promiscuous" throughout to refer to it. Gaonkar is a grim Puritan father thundering against "promiscuous uses and invocations of rhetoric" (38, and throughout).

For some reason his discussion of Trevor Melia is a respectful summary (45ff). No sneering or indignation. Similarly, he devotes five pages to a summary of Campbell's work on Darwin before raising a critical peep. As I've already said, the length of the summaries, and the many ingenuities and insights exhibited in the works, argues contrary to his surface theme for a brilliantly successful program of "globalization." Even when he summarizes Alan Gross, with whom he is less patient, or Lawrence Prelli, with whom he is still less so, the reader gets the impression of richness and intelligence in the texts criticized (as on 67–73), an impression which contradicts the merely a priori objections offered by Gaonkar himself.

The best question to ask in a seminar is "So what?" Most science and scholarship goes wrong by being irrelevant. In essence Dilip Gaonkar raises a bored yawn to the rhetoric of science: So what? But the weapon can be turned back on its wielder. All right, British departments of sociology in the 1970s and 1980s were open to the entry of people trained in science. The American departments of speech communication were then less ready, because of the Dilipian diffidence about rhetoric among its only defenders; because of the humanistic and therefore science-shy bent of rhetoricians; and, most

fatally, because of a continuing interest in the politics that political science had abandoned in favor of misuses of statistical significance (a misuse invading now communication studies, too). Yes, such traditions for a while made rhetorical studies of science less exciting to young people, though now no longer. But: so what? Gaonkar wants the delay to mean that there is a "predicament facing not only the rhetoric of science but every other proposed contemporary extension of rhetoric into the zone of interdisciplinarity" (41). The argument has nothing to do with the conclusion. It does not show what Gaonkar wishes it showed, that Little Rhetoric rules.

Gaonkar has three philosophical warrants for Little Rhetoric, which look cogent to people who have not thought them through. The first is what may be called the "*si omnia, nulla*" argument: if everything, nothing. If rhetoric is "everything," says Gaonkar, then it is nothing. "Si omnia, nulla" is a popular figure of argument in such discussions (the email conversation on the H-Rhetor list had a lively debate in the fall of 1994 on precisely the Big/Little Rhetoric definition, and turned on si omnia, nulla). Popular though it is, probably for its air of snappy profundity, it is in fact a silly non sequitur. If something is "everything," it does not follow that it is nothing. Atoms are "everything." That does not make atoms nothing. That air is everywhere does not make air nothing (consult Boyle and his pump). That language is made of words does not make the words nothing. If most speech has a persuasive perlocutionary force, "mere" rhetoric, what exactly is the problem? So what?

For example, Gaonkar takes Alan Gross to task for using "categories . . . so capacious that it would be impossible not to find them in any discourse that is 'situated' and 'addressed'" (62). What of it? So what else is new? I realize that many people believe a rule of scientific method that words cannot be universally applicable. But the belief is false, even preposterous. Gaonkar asserts that "a rhetorical reading merits attention only insofar as it proffers a distinct and 'contestable' (if not 'falsifiable') reading of a given scientific text" (62). The assertion is imperious nonsense from the philosopher's easy chair, a notably worn chair at that, thirty years old. Gaonkar writes later, "I argued that rhetoric as a language of criticism is so thin [i.e., general] that its applicability to any discourse is virtually guaranteed in advance" (69). He did not in fact "argue" anything of the kind. But suppose he had, and had established "thinness" in this sense. Still the impatient seminar participant will want to ask: So bloody what?

Gaonkar finds "reasonable" R. Michael Bokeno's formulation of si omnia, nulla: "If rhetorical study is to contribute . . . then a con-

ception of rhetoric which is smaller than the conception of human conceptual activity is a minimum theoretical requirement" (quoted 47). Who says? What rule of method requires so? Michael Billig (1987) has written a long and brilliantly persuasive book showing the opposite, that one can be said to be "arguing" (with oneself) when one is thinking. Gaonkar complains about Prelli: "the specificity of rhetoric is so attenuated that it becomes no more than a pleonastic qualifier" (71), and "there is no exit from rhetoric" (75). Well, what of it? Suppose there were not? "This is one sense of the promiscuous, both universal and empty, and is what the traditionalist objects to" (76). "While [Prelli's] move brings 'science' within the range of rhetoric, it also deprives rhetoric of any specificity" (73). Huh? Why? We are not told. Gaonkar never gets further than his alleged rule, unargued, that rhetoric must be defined narrowly. He does not show in what way the "specificity" is compromised, or whether it matters.

Gaonkar's second warrant for Little Rhetoric is, as I have observed, pre-Kuhnian, an antique philosophy of science. He argues that modern rhetoric is "thin," by which he means overgeneral. Anything fits its categories. So what? Here's what: such a framework is "invulnerable to falsification, and for that very reason . . . commands little sustained attention" (33; the self-deprecating anxiety in the phrase "commands little sustained attention" is palpable).

In someone claiming sophistication about the rhetoric of science, the Popperian flavor here is startling. "A critical statement is, in some sense, verifiable"—so says Edwin Black on page 7 of his classic, *Rhetorical Criticism: A Study in Method* (1978, originally published in 1965) in the spirit of 1965. But Gaonkar should know that Karl Popper's book of 1934, translated into English only in 1959, is not the last word on the philosophy of science. Gaonkar betrays no familiarity with what has happened since 1934, from the pens of Kuhn, Hesse, Lakatos, Feyerabend, and others, among them Karl Popper. What has happened is that falsification has been shown to be no criterion of science at all, and science has been shown to be rhetoric all the way down. Thermodynamics, for example, is a manipulation of an unfalsifiable definition of energy. That does not make the theory in any way doubtful. As Kuhn put it, "in scientific practice . . . the scientist often seems rather to be struggling with facts, trying to force them into conformity with a theory he does not doubt" (1977:193). Imre Lakatos (1976) argued that even in mathematics the alleged falsifications are fended off by a "protective belt" of redefinition.

Gaonkar's third and final warrant for Little Rhetoric is the fear and loathing that knows no name, the conservative's unargued horror of postmodernism retailed in the *New York Times* and the *Wall Street Journal*. Gaonkar approves again of Bokeno's "sharp and compelling" strictures on the rhetoric of science, namely, that rhetoric of science is "radically relativist." This is sharp and compelling? The newspapers dredge up the malarkey about "relativism" every time they comment on the culture wars. The charge is not sharp and compelling. It is routine (as Gaonkar might put it) and inaccurate and illogical.

Bokeno claims that the rhetoricians of science cannot be persuasive unless they accept absolutism. He's marshaling the usual *tu quoque* argument. You, oh relativists, must believe in absolutism, because you claim [here is the mistake] absolute truth for relativism. I have given the tu quoque argument a chapter's worth of attention in a recent book (1994), and cannot bear to go through it again. Suffice here to quote Bruno Latour's reply to a critic who had used the tu quoque on him. Here's sharp and compelling:

> Those who accuse relativists of being self-contradictory can save their breath for better occasions. I explicitly put my own account in the same category as those accounts I have studied without asking for any privilege. This approach seems self-defeating only to those who believe that the fate of an interpretation is tied to the existence of a safe metalinguistic level [thus also Stanley Fish, Richard Rorty, and D. McCloskey]. . . . This belief is precisely what I deny. . . . This reflexive position is the only one that is not self-contradictory. (Latour, 1984:266)

The one point Gaonkar makes beyond his vacuous three that has some bite is his criticism of early John Campbell for putting too much emphasis on Darwin's conscious intent. Gaonkar is here reinventing the New Critical "intentional fallacy" (he gives no sign that he knows that this is what he is doing). That Keats intended "Ode on a Grecian Urn" to be skillfully done is irrelevant to the question of whether it is. (Incidentally, Gaonkar himself commits the intentional fallacy in rejecting the identification of the British sociologists of science as rhetoricians: he claims that only if they say they are rhetoricians—as unbeknownst to Gaonkar some in fact have—are they to be accounted as doing the rhetoric of science.)

One can understand what battles Campbell had to fight against the naive view that scientific writing is entirely without intent at all, automatic "writing up the results," whose only intent is to "tell the

truth." Scientists say so. Saying so is a good move in a scientific debate, my "facts" against your "prejudice" (as in the debate over oxidative phosphorylation (Mulkay, 1985:43, 45, 48, 105, and throughout). Gaonkar notes that in recent essays Campbell has opted for a more intertextual approach. Instead of praising Campbell for learning something new about criticism, however, Gaonkar uses Campbell Mark II to sneer at Campbell Mark I, and then to raise a general sneer at Campbell and his works. It's again making the best the enemy of the good. He notes that Campbell "prefers to view the two interpretations [that is, Darwin as conscious rhetor and Darwin as unconscious user of the rhetorical materials in his culture] as complementary" (59). "Readers may not abide by his preference" (60), says Gaonkar with a sneer, not pausing to articulate why. In truth it's hard to see how else one could view speech except as Campbell Mark II does, as intent and socialization together. So for any text. Gaonkar himself, for example, has a conscious intent to belittle the rhetoric of science, but an unconscious attachment to the sneer.

Gaonkar has a bad case of what Stanley Fish (1989) calls "theory hope," the notion that ruminations from the philosopher's chair can do things like "justify a general hermeneutics." Gaonkar will not let the evidence alter his a priori view that Big Rhetoric is an impossibility. He says, "Obviously, rhetoric lacks a tradition that would enable an average but literate person to unproblematically identify at least the paradigm cases of rhetoric as rhetoric." He asked "why do we lack such an identity-bestowing tradition" in rhetoric as we have in poetry? The answer of course is that we did, for twenty-five hundred years in the West and for comparable periods in the Indian and Chinese traditions. The evidence shows, without lifting a philosophical finger, that there is nothing impossible about the average person being able to recognize rhetoric as rhetoric. People like Richard Lanham (1993) and me point this out daily.

Gaonkar wants to take a dim view. He takes, for example, a dim view of Prelli's optimistic picture of science as involving "audiences" and "conventions." The "sheer materiality of science as an institution," says Gaonkar, undercuts the notion of scientists as "self-monitoring rational actors" (70–71). Puzzlingly, he cites the social studies of knowledge in support of his materialist views. Collins, Mulkay, et al. (Ashmore, et al., 1989; Latour and Woolgar, 1979; Pinch, 1986; Shapin and Schaffer, 1985), showed on the contrary that science is a matter of arguments and conventions (and power and money, too, but that is more typical of Robert Merton than Thomas Kuhn). Gaonkar speaks respectfully throughout of

rhetorical sociology, but he doesn't get it. "Does [rhetoric] ever threaten," he asks rhetorically, "to become part of the substance of science?" He is forgetting that *res* and *forma* are intimately connected. If the rhetoric of science from Fleck in the 1930s to Gross in the 1990s had to be put in a sentence it would be *The substance of science is its rhetoric.* Gaonkar speaks of "reference" and "reality" as though now a long generation of the children of Thomas Kuhn had not made such talk look stunningly naive.

Gaonkar's distaste for the fragment of the rhetoric of science he has studied is therefore not to be given much weight. His distaste is misplaced, and what is more relevant here, unargued. It surely is a rule of method that unargued opinion, however finely expressed, is not to be credited. I have formulated a little joke about it: after one turn of the ignition key the movement against the rhetoric of science, whose chief member is Dilip Gaonkar, has stalled.

References

Ashmore, M., Mulkay, M. and Pinch, T. (1989). *Health and efficiency: A sociology of health economics.* Milton Keynes and Philadelphia: Open University Press.

Billig, M. (1987). *Arguing and thinking: A rhetorical approach to social psychology.* Cambridge: Cambridge University Press.

Black, E. (1978). *Rhetorical criticism: A study in method.* Madison: University of Wisconsin Press. Orig. pub. 1965.

Chandrasekhar, S. (1987). *Truth and beauty: Aesthetics and motivations in science.* Chicago: University of Chicago Press.

Collins, H. M. (1985). *Changing order: Replication and induction in scientific practice.* Sage: London and Beverly Hills.

Fish, S. E. (1989). *Doing what comes naturally: Change, rhetoric, and the practice of theory in literary and legal studies.* Durham, NC: Duke University Press.

Fleck, L. (1979). *Genesis and development of a scientific fact.* Chicago: University of Chicago Press. Orig. pub. 1935.

Gould, S. J. (1993). The composition and reception of "The spandrels of San Marco." In J. L. Selzer (Ed.), *Understanding scientific prose.* Madison: University of Wisconsin Press.

Krips, H. (1992). Ideology, rhetoric and Boyle's new experiments." Unpublished ms. for "Narrative Patterns In Scientific Disciplines," April 27-

30, 1992, Cohn Institute, Tel Aviv University; Edelstein Center, Hebrew University; and the Van Leer Jerusalem Institute.

Kuhn, T. (1962). *The structure of scientific revolutions*. Second ed. 1970. Chicago: University of Chicago Press.

———. (1977). *The essential tension: Selected studies in scientific tradition and change*. Chicago: University of Chicago Press.

Lakatos, I. (1976). *Proofs and refutations: The logic of mathematical discovery*. J. Worrall and E. Zahar (Eds.). Cambridge: Cambridge University Press.

Lanham, R. A. (1993). *The electronic word: Democracy, technology, and the arts*. Chicago: University of Chicago Press.

Latour, B., and Woolgar, S. (1979). *Laboratory life: The social construction of scientific facts*. Beverly Hills: Sage.

Latour, B. (1988). *The pasteurization of France*. A. Sheridan and J. Law (Trans.). Cambridge and London: Harvard University Press.

McCloskey, D. N. (1994). *Knowledge and persuasion in economics*. Cambridge: Cambridge University Press.

Mulkay, M. (1985). *The word and the world*. London: Allen and Unwin.

Pinch, T. J. (1986). *Confronting nature*. Holland: Reidel.

Plato. (1914). *Phaedrus*. H. N. Fowler (Trans.). Cambridge: Harvard University Press.

———. (1925). *Gorgias*. W. R. M. Lamb (Trans.). Cambridge: Harvard University Press.

Polanyi, M. (1962). *Personal knowledge: Towards a post-critical philosophy*. Chicago: University of Chicago Press.

Polya, G. (1954). *Induction and analogy in mathematics* (Vol. 1 of *Mathematics and plausible reasoning*). Princeton: Princeton University Press.

Shapin, S., and Schaffer, S. (1985). *Leviathan and the air-pump: Hobbes, Boyle and the experimental life*. Princeton: Princeton University Press.